جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Undergraduate Bulletin

2021

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Dhahran 31261, Saudi Arabia

About this Bulletin

The Undergraduate Bulletin of King Fahd University of Petroleum and Minerals (KFUPM) is an official publication issued by the Office of the Vice Rector for Academic Affairs.

This Bulletin was prepared during the 2020/2021 academic year and published in September 2021. The contents were compiled from various inputs received from the academic departments and administrative offices throughout the University.

The Bulletin provides information about all academic programs. It also gives information on academic regulations, admission criteria and selected activities and services. It is hoped that the Bulletin will serve as a useful guide to faculty members, students and staff whenever questions arise regarding academic matters such as University rules, curricula of programs, and courses and their prerequisites.

Dr. Ahmed Salah Nada
Editor, KFUPM Undergraduate Bulletin
September 19, 2021

ACKNOWLEDGEMENTS

The editor is extremely grateful for the generous support provided by the University Vice President of Academic Affairs, Dr. Mesfer M. Al-Zahrani. I would also like to thank my colleagues in the office of the Vice President of Academic Affairs. This assignment could not have been accomplished without the cooperation received from the University Deans and Chairmen, the Registrar, and all Departments involved.

FOREWORD

The revised Undergraduate Bulletin shows the commitment of King Fahd University of Petroleum & Minerals (KFUPM) to regularly update its academic programs to respond to global changes and react to the needs of the Kingdom of Saudi Arabia. The Bulletin contains detailed information of the current academic programs. It includes the degree plans, degree requirements, course descriptions and graduation requirements. It also outlines the policies, procedures, and student services available at the University at the time of publishing.

The Bulletin also imparts the compliance of all undergraduate academic programs to the requirements of national and international accrediting institutions ensuring continuous improvement of academic quality at the time of its publication.

Our academic programs are developed and updated to be proactive in preparing future generations of leaders. We make certain that students leave KFUPM with all of the necessary knowledge, skills, attitudes, and values that will enable them to be successful leaders and global citizens.

Through the various units and grants available at KFUPM, including Colleges, Centers of Excellence, and Research Groups, KFUPM continues to support and involve faculty members and students in research activities. The University's commitment to community service is maintained through a variety of formal and informal programs, with the additional challenge of instilling a culture of community service in its students.

I take this opportunity to extend my thanks and appreciation for the efforts of all those involved in the successful launching of this Bulletin. My special thanks are due to the President of the University for his leadership and continuous support of all academic activities, and to all University Deans, department Chairmen, faculty, support units, and individuals who contributed to the development of this Bulletin.

Dr. Mesfer Mohammad Al-Zahrani
Vice President of Academic Affairs
September 19, 2021

CONTENTS

GENERAL INFORMATION

HISTORY AND PHILOSOPHY OF THE UNIVERSITY

King Fahd University of Petroleum & Minerals (KFUPM) was officially established by a Royal Decree on 5 Jumada I, 1383 (23 September 1963). The first students were admitted a year later on 23 September 1964 when 67 young men enrolled in what was then named the College of Petroleum & Minerals (CPM). Since that time, the University's enrollment has grown to about 11,350 students during the 2020-2021 academic years.

The University's growth has been marked by two significant events. The first of these was when the University conferred its first engineering degrees in 1971/1972. In that year, four men received Baccalaureate Degrees. By the end of the academic year 2020/2021, 41,063 degrees have been awarded including 5,535 Master's and 467 PhD degrees. The second milestone was the official change in both name and status from a College to a University, which occurred in 1975, leading to the name University of Petroleum & Minerals. Later on, in the year 1986, the name was changed to King Fahd University of Petroleum & Minerals (KFUPM).

The rapid growth of KFUPM is related to the rapid economic and technical development of Saudi Arabia. It also reflects the rising expectations of the people of Saudi Arabia, the expanding opportunities for the country's young men, and the increasing importance of Saudi Arabia as a major source of the world's energy.

The vast petroleum and mineral resources of Saudi Arabia pose a complex and exciting challenge for scientific, technical and management education. To meet this challenge, the University has as its goals the advanced training of students in the fields of science, engineering and management for service and leadership in the Kingdom's petroleum and minerals industries, and the promotion of research resulting in contributions to knowledge in these fields. In addition, because it derives a distinctive character from its being a technological university in the land of Islam, the University is unreservedly committed to deepening and broadening the faith of its Muslim students and to instilling in them an appreciation of the major contributions of their people to the world of mathematics and science. All areas of KFUPM—facilities, faculty, students and programs—are directed to the attainment of these goals.

ORGANIZATION

The President is the chief academic and executive officer of the University, which is run by the Board of Trustees. The current chairman of the Board is H.R.H. Prince Abdulaziz bin Salman, who is also serving as the Minister of Energy. The recent transformation of KFUPM's status from a government University to a Non-profit Institute is an initiative aimed towards achieving Saudi Vision 2030. This transformation, started in October 2019, is an outcome of planning to expand the non-profit sector by increasing its contribution to national growth, which is one of the core elements of Saudi Vision 2030.

LOCATION

The University is located in Dhahran, near the headquarters of the Saudi Aramco Oil Company (SAUDI ARAMCO) in the Eastern Province of Saudi Arabia. The campus is situated near the Arabian Gulf at a distance of about 6 kilometers from the town of Khobar, and 15 kilometers from the city of Dammam. The academic buildings are located on a hill (*jebel*) which is 35 meters above the surrounding desert. The University overlooks the Arabian Gulf, and is about 25 kilometers away from the island of Bahrain which can be seen from the roofs of the academic buildings in clear weather.

The University is easily accessible by road or airline from any point in the Kingdom, or by air, sea and road routes from Europe, Asia, Africa, or other Middle Eastern countries. The highway distance to Riyadh is about 400 kilometers and that to Jeddah is about 1,300 kilometers. A network of paved roads leads to various distant points, such as Najran, Abha, and Jaizan in the far south, to Burayadah and Hail northwest of Riyadh, to the lovely mountain resort of Taif near Makkah and Jeddah, and to Qaiysumah, Turaif, and Tabuk along the northern frontier. King Fahd International Airport is about 40 kilometers from the University Campus, and a regular airline service exists to all domestic and many international terminals.

FACILITIES

The campus of the University features a physical plan of exceptional beauty and size. Constructed on *Jebel* Dhahran, the buildings are both architecturally imaginative and educationally sound and viable. Their exterior design combines the stark color and raggedness of the landscape with the graceful lines of the Islamic arch, dome, and minaret. Interiors feature laboratories, lecture halls, classrooms, seminar rooms, offices and a variety of special facilities including computer terminals, closed circuit television outlets, and other amenities. All buildings are centrally air-conditioned.

The academic complex consists of more than 50 major buildings. The facilities available include: faculty/staff offices; workshops and laboratory buildings, which include the heavy equipment laboratory building and the energy research laboratory building; the Information Technology Center; classrooms; the administration building; the Library; the faculty/student center, which includes the faculty dining hall, the post office, and the stationery shop; the auditorium which seats 850 people and is equipped for simultaneous translation in three languages; the gymnasium; a mosque; the Research Institute; the stadium, which seats 10,000 people; the Medical Center; the conference center; and multi-story parking garages. The facilities also include a natural exterior amphitheater, playing fields and indoor courts for intercollegiate and intramural sports, and the distinctive KFUPM water tower with circulatory water systems.

To the north of the *Jebel* there are: student housing including the student reception center, the student cafeteria, mosques, student clubs and services; a student commercial Center;; the projects & maintenance complex; the University storehouse; the Security & Safety department; the transportation department; the garage for maintenance department vehicles; and the Preparatory Year campus, consisting of the Preparatory Year faculty office building, two classroom buildings, and various laboratories and service buildings. A new academic complex consists of two classroom buildings, a faculty office building, an auditorium for 700 persons and a mosque. The buildings are equipped with high-tech facilities.

To the south of the *Jebel*, there is the faculty & staff housing including the Community Center and the coop store. The telephone exchange, the University Press building, the Bookstore, the University nursery and kindergarten schools, and the sweet water tanks are located on the southeast of the University campus.

Conference Center

The Center is adjacent to the main University concourse and car park, and has extensive modern facilities for hosting international-level conferences. Its main oval-shaped auditorium can accommodate about 98 people while the other four independent briefing and committee rooms each have a 30-seat capacity. There is also an auditorium with 128 seats.

Conference meetings are supported by the latest audio-visual equipment, Community Antenna Television (CATV), connecting with all parts of the KFUPM campus, and its own typing facility.

Medical Center

The KFUPM Medical Center provides the community with the following services:

- Primary health care.
- Laboratory and X-ray facility in parallel to the available medical facilities.
- Referrals to the local governmental hospitals for further diagnosis, consultations, and hospitalization.
- Multi-specialty clinics in Internal Medicine, Pediatrics, Gynecology & Obstetrics, Ophthalmology, Psychiatry, Dermatology, and Dentistry.
- Vaccinations, which include primary (essential) vaccinations for children, as well as participation in the national preventive campaigns.
- 24-hour first-aid service for management of emergency cases.
- 24-hour ambulance service to attend emergency cases.
- 24-hour nursing service which includes giving injections, dressing and all possible nursing assistance such as checking blood pressure and vision tests, etc.
- Facility for observation inside the Medical Center, resulting in either discharging the patients or referring them to hospitals.
- Issuance of medical reports for residence permits (Iqama), sick leave, etc.
- Provision of medicines according to University policy.
- General dental clinics for dental care and oral hygiene.
- Check-up service for new employees, including staff & faculty, laborers of KFUPM food services on a regular, three-monthly basis, housemaids and drivers working for staff & faculty, and KFUPM school children before registration and before frequent short activities.

Student Housing

The University provides housing for the total student enrollment in keeping with its policy of being an entirely residential institution. The undergraduate student dormitories, which constitute the majority of student housing at this time, are in three-storey air-conditioned buildings, containing furnished rooms, with two beds per room, bathrooms zones (toilets, showers, and hygienic facilities), study rooms, and facilities for the handicapped. These units are located in the student compound (*Al-Falah District*), in the north sector of the campus and have been modernized. As part of the program to provide newer facilities of modern design, consistent with the architecture of the University, most of the multi-story buildings are now completed and occupied.

Cafeteria

The student cafeteria—a large, spacious building— is situated adjacent to the student dormitories. It can accommodate more than 1500 students at a time. Students are provided with subsidized meals comprising breakfast, lunch and dinner.

The food preparation is handled by a well-qualified professional team in the central kitchen, fully furnished with modern equipment. The food services department makes sure that the food offered to students consists of a balanced diet conforming to the Saudi Standards (SASO).

Apart from the student cafeteria, there are a number of coffee shops located in different academic buildings and student dormitories.

Bookstore

The Bookstore is located near the KFUPM Press. Textbooks are issued to students and faculty free of charge. As a large number of specialized textbooks are needed for different University programs, a comprehensive textbook acquisition system is followed to ensure that the latest editions of books are used, as far as possible.

Sports and Recreation Facilities

The stadium, a major facility, is located near the main entrance to the University. It is designed to seat 10,000 spectators. The open stadium has flood lights, facilities for VIP seating, a press box, and TV booths. It is consistent with the construction style of all other permanent buildings within the academic complex.

Other available facilities are: swimming pools, changing rooms, soccer fields, tennis courts, athletics track, basketball and volleyball courts, handball courts, squash courts, athletic support facilities, and physiotherapy.

RESEARCH & INNOVATION

The Research Institute, a cornerstone of applied research activities at KFUPM created a strong research base and was recognized for solving critical scientific and technical problems as well as working on converting knowledge into practice. Working in collaboration with the faculty from academic departments and researchers from other research entities, its full-time researchers annually produced hundreds of research reports and publications for industrial and government sponsors.

Today, the university has completely overhauled both the research structure, and the programs. Our new research activities are designed to amplify the impact on society, solve challenging problems, and enrich knowledge for all humanity.

One of the most important aspects of the revised structure is the emphasis on interdisciplinary research. We believe that it takes the combined knowledge of multiple disciplines to make truly impactful research. Our new research centers are composed of multiple disciplines, and of researchers from different departments.

The Research Institute has numerous research centers, spanning areas from engineering, environment, water, refining and petrochemicals, to name a few. The recent strategic transformation of the Research Sector at KFUPM has resulted in establishing of new Research & Innovation (R&I) Centers and other existing units under the leadership of the Vice President of Research & Innovation (VPRI). These are:

- Deanship of Research Oversight and Coordination
- Interdisciplinary Research Center for Advanced Materials
- Interdisciplinary Research Center for Intelligent Manufacturing and Robotics
- Interdisciplinary Research Center for Membranes and Water Security
- Interdisciplinary Research Center for Intelligent Secure Systems
- Interdisciplinary Research Center for Smart Mobility and Logistics
- Interdisciplinary Research Center for Refining and Advanced Chemicals
- Interdisciplinary Research Center for Renewable Energy and Power Systems
- Interdisciplinary Research Center for Hydrogen and Energy Storage
- Interdisciplinary Research Center for Construction and Building Materials
- Interdisciplinary Research Center for Communication Systems and Sensing
- Interdisciplinary Research Center for Finance and Digital Economy
- Applied Research Center for Environment and Marine Studies
- Applied Research Center for Metrology, Standards, and Testing
- Applied Research Center for Strategic Studies and Planning
- SDAIA-KFUPM Joint Research Center for Artificial Intelligence
- Center of Excellence in Development of Non-Profit Organization
- Center for Integrative Petroleum Research
- Industry Collaboration
- Innovation & Technology Transfer
- Core Research Facilities

Some of the objectives, aims, and missions of the new Interdisciplinary Research Centers are:

- Development of advanced materials for oil and gas, pipelines, construction, packaging, healthcare, and other industries.
- Development of strong competence of KFUPM Automation in joint research programs with industry and outreach to other educational institutions.
- Providing effective solutions to real industrial gas separation, water treatments including oil/water separation and liquid mixtures separation problems through cutting edge academic research in the area of membrane science, engineering and technology.
- Development of solutions to local and global challenges related to the security and resiliency of intelligent systems.
- Development of strategies and implementation plans that help Saudi Arabia in addressing the future grand challenges of “Mobility/Transportation” a “Logistics”.

- Development of catalyst formulation and processes for downstream sector: refining, petrochemicals, and polymers.
- Development of sustainable and energy efficient solutions having social, environmental, and economic impact to achieve the objectives of Saudi Vision 2030.
- Development of hydrogen and energy storage programs that enable carrying out world-class research in areas of strategic importance for the Kingdom of Saudi Arabia, and support the same through outreach, teaching, and training.
- Conducting interdisciplinary research with the aim of developing sustainable construction and building materials and commercialization.
- Facilitating the translation of the knowledge in the areas of communication and radar systems, and sensing into commercial innovations.

Establishment of more IRCs is under study and evaluation and several are expected to be launched soon.

The new Vision and Mission for Research & Innovation is:

Vision: "To be globally recognized for impactful, interdisciplinary, forward-looking, cutting-edge research"

Mission: "To steer, enable and oversee an ambitious research portfolio, and to facilitate its translation to tangible knowledge-based contributions to the economy and society of the Kingdom and beyond".

DEANSHIP OF RESEARCH OVRESIGHT AND COORDIANTION

The Deanship of Research Oversight and Coordination (D-ROC) at the University was originally established as part of the Deanship of Graduate Studies in the year 2000, and then became an independent deanship for Scientific Research in September 2005. The name has been changed in February 2021 from Scientific Research to Research Oversight and Coordination. The Deanship has the role of oversight, planning, management, promotion and support of research activities that are carried out by faculty and researchers through internal and external funding. The Deanship is managed by the Dean of Research Oversight and Coordination. The functional responsibilities of the D-ROC include research activities such as funded projects, professional conference attendance, sabbatical leaves, release time, research scholarship programs and research awards. The Deanship manages and plans research and other scholarly activities through the Scientific Council, which is a regulatory body chaired by the Vice President for Research and Innovation with its members selected from various academic departments. The research committee is an executive body composed of 11 members who represent the different University Colleges and the Research Institute. The Arabic research committee concentrates on the review and support of Arabic book authoring and translation in addition to Arabic research projects and studies. The conference committee is dedicated to the evaluation of applications submitted by faculty to attend regional and international scientific and professional conferences and meetings. All committees are chaired by the Dean of Research Oversight and Coordination with members selected/elected from the different academic departments of the university.

Vision

To establish a conducive research environment and provide effective support to enable KFUPM to assume an international leadership role in innovative and quality research in cutting-edge knowledge and technologies found in key areas with a significant socio-economic impact.

Mission

To provide a stimulating environment and continuous support that empowers KFUPM faculty and researchers to enhance its national, regional and international leadership in quality research and scholarly activities in science, engineering, management and other related fields of significant importance to the Kingdom and worldwide.

Research Programs

- Research Groups Grants
- Internal Research Grants
- Directed Research Grants
- Startup Research Grants
- Book Writing and Translation Grants
- Socioeconomic Studies Grants
- Sabbatical Leave

Conference Attendance Support

Faculty members are eligible for a total of up to three conferences per year based on their activities on research.

DHAHRAN TECHNO-VALLEY

The Kingdom of Saudi Arabia has always been a lucrative market in this rapidly growing global economy and with the world witnessing accelerated development, there has always been an enhanced requirement of development efforts. The Kingdom's drive towards a Knowledge Based Economy (KBE) requires the integration of several activities: dissemination, transfer, generation, production, utilization and investment of knowledge in various activities of production and development.

King Fahd University of Petroleum and Minerals, through the growth of Dhahran Techno-Valley (DTV), has accelerated its links with industry and with those who create, develop, and use new technologies in Saudi Arabia. The mission of DTV is to support Saudi Arabia's ambition to advance technology transfer and establish a knowledge-based economy in the Kingdom. DTV is envisioned to be the Middle East's most prestigious research and technology development nucleus with comprehensive business support. Interaction between world-class researchers from multinational companies and the university community (faculty, researchers and students) in an easily accessible facility is being strongly promoted to tackle the emerging challenges presented by society and technology.

Brief History

King Fahd University of Petroleum and Minerals (KFUPM) initiated its technology development efforts in the year 2002 with the establishment of the Prince Abdullah bin Abdulaziz Science Park (PASP). Schlumberger, a global oil-field service provider was the first company to join PASP in the year 2003. In 2006, Dhahran Techno Valley was established as a subsidiary investment project of KFUPM. DTV has been founded to keep pace with the knowledge-based economy ideas and applications. In 2010, DTV Company (DTVC) was created by a Royal Charter, with terms set forth by the Council of Ministers. KFUPM's relentless efforts in developing innovative technologies for more than a decade now has made it one of the pioneer institutions in the Middle East and Globally.

Vision

To lead the commercialization of technologies by fostering the environment in which KFUPM and drivers of innovation work together to deliver economic opportunities of national and global value in the energy sector.

Organization Structure

The Dhahran Techno Valley Holding Company (DTVC) – a wholly owned subsidiary of the King Fahd University of Petroleum and Minerals (KFUPM) – is a key driver of the Dhahran Techno Valley Ecosystem, which was created to promote a knowledge-based economy in Dhahran and in the Eastern Province. This ecosystem includes KFUPM, national champions such as Saudi Aramco, SABIC and SEC, technology partners and small to medium size enterprises.

DTVC is composed of a holding structure that includes a holding company (Dhahran Techno Valley Holding Company) and five subsidiaries and branches (Dhahran Valley Technology Development Company, Dhahran Valley Knowledge Company, Business Park Complex Company, Dhahran Valley Business Services Company and University Schools Company). The role of the "Holding Company" is to provide strategic guidance, control and support capabilities to its subsidiaries and branches in addition to an identity that should bring together all the elements of this structure.

Dhahran Valley Technology Development Company (DVTDC) branch of Dhahran Techno Valley Holding Company is the key driver in the establishment of a knowledge-based ecosystem in the Eastern Province of Saudi Arabia, a model that can be replicated across the Kingdom. DVTDC is responsible for the management of the Dhahran Techno Valley Science Park and commercialization of technology emanating from the research activity occurring in the ecosystem.

Dhahran Valley Knowledge Company (DVKC) branch of Dhahran Techno Valley Holding Company is established to become a regional center of excellence for capabilities development and the transformation of knowledge into know-how. DVKC services include offering training and consultancy services, managing K-12 schools, and hosting science and technology related events.

Strategy & Goals

DTVC has set of following objectives to carry out its mission:

- Actively manage the leading energy and related industries science park in Saudi Arabia
- Deliver international-standard services to clients and National Champions
- Foster collaboration between park tenants, KFUPM, Saudi Aramco and other drivers of innovation
- Facilitate the launch of companies built around locally-developed technology
- Support technology related SMEs

INFORMATION & COMMUNICATIONS TECHNOLOGY CENTER

The Information & Communications Technology Center (ICTC) was established in 1964 as the primary computing facility at King Fahd University of Petroleum & Minerals (KFUPM). It provides computing and technical support services for the education, research and administration sectors at KFUPM. It also provides specialized IT services to other institutions, external entities and industrial companies in the Kingdom.

The ICTC mission is

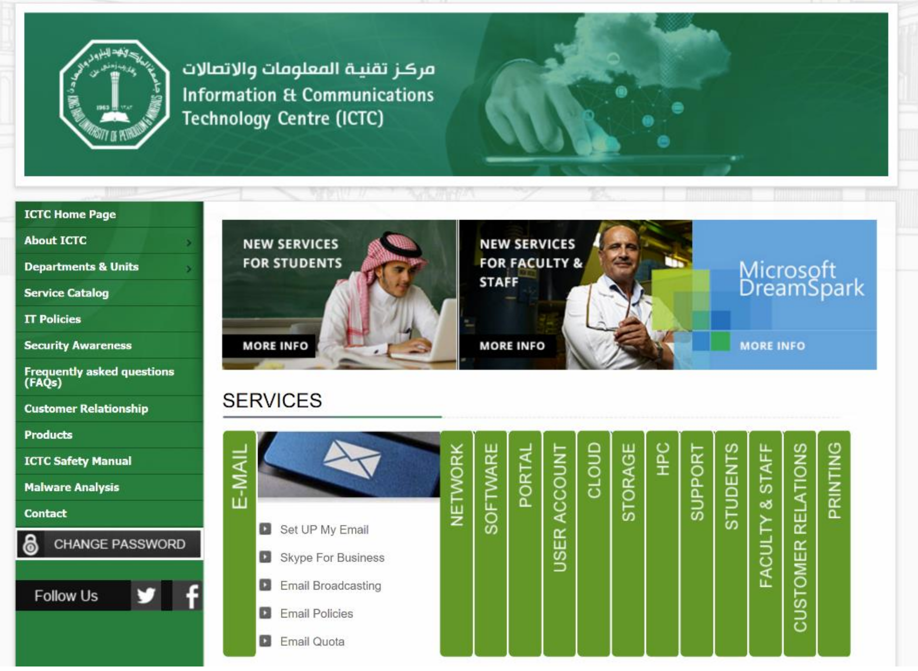
"To provide excellent IT services that foster productive education, research, community service, and administrative activities at KFUPM through competent staff, effective processes, and state-of-the-art systems."

The ICTC, as the main technical computing entity at KFUPM, consists of the following departments:

- IT Service Delivery (ITSD)
- Enterprise Applications Department (EAD)
- IT Infrastructure Services (ITIS)
- Solution Delivery department (SDD)
- Digital Risk and Information Security (DRIS)
- Telecommunications Department (TD)
- Business Support Unit (BSU)
- Project Management Office (PMO)

Services Offered by ICTC

The critical ICTC services offered to undergraduate students can be accessed through the link http://www.kfupm.edu.sa/centers/itc/default.aspx.



As indicated in the schematic above, ICTC offers a large number of services including Single Sign-on (Active Directory), cloud-based Microsoft 365, engineering and scientific software, network, security and printing services.

ICTC Enterprise Platforms & Services

The enterprise systems, maintained and supported by ICTC, include two major Enterprise Resource Planning (ERP) platforms, namely, the KFUPM Student Banner Information System and the KFUPM Oracle e-Business System deploying a large number of automated processes and services in the academic and the administrative/business domains respectively. Other major systems include the Blackboard Learning Management System, the University Library Portal running on the Sierra platform and a multi-tier Business Intelligence platform.

A considerable number of packaged and in-house developed systems provide various services such as academic evaluation, research support, cloud-based graduate admission, undergraduate admission, medical care, student housing and financial aid. The standard IT services maintained and supported by ICTC for the university community include user accounts, e-mail facility, correspondence tracking, document management, advanced digital security, smartcard, telecom and application development. All the software systems and services are available through the KFUPM Portal (https://portal.kfupm.edu.sa) deployed on the Luminis platform using a single sign-on account facility. An advanced e-Desk system at ICTC provides the university community with an enterprise platform to raise tickets and report issues with the IT and major business/maintenance services across the university.

The IT systems and services are operated, maintained and technically supported by the ICTC, thereby, ensuring high-quality services to the university community. The ICTC data center is a huge facility with the latest state-of-the-art IT infrastructure deployed to ensure round-the-clock services. The virtualization platform deployed in the ICTC data center supports three critical goals: efficient server consolidation, on-demand server provisioning and robust disaster recovery. The KFUPM enterprise storage facilities are designed based on advanced replication technologies facilitating high availability, reliability and business continuity.

The University networking facilities, operated and maintained by the ICTC, comprise of a redundant 10 Gigabit Ethernet backbone over fiber optic cables. All the academic buildings and the student housing buildings on campus connect to the backbone of ICTC building. The KFUPM wireless LAN infrastructure, with more than 2400 wireless access points spread across the campus including the student dormitories, serves to provide connectivity through wireless network. The wireless utilization statistics shows more than 12000 users accessing wireless LAN on a daily basis from all over KFUPM. The VPN services allow users to securely connect to the KFUPM network from anywhere in the world using normal internet connection.

ICTC also provides computer hardware including advanced workstations, desktops, laptops and mobile devices to the university community for teaching, learning, research and business use as per approved university policies. More than 60 computer labs with workstations and desktops are located across the campus for teaching and learning purposes. The computer hardware, assigned to the labs and users, is regularly upgraded to the latest specifications.

LIBRARY

The University Main Library is centrally located in Building 8 within walking distance from most of the academic buildings. The Deanship of Library Affairs supports teaching and research in line with KFUPM's mission by providing access to recorded knowledge through collections, services, cooperative programs, and connections to worldwide print and electronic resources. It is an "open stack" Library, allowing users free access to its resources. There are many reading areas provided on the first, third, and fourth floors for (studying, student-teacher meetings, and academic discussions). The Library encourages the maximum utilization of its resources and services. The University Library operates with minimum regulations and restrictions.

The current collection of monographs and bound periodicals totals 362,640 volumes, of which 75% is in Science and Engineering, and the remaining 25% in Humanities and Social Sciences. In addition to the print collection, the Library provides access to more than 546,110 electronic books through various aggregating databases. There are 4,713 audio visuals educational films and 4,829 items available in computer files.

The Library has a sufficient collection of electronic resources, including 208 online databases providing article-level and abstract-level access to more than 91,129 journal titles. The Library is a member of the prestigious Saudi Digital Library – SDL Consortia, a pioneering project of the National Center for E-Learning, Ministry of Higher Education. Most of the electronic resources, including online databases can be accessed in both on KFUPM campus & remotely.

In addition, providing a complete range of Library services to the KFUPM community, it also provides borrowing privileges and other selected services to local government agencies and private institutions.

The Library's major services are:

- Circulation of library materials
- Reference and Information Services
- Ask a Librarian online service

- Research assistance, including literature searches and on-line searching of bibliographic and full-text databases
- Interlibrary loan service
- Library instruction service for new faculty
- Training students for the effective use of the Library facilities
- Online book recommendation facility

There are two separate Internet search labs for KFUPM community with over 45 high-end computers providing access to electronic resources through the Intranet and Internet.

The Library's auditorium can be used by KFUPM members for many activities such as seminars, lectures, short courses, thesis defenses and many academic purposes.

The Library is currently using 'Sierra" an Integrated Library System, the most popular next-generation library management system, to provide efficient library services to our user community through "SmartSearch" platform. Sierra system integrates multiple workflows, e-resources management, circulation, cataloging, acquisitions and more. Moreover, this system combines proven connected workflows with open technology platform to extend the capabilities of different Library system such as library discovery service (EDS) to meet the ever-evolving needs of our faculty and students.

For the convenience of users, the Library manages to implement RFID system. This type of technology replaces both bar-coded labels and traditional theft-detection tags in Library. Some of the major advantages of RFID system are 'faster check-out/check-in which reduces the amount of time required to perform circulations operations which simplified patron to self-check-out that becomes more reliable and pleasant experience for the Library patron.

For further facilitate our users a self-check-out machine and a book drop station is available for checking-out and returning of Library materials without the mediation of the staff. The Library also possess (Book or Journal) head-scanning machine, to scan the Library collection.

In addition to providing these services and resources, the Library also acts as a node for providing access to iThenticate and Turnitin software for checking originality (plagiarism), and other user-centric services.

DEANSHIP OF ACADEMIC DEVELOPMENT

Education is central to the mission of King Fahd University of Petroleum & Minerals (KFUPM). Excellence in education builds upon a culture of continuous development of faculty in their teaching role and the development of curricula, and facilities. The purpose of Deanship of Academic Development (DAD) is to conduct activities and establish processes and facilities that promote innovation and development in teaching and assessment practices, learning technologies, classrooms, curriculum design and quality assurance of academic programs. The ultimate goal is to maximize the potential for student learning. The University has a rigorous academic system based on the regulations of the Ministry of Higher Education, on international standards and through various academic committees at all University levels. The Deanship of Academic Development (DAD) enables the University community, particularly the faculty members, to reach their ambitions in teaching, to assure the highest quality in academic programs, and to utilize the latest technologies in teaching.

DAD creates a focal point for the emphasis on academic matters such as teaching excellence, mapping and monitoring of educational processes, program development, quality assurance, and learning technologies. It deals directly with issues related to the development of academic excellence for all faculty members through a variety of means such as workshops, discussion forums, seminars, publications, and faculty peer consultation.

Mission

To assist the University in continuously improving its academic system by enabling faculty members to reach their ambitions in teaching, and support the University in enhancing its academic programs, facilities and processes to the highest quality standards

Objectives

DAD approach towards its mission of facilitating all concerned roles and organizational units for continuously improving the academic system of the University is guided by a framework of objectives:

1. Excellence in Teaching Pedagogies: Enhance teaching effectiveness by enabling best pedagogical and evaluation practices.
2. Excellence in Learning Technologies: Enhance teaching effectiveness by enabling the use of latest and most proven instructional technologies
3. Effective Processes and Regulations: Enhance the effectiveness of academic processes and regulations
4. Quality assurance: Assist the university to ensure quality of academic systems and adhere to the highest academic standards.

Activities and Services

In order to achieve its objectives, DAD identified specific fields of interest, which are reviewed periodically according to the University's evolving plans and policies. The main areas currently under DAD focus include:

1. Academic faculty development
2. Enhanced teaching and learning
3. Development of academic leadership
4. Fellowships and grants
5. Documenting academic policies and procedures
6. Institutionalizing educational processes
7. Quality assurance of academic programs
8. Instructional technologies

DAD offers a range of academic development workshops, discussion forums and seminars in which international, national and local experts participate. The Deanship, through its Centers, sponsors activities related to teaching, faculty evaluation, student learning and curriculum often with a specific audience in mind, such as new faculty members, department chairmen, and college deans. The Deanship also conducts training programs on learning technologies and develops its own expertise in this direction. In addition, personal consultation is available to faculty members to enhance teaching.

DAD identifies projects and provides financial support/incentives through various grants to enable faculty teams to carry out up to one year long projects on issues related to academic development. The faculty members involved are expected to conduct studies in various academic development areas such as faculty development; enhancement of the learning environment; technology-enhanced learning, etc. The Deanship is keen to collaborate with the members of the University community on issues that lead to academic development at KFUPM. DAD also manages a resource center, offering a range of books, newsletters, journals and multimedia references relating to its main areas of interest, especially teaching and learning and quality-assurance-related issues. In addition, the Deanship publishes the proceedings of its workshops and discussion forums. These resources can be accessed by contacting the Deanship's office.

Organization of the Deanship of Academic Development

The Deanship of Academic Development (DAD) has following organizational units under its patronage, namely:

1. Teaching & Learning Center
2. Educational Effectiveness and Efficiency Center
3. Learning Technology Center
4. Academic Assessment Center
5. Academic Studies Unit

Each of the center and unit carries out various activities in its specific domain and is headed by a Director who reports to the Dean. The Dean reports to the Vice President of Academic Affairs of the University. The Deanship has an Advisory Council and a Student Advisory Committee.

Teaching & Learning Center

KFUPM believes that every individual at KFUPM has a right to experience personal growth and development through enriched academic development opportunities. The purpose for establishing the Teaching & Learning Centre (TLC), as one of the centers of the Deanship of Academic Development, is to provide such experience by promoting excellence in teaching at all ranks and excellence in student learning inside and outside the classroom. The TLC empowers inspirational teaching and cutting-edge pedagogy through a number of developmental activities that include workshops, mini-courses, seminars, consulting services and resources to the faculty and graduate teaching assistants to enhance teaching and learning. The TLC also administers several academic development programs such as academic professional development program and academic leadership program as well as academic development grants.

Educational Effectiveness and Efficiency Center

The Educational Effectiveness & Efficiency Center (EEEC) has been established for the purpose of mapping and monitoring the educational processes of the university and maintaining a current registry of academic policies and procedures. The center works with academic departments to develop existing and new academic policies, procedures and/or guidelines. Processes are institutionalized to identify educational risks in conforming to such policies and procedures, and to systemically align their activities with the strategic goals.

EEEC has also developed strategies to document and update academic policies and procedures. The services of promoting and developing best practices in academic testing and evaluation have also been delegated to the EEEC.

Learning Technology Center

With new emerging instructional technologies and their influence on teaching and learning, it becomes a must to equip faculty members with the necessary skills and tools to cope with these developments and gain their benefits in teaching and learning. The Learning Technology Center (LTC) assists the University community in exploiting the potential of technology to enhance teaching and learning. LTC provides assistance to KFUPM faculty to enhance teaching and learning effectiveness through the development of interactive online supplementary material, organizing training workshops related to the development and delivery of online material, and organizing training workshops on the use of technology in the classroom. The center also operates, maintains, and provides technical support for the learning management system. In addition, the center advises the University on technological trends and tools that have the potential of benefiting the educational sector for possible adoption.

Academic Assessment Center

Continuous assessment is the key for quality assurance at the university. The aim of assessment is to understand how educational programs along with institutional processes and resources are working and to determine whether they are contributing to student growth and development. The Academic Assessment Center (AAC) focuses on activities at the campus related to the assessment of academic programs as well as the assessment of institutional processes and services. The center strives to achieve its mission towards developing quality education that meets local industry needs following reputable international standards. It provides the necessary services and support for the various academic programs at the University. It also facilitates and coordinates their efforts to meet their objectives and institutional goals.

Academic Studies Unit

Academic Studies Unit (ASU) provides a more scholarly basis to the programs and activities of the Deanship of Academic Development by conducting studies in support of the activities of the Deanship. The unit administers the online student feedback system for course and instructor evaluation and provides structured and on-demand reports about student feedback. The unit also conducts surveys and other similar studies at the university to identify needs for new academic approaches which may enhance student learning and achievement within academic programs. The unit also reviews the current literature and reports about new trends in the development of higher education.

DEANSHIP OF STUDENT AFFAIRS

The Deanship of Student Affairs deals with all issues concerning students and helps them from the joining date until graduation. According to its administrative structure, the Deanship consists of three main Assistant Deanships: Student Affairs, Employment & Training, and Counseling & Advising. The main units and departments of the Deanship include: the General Directorate of Student Affairs, Student Housing Department, Student Activities

Department, Student Fund, Counseling and Advising Center (CAAC), Training Department, Alumni Department, Career Guidance Department, Part-Time Unit, Scholarship Program Unit, Alumni Club, Religious Affairs Committee in Student Housing, and the Special Needs Office.

General Directorate of Student Affairs

The Deanship of Student Affairs is always concerned for the student and gives him full support and care since the day he joins the university until the day he graduates. The General Directorate of Student Affairs plays a vital and steady role in providing this care through the facilitation of the tasks of students in the University. The Directorate provides the following services for students: issuing identification certificates, clearance certificates, and low-price ticket certificates; issuing university ID's, contacting parents (when appropriate), issuing official medical excuses, and replying to all student inquires and directing the students to the appropriate parties.

The Student Records division plays a vital role in keeping the Deanship's documents and transactions in good order and in regularly updating the many regulations and instructions pertaining to the deanship. The work in this division is divided into two main areas:

1. Student records: to keep a student's original certificates when accepted into the University and any other formal papers during his stay at the University.
2. Various records: to keep all correspondences that come to the Deanship from its various departments in addition to bylaws and regulations.

Student Housing Department

To support KFUPM students' academic achievements, the University pays special attention to student accommodation. The Student Housing Department provides the requisite services and facilities for students on the university campus. The University aims to provide an accommodation environment that supports students in their studies and promotes their social communication. The student housing comprises modern buildings with about 4000 furnished rooms that can accommodate up to 8000 students. The students are received by the deanship or any other rules or regulations.living on campus enjoy many services including internet and phone services in each room, transportation to and from academic buildings, maintenance, hygiene, recreation facilities, car parking, and general services such as food supplies, student services, restaurants, and cafes. Moreover, students can enjoy and participate in several cultural, social, and sports activities organized by the students' clubs.

The student housing department uses an effective electronic system to manage student accommodation whereby students can submit their applications and execute a number of housing services electronically. In addition, they are kept well-informed about available lists of housing, and they can register in the lists announced by the Housing Department.

Student Activities Department

The primary objective that lies behind the attention paid to student activities is to provide a healthy and active atmosphere that enables each student to practice his hobbies, activities and suitable recreational preferences after the daily efforts exerted in studying. Students play the main role in planning all extracurricular activities that are coordinated and executed through students clubs, supervised by the Deanship of Student Affairs. The Department of Student Activities aims to help students to form a well-balanced personality and to invest their time in meaningful and fruitful programs to enhance their talents and abilities. Students also receive training in leadership, loyalty and in how to bear responsibility; brotherly ties among students are strengthened, and a spirit of cooperation and harmony is fostered among students and between students and their instructors. The department also provides opportunities for students to get to know some of the administrative and social aspects.

There are 40 clubs supervised by the Student Activities Department, covering all scientific disciplines in the University, as well as sports, social, cultural and art activities. The University through the student fund provides full financial support for all approved programs and activities proposed by the student clubs. The activities of students' clubs focus on establishing training courses, scientific visits, scientific competitions, lectures, exhibitions, excursions, cultural competitions, art, literary programs, scouting, sports activities, receiving school delegations, and representing the University in many forums in the Kingdom and internationally. There are allocated offices and halls for club members.

Training Department

The task of the Training Department is to follow up on all programs of Cooperative Training and Summer Training for all university students. It approaches various companies to provide training opportunities, nominates students for training in these companies, each according to his field, and then monitors their training until the end of the training period. Forming a triangular link between students, training companies and academic departments is the prime aim of the department.

The Cooperative Program (Coop) is a structured educational strategy, integrating the theoretical knowledge learned in the classrooms and laboratories with real world experiences. The Coop was first introduced at KFUPM in 1970. It is one of the graduation requirements and is considered as a graded nine credit hours for students in some academic majors. The Coop program extends for a period of twenty-eight weeks. The objectives of the program are to enable the student to link theory and practice, to provide guidance for future career opportunities, familiarize the student with the work environment after graduation, develop the student's work ethic, communication, management, and teamwork skills, and to establish strong relationships between the University and industry. The Coop Department is responsible for coordinating with the employers to provide suitable training opportunities for the students.

The Summer Training Program is similar to the cooperative program in its objectives except that it lasts for eight weeks. It is one of the graduation requirements for some academic departments. The Summer Training Department is responsible for coordinating with the employers to provide suitable training opportunities for the students.

Career Guidance Department

It is a specialized department to help students choose the most suitable major based on accurate information about their inclinations, attitudes and abilities. The information is obtained through various activities and events, including the use of the career Oasis program, which helps to determine the academic preferences of students according to their understanding and career goals. The Department informs students about the requirements of the job market and prepares them to get the right job through recruitment events , such as Open Day (during the first semester of the academic year), Career Day (during the second semester), and Specialty Day for Preparatory Year students. The Department provides short courses on decision-making and proper career planning, and arranges for personal pilot job interviews for students expected to graduate. Moreover, the department invites specialists from inside and outside the Kingdom to give lectures to help new students to choose the appropriate major. These lectures help students to clarify their perceptions in general, especially after hearing the outstanding experiences and stories of success from the guests.

Alumni Department

There are a number of tasks and services provided by this department. These include reviewing the graduation documents, having them signed by the the relevant University officials, and then delivering them to graduates, issuing certificates of good behavior, ratifying the document copies, preparing the final graduation certificates to be signed by concerned officials and delivering them to graduates, participating in the annual graduation and honor awards ceremonies, providing employers with requested information regarding the alumni for the purpose of recruitment, and informing alumni about the employment opportunities available in organizations and companies in the private and public sectors.

Scholarship Program Unit

Major national and international companies and government agencies provide scholarship opportunities for high achievers among the University students.This unit coordinates with different divisions of the University to provide the necessary support to such companies and agencies to announce their scholarship opportunities to all students and also to help them in identifying eligible and qualified students. The Scholarship Program Unit honors the signed agreement between the sponsoring agency and the student, delivers official documents and graduation certificates, and provides the necessary information to the concerned officials of the sponsoring agencies which include the academic status and progress of the student and the delivery of official documents and graduation certificates.

Part Time Unit

This unit coordinates part-time work inside the University, nominating and assigning students to part-time jobs based on the actual needs of the academic and administrative departments in the University.

Counseling and Advising Center (CAAC)

The main objective of the CAAC is to help equip KFUPM graduates with the right technical information and the proper personal skills. It aims to provide all students with academic and social counseling and advising. The CAAC has many objectives, among which are the following:

1. Assisting the students to achieve psychological, social and academic adjustment.
2. Psychological prevention of emotional and psychological disorder through primary and secondary prevention.
3. Assisting to modify unwanted behavior.
4. Psychological support to face psychological social and academic stresses.

5. Holding lectures workshops and discussions for educational and preventive goals.
6. Provide psychological, social and academic help, guidance and advice to all students.
7. Prepare new students for university life.
8. Activate/improve academic advising.
9. Looking after students with poor academic performance and providing the necessary guidance and follow ups.
10. Studying the behavior and common practices of student and the expected effects.

The services provided by the CAAC include counseling in the following forms:

1. ***Individual Counseling:*** A student meets with a counselor on a one-to-one basis to work through personal concerns.
2. ***Group Counseling:*** Counseling in groups offers a broad range of insight and support from peers and professional counselors.
3. ***Student/Guardian Counseling:*** Couples counseling works toward alleviating the strains in close relationships. In such cases, one of the relatives, usually the father or a brother, are contacted and asked to visit the center.

Counseling is a collaborative process, which involves the development of a unique, confidential helping relationship. The CAAC treats all of its contacts with students in a highly confidential manner.

In addition, the CAAC arranges and conducts skill-building workshops and interactive seminars, which provide a structured presentation of information and skills practice appropriate to the students' personal development and career in the University. The CAAC participates in the issuance of bulletins and brochures on different topics that relate to student life and skill development. The Center also participates with relevant departments in supervising the social activities in the student dorms and it participates in planning and conducting the introductory (preparatory) program for new students. Furthermore, the Center studies student requests related to loans and financial aid, the part-time employment program, and housing, and makes the appropriate recommendation. It also interviews students who are planning to withdraw from the University and provides them with appropriate alternatives.

Faculty members are encouraged to utilize the services of the CAAC by referring the student to the Center or by seeking advice on what might be done for a particular student or group of students.

Student Fund

The Student Fund, established in 1406 H / 1986 by a decision of the the University Council, is considered to be one of the most important elements of the Deanship of Student Affairs as it is directly connected with the student and his financial needs .

The Student Fund performs various tasks including the financial assistance for students through subsidy and loans, as well as provides incentives for honor students. One of the vital tasks of the Student Fund is to support the students’ activities through Student Activities Clubs. The Student Fund also contributes to cooperative projects that would benefit the students.

The Student Fund council management includes the Dean of Student Affairs (President), the Assistant Dean for Student Affairs (Vice President), the Executive Manager for the Student Fund (member), the Financial Controller (member), three faculty members (members), and three distinguished students (members).

Alumni Club

The Club was established by the University Board in 1420 H /1999 and its headquarters are located at KFUPM in Dhahran. It aims to enhance the role of alumni in serving the Kingdom and society. The Club provides continuous communication with alumni, aiming to strengthen the relations between the University and the establishments where alumni are working and encouraging them to contribute finicial and moral support to University programs and activities. The membership of the Club is divided into active, associate, and honorary membership. The Club has a council consisting of nine members who meet the selection requirements established by the University Council, and are chosen for three years (renewable) by the University Council as per the nomination of the Rector of the University The head of the council is a member of the KFUPM Board of Executives.

Religious Affairs Committee in Student Housing

The Islamic religion and moral values form an important part of the student's life in the University, so that the Deanship has focused on the allocation of a committee for Religious Affairs in Student Housing. This committee supervises a number of activities including:

1. Sport competitions and courses among groups.
2. Religious lectures during the week days.
3. Brief meetings after Isha prayer or Fajr prayer to discuss some religious issues.
4. Religious seminars, open discussion that would be held periodically.

GRADUATION

Upon satisfactory completion of all requirements for a degree from the University, students are invited to participate in the graduation ceremony. This colorful, time-honored university tradition, was instituted at KFUPM in 1972, and was the first such ceremony to be held at a university in Saudi Arabia.

A unique feature of the graduation ceremony is the dress worn by graduates. Designed especially for KFUPM, the gown is the Arabian *meshlah*, featuring the color of the specific college from which a particular student graduates. Instead of the usual "mortarboard" cap, the KFUPM graduate wears his traditional *ghutra* and *egal*.

The ceremony and the dresses are an impressive blending of academic and Arabian traditions.

ACADEMIC REGULATIONS

ACADEMIC REGULATIONS AND IMPLEMENTATIONS

The Undergraduate Study and Examinations Regulations and the KFUPM Rules for Their Implementation issued by the Deanship of Admissions and Registrations, Second Edition 2011/2012, is the basis of Articles (A1) to (A53) and their Implementations, provided herewith.

The Deanship of Admissions and Registrations will provide any further assistance in this matter.

DEFINITIONS

Article One

The Academic Year is:	Two regular semesters and a summer semester, if any.
The Academic Semester is:	A term of no less than (15) weeks of instruction not including the registration and final examination periods.
The Summer Semester is:	A period of instruction not exceeding (8) weeks not including the registration and final examination periods. The weekly duration of each course in the summer semesters is twice its duration during a regular academic semester.
The Academic Level:	Indicates the study level in accordance with the specifications of each approved degree plan.
The Degree Plan is:	A combination of required, technical elective and free-elective courses that constitute the total number of credit hours required for graduation in a major. The student has to successfully pass the specified courses in order to earn the degree in that major.
A Course is:	A subject of study within a certain academic level of the approved degree plan in each major. Each course has a number, code, title and a detailed description of its contents which distinguishes it from the other courses. A special file of each course is kept in the corresponding department for follow-up, evaluation and updating purposes. Some of the courses may have pre-requisite or co-requisite requirement(s).
The Credit Hour is:	Each of the weekly lectures or clinical lessons with a duration not less than 50 minutes or a laboratory session or field study of not less than 100 minutes duration.
Academic Probation is:	A notification given to a student with a cumulative GPA below the minimum acceptable limit as explained in these regulations.

The Class Work Score is:	The score which reflects the student's standing during a semester according to his performance in the examinations, research and other activities related to a particular course.
The Final Examination is:	An examination in the course, given once at the end of every semester.
The Final Examination Score is:	The score attained by the student in each course in the final examination.
The Final Score is:	The total of the class work score plus the final examination score calculated for each course out of a total grade of 100.
The Course Grade is:	A percentage, or alphabetical letter, assigned to a student, indicating the final grade he received in a course.
Incomplete Grade is:	A provisional grade assigned to each course in which a student fails to complete the requirements by the required date. This is indicated in the academic record by the letter grade "IC".
In Progress Grade is:	A provisional grade assigned to each course which requires more than one semester to complete. The letter grade "IP" is assigned in this case.
Semester GPA is:	The total quality points the student has achieved, divided by the credit-hours assigned for all the courses the student has taken in any semester. The quality points are calculated by multiplying the credit-hours by the grade earned in each course (see Appendix B).
Cumulative GPA is:	The total quality points the student has achieved in all courses he has taken since his enrollment at the University, divided by the total number of credit-hours assigned for these courses (see Appendix B).
Graduation Ranking is:	The assessment of the student's scholastic achievement during his study at the University.
Course Load is	The total number of credit hours a student is allowed to register in a semester. The upper and lower limits of the course load are fixed as per the implementation rules of the university.

DEFINITIONS OF TERMS USED IN THE IMPLEMENTATION RULES

The Grading System applicable at KFUPM	Appendix "C" shows the grading system applicable at the University including the points assigned to each grade. The maximum GPA a student may attain is 4.00.
Transcript	An official document that includes all the courses a student has taken at the University as of the date of its printing. It indicates course codes, numbers and credit hours, the grades earned by the student, semester GPA, and cumulative GPA. In addition, it includes the list of courses and credits transferred, if any.
Major GPA	The major GPA is calculated on the basis of all the letter grades assigned in the courses taken in the student's major, as specified in the degree plan. The major GPA is determined by the last grade assigned in each course.
The Credit-Hour for the Laboratory or Field Sessions	The duration of laboratory sessions or field study usually ranges from 150 to 200 minutes; a minimum of 100 minutes is assigned in some programs.
The Admission & Academic Standing Committee	This is a consultative committee set up by the Rector of the University to study applications for transfer, readmission petitions, suspensions, and dismissals, and to reach the appropriate recommendations in accordance with the regulations.
Promotion from Prep-Year Courses	This is based upon successfully passing all or some of the Prep-Year courses in accordance with the rules set by the University.
The Cooperative Program	A period not exceeding (28) weeks of on-the-job training spent by the student, as per the requirement of his major. The student must complete the cooperative program before his last semester at the University.
Summer Training	A period not exceeding (8) weeks of on-the-job training spent by the student, as per the requirement of his major. The student must complete the summer training before his last semester at the University.

ADMISSION OF NEW STUDENTS

Article Two

Based upon the recommendation of the college councils and the other concerned bodies of the University, the University Council determines the number of new students to be admitted in the following academic year.

Implementation Rules of Article Two

1. The Deanship of Admissions & Registration prepares a draft recommendation to the University Council in coordination with the concerned bodies of the University regarding the number of students to be admitted into the university during the following academic year.
2. The Deanship of Admissions & Registration and the colleges in the University coordinate with each other in the matter of determining the majors of the students who are expected to complete the Preparatory Year Program. The major of these students will be determined according to their own choice, based upon the conditions set by the University.

Article Three

An applicant for admission to the University must satisfy the following conditions.

a. He should have a secondary school certificate, or its equivalent from inside or outside the Kingdom of Saudi Arabia.
b. He should have obtained his secondary school certificate in a period of less than 5 years prior to the date of application. However, the University Council may waive this condition if the applicant has a satisfactory explanation.
c. He must have a record of good conduct.
d. He must successfully pass any examination or personal interviews as determined by the University Council.
e. He must be physically fit and healthy.
f. He must obtain the approval of his employer, if he is an employee of any government or private agency.
g. He must satisfy any other conditions the University Council may deem necessary at the time of application.

Implementation Rules of Article Three

Applicants having Saudi secondary school certificates must have majored in the natural sciences. If the applicant earned his secondary school certificate from outside the Kingdom, equivalent requirements apply.

Article Four

Admission is granted to applicants who satisfy all admission requirements, and is based on the applicant's grades in the secondary school examinations, the interviews and admission examinations, if any.

Implementation Rules of Article Four

1. After the completion of the admission examinations, the Deanship of Admissions & Registration makes a recommendation to admit the candidates who fulfilled the criteria based on the highest compound evaluation and the capacity designated by the University. After the Rector of the University approves the recommendation, candidates are informed accordingly.

2. Admission will be canceled for candidates who have been informed of their admission but fail to report on the designated time.

3. All newly admitted students are required to complete the Preparatory Year Program before starting their undergraduate study. Students may be exempted from part or the whole program according to the implementation rules of the promotion exams.

4. The Preparatory Year Program

4.1 The Preparatory Year Program aims at preparing the newly admitted students for undergraduate study and university life, and enhancing their opportunity for success and excellence through the following:

a. Developing students' skills in English to enable them to study and communicate in English during their undergraduate study.
b. Strengthening students' understanding and comprehension of basic mathematical concepts, and developing their analytical and critical thinking abilities through solution approaches to mathematical problems.
c. Providing the students with the basic knowledge and skills to prepare them for academic endeavor, develop effective learning styles, adapt to University life, choose their field of study, and practice a healthy lifestyle.

4.2 The duration of the Preparatory Year Program is one academic year, (the summer semester, if necessary), during which English, Mathematics, or any other courses that the University deems necessary, are offered.

4.3 The grades earned by the student in the preparatory year courses are recorded in his transcript together with the semester GPA and his cumulative GPA. However, these grades are not counted in calculation of cumulative GPA for the undergraduate program. The effect of the academic status assigned to the student at the end of his last semester in the preparatory year continues through his subsequent University academic level (i.e., first semester of the freshman year).

4.4 If a student earns a grade of C or above in all the English and Mathematics courses, and a grade of D or above in the remaining preparatory year courses in the allowed period, then he will be promoted to the first academic level in the University, and has the right to select a major of his choice in accordance with the rules set by the University.

4.5 A student may be exempted from studying Preparatory Year English module(s), if he proves his proficiency in English before starting study in the Preparatory Year Program as per rules set by the University.

4.6 If a student successfully passes all the preparatory year English modules, and is left with the remaining preparatory year courses, he may be allowed to register for some University courses in accordance with the rules set by the University.

4.7 A student will be dismissed from the Preparatory Year Program if either:

1. He earns the grade less than C three times or more in all English Modules or earns the grade F or DN or WF twice consecutively in the same Mathematics preparatory year course; or

2. He fails to complete all the preparatory year courses within the duration of the program in addition to a maximum of one half of that duration.

ACADEMIC REGULATIONS

Article Five

a. The student gradually progresses in his study in accordance with the implementation rules approved by the University Council.
b. Degree plans of undergraduate study are designed to comprise a minimum of eight (8) semesters.

Implementation Rules of Article Five

1. The University publishes for the students through available means all rules, regulations, and requirements related to study and graduation at the University, which students are responsible to know and follow. Academic advisors assist students in planning their academic programs, but their academic advising activities do not relieve students of this responsibility. Therefore every student should be thoroughly familiar with all the academic regulations and the degree conferral system and remain informed about them throughout his career at the University. A student may consult with his academic advisor or the department's Chairman in this respect.

2. The University assigns an academic advisor to each student to assist him in matters relating to his academic progress such as:

   a. selecting a degree program consistent with the student's objectives and ability;
   b. interpreting and understanding the academic regulations;
   c. informing the student of the sequence of required and elective courses in his degree program and suggesting electives;
   d. monitoring the student's progress and performance;
   e. assisting in early registration and other registration activities; and
   f. assisting in course substitution, if necessary.

   The academic advisor is a faculty member in the academic department or the college in which the student is enrolled. The advisor of the preparatory year students is the Assistant Dean for Preparatory Year Affairs in the College of Applied & Supporting Studies or anyone else assigned to act as an advisor amongst the faculty members.

3. Degree Plan

The courses of each degree are spread over academic levels. The required as well as elective courses and the number of credit hours that a student needs to successfully complete in order to receive a degree in his major field are clearly specified for each academic level. This distribution of courses and credit hours is called "the Degree Plan". All degree plans are approved by the University Council. The academic departments regularly review and update the degree plans in order to provide students with continuously updated programs. The following rules apply to the degree plans.

a. The academic departments select the acceptable elective courses and present them to the relevant College Council. The approved list is forwarded to the Deanship of Admissions & Registration for implementation.

b. In special circumstances, some students may change from one degree plan to another, provided this does not affect their graduation requirements.

c. In introducing any changes to a degree plan, it is anticipated that some courses may not be offered, or may be discontinued, or new courses may be included in the degree plan. Therefore, the concerned academic department should take into consideration the time needed for out-of-phase students by introducing an implementation plan that allows them to complete their graduation requirements in accordance with their original degree plan.

d. If the old degree plan requires studying a course that has been canceled, and consequently it becomes impossible to register for such a course, the course could be substituted by an alternative course, consistent in level, subject area, and credit hours, with the approval of the academic advisor, the department council, and the relevant Vice Rector of the University. The Deanship of Admissions & Registration should be informed about the approval of this substitution for implementation.

e. A readmitted student will be subject to the degree plan assigned to him during his last semester at the University before receiving discontinued status. However, if this plan has been canceled, he will be placed in the most recent plan in his major based on a recommendation from the academic department concerned.

f. Students are required to study within the framework of their approved degree plan and once they fulfill all the requirements they are nominated for graduation.

4. Assignment of Academic Status

A student's academic status will be determined at the end of each semester and will appear on the transcript that shows his achievements throughout his undergraduate study. However, the summer semester does not change the academic status. A student's academic status may be one of the following:

Good Standing

Good Standing status is maintained when the student's cumulative GPA and semester GPA are at least 2.00. Students are expected to maintain this standing till their graduation.

Academic Warning

A student will be placed under Academic Warning status after the final grades have been processed at the end of each semester (except summer semester) if any of the following cases occurs:

a. his cumulative GPA is less than 2.00 but more than 1.00;
b. his semester GPA is less than 2.00.

Academic Probation

A student is placed under Academic Probation status after the final grades have been processed at the end of each semester (except summer semester), if his cumulative GPA is less than 1.00.

5. Discontinuation from Study

Carrying forward the academic status that was assigned to a student at the end of his last semester in the Preparatory Year program, he shall be discontinued for at least one semester if any of the following cases occurs:

a. his semester GPA is less than 1.00;
b. he was previously on academic warning or probation in a regular semester and in the next term achieved a semester GPA of less than 1.75;
c. the student receives three consecutive academic warnings.

The Rector of the University may however give the student an opportunity to continue his studies following the recommendation of the Admission & Academic Standing Committee.

6. Ending of Academic Warning or Discontinuation Status

a. After the lapse of one regular semester from issuing the warning or probation, the academic status can be revoked if the student achieves a semester and cumulative GPA of 2.00 or above at the end of that semester.
b. A student who has been discontinued may apply for readmission within the period specified by the Deanship of Admissions & Registration. The Admission and Academic Standing Committee, in coordination with the concerned college, if needed, considers applications for readmission of the student. The discontinuation period is not counted in the period required to finish the degree.

7. Conferral of Two Undergraduate Degrees

After obtaining the approval of the two department councils and the two college councils concerned, a student may apply for two undergraduate degrees provided he has completed at least 32 credit hours and his cumulative GPA is not less than 3.00. The two degrees are granted when the following requirements are fulfilled:

a. The course and cumulative GPA requirements for each degree must be individually satisfied.

b. The total credit-hours completed should be at least 28 in excess of that which is required by whichever of the two degree programs carries the higher credit-hour requirement.
c. If both programs have cooperative assignments, the student may take one assignment and substitute the other by taking courses as determined by the councils of the two colleges concerned, in accordance with the study plan of the two degrees.
d. If both programs require summer training, the student may undertake one program as per the recommendation of the councils of the two colleges concerned.

8. KFUPM employees may be admitted and registered for an undergraduate program on a part-time basis in accordance with the procedures approved by the Rector of the University.

THE ACADEMIC LEVELS SYSTEM

Article Six

According to the rules and regulations established by the University Council, some colleges may formulate their programs on the basis of a full academic year. In this case the academic year is equivalent to two academic levels.

Article Seven

The academic levels system divides the academic year into two regular semesters. There may be a summer semester, the duration of which is considered as half a regular semester. The degree requirements are divided into various levels in accordance with the degree plan approved by the University Council.

Implementation Rules of Article Seven

For some of the University programs, a semester may be divided into two parts. The governing regulations shall be approved by the University Council.

Article Eight

The University Council sets up the detailed regulations which govern registration, dropping, and adding of courses within the levels of the approved degree plan while ensuring the specified minimum course load for the students.

Implementation Rules of Article Eight

1. Registration Procedures

1.1 The approval of the academic advisor is required for completing the registration process in accordance with the rules set by the University.

1.2 Early Registration

At approximately the middle of the first (fall) semester, early registration is held for the courses to be taken by students during the second (spring) semester; and in the middle of the second semester, early registration is held for both the coming summer semester and the first semester of the following academic year. Early registration is required of all enrolled students during the semester. Students who early registered for a particular semester are also required to do registration confirmation on the scheduled registration day for that semester.

1.3 <u>Formal Registration Confirmation</u>

Formal registration confirmation is held at the beginning of each semester or summer semester. Students are required to complete registration confirmation as specified in the academic calendar. Each student must do registration confirmation himself. Registration by proxy or any other way is not permitted at all.

1.4 <u>Late Registration</u>:

If necessary, a student may be allowed to register late during the period specified in the academic calendar, in accordance with the rules set by the University. The student is responsible for all the consequences of his late registration.

1.5 <u>Adding and Dropping Courses</u>

A student may change his registration by adding some courses during the period specified in the academic calendar. Also, courses will not appear in the student's transcript if dropped during the first two weeks of classes in a regular semester (the first week in a summer semester). The following conditions apply:

First: <u>Dropping Courses</u>

a. The course load must remain at or above the minimum allowable limit. See Implementation Rules of this Article.
b. If the course being dropped is a co-requisite for another registered course, the two courses should be dropped simultaneously, or continued to be studied together.
   (See Implementation Rules of Article 13.)

Second: <u>Adding Courses</u>

a. The course load should not exceed the maximum allowable limit (See Implementation Rules of this Article).
b. The courses added should not result in a conflict in the student's schedule or final examinations.
c. If a student desires to add a course section that is closed, and taking into consideration the evenness of distribution of students among sections of that course, then he must get the approval of the Chairman of department offering the course, and submit it to the Deanship of Admissions & Registration within the specified time.

2. <u>Auditing a Course</u>

A student can change the status of a course for which he has already registered, from regular to audit, with the concurrence of the course instructor and subsequent approval of the Chairman of the department offering the course, and the Chairman of the student's major department. However, while making a request to audit a course, the student must bear in mind that:

a. he can audit a course only if he is expected to graduate in the current semester;
b. he cannot audit a course that he needs in order to graduate;
c. the "audit" status for a course cannot be changed to "credit" status after the “adding” period;
d. once a course has been audited, it cannot be repeated for credit in subsequent semester(s) except if it is a required course in a new major. This exception will require approval of the advisor, the Chairman of the (major) department, the Dean of the college and the Vice Rector for Academic Affairs;
e. the deadline for receiving audit requests by the Deanship of Admissions & Registration is the last day for dropping course(s) with the grade of W in the respective term as indicated in the academic calendar. (See Implementation Rules for Article 28.)

3. Course Substitution in the Degree Plan

Some courses can be exchanged or substituted by other courses with the approval of the relevant Vice Rector of the University, then informing the Deanship of Admissions & Registration for implementation. This is only possible in cases such as: if certain courses in the student’s degree plan are discontinued, or changes are made in the contents of a course, or a new curriculum is adopted that does not include certain courses required by the student.

4. Repeating a Course

A student who obtains a failing grade in a required course must repeat this course. Additionally, a student can repeat a course for which he previously obtained a D or D+ grade. The last grade will reflect the student's performance in such a course. Should a student repeat a required course in which he had earned a D or D+ grade, and fail, he must repeat the course and get a passing grade. All the grades are included in the GPA calculation in the student’s transcript.

5. Enrollment in the Cooperative Program

Some students, according to the requirements of their majors and degree plans, should spend a period (not exceeding 28 weeks) of practical training in their major field. The student must remain in continuous contact with his academic department during the training period. In order to qualify for enrollment in this program the student should:

a. have completed more than 85 credit hours of his degree plan and should complete the cooperative assignment before his last semester at the University;
b. have completed all the required courses as identified by his major department;
c. have a cumulative GPA and major GPA of 2.00 or above;
d. not be discontinued from study.
e. not be allowed to take any other courses along with the Cooperative Program.

6. Enrollment in Summer Training

Some students, according to the requirements of their majors and degree plans, should spend a summer training period of eight (8) weeks in their major field. The student should complete the summer training period before his last semester at the University. In order to qualify for enrollment in this program the student should:

a. have completed more than 65 credit hours of his degree plan;
b. have completed all the required courses as identified by his major department;
c. have a cumulative GPA and major GPA of 2.00 or above;
d. not be discontinued from study;
e. not be allowed to take any other courses along with the Summer Training.

7. Course Load

A course load is defined as the number of credit-hours for which a student is registered in a regular semester or a summer semester. The course load varies from one major to another and is determined as follows:

(a) The Minimum and Maximum Course Load Limit in a Regular Semester for a Student with Good Standing:

- The minimum course load limit is 12 credit hours during a regular semester. However, this condition will be relaxed in the last semester before graduation.
- The maximum course load is 19 credit hours.
- A student is permitted to register for 21 credit hours with the approval of his department Chairman, if the student has maintained a minimum cumulative GPA of 3.00 in the preceding semesters that include the last 28 credit hours taken by the student.
- The maximum course load in a summer semester is 8 credit hours.

(b) Minimum and Maximum Course Load for a Student on Academic Warning or Probation:

- The minimum course load is 12 credit hours in a regular semester.
- The maximum course load is 15 credit hours in a regular semester.
- The maximum course load is 7 credit hours in a summer semester.

(c) Maximum Course Load for a Student in his Last Term Before Graduation

- The maximum course load is 20 credit hours in a regular semester.
- The maximum course load is 9 credit hours in a summer semester.
- The student should have maintained a minimum cumulative GPA of 2.00 in the preceding semesters that include the last 28 credit hours taken by the student.

8. Student Transcript of Academic Record

8.1 At the end of each academic term, a copy of the student's academic record (the Transcript) is made available for him. No copy of the transcript is issued, given or sent to any outside agency or any other person without a written authorization by the student. No partial records are issued. The transcript must comprise the complete academic record of the student from the date of admission to the issue date.

8.2 The accuracy of a student record is of the utmost importance and errors should be brought to the immediate attention of the Deanship of Admissions & Registration.

ATTENDANCE AND WITHDRAWAL

Article Nine

A regular student should attend all classes and laboratory sessions. A student may be discontinued from a course and denied entrance to the final examination if his attendance is less than the limit determined by the University Council. This limit cannot be less than 75% of classes and lab sessions assigned to each course during the semester. A student who is denied entrance to the examination due to excessive absences will be considered as having failed that course with a DN grade.

Implementation Rules of Article Nine

If the number of unexcused absences for a student exceeds 20% of the lecture and laboratory sessions scheduled for a course, then he is not allowed to continue in the course or take the final examination and shall be given a DN grade by the course instructor with the department Chairman's approval.

Article Ten

The college council - or whatever body it delegates its authority to - may exempt a student from the provisions of Article Nine and allow him to attend the final examination if he provides an excuse acceptable to the council. For such an exemption provided by the University Council, the minimum attendance requirement is not less than 50% of the lecture and laboratory sessions scheduled for the course.

Implementation Rules of Article Ten

1. If the attendance of a student is less than two thirds (2/3) of the lecture and laboratory sessions scheduled for a course, then he is not allowed to continue in the course or take the final examination and shall be given a DN grade by the course instructor with the approval of the department's Chairman.

2. The college council - or whatever body it delegates its authority to - may revoke the DN grade assigned to the student in a course, and allow him to continue in that course and take the final examination if he furnishes an excuse acceptable to the council, provided that his total attendance in the lecture and laboratory sessions is not less than two thirds (2/3), and his unexcused absences do not exceed 20%, as the Implementation Rule for Article Nine applies for his case.

Article Eleven

A student who fails to attend the final examination will be given zero in that examination. In this case, his course grade will be calculated on the basis of the class work score he earned in the course.

Article Twelve

If a student fails to attend the final examination of any of his scheduled courses due to circumstances beyond his control, the college council, in exceptional cases, may accept the excuse and arrange a make-up examination for the student within a period not exceeding the end of the next semester. In such cases the course grade will be given to the student after the make-up examination.

Implementation Rules of Article Twelve

1. The student must furnish the excuse to his instructor and request a make-up examination before the end of the next regular semester.

2. The course instructor shall submit his report to the department Chairman for presentation to the departmental council and then the college council.

3. Under exceptionally pressing circumstances, the college council may accept the student's excuse and give him a make-up examination before the end of the following semester. The final grade will be given to the student after that make-up examination.

Article Thirteen

(a) A student may be allowed to withdraw for a semester and not be considered as having failed the courses if he furnishes an acceptable excuse to the authorized body as determined by the University Council, during the time period specified in the implementation rules approved by the University Council. The student is given a “W” grade for the courses, and the semester is counted towards the period required to complete graduation requirements.

(b) A student may withdraw from a course or a number of courses in accordance with the implementation rules approved by the University Council.

Implementation Rules of Article Thirteen

1. The Deanship of Student Affairs shall study all applications for withdrawal for the semester. If the request is approved, withdrawal procedures are completed at the Deanship of Admissions & Registration, and the student’s enrollment is suspended.

2. If a student has received any course grades before submitting an application to withdraw for a semester, all such grades are retained in his academic record.

3. A student is not allowed to withdraw for more than two consecutive and three non-consecutive semesters during his entire course of study at the university. The Rector of the University, or whomever he delegates his authority, may exempt a student from this provision. The period of interruption of study is counted towards the period required to

complete graduation requirements.

4. A student may withdraw from a course or a number of courses during the periods specified in the academic calendar that is approved by the University Council as follows:

   - withdraw from a course or a number of courses without permanent record during the first two weeks of a regular semester.
   - withdraw from a course or a number of courses with “W” grade during the next four weeks.
   - withdraw from all courses with “W” grade during the four weeks that follow.
   - withdraw from all courses during the very next four weeks and his grade in each course is determined as "Withdrawn with Pass (WP)" or "Withdrawn with Fail (WF)". The grade will be assigned by the instructor, with the approval of the department Chairman, in the light of the student's performance before his application to withdraw.

5. If a student withdraws during the 15th week, Article Eleven applies.

6. A Preparatory Year student is not allowed to withdraw from any course or a number of courses included in the Preparatory Year Program. However, if he wants to withdraw from all courses, the withdrawal system/schedule indicated in the Preparatory Year academic calendar approved by the University Council shall apply.

INTERRUPTION AND SUSPENSION OF ENROLLMENT

Article Fourteen

A student may submit an application for suspension of enrollment, for reasons acceptable to the college council, provided the suspension period does not exceed two consecutive semesters, or a maximum of three non-consecutive semesters, during his entire course of study at the University. Otherwise, his enrollment status will be canceled. However, the University Council may, at its discretion, make exceptions to this rule, and the suspension period will not be counted towards the period required to complete graduation requirements.

Implementation Rules of Article Fourteen

1. The Deanship of Admissions & Registration studies and makes a decision on all applications for suspension of enrollment for the semester. Then the student’s enrollment is suspended.

Article Fifteen

If a student interrupts his studies for one semester without submitting an application for suspension of enrollment, his enrollment status at the University will be canceled. The University Council however, may at its discretion, cancel a student's enrollment status if he discontinues his studies for a period of less than one semester. As for student studying by association, his enrollment is canceled if he becomes absent from all final examinations for the semester without presenting an acceptable excuse.

Article Sixteen

A student is not considered to have interrupted his studies during the terms he spends as a visiting student in other universities.

RE-ENROLLMENT

Article Seventeen

A student, whose enrollment status has been canceled, may apply for re-enrollment with the same University ID 'number and academic record he had before his suspension, provided:

a. that he applies for re-enrollment within four regular semesters from the date of cancellation of his enrollment status;
b. the relevant college council and concerned departments agree on his re-enrollment;
c. that four or more semesters have lapsed since cancellation of his enrollment, in which case the student can apply to the University for admission as a new student without considering his old academic record, if he fulfills all the admission requirements for new students. The University Council may exempt a student from this provision in accordance with the regulations issued by the Council;
d. that he has not been re-enrolled previously. Under exceptionally pressing circumstances, the University Council may exempt a student from this condition; and
e. that he was not dismissed for academic reasons.

Implementation Rules of Article Seventeen

1. A suspended student should submit his re-enrollment application to the Deanship of Admissions & Registration, during the period specified by the Deanship, before the beginning of the semester in which he intends to resume study.
2. The Deanship of Admissions & Registration coordinates with the relevant college council in order to arrive at a decision regarding the application.
3. A student who interrupts his studies for more than four semesters may apply for admission as a new student if he fulfills all admission requirements for new students. No credits will be transferred from his previous record, though such credits will appear in his new academic record.
4. This article does not apply to students who are dismissed.

Article Eighteen

A student who has been dismissed from the University for academic or disciplinary reasons - or from other universities for disciplinary reasons - will not be re-enrolled at the University. If it becomes known later that a student has been dismissed for such reasons, his enrollment will automatically be considered null and void as of the re-enrollment date.

GRADUATION

Article Nineteen

1. A student graduates after successfully completing the graduation requirements according to the degree plan, provided his cumulative GPA is not less than what is specified by the University Council for each major, and in any case is not less than "Pass".
2. Following the recommendation of the department council, the college council may determine certain additional courses the student should take to improve his cumulative GPA if he has passed the required courses, but his graduation GPA is not satisfied.

Implementation Rules of Article Nineteen

1. A student should successfully complete all graduation requirements according to the degree plan of his major.
2. A student must attain a cumulative GPA and major GPA of 2.00 or above to graduate.
3. To obtain any degree from KFUPM, the student must have studied at KFUPM a minimum of 65 credit-hours, including at least 25 credit hours in his major field.
4. The Deanship of Admissions & Registration will prepare a list of students expected to graduate at the end of each semester, and present it to the University Council.
5. The Deanship of Admissions & Registration notifies the relevant departments to review the academic records and degree plans of all candidates for graduation to ensure that they have satisfied all graduation requirements. Then, the departments provide the Deanship of Admissions & Registration with a list of the students who qualify for graduation.
6. The Deanship of Admissions & Registration minutely reviews and checks all student records to ensure that all the graduation requirements have been completed.
7. The Deanship of Admissions & Registration shall prepare a list of students who have actually graduated at the end of each semester, and present it to the University Council.
8. A graduating student is obliged to obtain a clearance form from the Deanship of Student Affairs and have it signed by the following departments:
   The Central Library, Bookstore, Security, Medical Center, Student Housing, Academic Major Department, Student Fund, Deanship of Admissions & Registration, Accounting, and any other departments as determined by the Deanship of Student Affairs.
9. The Deanship of Admissions & Registration prepares and issues the official graduation certificates and degrees and maintains copies of these documents.
10. No change is to be introduced to the academic record in any case after the graduation document is issued.

DISMISSAL

Article Twenty

Dismissal from the University will occur in the following circumstances:

a. A student will be dismissed if he obtains a maximum of three consecutive academic probations as the result of his cumulative GPA being less than the GPA needed for graduation as per Article 19 of these regulations. Following the recommendation of the college council, the University Council may allow the student a fourth opportunity to improve his cumulative GPA by taking additional courses.

b. A student will be dismissed if he fails to complete the graduation requirements within a maximum additional period equal to one half of the period determined for his graduation in the original program period. The University Council, however, may exempt the student from this restriction and give him the opportunity to complete the graduation requirements within an additional period of maximum duration equal to that of the original program.
c. The University Council, in exceptional cases, may address status of the students on whom the provisions of (a) and (b) above apply, and give them an additional opportunity not exceeding two semesters to complete the graduation requirements.

Implementation Rules of Article Twenty

1. A student is dismissed if he receives three consecutive academic probations.
2. Following the recommendation of the Deanship of Admissions & Registration in coordination with the college council, the University Council may allow the student a fourth opportunity to improve his cumulative GPA.
3. A student is dismissed if he fails to complete the graduation requirements within an additional period equal to one half of the original program's duration. The University Council, based upon the recommendation of the Deanship of Admissions & Registration in coordination with the college council, may exempt the student from this restriction and give him the opportunity to complete the graduation requirements within an additional period of maximum duration equal to that of the original program.
4. A student is dismissed if he fails to complete the graduation requirements within an additional period equal of to that of the original program’s duration. Following the recommendation of the Deanship of Admissions & Registration in coordination with the college council, the University Council may grant the student an additional opportunity not exceeding two regular semesters to complete the graduation requirements.
5. The Deanship of Admissions & Registration informs the student of his dismissal and cancels his enrollment.
6. A dismissed student is obliged to obtain a clearance form from the Deanship of Student Affairs and have it signed by all the relevant departments as mentioned in Article Nineteen.

STUDY BY AFFILIATION

Article Twenty-One

Based upon the recommendation of the colleges, the University Council may adopt the principle of admission by affiliation in some colleges and majors which allow this option. The University Council sets the rules and regulations for affiliation according to the following parameters:

(a) The credit-hours required for the graduation of an associate student should not be less than the credit-hours required of a regular student.
(b) The associate student will be treated, with regard to admission, grading, transfer, dismissal and re-enrollment, in exactly the same manner as a regular student except the requirement regarding class attendance.
(c) On the basis of the college council's recommendation, the University Council determines the rules required to evaluate the performance of associate students.

(d) The student transcript, graduation certificate, and degree, must indicate that the student has studied "by affiliation".

EXAMINATIONS AND GRADES

Article Twenty-Two

The class work score shall comprise not less than 30% of the course total score, as found by the college council on the basis of the recommendation of the department council offering the course.

Article Twenty-Three

The class work score is evaluated either by:

(a) oral and practical examinations, research, other class activities or some or part of all these and at least one written examination; or,
(b) at least two written examinations.

Article Twenty-Four

Based upon the recommendation of the department council offering the course, the college council may include practical or oral tests in the final examination of any course, and allocate a percentage to these tests as part of the final examination score.

Article Twenty-Five

Upon the instructor's recommendation, the council of the department which teaches the course may allow the student to complete the requirements of any course during the next term. In such an event, the grade IC will be recorded for the student in his academic record. IC grades are not included in the calculation of the semester and cumulative GPA until the student obtains his final grade in the course by completing all the requirements. If no change has been made in the IC grade after the lapse of one semester, the IC status will be changed to an F grade which will be included in the calculation of semester and cumulative GPA.

Implementation Rules of Article Twenty-Five

1. The course instructor may allow the student to complete the course requirements during the following term if there are exceptional circumstances which are beyond the student's control.
2. The course instructor assigns an IC grade for the student and submits a report to the department Chairman indicating the reasons and justifications for assigning the IC grade, and identifies the work and the time required to complete the course requirements.
3. The student must complete the course requirements by the end of the next regular semester. However, exceptions may be made in the following cases:
   (a) A student who attained an IC grade in the co-op program may, with the approval of the department Chairman, extend completion of the course requirements for one additional regular semester.
   (b) A student who attained an IC grade in a course in the semester preceding his co-op program may, with the approval of the department Chairman, extend completion of

that course's requirements within a maximum period of one regular semester after returning from the co-op program.

4. When the student completes the course requirements within the specified period, the course instructor changes the student grade from IC to the new earned grade. The instructor also informs the Deanship of Admissions & Registration of the grade change within this period through the department Chairman concerned.
5. The Deanship of Admissions & Registration changes the grade to F and informs the student, course instructor and department Chairman accordingly if the grade has not been changed by the instructor within the specified period.
6. A student cannot repeat a course in which he previously earned an IC grade and the said grade has not been changed.
7. If a student has an IC grade, this results in the suspension of the student's academic standing during that semester. This also includes the suspension of distinction status.
8. A student is not allowed to register for a course wherein he earned an IC grade in the pre-requisite(s) of that course.

Article Twenty-Six

Courses involving symposia, research, field work, or of a practical nature, may be excluded from some or all the rules of Articles 22, 23 & 25 following a decision by the college council and the recommendation of the department council teaching the course. The college council identifies alternate ways to evaluate the student's achievement in such courses.

Article Twenty-Seven

If any course of a research nature requires more than one semester for its completion, the student will be assigned an IP grade, and after the completion of the course, the student will be given the grade he has earned. However, if he fails to complete the course on time, the department council teaching the course may approve the assignment of an IC grade for this course in his record.

Article Twenty-Eight

The grades a student earns in each course are calculated as follows:

Percentage	Grade	Grade Code	GPA (out of 5.00)	GPA (out of 4.00)
95 - 100	Exceptional	A+	5.00	4.00
90 - less than 95	Excellent	A	4.75	3.75
85 - less than 90	Superior	B+	4.50	3.50
80 - less than 85	Very Good	B	4.00	3.00
75 -less than 80	Above Average	C+	3.50	2.50
70 - less than 75	Good	C	3.00	2.00
65 - less than 70	High Pass	D+	2.50	1.50
60 - less than 65	Pass	D	2.00	1.00
Less than 60	Fail	F	1.00	0.00

Implementation Rules of Article Twenty-Eight

1. The student's final course grade will be one of the nine levels mentioned in the Article and his grades will be calculated in accordance with this distribution. The course instructor may consider other known assessment methods such as the grade average and the standard deviation in determining the student's end-of-course grade which reflects his achievement in the course.

2. The grade AU will be assigned to students who attend a course as auditors without being given any grades, regardless of their performance in the course. The effect of this assignment on the student's cumulative or semester grade is the same as the grade "No grade-Pass" or NP. However, if the instructor informs the Deanship of Admissions & Registration that the student was absent for more than one third of the classes, the course will be eliminated from his record. See Implementation Rules for Article 8.

3. The grades "No grade-Pass (NP)" or "No grade-Fail (NF)" are assigned for courses offered on the basis of pass or fail.

4. If a student is registered in the Cooperative Program in summer semester and is assigned an IP grade in it, the IP grade will be changed to:
   a. NP grade, if the student passes the Cooperative Program.
   b. F grade, if the student fails the Cooperative Program.

5. The grade "Withdrawn with Pass (WP)" or "Withdrawn with Fail (WF)" is given in accordance with Implementation Rules for Article 13.

Article Twenty-Nine

In accordance with the requirements of Article 19, and based on the cumulative Grade Point Average achieved by a graduating student, his graduation rank is assigned to one of the following :

	Rank	Range of Cumulative GPA	
		Out of 5.00	**Out of 4.00**
1.	Excellent	4.50 - 5.00	3.50 - 4.00
2.	Very Good	3.75 - less than 4.50	2.75 - less than 3.50
3.	Good	2.75 - less than 3.75	1.75 - less than 2.75
4.	Pass	2.00 - less than 2.75	1.00 - less than 1.75

Article Thirty

First honors will be granted to graduating students who achieve a cumulative GPA of 4.75 - 5.00 (out of 5.00) or 3.75 - 4.00 (out of 4.00). Second honors will be granted to graduating students who achieve a cumulative GPA of 4.25 - less than 4.75 (out of 5.00) or 3.25 - less than 3.75 (out of 4.00).

In order to be eligible for the first or the second honors the student:

(a) must not have failed in any course at the university he is currently attending or any other university;
(b) must have completed all graduation requirements within a period of duration ranging between the maximum and minimum limits for completing the program of study in a college;
(c) must have completed 60% or more of the graduation requirements at the university from which he graduates.

Implementation Rules of Article Thirty

1. Third honors will be granted, at the time of graduation, to students who achieve a cumulative GPA of more than 3.00 (out of 4.00), and the conditions for offering first and second honors do not apply. However, they must fulfill the terms of paragraphs (b) and (c) of Article 30.

2. The provisions of (a) of Article 30 do not apply to a student who has failed in any Preparatory Year course.

3. At the end of each semester, the Deanship of Admissions & Registration records the names of distinguished students on the University distinction list, on the basis of their semester GPA and the quality points earned in this semester, as follows:

Distinction	Requirements		
	Semester GPA	&	Quality Points
First Distinction	3.75 - 4.00	&	60 or above
Second Distinction	3.50 - 3.74	&	56 or above
Third Distinction	3.00 - 3.49	&	48 or above

4. A student earns the rank of 'Excellent' for an academic year if he achieves one of the distinction ranks of paragraph 3, in both the first and second semesters of that year.

5. A student receives his distinction reward remuneration in the semester in accordance with the Regulations for Financial Affairs in the Saudi Universities.

FINAL EXAMINATION PROCEDURES

Article Thirty-One

The college council may set up a committee to cooperate with the departments in organizing the activities related to the final examination. This committee's charges should include reviewing of mark sheets and submitting them to the relevant committee within three days from the examination date of the course.

Article Thirty-Two

The college council may apply the principle of strict confidentiality in the final examinations procedures.

Implementation Rules of Article Thirty-Two

A course instructor or coordinator should apply caution and confidentiality in examinations procedures.

Article Thirty-Three

A course instructor prepares the examination questions. However, if the need arises, the college council may assign another teacher to do the same, based on the recommendation of the department Chairman.

Article Thirty-Four

A course instructor grades the final examination papers and if necessary the department Chairman may assign one or more additional instructors to participate in the grading process. The college council may also assign the grading process to another instructors(s), when the need arises.

Implementation Rules of Article Thirty-Four

In the case of common examinations for a multi-section course, the grading of the examination may be assigned to course instructors regardless of which sections they teach.

Article Thirty-Five

The instructor who corrects the final exam, and records the marks obtained by students on the designated grade list, signs his name on the grade sheet and has it countersigned by the department Chairman.

Implementation Rules of Article Thirty-Five

1. The Deanship of Admissions & Registration determines the procedures for submitting final grades in accordance with the dates specified in the academic calendar. Course instructors submit the students' grades accordingly.

2. No grade shall be corrected or changed after the submission of the grade records to the Deanship of Admissions & Registration without a written request from the course instructor that includes proper justifications. Such request must be endorsed by the department Chairman. The Dean of Admissions & Registration should be informed of the change no later than the beginning of the final examination period of the next term. Only the new grade will appear in the student's record.

Article Thirty-Six

No student is to be given more than two examinations in one day. The University Council may allow for exceptions to this rule.

Implementation Rules of Article Thirty-Six

1. The Deanship of Admissions & Registration schedules the final examinations in such a way that no student is given more than two exams in one day.
2. Every semester the Deanship of Admissions & Registration prepares the schedule of the final examinations listing the date, time and location of examinations. The following considerations are observed:

   (a) The final examinations schedule must be maintained free from conflicts to the maximum extent possible.
   (b) The classrooms and auditoria in which the examinations shall be held are reserved.
   (c) The departments and students are informed by an announcement of the schedule of final examinations at least one week before the commencement of the final examinations period as specified in the University's academic calendar.
3. All course instructors and students should abide by the examination schedule prepared by the Deanship of Admissions & Registration.

4. In the event of a conflict in a student's final exams, the course instructors provide make-up examinations for such courses with the approval of the Dean of Admissions & Registration and the chairmen of the departments concerned. The make-up exam is to be given during the final examination period.

5. The schedule of a final examination of a certain course may be changed for justifiable reasons upon the recommendation of the course instructor and the department Chairman. The college council, in coordination with the Deanship of Admissions & Registration, decides on such cases. The recommended new date and time of the final exam of this course must fall within the final examination period.

6. An instructor of a course which does not require final examinations, as per its approved description, may give alternative examinations or homework assignments to the students instead of the final examination.

Article Thirty-Seven

No student will be allowed to sit for a final examination after the lapse of 30 minutes from the beginning of the examination. Also, no student will be allowed to leave the examination venue less than 30 minutes after the beginning of the examination.

Article Thirty-Eight

Cheating, or attempting to cheat, or violating instructions and examination regulations shall render the offender subject to punishment in accordance with the Student Disciplinary Rules as issued by the University Council.

Implementation Rules of Article Thirty-Eight

1. Cheating is an act of dishonesty and faculty members and students must maintain trust and honesty to ensure and protect the integrity of grades.

2. All academic work or requirements assigned to a student must be carried out by him

without any unauthorized aid of any kind.

3. Instructors must exercise due professional care in the supervision and verification of academic work so that honest effort on the part of the students will be positively encouraged.

4. A course instructor who discovers that a student is cheating or helps in cheating in homework assignments, quizzes or any other requirements of the course shall assign for the student a zero grade in that work. The instructor shall report in writing the case and his recommendations to the department Chairman who, in turn, shall submit the case to the Dean of the college. After deliberating the case, the college council, may review the penalty or approve the instructor's decision(s) or give a DN grade to the student in the course, or else if further action is required refer it to the Student Affairs Committee for review and submitting its recommendation to the Rector of the University based on the Student Disciplinary Rules. A student has the right to appeal to the Dean of Student Affairs within one week of notification of the disciplinary decision.

5. A course instructor or a supervisor of a course examination who discovers that a student is cheating, attempting to cheat or helps in cheating in any of the written examinations must not allow the student to continue in the examination, and the student deserves an DN grade in that course. The instructor shall report the case in writing to the department Chairman who, in turn, shall submit the case to the Dean of the college. After deliberating the case, the college council may decide:

   (a) that the student does not deserve the DN grade. In this case, the instructor gives the student a make-up exam;
   (b) that the student deserves the DN grade. In this case, the college council refers the case to the Student Affairs Committee for review and submitting its recommendation to the Rector of the University based on the Student Disciplinary Rules. A student has the right to appeal to the Dean of Student Affairs within one week of notification of a disciplinary decision.

Article Thirty-Nine

If the need arises, the council of the college which offers the course may agree to the re-grading of examination papers within a period not exceeding the beginning of the next semester's examinations.

Implementation Rules of Article Thirty-Nine

A student who feels strongly that he has received a grade that is demonstrably inaccurate, or that the grading was unfair, must promptly discuss the matter with the instructor of the course. If the student and his instructor are unable to arrive at a mutually agreeable solution, the student may forward an official appeal to the Chairman of the department offering the course, no later than the end of the fourth week of the next semester. The department Chairman will investigate whether the appeal is justified by reviewing the instructor's evaluation of the student based on the student's class work and final examination scores. The department Chairman will then take appropriate action, if he deems necessary, by submitting the student's appeal to the college council to decide on the case.

Article Forty

Following the recommendation of the relevant department council, the college council determines the duration of the final written examinations which, in any case, should not be less than one hour and not more than three hours' duration.

Article Forty-One

Consistent with the provisions of Articles 31-40 of this document, the University Council establishes the regulations that govern the final examination procedures.

TRANSFER

TRANSFER FROM ONE UNIVERSITY TO ANOTHER

Article Forty-Two

The transfer of a student from outside the University may be accepted under the following conditions.

a. The student should be enrolled at a recognized college or university.
b. The student must not have been dismissed from that university for disciplinary reasons.
c. The student must satisfy the transfer provisions as determined by the University Council.

Implementation Rules of Article Forty-Two

All transfer applications are submitted to the Admission & Academic Standing Committee which studies the application and ensures that the applicant fulfills the requirements of this article, in addition to any other provisions the Committee deems necessary in coordination with the colleges concerned.

Article Forty-Three

The college council shall review the courses taken by the student outside the University based on the recommendations of the departments which offer equivalent courses. The courses evaluated as equivalent will be transferred to the student's record but will not be included in the calculation of his cumulative GPA.

Implementation Rules of Article Forty-Three

In order to get transfer of credit for any course taken outside the University, the following provisions shall be observed:

1. the student should have completed the Preparatory-Year program, or have been admitted to the university as freshman student;
2. the student should have obtained grade of C or higher in that course;
3. the course was taken at a recognized college or university;
4. the course is equivalent in its contents to one of the courses which are included in the

KFUPM degree requirements. Otherwise, it may be counted as an elective with the approval of the council of the department offering the degree program and the college council concerned.

5. The grade earned by the student in the course is not included in the student's cumulative GPA.
6. Courses taken at two different institutions at the same time are not considered for transfer of credit.
7. Courses taken at another institution simultaneously while studying at KFUPM (in the same semester) are not considered for transfer of credit.

Article Forty-Four

If, after his transfer, it is discovered that a student had been dismissed from his previous university for disciplinary reasons, his enrollment will be considered canceled as from the date of acceptance of his transfer to the University.

Article Forty-Five

The transfer of a student from one university to another during any semester takes place in accordance with the procedures and the dates announced by the university to which the student is transferring, under the general transfer rules.

TRANSFER FROM ONE COLLEGE TO ANOTHER WITHIN THE SAME UNIVERSITY

Article Forty-Six

A student may be transferred from one college to another within the University in accordance with rules established by the University Council.

Implementation Rules of Article Forty-Six:

1. A student may transfer from one college to another within the University before he completes the fourth academic level in his undergraduate studies.
2. The student should continue to study all the courses he registered for at the level preceding the transfer, in compliance with the adding and dropping rules.
3. The transfer from one college to another will appear in the academic record of the student starting the term following the transfer.
4. A student is allowed a maximum of two transfers from one college to another.

Article Forty-Seven

The academic record of a student transferred from one college to another includes all the courses he has studied together with the grades and the semester and cumulative GPA's obtained throughout his period of study at the University.

TRANSFER FROM ONE MAJOR TO ANOTHER WITHIN THE SAME COLLEGE

Article Forty-Eight

With the approval of the Dean of the relevant college, a student may transfer from one major to another within the same college according to the rules established by the University Council.

Implementation Rules of Article Forty-Eight

1. A student may transfer from one major to another within his college at any time before he completes the fourth academic level in his undergraduate studies. The college council may consider exceptional cases after that level.
2. The transfer to the new major will appear in the academic record of the student starting the term following the transfer.
3. A student is allowed a maximum of two transfers from one major to another within the same college. The college council may consider exceptional cases.

Article Forty-Nine

The academic record of a student transferring from one major to another will include all the courses the student has taken, including the grades and the semester and cumulative GPA's obtained throughout his period of study at the University.

VISITING STUDENTS

Article Fifty

A "visiting student" is a student who studies some courses at another university or in one branch of the university to which he belongs without transferring. Equivalency for such courses shall be granted according to the following rules.

a. The student must obtain prior approval from the college at which he is studying.
b. The student should be enrolled at a recognized college or university.
c. The course the student is taking outside his university should be equivalent to one of the courses included in his degree requirements.
d. If the visiting student is studying in one of the branches of the university to which he belongs, the case should be dealt with in accordance with Article 47.
e. The University Council determines the maximum credit hours to be allocated to a visiting student from outside the University.
f. The course grades credited to the visiting student will not be considered in his cumulative GPA.
g. The University Council may establish other conditions regarding visiting students.

Implementation Rules of Article Fifty

Case One: A student from KFUPM visiting another university

(a) The student should submit to the Chairman of the academic department a written application indicating the course(s) he intends to study at the other university. The department council sets up a committee to evaluate these courses and suggest, if applicable, the equivalent courses at KFUPM.

(b) After completing the course(s) the student submits a formal request to the Deanship of Admissions & Registration for transfer of credit. The final decision whether or not to accept a course for transfer is made in compliance with the Implementation Rules of Article 43.

(c) Notwithstanding the degree requirements, the maximum total credit hours that can be transferred from outside the University is 48 and the student's grade in each transferred course must not be lower than C. These grades are not included in the cumulative or major GPA.

(d) The maximum number of semesters a student can study outside the University is three consecutive or non-consecutive semesters (except summer semesters).

(e) The student will receive KFUPM stipend as per the governing rules and regulations for stipends.

(f) The student can apply to get approval to study a summer term in another university only if:

i. The summer term is part of the Study Abroad Program or;
   The student is a candidate to graduate in that summer or the following term and the registered course is not offered at KFUPM in the summer term.
ii. The course(s) is/are equivalent to KFUPM course(s) in terms of credit hours, content and mode of delivery.
iii. The delay in taking the course on time is for reasons beyond the control of the student.

Case Two: A student from another university visiting KFUPM

(a) The student should submit approval from the institution at which he is currently studying, indicating justifications for taking the courses outside his institution. The student must satisfy all the requirements of the courses for which he is intending to register.

(b) The courses for which the student wishes to register must be available and not fully enrolled.

(c) All courses should be recorded in a unified academic record, including all courses studied at this University while a regular or visiting student.

(d) The student will not receive KFUPM stipend and will not be provided with textbooks.

GENERAL RULES

Article Fifty-One

These regulations supersede all the preceding rules and regulations established for study and examinations at the undergraduate level.

Article Fifty-Two

The University Council may set up implementation rules which will not contradict these regulations.

Implementation Rules of Article Fifty-Two

The University Council reserves the right to interpret and amend the implementation rules accompanying these regulations.

Article Fifty-Three

The Higher Education Council reserves the right to interpret these regulations.

APPENDICES

APPENDIX (A)

Academic Records and Grade Codes

Academic Record

The academic record is a statement which explains the student's academic progress. It includes the courses studied in each term with course numbers, codes, number of credit-hours, the grades attained and the codes and points of these grades. The record also shows the semester, cumulative GPA and the student's academic status in addition to the courses from which a transferred student is waived.

Grade Codes

Letter Grades	Marks	Points		Meaning
A+	95-100	4.00	5.00	Exceptional
A	90 - Less than 95	3.75	4.75	Excellent
B+	85 - Less than 90	3.50	4.50	Superior
B	80 - Less than 85	3.00	4.00	Very Good
C+	75 - Less than 80	2.50	3.50	Above Average
C	70 - Less than 75	2.00	3.00	Good
D+	65 - Less than 70	1.50	2.50	High-Pass
D	60 - Less than 65	1.00	2.00	Pass
F	Less than 60	0.00	1.00	Fail
IP	–	–	–	In-Progress
IC	–	–	–	Incomplete
DN	–	0.00	1.00	Denial
NP	60 or above	–	–	No grade-Pass
NF	Less than 60	–	–	No grade-Fail
W	–	–	–	Withdrawn

APPENDIX (B)

Example of the Calculation of Semester and Cumulative GPA

First Semester

Course	Cr Hrs	%	Code	GPA		Quality Points	
IAS 301	2	85	B+	4.50	3.50	9	7
CHEM 324	3	70	C	3.00	2.00	9	6
MATH 235	3	92	A	4.75	3.75	14.25	11.25
PHYS 312	4	80	B	4.00	3.00	16	12
Total	12					48.25	36.25

$$\text{First Semester GPA} = \frac{\text{Total Quality Points (48.25)}}{\text{Total Credits(12)}} = 4.02$$

Or

$$\text{First Semester GPA} = \frac{\text{Total Quality Points (36.25)}}{\text{Total Credits(12)}} = 3.02$$

Second Semester

Course	Cr Hrs	%	Code	GPA		Quality Points	
IAS 104	2	96	A+	5.00	4.00	10	8
CHEM 327	3	83	B	4.00	3.00	12	9
MATH 314	4	71	C	3.00	2.00	12	8
PHYS 326	3	81	B	4.00	3.00	12	9
Total	12					46	34

$$\text{Second Semester GPA} = \frac{46}{12} = 3.83 \text{ or } \text{Second Semester GPA} = \frac{34}{12} = 2.83$$

$$\text{Cumulative GPA} = \frac{\text{Total Quality Points } (48.25 + 46)}{\text{Total Credits}(12 + 12)} = 3.93 \text{ or } \frac{36.25 + 34}{12 + 12} = 2.93$$

APPENDIX (C)

The Grading System Applicable at KFUPM

Grade Codes

Letter Grades	Marks	Points		Grades in English
A+	95-100	4.00	5.00	Exceptional
A	90 - Less than 95	3.75	4.75	Excellent
B+	85 - Less than 90	3.50	4.50	Superior
B	80 - Less than 85	3.00	4.00	Very Good
C+	75 - Less than 80	2.50	3.50	Above Average
C	70 - Less than 75	2.00	3.00	Good
D+	65 - Less than 70	1.50	2.50	High-Pass
D	60 - Less than 65	1.00	2.00	Pass
F	Less than 60	0.00	1.00	Fail
IP	–	–	–	In-Progress
IC	–	–	-	Incomplete
DN	–	0.00	1.00	Denial
NP	60 or above	–	–	No grade-Pass
NF	Less than 60	–	–	No grade-Fail
W	–	–	–	Withdrawn
WP	–	–	–	Withdrawn with Pass
WF	–	–	–	Withdrawn with Fail
AU	–	–	–	Audit

ACADEMIC COLLEGES, DEPARTMENTS, AND PROGRAMS

ACADEMIC COLLEGES, DEPARTMENTS, AND PROGRAMS

College of General Studies
Preparatory Year Program
Islamic and Arabic Studies
Physical Education
English Language

KFUPM Business School
Accounting and Finance
Accounting
Finance
Information Systems and Operations Management
Management Information Systems
Management and Marketing
Management
Marketing
Global Studies

College of Engineering and Physics
Aerospace Engineering
Aerospace Engineering
Applied Aerospace Engineering
Electrical Engineering
Electrical Engineering
Applied Electrical Engineering
Mechanical Engineering
Mechanical Engineering
Applied Mechanical Engineering
Control and Instrumentation Engineering
Physics

College of Petroleum Engineering and Geosciences
Geosciences
Geology
Geophysics
Petroleum Engineering
Center for Integrative Petroleum Research

College of Computing and Mathematics
Computer Engineering
Information and Computer Science
Computer Science
Software Engineering
Industrial and Systems Engineering
Mathematics
Mathematics
Actuarial Science and Financial Mathematics

College of Chemicals and Materials
Bioengineering
Chemical Engineering
Chemical Engineering
Applied Chemical Engineering
Chemistry
Materials Science and Engineering

College of Design and Built Environment
Architectural Engineering
Architecture
City and Regional Planning
Civil and Environmental Engineering
Civil Engineering
Applied Civil Engineering
Construction Engineering & Management

COLLEGE OF GENERAL STUDIES

Dean: Dr. Hattan Tawfiq

PROGRAMS

PREPARATORY YEAR PROGRAM

DEPARTMENTS

ISLAMIC & ARABIC STUDIES
PHYSICAL EDUCATION
ENGLISH LANGUAGE

The College of General Studies (CGS) was established in 2007 to provide core courses in disciplines not covered by the other colleges. The College is responsible for developing in all KFUPM students the crucial knowledge, skills, attributes, and values to be competitive in the market place and to realize their role as leaders in their communities. Through its programs and the courses offered, the College provides University students with the opportunities to expand their horizons and vision, reinforce their ethical and moral values, develop their communication skills, and enhance their personal characteristics and positive behavior.

The College is committed to having a major influence on KFUPM graduates by maintaining close contact with both students and academic departments, and by continuously assessing and developing its programs and courses to accommodate the changing needs and conditions required to accomplish its set objectives and goals.

Vision

To be a leading multidisciplinary platform for fostering academic and professional success, excellence in research, and community service.

Mission

- To prepare students for success at KFUPM and beyond.
- To train students for successful and leadership roles in society by providing them with foundational skills and values.
- To contribute to national development by exceling in community service and research.

Values

The intellectual environment at the College motivates students to acquire and practice professional and Islamic values such as discipline, moderation, tolerance, and integrity in order to develop as ethical citizens and professionals.

Goals

CGS goals reflect its strategic issues inferred from the SWOT analysis and aligned with KFUPM’s goals and strategies.

1- Build a highly qualified national and international faculty body.
2- Develop students' English language proficiency to successfully pursue their undergraduate education and future careers.
3- Improve student retention rate in the Preparatory Year Program.
4- Cultivate students’ knowledge in social sciences and humanities as well as values, skills, and attitudes.
5- Excel in community-related research and services.

College Programs and Departments

The College comprises one program: the Preparatory Year Program (PYP); and three supporting academic departments: the Islamic and Arabic Studies Department; the Physical Education Department; and the English Language Department. The Departments offer courses that are core requirements for all KFUPM students.

Preparatory Year Program

The PYP aims to prepare students for entry to undergraduate studies by exposure to various academic programs and courses including:

1. Preparatory English Program.
2. Preparatory Math Program.
3. Preparatory Science and Engineering Program.

In addition, the PYP offers students extra-curricular activities to help them adjust to the University life.

Islamic & Arabic Studies Department

The department offers courses in Islamic ideology, professional ethics and human rights in Islam, Writing for Professional Needs, communication skills, Arabic and Islamic history, Arabic literature as well as other courses in Islamic and Arabic studies.

Physical Education Department

The Department offers courses to Preparatory Year and Undergraduate students designed to raise their awareness of the following aspects: personal health; physical fitness; and knowledge of sports. The department also offers special courses for students with special needs. In addition, the department organizes activities to raise community awareness about healthy lifestyle and physical fitness.

English Language Department

The department is responsible for improving students' English Language and communication skills to better prepare them for their academic studies and future career. The Department offers three courses in Academic Discourse (ENGL 101); Introduction to Report Writing (ENGL 102), and Academic and Professional Writing (ENGL 214).

Preparatory Year Program

Assistant Dean for Prep Year Affairs: Dr. Abdulaziz Al-Assaf

Since the establishment of KFUPM in 1963, the Preparatory Year Program (PYP) has been a core component of the University's academic curriculum. It is comprised of three interdependent programs: English, Mathematics, and Science & Engineering. It is continually developing, concurrent with KFUPM academic programs.

Vision

To be an innovative program in preparing students for successful university study.

Mission

1. To ensure that students attain a level of academic proficiency that allows them to participate fully at KFUPM.
2. To provide students with sound academic skills.
3. To help students develop into well-rounded individuals.

Goals

1. Improving students' English proficiency.
2. Reviewing and reinforcing students' mathematical and basic science knowledge and skills.
3. Consolidating students' knowledge in engineering technology.
4. Developing students' personal and interpersonal skills.
5. Promoting students' physical and mental well-being.

Values

1. Discipline: being hard-working and serious in teaching and learning.
2. Excellence: promotion of highest academic standards.
3. Care: supporting and motivating students and faculty.

Learning Outcomes

Upon successful completion of the PYP, a student should be able to:

1. Participate fully in professional environments where the medium of communication is English.
2. Comprehend fundamentals of mathematics, physical sciences, computer science, and engineering.
3. Identify and solve practical academic problems.
4. Practice life skills such as goal setting, time management, teamwork, and communication.
5. Demonstrate hard-work, perseverance, commitment, discipline, and respect for others.

Skip-Prep Program

During summer period, the Preparatory Year Program conducts several courses for English and Math as part of the Skip Prep Program. Skip-Prep Program gives the newly admitted students a chance to comprehend English and Math material and develop their proficiency prior to their enrollment at the University. The main objective of the program is to provide support to all students so they will be more confident in their study at KFUPM and have a chance to skip the program partially or completely.

Prep Year Program Courses

<table>
<tr><th>COURSE</th><th>TITLE</th><th>LT</th><th>LB</th><th>CR</th><th>COURSE</th><th>TITLE</th><th>LT</th><th>LB</th><th>CR</th></tr>
<tr><td>ENGL 01-xx</td><td>Prep. English I</td><td rowspan="2">15</td><td rowspan="2">5</td><td>4</td><td>ENGL 03-xx</td><td>Prep. English III</td><td rowspan="2">15</td><td rowspan="2">5</td><td>4</td></tr>
<tr><td>ENGL 02-xx</td><td>Prep. English II</td><td>4</td><td>ENGL 04-xx</td><td>Prep. English IV</td><td>4</td></tr>
<tr><td>MATH 001</td><td>Prep. Math I</td><td>3</td><td>1</td><td>4</td><td>MATH 002</td><td>Prep. Math II</td><td>3</td><td>1</td><td>4</td></tr>
<tr><td>PYP 001</td><td>Prep. Physical Science</td><td>2</td><td>0</td><td>2</td><td>PYP 002</td><td>Prep. Computer Science</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>PYP 003</td><td>Life Skills</td><td>0</td><td>2</td><td>1</td><td>PYP 004</td><td>Prep. Eng. Technology</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td>PE 001</td><td>Prep. Health and Physical Educ. I</td><td>0</td><td>2</td><td>1</td><td>PE 002</td><td>Prep. Health and Physical Educ. II</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td colspan="2"></td><td>20</td><td>10</td><td>16</td><td colspan="2"></td><td>18</td><td>12</td><td>15</td></tr>
<tr><td colspan="10">Total credit hours required in Preparatory Program: 31</td></tr>
</table>

**Prep. English 00 is offered prior to Prep. English I for those students who fall below the standard level of English proficiency required for entry into Prep. English I. English I & II as well as Prep. English III and Prep. English IV are offered as continuing courses only after a satisfactory grade is achieved following the first 8 weeks of a semester.

Above, where ENGL01-xx is listed, xx refers to FH (first half) or SH (second half) meaning the first or second half of the semester.

Preparatory English Program (PEP)

Director: Mr. Barrett Brookshire

Faculty

Ahmad	Green	Oxley
Ahmed	Green	Painter
Amison	Gribben	Patterson
Antonucci	Hillmer	Pearce
Armstrong	Holland	Pennington
Arnolds	Honnen	Phillips
Aurelius	Hudson	Pitts
Bain	Hypher	Quraishi
Baker	Kearney	Read
Ballard	Knight	Reynolds
Bicchieri	LaMere	Riley
Brown	Lavelle	Roperti
Cassidy	Lewis	Santoro
Chumas	Loftus	Shahit
Ducken	Lowery	Smith
Duquette	McCarthy	Smith
Eggiman	McClane	Snow
Fernelius	McKay	Snyman
Flores	McLaren	Webster
Garlington	McNeal	Wick
Graham	Milburn	Wilson

The Preparatory English Program (PEP) is responsible for developing students' English proficiency to the level required at KFUPM, where English is the language of instruction.

All new students' English proficiency is assessed upon arrival at KFUPM. Students who demonstrate high proficiency in English by presenting internationally recognized examination scores from the TOEFL iBT or IELTS exams may earn exemption from all PEP courses. Additionally, students who demonstrate equally high proficiency during Placement testing week can receive exemption if they demonstrate complete knowledge of skills and language ability covered in PEP courses. Students who receive exemption are able to register for some freshman level courses in their first year at KFUPM.

All other students are placed into one of five courses designed to consolidate, develop and build upon basic abilities in English. Courses are administered in half-semester modules and consist of four hours of English instruction per day, five days a week for seven and a half weeks. Each course is specifically designed to help students develop their English language skills in reading, listening, writing, and speaking, which are all needed to succeed in future academic study at KFUPM. Grammar and vocabulary instruction support these skills, as do projects and computer-based exercises. Alongside the development of language, PEP courses also aim to help students develop the study skills and self-discipline necessary for success in their academic careers at KFUPM.

PEP modular courses are designed as a continuum, where objectives and learning outcomes are progressive throughout the entire program. The skills developed in one course are the foundation for advancement in the next course. Lower levels, courses labeled ENGL00 and ENGL01, build familiarity with basic General English. Courses ENGL02 and ENGL03 build upon this knowledge and introduce basic academic skills. Upon completion and advancement to the ENGL04 course, students have the working grounds for engaging in integrated skills practice. The objectives in each subsequent course for listening, speaking, reading, and writing are designed to support and build upon previously obtained skills. This ensures that the students continue building upon the skills they have obtained throughout their journey in the PEP.

As a natural benefit of an intensive English Program, students' ability to cope with the rigor of university-level study is improved. A particularly advantageous aspect of the Preparatory English Program is that some course material is designed, written, and produced by PEP faculty, allowing specific needs for KFUPM to be addressed and incorporated into course content.

Students who successfully complete the program are equipped with a solid foundation for all future courses in the English medium. This foundation allows for a natural transition to academic courses in their freshman year and beyond.

Other Features of the PEP

The PEP is well equipped with modern educational aids such as modern classrooms equipped with technology needed to facilitate language learning. English instruction is varied and dynamic, with integration of 21st Century Skills in classroom lectures. Dynamic classroom environments where group work, use of smartphone apps and computer based supplemental software is incorporated. The PEP also has access to computer laboratories where students can learn using various websites or complete assignments. Students are also given access to a range of material prepared by faculty members as well as commercial software and the facility to produce printed copies of written assignments.

The PEP partners with the Deanship of Continuing Education to offer evening courses for both the KFUPM community and the community at large. These evening courses in English are offered each semester to support KFUPM's vision of being a regional leader in education. Through the Deanship of Continuing Education, in partnership with the PEP, other specialized courses are sometimes designed and offered to meet the needs of local industry.

The Preparatory English Program also provides professional editing services through various partnerships with KFUPM colleges. Papers, theses and other documents prepared by professors and lecturers at KFUPM published in academic journals and elsewhere, are edited by experienced Preparatory Year English faculty members.

The PEP also conducts examinations to assess the English proficiency of KFUPM graduate students who apply for post-graduate studies. Based on earned results, recommendations are sent to the Dean of Graduate Studies about suitability for pursuit of graduate studies at KFUPM.

The Preparatory English Program serves KFUPM in order to ensure all students are proficient in English upon completion of the program. The PEP does not grant certificates or degrees, however students who successfully complete the PEP after having received a grade C or above in all courses are well-prepared for success in their future study at KFUPM.

Preparatory Math Program (PMP)

Director: Mr. Husam Sharqawi

Faculty

Abdelrazec	Al-Gharabli	Ibrahim
Elghanmi	Al-Mahdi	Mugbil
Ahmed	Al-Omari	Mu'azu
Aijaz	Al-Shawish	Marsli
Awad	Dehwah	Qureshi
Audu	Demir	

The Preparatory Year Math Program consists of two courses. The first course is Math 001 (College Algebra and Trigonometry I) which contains standard topics of college Algebra whereas the second course, Math 002 (College Algebra and Trigonometry II), contains trigonometry and extended topics in college Algebra.

The program aims to:

1. Reinforce and Review the student's knowledge of mathematical and analytical skills through the medium of English.
2. Develop student's writing skills in Math through interrelated logical procedures.
3. Provide students with the ability to use their understanding to produce and communicate mathematics.
4. Prepare students to apply Math skills in advanced degree programs.
5. Prepare students to acquire a solid foundation in algebra and trigonometry.
6. Shape students' Mathematics study habits through emphasizing useful Math study habits and skills that will facilitate their academic success at KFUPM.

The program is designed such that students are continuously involved in lectures, class work and self-learning activities, mainly solving problems during the recitation classes and through weekly online assignments and knowledge tests to enable them to master course topics through a continuous cycle of mastery, knowledge retention, and positive feedback. Peer tutoring is an essential component of the learning process, weekly training in-person sessions and online sessions are conducted in which students can enhance their knowledge and have the opportunity to share and exchange ideas with fellow students and their instructors. Moreover, students can benefit from resources made available through the LMS (BlackBoard) by their instructors and the Prep-Math Program.

Preparatory Science & Engineering Program (PSEP)

Director: Dr. Rezqallah Malkawi

Faculty

Abulkhair	Siddiqui	Islam
Ali	Murshidy	Al-Otaibi
Baqais	Al-Zoubi	Samiuddin
Mohamed	Butt	Abu Alrub
Farahat	Sharif	Ahmed
Ahmed	Syed	
Qayyum	Putu	
Sankaran	Haque	

The PSEP was formed on May 17, 2010. This department is comprised of the PYP 001 (Physical Science), PYP 002 (Computer Science), PYP 003 (Life Skills), and PYP 004 (Engineering Technology) courses. Half of the newly admitted students take PYP 001 & PYP 003 in the first semester and PYP 002 & PYP 004 in the second semester or vice versa.

The PSEP aims to provide students with basic understanding of science and engineering concepts as well as the necessary life skills to prepare them for undergraduate studies.

Department of Islamic and Arabic Studies

Chairman: Dr. Ramy A. Alshebl

Faculty

Alabri	Mubarak	Al-Enaizan
Aldossary	Almuzeini	Al-Assaf
Alamri	Alghamdi	Alharbi
Al-Dossary	Al-Ghahtani	Howsawi
Al-Humeidan	Al-Qahtani	Ibrahim
Al-Khaledi	Al-Saadi	Jurayan
Alrashood	Al-Sulaiman	Osman
Al-Omar	Al-Sulami	Sendi
Alshammari	Alshebl	Almugim
Al Zahrani	Al-Zahrani	Al Zahrani
Altwaigeri		

The Islamic & Arabic Studies Department (IAS) is one of the academic departments under the College of General Studies. Since its establishment, the IAS department has worked in harmony with the needs of higher education in Saudi Arabia, and has remained consistent with university policy, placing great emphasis on the enhancement of Islamic culture and the moderate understanding of its meanings. The IAS department consists of two fields of study, Islamic Studies and Arabic Studies. As a supporting academic department, its role is not only limited to the academic teachings, but also includes research activities, social activities, and interaction with communities inside and outside KFUPM.

Mission

The main objectives of the IAS department are to broaden the students' intellectual horizon in the Islamic and Arabic studies in line with the academic needs of KFUPM. This will benefit students in their professional career after graduation.

Objectives

- To enhance moral values and good behavior and encourage students to practice the Islamic ethics.
- To develop the immunity against ideological and behavioral difference.
- To improve oral and written communication skills with useful applications and experimental activities with the aid of modern technical educational support.
- Continuous course development with the assistance of modern teaching techniques and with the cooperation of other leading academic departments.

Required Islamic Studies Courses (4 Credit Hours)

Each undergraduate student must take four credit hours (i.e. two courses) in Islamic Studies. These courses are "Belief and its Consequences" (IAS 111), and "Ethics & Governance" (IAS 212).

Required Arabic Language Courses (2 Credit Hours)

Each Arabic-speaking undergraduate student, in all majors, must take two credit hours in Arabic Language. This course is "Language Foundation" (IAS 121)

Required course (2 Credit Hours)

Students must take (IAS xxx) either Arabic or Islamic course.

Elective Courses

In addition to the above, a student, in some departments, may select an elective course from: "Al-Sirah Al-Nabawiyyah" (IAS 416), "Contemporary Financial Transactions in Islam" (IAS 418), and "Inimitability of Al-Quran" (IAS 419), "Human Rights in Islam" (IAS 322), "Writing for Professional Needs" (IAS 201), "Oral Communication Skills" (IAS 301), and "Effective Language Communication" (IAS 321).

Courses for Non-Arabic-Speaking Students

Each non-Arabic-speaking student is required to take a sequence of three two-credit hour courses in Arabic as a "Second Language" in lieu of IAS 101, 201, and 301, as follows: "Reading and Writing" (IAS 131), "Grammar and Composition" (IAS 231), and "Literature and Text" (IAS 331). Plus "Belief and its Consequences" (IAS 111) in English.

Physical Education Department

Chairman: Dr. Abdulhameed Al Ameer

Faculty

Al Ameer	Ibrahim	Allen
Rabaan	Abu Hilal	Choi
Moataz	Adejumo	Seung Min
Kaukab	Hamdan	Tabur
Tomar	Antony	Ibeid
Tufekcioglu	Pacholek	Yekini
Aleidi	Radhyan	Alwaleedi
Alsayyah		

Health education is a social science that draws its principles from the biological, environmental, psychological, physical, and medical sciences to promote health and prevent disease, disability and premature death through education-driven, voluntary, behavior-change activities. Knowing how to live healthily is the secret for living a good life. This is more important in today's society, where unhealthy diets such as fast food and unhealthy habits such as playing computer games and drug abuse are prominent. It is also necessary that students know and are able to keep themselves healthy by not giving into these external influences. Health Education develops in the students a positive attitude to take care of their health and not to neglect it and provides opportunities to apply this knowledge and practice good health habits on themselves that will last them a lifetime.

The initiation of physical education courses and activities in the realm of educational pursuits at KFUPM has contributed to shape the destiny of many brilliant students in making their life healthy, peaceful, and enjoyable. As the idiom "A sound mind in a sound body" goes, there should be a balance between brawn and brain, and this is a vital factor that leads to tranquility, peace, friendship, comradeship, serenity, and above all to the wellness of an individual.

KFUPM is the only university in the whole Gulf region to make physical education compulsory for students during their time at the university. Students must undergo three physical education courses during their time at KFUPM, two during the preparatory year and one during the undergraduate years; in addition, there are two special courses for students with special needs are equivalent to the undergraduate courses.

Vision

To aspire to be the leader in providing the best physical education activities to combat stress and other related diseases, which are the bane of life today. The department will be at the forefront of inculcating healthy habits and providing the knowledge of how to avoid addictive behavior leading to a deterioration in health. The department aims to contribute to society by promoting the health of the nation's citizens.

Mission

The Department's mission is to provide a solid foundation for the future life of the students through appropriate physical education programs and health-related issues, which will inculcate fitness and wellness in their lifestyles and thereby enhance the quality of their life.

Objectives

- Identify the basic physical education content, concepts and tools related to the development of the physically educated person and offer a wide variety of physical activities.
- Compile a learning plan will enable students to understand the pedagogical process and practice it through peer and field experiences.
- Teach responsible personal and social behavior during physical activity.
- State the basic concepts and issues related to general health education programs and reduce health risks.
- Provide relief from stress and enjoyment in participation.
- Teach the specified sports, their history, laws, rules, skills and tactics.
- Encourage students to participate with confidence in sports.

Learning outcomes for students

- To understand the knowledge and skills needed for movement and so obtain the foundation for enjoyment, continued social development through physical activity and access to a physically active lifestyle.
- To understand the relationship between physical education and general health in their daily life.
- To be able to assess performance accurately and develop plans for improvement.
- To be able to reflect, plan and act in order to develop essential knowledge and understanding, attitudes, values and skills promotes healthy practices, encourage participation in regular physical activity, and support the maintenance of a healthy lifestyle.
- To learn the skills, tactics, and methods of play of the specified sports.

During the first and second semesters of the preparatory year the courses offered are PE 001 and PE 002, in which the student is introduced to three weeks of health education and twelve weeks of physical education (specified sports), where swimming is a compulsory activity for all.

The students take the above courses as per the syllabus prepared by the Physical Education Department are as follows:

Unit	No. of weeks	Hours per week	Total hours
Preparatory Health Education	3	2	6
Preparatory Physical Education (specified sports) includes 2 weeks of Pre-Test and 2 weeks of Post Test in Physical Fitness.	12	2	24
Total			**30**

At the undergraduates' level the courses offered are PE 101 and two PE special courses, PE 201 and PE 202. In these courses student studies three weeks of health education and twelve weeks of physical education (specified sports) in each course and the number of hours per week and the total hours are the same as for the preparatory classes i.e. six hours health education and twenty-four hours of physical education making it thirty hours totally. The course taken at the undergraduate level is either a continuation of the courses at the preparatory level but an advance stage or some new activities are introduced.

The students who are suffering from physical disabilities, deformities and the cases who are recovering from surgery or accidents receive rehabilitation through a special needs course which is a part of the 101 course. In addition, the department also caters to the needs of under-nourished and obese students through special programs.

The physical education department also takes care of the coaching of University teams in specified games are approved by the Saudi University Sport Federation. The teams trained by expert coaches participate in the Gulf inter-university competitions.

The department also provides consultancy to the University community, which includes the faculty members, staff and employees through various programs and takes care of rehabilitation for the individuals in the physical therapy unit (located in the stadium). The health clubs for the community provide special programs for the members to maintain their health, fitness and general well-being.

The department also makes available its entire infrastructure, including facilities and equipment, to those students, faculty, and staff who seek recreation through various physical activities after regular working hours.

English Language Department

Chairman: Dr. Malcolm Bancroft

Faculty

Albright	Daly	Mahmood
Anyan	Dusthimer	Mahony
Aurelius	Edwards	Otto
Bancroft	Gazdar	Owen
Bartle	Hamilton	Pearson
Berry	Hicks	Ray
Bilaal	Jenkins	Ryall
Blazenko	King	Schofield
Brad	Korst	Watts
Brown	Le Seelleur	
Canning	Lees	
Cullen	Lowry	

The English Language Department (ELD) consists of a Chairman and a teaching faculty of 34 lecturers. The department program offers three undergraduate-level English language courses: English 101 (An Introduction to Academic Discourse), English 102 (An Introduction to Report Writing), and English 214 (Academic & Professional Communication).

English 101 is a freshman English course that marks a transition from the Preparatory English Program (PEP) to undergraduate English studies. The primary aim of this course is to introduce students to an academic approach to thinking, reading, speaking, writing and language usage in an integrated, meaningful manner such that they are able to apply the skills learnt to their departmental studies. In addition, the ENGL 101 course aims to further develop the linguistic accuracy and range in English that students have acquired in their Preparatory Year.

The ENGL 102 and 214 courses concentrate on consolidating students' academic approach to thinking, reading, speaking, writing and language usage, as initiated in ENGL 101. In addition, the ENGL102 and 214 courses aim to develop and expand on the students' abilities to synthesize and evaluate information and conduct basic, independent research leading to the writing of a report. Additionally, in English 214, students are taught professional skills such as business correspondence, job interviewing, and multimedia presentations.

In all three courses, students will be expected to take on varying degrees of responsibility for their own learning and to perform a number of independently based tasks and activities outside the classroom. Indeed, the focus of all courses will be on students learning rather than teachers teaching.

Mission

The mission of the English Language Department is to provide the University's undergraduate students with the English language skills necessary to succeed in academic and professional life.

Vision

Our vision is the continuous development of our faculty and teaching curricula in order to equip the University's graduates with outstanding English language communication skills that will enhance the University's reputation and help make KFUPM graduates the most sought-after recruits nationally and regionally.

Goal

The main function of the ELD is to provide a language learning environment that is conducive to the teaching and learning of English language communication skills. The emphasis is twofold: *academic*—providing students with the linguistic and communicative skills needed in their university studies, including preparation for co-op and summer training); and, *professional*—providing students with high-level English language skills that will enable them to function at a high level in the workplace in reading, writing and speaking.

Program Objectives:

- To establish agreed standards of performance and proficiency in English at all levels in the University.
- To contribute to the development of courses that help to raise all students to acceptable levels of proficiency in English.
- To raise the standards of communicative competence for all students completing English courses in KFUPM.
- To broaden students' awareness of the world around them so that they are aware of, and equipped to deal with the challenges facing Saudi Arabia in the 21st century.

Outcomes:

Upon completion of the ELD courses, undergraduate students should be able to:

- Apply the critical thinking skills of analysis, synthesis and evaluation to a variety of texts.
- Apply a variety of strategies for planning, writing and revising academic essays and reports.
- Write well-organized, unified, coherent essays and reports.
- Work collaboratively with peers to plan, develop, and carry out writing projects and provide constructive feedback.
- Conduct basic research by accessing appropriate print and electronic sources in the Library and by using advanced search skills on the Internet.
- Incorporate source material into essays and reports by summarizing, quoting, and paraphrasing correctly.
- Provide documentation for sources with a Works Cited/References page and parenthetical citations using the APA style (English 102 and English 214)
- Appreciate the need for formal correctness in their writing through the use of revision and editing skills.
- Present information in an engaging and organized manner to an audience
- Utilize basic body language techniques to improve their delivery of presentations (eye contact / stance / gesture)
- Utilize clear, effective visual techniques to exemplify and provide support in their presentations.
- Review general reading in order to focus their search for texts on a specific area.
- Evaluate a variety of reading texts for their suitability by assessing relevance to topic and task; readability; elements of bias, and appropriateness of text type.
- Understand and avoid plagiarism by:
  - taking appropriate notes from a variety of texts and keeping such notes in an organized manner
  - taking full citation notes on parts of texts to be summarized, paraphrased or quoted in later written tasks.
  - Recording full reference information from all texts consulted and utilized using a consistent referencing format.
- Use appropriate language and techniques to write a letter, memo or email to a person, institution or business organization for a variety of purposes.
- Compose an appropriately designed CV/Résumé in support of a job application.
- Perform well in job interviews.

COLLEGE OF ENGINEERING & PHYSICS

Dean: Dr. Mamdouh A. Al-Harthi

DEPARTMENTS

AEROSPACE ENGINEERING
ELECTRICAL ENGINEERING
MECHANICAL ENGINEERING
CONTROL & INSTRUMENTATION ENGINEERING
PHYSICS

Vision

To be a leading college in engineering & physics education, research, and professional development.

Mission

- To attract and produce talented, broadly educated, and globally competitive graduates empowered to be future leaders
- To conduct top-quality research of high relevance to the nation and the region
- To engage in outreach programs which serve the needs of the local industry and the community

Philosophy

The programs of the College of Engineering & Physics are designed to develop intellectually curious and socially conscious minds that can create knowledge, carry out interdisciplinary research, and provide transformative solutions for the betterment of society. A sound knowledge of engineering and related disciplines is required so that the graduate can work effectively with other engineers, scientists, and technicians in fulfilling challenging assignments. Further, emphasis is placed on relevant general education to make college graduates aware of society's concerns in addition to technical issues, such as safety, aesthetics, economics, and the cost of energy and science in their decision-making process. Clear and precise communication skills, oral and written, are required for delivering judgments, drawing plans, and making decisions.

College Programs

The undergraduate programs of the College of Engineering & Physics provide students with a range of educational opportunities for intellectual growth and attainment of professional competence in the discipline they choose. Equipped with the knowledge of mathematics, physical sciences, computational techniques, and statistical analysis of data, the graduate can engage in creative design and construction, synthesis of systems, and research and development. The College curricula provide flexibility through elective courses and concentrations where courses selection decisions are left to the student and his advisor.

Curricular Requirements

The main features of the undergraduate programs in the college include:

Foundation Courses: To qualify our graduates in the digital era, all programs in the college are equipped with three digital literacy courses on Programming, Data Science, and Artificial Intelligence. Moreover, all programs contain the course "Business and Entrepreneurship", which provides students with the foundations of core business functions and concepts of management, marketing, finance, accounting, business legalities/law, and entrepreneurial mind-set. The engineering programs contain a number of courses in basic sciences to provide students with a solid background in the physical sciences and mathematics.

Depth Courses: At least one full year of study is devoted to the student's major field. Courses in this category are required courses designed to give the student the depth in his major. Every program contains a number of departmental electives, which are left open to the student to take from a wide pool of courses to extend his knowledge in his own area of interest within his major. Student in the engineering programs take a course leading to a capstone design project where they apply their engineering knowledge and design skills in planning and designing a real-world engineering project. The design should take into consideration appropriate constraints such as economic factors, safety, reliability, ethics, and environmental and social impacts. Physics students, instead, take a course in undergraduate research.

Breadth Courses: Several courses in every program are required to give the student some breadth of study in science and technology. In addition, under the heading of "Technical Electives", students are permitted to extend their study into more advanced courses in fields other than their major.

General Education Courses: Several courses are designed within the framework of the curriculum to broaden the students' general education. Such courses include Islamic history and culture, Arabic language and literature, English and economics.

Concentrations: Students in any program have the option of replacing elective course by a set of designated courses in various concentrations related to their field. Concentrations are designed based on the current job market in consultation with major industry players, and they are multi-disciplinary in nature.

Graduation Requirements

In order to qualify for graduation, student must

1. complete all required and elective courses in the selected degree program with a cumulative GPA of 2.00 or better;
2. achieve a major GPA of 2.00 or better;
3. complete successfully after the third year an 8-week summer training program in industry (for the science option) or 16-week internship (for the applied program).

Department of Aerospace Engineering

Chairman: Dr. Ayman M. Abdallah

Faculty

Abdallah	Alhazmi	Qasem
Abdelrahman	Ghazy	Vattathurvalappil
Al-Fifi	Ghazzawi	

Introduction

Aerospace Engineering is one of the most important strategic fields in the world from at least two aspects: first, its effect on the infrastructure of the country such as air transportation, civil aviation, industry, and economy; second, its relevance to defence issues including Air Force and Air Defence.

The aviation market in the middle east, a main industry attraction for AE graduate students, has consistently outperformed most of the regional markets in the past decade since the establishment of the AE BS Program. Between 2012 and 2032 growth in air passenger and cargo traffic in the region is expected to outperform all other regions in the world. Growth is also driven by establishment of new aerospace engineering companies and government organizations that cater to both civil and defence related sectors in the Kingdom. Also, the AE department aspires to contribute in one of the aims of Kingdom's Vision 2030, which is to involve industry experts and national academic institutions in exchanging knowledge and technology to build national expertise in the fields of manufacturing, maintenance, repair, research and development of aerospace defence industry.

Vision

The Aerospace Department at KFUPM aims at being a distinguished department known for its world-class competitive graduates, cutting edge research, leadership in aerospace engineering education, and professional society-related services.

Mission

The mission of the AE department is:

- to graduate leaders who are knowledgeable and equipped with the required professional skills to solve standing and emerging challenges.
- to provide excellent environment for education to support active learning and critical thinking.
- to provide a leading-edge research in collaboration with academic and industrial stakeholders.

Bachelor of Science (BS) IN AEROSPACE ENGINEERING

The Aerospace Engineering (AE) Program is designed to cover all fundamental aspects. The curriculum includes general education courses in Mathematics, Chemistry, Physics, Engineering, Computer Science, Islamic and Arabic Studies, English, and Physical Education. The program also provides the students with a strong base in the main areas of Aerospace Engineering: Aerodynamics and Gas Dynamics, Flight Dynamics and Control, Aerospace Structures, Flight Propulsion and other related fields such as Aerospace Systems Maintenance, Helicopter, Avionics, Flight Traffic Control, Flight Safety, Electronic Warfare and Radar, Astronautics and current trending topics like Unmanned Aerial Systems (UAS). Moreover, the curriculum is also augmented by several elective courses in various branches of Aerospace Engineering. A student can take two courses from Aerospace Engineering, two from other engineering/sciences/management fields, and two from General Studies subjects to broaden his knowledge of aerospace and in areas of his interest. It balances theory with application and provides practical experience through appropriate laboratory sessions. The program includes a senior project, a capstone design course, which provides the student with an opportunity to work with a design team that exposes him to unstructured problem-solving situations. Every Aerospace Engineering student is required to spend 8 weeks in summer training to make use of his knowledge and to acquire valuable experience in an industrial environment.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Aerospace Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Aerospace Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Graduates will excel in their professional career to meet the expectations of employers of aerospace engineers.
2. Qualified graduates will be able to pursue advanced Aerospace Engineering degrees in excellent world universities if they so desire.
3. Graduates will assume leadership roles in their profession and in their communities.

- **Student Outcomes (SOs)**

The ***Aerospace Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. communicate effectively with a range of audiences.

4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Aerospace Engineering

Every student majoring in Aerospace Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, 371	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
Science Elective	XXX xxx Science Elective	3
		32

(d) Core Requirements (47 credit hours)		
Statics	CE 201	3
Dynamics	ME 201	3
ME Drawing & Graphics	ME 210	3
Fundamentals of Thermo-fluids	AE 211	3
Introduction to Aerospace Engineering	AE 221	3
Introduction to AE Structures & Materials	AE 228	3
AE Vehicle Performance	AE 230	3
Fundamentals of AE Design	AE 312	1
AE Systems and Control	AE 313	3
Gas Dynamics	AE 325	3
Flight Structures	AE 328	3
Aerodynamics	AE 333	3
AE Numerical Methods Lab	AE 357	1
Senior Design	AE 412	2
Aerospace Engineering Lab	AE 421	1
Flight Propulsion	AE 422	3
Flight Dynamics	AE 426	3
Aerospace System Design	AE 427	3
		47

(e) Electives (15 credit hours)

AE Electives	Two AE xxx Courses	6
Engineering Elective	One XXX xxx Course	3
Free Electives	Two XXX xxx Courses	6
		15

(f) Summer Training (0 credit hours)

Each student must participate in an eight-week program of industrial experience and submit a formal report at the end of the training period.

Summer Training	AE 399	0
		0

The total number of credit hours required is **128**

Aerospace Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4
ENGL 101	Intro. to Academic Discourse	3	0	3
IAS 121	Language Foundation	2	0	2
MATH 101	Calculus I	4	0	4
PHYS 101	General Physics I	3	3	4
PE 101	Health and Physical Education I	0	2	1
	Total	15	9	18

Course	Title	LT	LB	Cr
ENGL 102	Intro. to Report Writing	3	0	3
IAS 111	Belief & Its Consequences	2	0	2
ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 102	Calculus II	4	0	4
PHYS 102	General Physics II	3	3	4
	Total	14	6	16

Sophomore Year

Course	Title	LT	LB	Cr
AE 211	Fundamentals of Thermo-fluids	3	0	3
ENGL 214	Academic & Professional Comm.	3	0	3
IAS 212	Ethics and Governance	2	0	2
ISE 291	Intro. to Data Science	3	0	3
MATH 201	Calculus III	3	0	3
CE 201	Statics	3	0	3
	Total	17	0	17

Course	Title	LT	LB	Cr
AE 221	Introduction to AE	2	3	3
AE 228	Introduction AE Struct. & Mat	3	0	3
COE 292	Intro. to Artificial Intelligence	3	0	3
MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
ME 201	Dynamics	3	0	3
	Total	14	3	15

Junior Year

Course	Title	LT	LB	Cr
ME 210	ME Drawing and Graphics	2	3	3
AE 230	AE Vehicle Performance	3	0	3
AE 313	AE Systems and Control	2	3	3
AE 357	AE Numerical Methods Lab	0	3	1
MATH 371	Intro. to Numerical Computing	3	0	3
XXX xxx	Engineering Elective	3	0	3
	Total	13	9	16

Course	Title	LT	LB	Cr
AE 312	Fundamentals of AE Design	1	0	1
AE 325	Gas Dynamics I	3	0	3
AE 328	Flight Structure I	3	0	3
AE 333	Aerodynamics I	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2
CGS 392	Career Essentials	0	2	1
	Total	15	2	16

Summer Session

Course	Title	LT	LB	Cr
AE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr
AE 412	Senior Design	2	0	2
AE 421	AE Lab	0	3	1
AE xxx	AE Elective I	3	0	3
AE xxx	AE Elective II	3	0	3
GS xxx	GS Elective	3	0	3
XXX xxx	Science Elective	3	0	3
	Total	14	3	15

Course	Title	LT	LB	Cr
AE 422	Flight Propulsion I	3	0	3
AE 426	Flight Dynamics I	3	0	3
AE 427	Aerospace Vehicle Design	3	0	3
XXX xxx	Elective I	3	0	3
XXX xxx	Elective II	3	0	3
	Total	15	0	15

Total Credit Hours	128

Bachelor of Science (BS) IN APPLIED AEROSPACE ENGINEERING

The Applied Aerospace Engineering (AAE) Program is designed to cover all fundamental aspects. The curriculum includes general education courses in Mathematics, Chemistry, Physics, Engineering, Computer Science, Islamic and Arabic Studies, English, and Physical Education. The program also provides the students with a strong base in the main areas of aerospace engineering: Aerodynamics and Gas Dynamics, Flight Dynamics and Control, Aerospace Structures, Flight Propulsion and other related fields such as Aerospace Systems Maintenance, Helicopter, Avionics, Flight Traffic Control, Flight Safety, Electronic Warfare and Radar, Astronautics and current trending topics like Unmanned Aerial Systems (UAS). Moreover, the curriculum is also augmented by elective courses in various branches of Aerospace Engineering. A student can take one course from Aerospace Engineering, one from math/basic sciences fields, and two from General Studies subjects to broaden his knowledge of aerospace and in areas of his interest. It balances theory with application and provides practical experience through appropriate laboratory sessions. The program includes senior design courses, a capstone design course which provides the student with an opportunity to work with a design team that exposes him to unstructured problem-solving situations. Every Applied Aerospace Engineering student is required to spend 15 weeks in industry to make use of his knowledge and to acquire valuable experience in an industrial environment.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Applied Aerospace Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Applied Aerospace Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Graduates will excel in their professional career to meet the expectations of employers of aerospace engineers.
2. Qualified graduates will be able to pursue advanced Aerospace Engineering degrees in excellent world universities if they so desire.
3. Graduates will assume leadership roles in their profession and in their communities.

- **Student Outcomes (SOs)**

The ***Applied Aerospace Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Applied Aerospace Engineering

Every student majoring in Applied Aerospace Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, 371	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
Science Elective	XXX xxx Science Elective	3
		32

(d) Core Requirements (47 credit hours)		
Statics	CE 201	3
Dynamics	ME 201	3
ME Drawing & Graphics	ME 210	3
Fundamentals of Thermo-fluids	AE 211	3
Introduction to Aerospace Engineering	AE 221	3
Introduction to AE Structures & Materials	AE 228	3
AE Vehicle Performance	AE 230	3
Fundamentals of AE Design	AE 312	1
AE Systems and Control	AE 313	3
Gas Dynamics	AE 325	3
Flight Structures	AE 328	3
Aerodynamics	AE 333	3
AE Numerical Methods Lab	AE 357	1
Senior Design	AE 412	2
Aerospace Engineering Lab	AE 421	1
Flight Propulsion	AE 422	3
Flight Dynamics	AE 426	3
Aerospace System Design	AE 427	3
		47

(e) Electives (15 credit hours)

AE Electives	Two AE xxx Courses	6
Engineering Elective	One XXX xxx Course	3
		15

(f) Internship (6 credit hours)

Each internship student must participate in a 15-week program of industrial experience and submit a report.

Internship	AE 398	6
		6

The total number of credit hours required is **128**

Applied Aerospace Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	ENGL 102	Intro. to Report Writing	3	0	3
ENGL 101	Intro. To Academic Discourse	3	0	3	IAS 111	Belief & Its Consequences	2	0	2
IAS 121	Language Foundation	2	0	2	ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	PHYS 102	General Physics II	3	3	4
PE 101	Health and Physical Education I	0	2	1					
	Total	15	9	18		Total	14	6	16

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
AE 211	Fundamentals of Thermo-fluids	3	0	3	AE 228	Introduction to AE Struct. & Mat	3	0	3
AE 221	Introduction to AE	2	3	3	AE 230	AE Vehicle Performance	3	0	3
ENGL 214	Academic & Professional Comm.	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
ISE 291	Intro. to Data Science	3	0	3	IAS 212	Ethics and Governance	2	0	2
MATH 201	Calculus III	3	0	3	MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
CE 201	Statics	3	0	3	ME 201	Dynamics	3	0	3
	Total	17	3	18		Total	17	0	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ME 210	ME Drawing and Graphics	2	3	3	AE 312	Fundamentals of AE Design	1	0	1
AE 313	AE Systems and Control	2	3	3	AE 333	Aerodynamics I	3	0	3
AE 325	Gas Dynamics I	3	0	3	AE 422	Flight Propolusion I	3	0	3
AE 328	Flight Structure I	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
AE 357	AE Numerical Methods Lab	0	3	1	GS xxx	GS Elective	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2	XXX xxx	Engineering Elective	3	0	3
MATH 371	Intro. to Numerical Computing	3	0	3	CGS 392	Career Essentials	0	2	1
	Total	15	9	18		Total	16	2	17

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
AE 398	Internship	0	0	6	AE 412	Senior Design	2	0	2
					AE 421	AE Lab	0	3	1
					AE 426	Flight Dynamics I	3	0	3
					AE 427	Aerospace Vehicle Design	3	0	3
					AE xxx	AE Elective I	3	0	3
					AE xxx	AE Elective II	3	0	3
					XXX xxx	Science Elective	3	0	3
	Total	0	0	6		Total	17	3	18

Total Credit Hours	128

Department of Electrical Engineering

Chairman: Dr. Abdallah Al-Ahmari

Faculty

Abdul-Jauwad	Al-Ohali	Kousa
Abido	Al-Qahtani, K	Landolsi
Abu-Al-Saud	Al-Qahtani, M	Mahnashi
Abuelmaatti	Alsaihati	Masoud
Al-Absi	Al-Shahrani	Masoudi
Alahmadi	Al-Shaikhi	Mesbah
Al-Ahmari	Alsunaidi	Mohandes
Al-Akhdar	Al-Suwailem	Mousa
Alawami	Al-Zaher	Muqaibel
Al-Baiyat	Ashraf	Naveed
Al-Battal	Bakhashwain	Nuruzzaman
Al-Dharrab	Balghonaim	Qureshi
Aldohan	Deriche	Ragheb
Al-Duwaish	El-Amin	Shafi
Alghadhban	Habiballah	Sharawi
Alghamdi	Hammi	Sheikh
Al-Hamouz	Hassan	Sorour
Al-Jamid	Hussein	Tasadduq
Al-Maghrabi	Ibrir	Zerguine
Al-Muhaini	Johar	Zidouri
Al-Naffouri	Kassas	Zummo

Introduction

The contribution of electrical engineering to modern society is a fact underlying a large number of products and services. Most modern appliances are electrically powered. Moreover, services such as global communications and large computing facilities are electronically-based. At present, equipment used in medical diagnosis and treatment relying on electrical engineering principles is finding widening applications. In addition to these examples, electrical engineering concepts deriving from such disciplines as control theory and information theory have had applications in economics, management, physiology, energy, and biomedicine.

Many of the products and services utilized all over the world are based on the work of electrical engineers. The availability of electric power for domestic and industrial use, the extensive, fast and reliable communications, and the large computational capacity achieved with modern computers are only some examples of the contributions of electrical engineers to human advancement. In addition to this, contributions by electrical engineers to the development of concepts in signals and systems, communications, simulation, analysis and control are applied in areas such as economics, management, psychology, and physiology.

Vision

To be globally known for skillful graduates and quality research with focus on national needs.

Mission

- Imparting profound knowledge in the areas of electrical engineering.
- Enriching graduates with technical and soft skills to take up leading role in the society.
- Producing high quality research with focus on energy-related challenges.

Bachelor of Science (BS) IN ELECTRICAL ENGINEERING

In training students, the electrical engineering program emphasizes three aspects. First, subjects in science such as mathematics, physics, and chemistry enable the student to develop the necessary analytical ability and prepare him with a sound scientific foundation. Second, subjects related to humanities and general studies ensure excellent skills and a broader outlook. Third, subjects that cover the main disciplines in electrical engineering (Energy, Control, Communications, Signal Processing, Electromagnetics, Electronics, and Digital Systems) ensure a broad knowledge of electrical engineering. Students can acquire greater depth and specialization through the choice of EE electives. These three aspects are supported with laboratories, summer training and a senior project. Laboratory experience exposes the students to the instrumentation, design, engineering practice, and construction of electrical and electronic devices and circuits. Our laboratories are equipped with state-of –the-art equipment. This is complemented by a summer employment program in which the student undergoes industrial training. Team work and design aspects are further emphasized through the senior project.

The curriculum and the courses in our program undergo continuous evaluation and updating to guarantee that our graduates are at the forefront of knowledge in the field. New courses related to wireless communications, renewable energy, etc., have been introduced to match the rapid growth.

After completing the undergraduate program in electrical engineering, the student is qualified to take up responsible employment or engage in higher studies by enrolling in a graduate program. Numerous work opportunities for electrical engineers exist in the Kingdom of Saudi Arabia and overseas, where graduates may work in the areas of communications – including telephony, internet services, and point-to-point radio and television, as well as the areas of power engineering, electrical installation, broadcasting, microwave, satellite, and mobile communications. Graduates are also employed by industry for work in information processing, computers, and in systems analysis. Other opportunities exist in industrial electronics, instrumentation, manufacturing technology, and training. Some of the graduates go on to pursue their graduate studies towards the MSc or PhD either at KFUPM or at top universities around the world.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Electrical Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Electrical Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. attain employment in governmental or private sector, or engage in entrepreneurship.
2. advance their careers by demonstrating leadership and interpersonal skills including teamwork and communication skills.
3. pursue their professional development through self-learning or pursue advanced degrees.

- **Student Outcomes (SOs)**

The ***Electrical Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Electrical Engineering

Every student majoring in Electrical Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (35 credit hours)		
Math	MATH 101, 102, 201, 208, EE 315	17
Physics	PHYS 101, 102, 305	11
Chemistry	CHEM 101	4
Science Elective	XXX xxx Science Elective	3
		35

(d) Core Requirements (40 credit hours)		
Digital Logic Design	COE 202	3
Electric Circuits I, II	EE 201, 213, 271	6
Electronics I, II	EE 203, 272, 303	7
Signals and Systems	EE 207	3
Electric Energy Eng.	EE 360	3
Digital Systems Eng.	EE 390	3
Fundamentals of EE Design	EE 311	3
Electromagnetic Waves & Applic.	EE 340	3
Communications Eng.	EE 370	3
Control Eng.	EE 380	3
Senior Design Project	EE 411	3
		40

(e) Electives (19 credit hours)		
Electrical Engineering Electives	Four EE 4xx Courses	12
Electrical Engineering Lab Electives	Three EE 3xx Lab Courses and One EE 4xx Lab Course	4
Technical Elective	One XE xxx Course	3
		19

(f) Summer Training (0 credit hours)

Summer Training	EE 399	0
		0

The total number of credit hours required is **128**

Electrical Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	ENGL 102	Introduction to Report Writing	3	0	3
ENGL 101	Intro. to Academic Discourse	3	0	3	IAS 111	Belief & Its Consequences	2	0	2
IAS 121	Language Foundation	2	0	2	ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	PE 101	Health and Physical Education I	0	2	1
					PHYS 102	General Physics II	3	3	4
	Total	15	7	17		Total	14	8	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
COE 202	Digital Logic Design	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
EE 201	Electric Circuits I	3	0	3	EE 203	Electronics I	3	0	3
ENGL 214	Academic & Professional Comn.	3	0	3	EE 207	Signals & Systems	3	0	3
ISE 291	Intro. to Data Science	3	0	3	EE 213	Electric Circuits II	2	0	2
MATH 201	Calculus III	3	0	3	EE 271	Electric Circuits II lab	0	3	1
					EE 272	Analog and Digital Electronics Lab	0	3	1
					MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
	Total	15	0	15		Total	14	6	16

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
EE 303	Electronics II	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
EE 315	Prob. Methods for EE	3	0	3	EE 311	Fundamentals of EE Design	3	0	3
EE 360	Elec. Energy Eng.	3	0	3	EE 340	Electromagnetic Waves & Applic.	3	0	3
EE 390	Digital Sys. Eng.	3	0	3	EE 370	Communications Eng.	3	0	3
EE 3xx	Lab Elective I	0	3	1	EE 380	Control Eng.	3	0	3
PHYS 305	Electricity And Magnetism I	3	0	3	EE 3xx	Lab Elective II	0	3	1
					CGS 392	Career Essentials	0	2	1
	Total	15	3	16		Total	15	5	17

Summer Session

Course	Title	LT	LB	Cr
EE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
EE 3xx	Lab Elective III	0	3	1	EE 411	Senior Design Project	1	6	3
EE 4xx	EE Elective I	3	0	3	EE 4xx	EE Elective III	3	0	3
EE 4xx	EE Elective II	3	0	3	EE 4xx	EE Elective IV	3	0	3
GS xxx	GS Elective	3	0	3	EE 4xx	Lab Elective I	0	3	1
IAS 212	Ethics and Governance	2	0	2	IAS xxx	Islamic/Arabic Elective	2	0	2
XXX xxx	Science Elective	3	0	3	XE xxx	Technical Elective	3	0	3
	Total	14	3	15		Total	12	9	15

Total Credit Hours	128

Bachelor of Science (BS) IN APPLIED ELECTRICAL ENGINEERING

In training students, the Applied Electrical Engineering program emphasizes three aspects. First, subjects in science such as mathematics, physics, and chemistry enable the student to develop the necessary analytical ability and prepare him with a sound scientific foundation. Second, subjects related to humanities and general studies to ensure excellent skills and a broader outlook. Third, subjects that cover the main disciplines in electrical engineering (Energy, Control, Communications, Signal Processing, Electromagnetics, Electronics, and Digital Systems) ensure a broad knowledge of electrical engineering. Students can acquire greater depth and specialization through the choice of EE electives. These three aspects are supported with laboratories, internship training and a senior project. Laboratory experience exposes the students to the instrumentation, design, and construction of electrical and electronic devices and circuits. Team work and design aspects are further emphasized through the senior project. A prominent characteristic of applied electrical engineering is the requirement that students spend 28 weeks in industry, a requirement that is satisfied through the internship program.

The curriculum and the courses in our program undergo continuous evaluation and update to guarantee that our graduates are at the forefront of knowledge in the field. New courses related to wireless communications, renewable energy, etc., have been introduced to match the rapid growth.

After completing the undergraduate program in applied electrical engineering, the student is qualified to take up responsible employment. Numerous work opportunities for applied electrical engineers exist in the Kingdom of Saudi Arabia and overseas, where graduates may work in the areas of communications, including telephony, internet services, radio and television, much of which incorporates the expanding field of microwaves. The areas of power engineering, electrical installation, broadcasting, and education also provide good career opportunities. A large number of graduates are also required by industry for work in information processing, computers, and systems analysis. Other opportunities exist in industrial electronics, instrumentation, manufacturing technology, and training. Some of the graduates go on to pursue their graduate studies towards the MSc or PhD either at KFUPM or at top universities around the world.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **“Applied Electrical Engineering”** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Applied Electrical Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. attain employment in governmental or private sector, or engage in entrepreneurship.
2. advance their careers by demonstrating leadership and interpersonal skills including teamwork and communication skills.

3. pursue their professional development through self-learning or pursue advanced degrees.

- **Student Outcomes (SOs)**

The ***Applied Electrical Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirement for the Bachelor of Science (BS) Degree in Applied Electrical Engineering

Every student majoring in Applied Electrical Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (35 credit hours)		
Math	MATH 101, 102, 201, 208, EE 315	17
Physics	PHYS 101, 102, 305	11
Chemistry	CHEM 101	4
Science Elective	XXX xxx Science Elective	3
		35

(d) Core Requirements (40 credit hours)		
Digital Logic Design	COE 202	3
Electric Circuits I, II	EE 201, 213, 271	6
Electronics I, II	EE 203, 272, 303	7
Signals and Systems	EE 207	3
Electric Energy Eng.	EE 360	3
Digital Systems Eng.	EE 390	3
Fundamentals of EE Design	EE 311	3
Electromagnetic Waves & Applic.	EE 340	3
Communications Eng.	EE 370	3
Control Eng.	EE 380	3
Senior Design Project	EE 411	3
		40

(e) Electives (13 credit hours)		
Electrical Engineering Electives	Two EE 4xx Courses	6
Electrical Engineering Lab Electives	Three EE 3xx Lab Courses and One EE 4xx Lab Course	4
Technical Elective	One XE xxx Course	3
		13

(f) Internship (6 credit hours)

Internship	EE 398	6
		6

The total number of credit hours required is **128**

Applied Electrical Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4
ENGL 101	Intro. to Academic Discourse	3	0	3
IAS 121	Language Foundation	2	0	2
MATH 101	Calculus I	4	0	4
PHYS 101	General Physics I	3	3	4
	Total	15	7	17

Course	Title	LT	LB	Cr
ENGL 102	Introduction to Report Writing	3	0	3
IAS 111	Belief & Its Consequences	2	0	2
ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1
PHYS 102	General Physics II	3	3	4
	Total	14	8	17

Sophomore Year

Course	Title	LT	LB	Cr
COE 202	Digital Logic Design	3	0	3
EE 201	Electric Circuits I	3	0	3
ENGL 214	Academic & Professional Comn.	3	0	3
IAS 212	Ethics and Governance	2	0	2
ISE 291	Intro. to Data Science	3	0	3
MATH 201	Calculus III	3	0	3
	Total	17	0	17

Course	Title	LT	LB	Cr
COE 292	Intro. to Artificial Intelligence	3	0	3
EE 203	Electronics I	3	0	3
EE 207	Signals & Systems	3	0	3
EE 213	Electric Circuits II	2	0	2
EE 271	Electric Circuits II lab	0	3	1
EE 272	Analog and Digital Electronics Lab	0	3	1
IAS xxx	Islamic/Arabic Elective	2	0	2
MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
	Total	16	6	18

Junior Year

Course	Title	LT	LB	Cr
EE 303	Electronics II	3	0	3
EE 315	Prob. Methods for EE	3	0	3
EE 360	Elec. Energy Eng.	3	0	3
EE 390	Digital Sys. Eng.	3	0	3
EE 3xx	Lab Elective I	0	3	1
EE 3xx	Lab Elective II	0	3	1
PHYS 305	Electricity And Magnetism I	3	0	3
	Total	15	6	17

Course	Title	LT	LB	Cr
BUS 200	Business & Entrepreneurship	3	0	3
EE 311	Fundamentals of EE Design	3	0	3
EE 340	Electromagnetic Waves & Applic.	3	0	3
EE 370	Communications Eng.	3	0	3
EE 380	Control Eng.	3	0	3
XXX xxx	Science Elective	3	0	3
CGS 392	Career Essentials	0	2	1
	Total	18	2	19

Senior Year

Course	Title	LT	LB	Cr
EE 398	Internship	0	0	6
	Total	0	0	6

Course	Title	LT	LB	Cr
EE 3xx	Lab Elective III	0	3	1
EE 411	Senior Design Project	1	6	3
EE 4xx	EE Elective I	3	0	3
EE 4xx	EE Elective II	3	0	3
XE xxx	Technical Elective	3	0	3
EE 4xx	Lab Elective I	0	3	1
GS xxx	GS Elective	3	0	3
	Total	13	12	17

Total Credit Hours	128

Department of Mechanical Engineering

Chairman: Dr. Khaled Al-Athel

Faculty

Abdul Samad	Al-Sulaiman	Leseman
Abdulazeem	Alzahrani	Mekid
Abu-Dheir	Alzaydi	Merah
Akhtar	Anis	Mezghani
Al-Athel	Antar	Mokheimer
Al-Badour	Bahaidarah	Muhammad
Albinmousa	Baig	Munteshari
Alhems	Bashmal	Patel
Ali, M	Bazoune	Qureshi
Ali, U	Ben-Mansour, R	Raza
Al-Mangour	Bin-Mansoor, S	Said
Al-Merbati	Fallata	Sarhan
Al-Qahtani, H	Furquan	Shaukat
Al-Qahtani, M	Gasem	Shuja
Al-Quaity	Habib	Sorour
Al-Qutub	Hassan	Toor
Alsaeed	Hawwa	Yaqub
Al-Sarkhi	Jaber	Yilbas
Al-Sharafi	Khalifa	Zahoor
Al-Shehri	Khater	Zubair
Al-Solihat		

Introduction

Mechanical engineering is one of the oldest, broadest, and perhaps most versatile discipline among all engineering disciplines. Mechanical engineers use the principles of energy, mechanics, and materials to design and manufacture machines and devices of all types, and create the systems and processes that drive technology and virtually every industry. The key characteristics of the mechanical engineering profession are its breadth, flexibility, and individuality. Mechanical engineering derives its breadth from the need to design and manufacture everything from small individual components and devices to large engineering structures and systems. Its flexibility emanates from its scope involving materials, solid and fluid mechanics, thermodynamics, heat transfer, control, instrumentation, design, and manufacturing. Its individuality lies in the ever-emerging specialized mechanical engineering fields such as biomechanics, robotics, mechatronics, nanomechanics, microfluidics, micropower generation, MEMS and NEMS.

Mechanical engineering encompasses an understanding of core concepts including mechanics, kinematics, thermodynamics, heat transfer, materials science, structural and manufacturing analyses. Mechanical Engineers use these core concepts to conceive, design, develop, manufacture, and maintain devices and tools, equipment and machinery, products and plants that run the engineering industry. Mechanical engineers also use these core principles to ensure that the products are manufactured economically, and function safely, efficiently and reliably. Mechanical engineers work in the automotive, aerospace, chemical, computer, power, petrochemical, marine and machine tool manufacturing industries, to name a few. Thus, it may be safely stated that every product or service in the modern world has probably been touched in some way by a mechanical engineer.

Mission

The Mechanical Engineering Department is committed to providing the highest quality education in mechanical engineering, conducting world-class basic and applied research, addressing the evolving needs of industry and society, and supporting the development of more competitive and new industries in the Kingdom of Saudi Arabia.

Vision

The Mechanical Engineering Department at KFUPM will seek distinction as a leader in providing world-class mechanical engineering education to the Kingdom of Saudi Arabia and the Gulf region. The graduates of the Department will be at the forefront of establishing, advancing, and expanding an indigenous knowledge base, which can be solidly relied upon accepting future challenges, providing proper directions for industrial growth, and furnishing reliable solutions to engineering problems.

Bachelor of Science (BS) IN MECHANICAL ENGINEERING

The mechanical engineering curriculum at KFUPM has been designed to provide a broad yet rigorous understanding of core mechanical engineering subjects in thermal sciences, mechanical design, materials science and manufacturing processes in the first three years of study. During these years the ME curriculum aims to develop critical thinking and problem-solving skills using the principles of science and mathematics. ME students have to take an 8-week Summer Training Program in industry. After completion of his summer training each student is required to submit a formal summer training report. In the senior year, the students have sufficient flexibility to select ME and Technical Electives from a broad spectrum of courses in the areas of thermo-fluids, design and dynamics, or materials and manufacturing. A senior Capstone Design project taken over the two final semesters provides each student with the opportunity to integrate his knowledge of the previous three years, exercise his creativity, enhance his individuality, and develop entrepreneurship skills.

The employment opportunities for ME graduates from KFUPM have been very good and are expected to become even better with the rapid pace of industrialization in the Kingdom of Saudi Arabia. Large-scale expansions in the petrochemical, chemical process, and power generation industries will require a growing influx of ME graduates. Also, many ambitious programs in clean water, clean energy, nanotechnology, and nuclear power generation will result in a substantial increase in the demand for ME graduates in the short and long term.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Mechanical Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Mechanical Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Knowledge and competencies to pursue a successful career in mechanical engineering, other related fields, or engage in entrepreneurship.
2. Continuation of their lifelong learning and professional development through self-study, continuing education, graduate studies, or professional certification.
3. Lead and actively participate in efforts to address social, technical and business challenges of the 21st century and in line with the Kingdom's Vision 2030.

- **Student Outcomes (SOs)**

The ***Mechanical Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Mechanical Engineering

Every student majoring in Mechanical Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 202, 317, STAT 319	20
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		32

(d) Core Requirements (50 credit hours)		
Statics & Strength of Materials	CE 202	3
EE Principles and Applications	EE 234, 235	4
Mechanical Engineering Drawing & Graphics	ME 210	3
Intro. to Mechanical Engineering Design	ME 218	2
Dynamics & Control	ME 201, 401	6
Thermodynamics	ME 203, 204	6
Machine Design	ME 301, 302	6
Mechanical System Design Lab	ME 303	1
Materials Science and Engineering	ME 216, 217	4
Manufacturing Processes	ME 322, 323	4
Fluid Mechanics	ME 311	3
Heat Transfer	ME 315	3
Thermofluids Lab	ME 316	1
Measurements and control Lab.	ME 402	1
Senior Design Project	ME 411, 412	3
		50

(e) Electives (12 credit hours)		
Mechanical Engineering Electives	Three ME 4xx Courses	9
Technical Elective	One XE xxx courses	3
		12

(f) Summer Training (0 credit hours)

Summer Training	ME 399	0
		0

The total number of credit hours required is **128**

Mechanical Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	ENGL 102	Introduction to report writing	3	0	3
ENGL 101	Intro. to Academic Discourse	3	0	3	IAS 111	Belief & Its Consequences	2	0	2
IAS 121	Language Foundation	2	0	2	ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1	PHYS 102	General Physics II	3	3	4
PHYS 101	General Physics I	3	3	4					
	Total	15	9	18		Total	14	6	16

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CE 202	Statics & Strength of Materials	3	0	3	ENGL 214	Academic & Professional Comn.	3	0	3
MATH 201	Calculus III	3	0	3	ISE 291	Intro. to Data Science	3	0	3
ME 203	Thermodynamics I	3	0	3	MATH 202	Elements of Differential Equations	3	0	3
ME 210	ME Drawing & Graphics	2	3	3	ME 201	Dynamics	3	0	3
ME 216	Materials Science and Eng.	3	0	3	ME 204	Thermodynamics II	3	0	3
ME 217	Materials Lab	0	3	1	ME 218	Intro. ME Design	1	3	2
	Total	14	6	16		Total	16	3	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
COE 292	Intro. to Artificial Intelligence	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
EE 234	EE Principles and Applications	3	3	3	CGS 392	Career Essentials	0	2	1
EE 235	EE Principles and Applications Lab	0	3	1	IAS 212	Ethics and Governance	2	0	2
ME 301	Machine Design I	3	0	3	STAT 319	Prob.& Stat. for Engineers	2	3	3
ME 311	Fluid Mechanics	3	0	3	ME 302	Machine Design II	3	0	3
ME 322	Manufacturing Processes	3	0	3	ME 303	Mechanical System Design Lab	0	3	1
ME 323	Manufacturing Lab	0	3	1	ME 315	Heat Transfer	3	0	3
					ME 316	Thermo-fluid Lab	0	3	1
	Total	15	9	17		Total	13	11	17

Summer Session

Course	Title	LT	LB	Cr
ME 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 371	Intro. Numerical Methods	3	0	3	GS xxx	GS Elective	3	0	3
ME 401	System Dynamics & Control	3	0	3	IAS xxx	Islamic/Arabic Elective	2	0	2
ME 402	Measurements & Control Lab	0	3	1	ME 412	Senior Design Project II	0	6	2
ME 411	Senior Design Project I	1	0	1	ME 4xx	ME Elective III	3	0	3
ME 4xx	ME Elective I	3	0	3	XE xxx	Technical Elective	3	0	3
ME 4xx	ME Elective II	3	0	3					
	Total	13	3	14		Total	11	6	13

Total Credit Hours	128

Bachelor of Science (BS) IN APPLIED MECHANICAL ENGINEERING

The Applied Mechanical Engineering (AME) curriculum at KFUPM has been designed to provide a broad yet rigorous understanding of core mechanical engineering subjects in thermal sciences, mechanical design, materials science and manufacturing processes in the first three years of study. During these years, the AME curriculum aims at developing critical thinking and problem-solving skills using the principles of science and mathematics. In the second semester of the junior year each AME student is required to go on a 15-week program of internship industry experience. After completion of his internship training each student is required to submit a formal internship report and make an oral presentation of his internship experience. In the senior year the students have sufficient flexibility to select ME Electives from a broad spectrum of courses in the areas of thermo fluids, design and dynamics, or materials and manufacturing. A senior Capstone Design project spread over two semesters provides each student with the opportunity to integrate his knowledge of the previous three years, exercise his creativity, enhance his individuality, and develop entrepreneurship skills.

The employment opportunities for AME graduates from KFUPM have been very good and are expected to become even better with the rapid pace of industrialization in the Kingdom of Saudi Arabia. Large-scale expansions in the petrochemical, chemical process, and power-generation industries will require a growing influx of AME graduates. Also, many ambitious programs in clean water, clean energy, nanotechnology, and nuclear power generation will result in a substantial increase in the demand for AME graduates in both the short and long term.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Applied Mechanical Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Applied Mechanical Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Knowledge and competencies to pursue a successful career in mechanical engineering, other related fields, or engage in entrepreneurship.
2. Continuation of their lifelong learning and professional development through self-study, continuing education, graduate studies, or professional certification.
3. Lead and actively participate in efforts to address social, technical and business challenges of the 21st century and in line with the Kingdom's Vision 2030.

- **Student Outcomes (SOs)**

The ***Applied Mechanical Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. communicate effectively with a range of audiences.

4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Applied Mechanical Engineering

Every student majoring in Applied Mechanical Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 202, 317, STAT 319	20
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		32

(d) Core Requirements (50 credit hours)		
Statics & Strength of Materials	CE 202	3
EE Principles and Applications	EE 234, 235	4
Mechanical Engineering Drawing & Graphics	ME 210	3
Intro. to Mechanical Engineering Design	ME 218	2
Dynamics & Control	ME 201, 401	6
Thermodynamics	ME 203, 204	6
Machine Design	ME 301, 302	6
Mechanical System Design Lab	ME 303	1
Materials Science and Engineering	ME 216, 217	4
Manufacturing Processes	ME 322, 323	4
Fluid Mechanics	ME 311	3
Heat Transfer	ME 315	3
Thermofluids Lab	ME 316	1
Measurements and control Lab.	ME 402	1
Senior Design Project	ME 415	3
		50

(e) Electives (6 credit hours)		
Mechanical Engineering Electives	Two ME 4xx Courses	6
		6

(f) Internship (6 credit hours)

Internship	ME 398	6
		6

The total number of credit hours required is **128**

Applied Mechanical Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4
ENGL 101	Intro. Academic Discourse	3	0	3
IAS 121	Language Foundation	2	0	2
MATH 101	Calculus I	4	0	4
PE 101	Health and Physical Education I	0	2	1
PHYS 101	General Physics I	3	3	4
	Total	15	9	18

Course	Title	LT	LB	Cr
ENGL 102	Introduction to report writing	3	0	3
IAS 111	Belief & Its Consequences	2	0	2
ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 102	Calculus II	4	0	4
PHYS 102	General Physics II	3	3	4
	Total	14	6	16

Sophomore Year

Course	Title	LT	LB	Cr
CE 202	Statics & Strength of Materials	3	0	3
ENGL 214	Academic & Professional Writing	3	0	3
MATH 201	Calculus III	3	0	3
ME 203	Thermodynamics I	3	0	3
ME 210	ME Drawing & Graphics	2	3	3
ME 216	Materials Science and Eng.	3	0	3
ME 217	Materials Lab	0	3	1
	Total	17	6	19

Course	Title	LT	LB	Cr
EE 234	EE Principles and Applications	3	0	3
EE 235	EE Principles and Applications Lab	0	3	1
ISE 291	Intro. to Data Science	3	0	3
MATH 202	Elements of Differential Equations	3	0	3
ME 201	Dynamics	3	0	3
ME 204	Thermodynamics II	3	0	3
ME 218	Intro. ME Design	1	3	2
	Total	16	6	18

Junior Year

Course	Title	LT	LB	Cr
COE 292	Intro. to Artificial Intelligence	3	0	3
IAS 212	Ethics and Governance	2	0	2
STAT 319	Prob.& Stat. for Engineers	2	3	3
ME 301	Machine Design I	3	0	3
ME 311	Fluid Mechanics	3	0	3
ME 322	Manufacturing Processes	3	0	3
ME 323	Manufacturing Lab	0	3	1
	Total	16	6	18

Course	Title	LT	LB	Cr
BUS 200	Business & Entrepreneurship	3	0	3
CGS 392	Career Essentials	0	2	1
IAS xxx	Islamic/Arabic Elective	2	0	2
MATH 371	Intro. Numerical Methods	3	0	3
ME 302	Machine Design II	3	0	3
ME 303	Mechanical System Design Lab	0	3	1
ME 315	Heat Transfer	3	0	3
ME 316	Thermo-fluid Lab	0	3	1
	Total	14	8	17

Senior Year

Course	Title	LT	LB	Cr
ME 398	Internship	0	0	6
	Total	0	0	6

Course	Title	LT	LB	Cr
GS xxx	GS Elective	3	0	3
ME 401	System Dynamics & Control	3	0	3
ME 402	Measurements & Control Lab	0	3	1
ME 415	Senior Design Project	0	9	3
ME 4xx	ME Elective I	3	0	3
ME 4xx	ME Elective II	3	0	3
	Total	12	12	16

Total Credit Hours 128

Department of Control and Instrumentation Engineering

Chairman: Dr. Mujahed Al-Dhaifullah

Faculty

Al-Amer	Al-Sunni	Emzir
Al-Saif	Al-Yazidi	Mahmoud
Al-Shehri	Elferik	Mysorewala

Introduction

The Control and Instrumentation Engineering (CIE) has multidisciplinary objectives in engineering education. CIE builds on a judicious integration of various scientific and engineering fields so as to achieve its global objective of accomplishing optimum productivity through an optimal use of the available resources. The CIE program aims to prepare students to use their problem-solving skills to tackle technological issues in a variety of engineering systems and to be a lifelong learner up-to-date with the latest scientific and technological advances in the field.

The main objective of the CIE department is graduating engineers who can carry out analysis, design, evaluation, and implementation of modern control and instrumentation systems for key local/regional industries.

Vision

To become a well-recognized worldwide center of excellence in education and research in the areas of Control and Instrumentation Engineering.

Mission

The mission of the Control and Instrumentation Engineering department is to provide high quality education, research and community services in the areas of Control and Instrumentation.

Goals

- To provide a high quality, state-of-the-art education in Control, Automation, and Instrumentation Engineering that produces professionals who are capable of performing jobs in their fields of specialization at the highest level of quality, competitiveness and professionalism.

- To conduct research that expands knowledge in the areas of Control, Automation, and Instrumentation and to provide a high-quality graduate program that prepares students properly in their areas of specialty.

- To provide industry with a high-quality professional training, applied projects, and consultation services in the area of Control, Automation, and Instrumentation that is up-to-date and competitive worldwide.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **“Control and Instrumentation Engineering”** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Control and Instrumentation Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Become leading professionals in their careers by demonstrating technical expertise in Control and Instrumentation Engineering and interpersonal skills.
2. Continue their professional development and learning to adapt to ever-changing environments.
3. Make positive contributions to their organizations, profession, and society at large.

- **Student Outcomes (SOs)**

The ***Control and Instrumentation Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. communicate effectively with a range of audiences.

4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Control and Instrumentation Engineering

Option I: Summer Training

The degree requirements for the CIE program (Summer Training Option) can be grouped into broad sets of requirements as shown below:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (26 credit hours)		
Math	MATH 101, 102, 201, 208	14
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		26

(d) General Engineering Fundamentals (19 credit hours)		
Probability and Statistics	ISE 205	3
Engineering Economic Analysis	ISE 307	3
Electrical Circuits I	EE 201	3
Thermodynamics I	ME 203	3
Electronics	EE 203, 237	4
Numerical Methods	CIE 301	3
		19

(e) Core Requirements (34 credit hours)		
Design of Digital Systems	CIE 204	3
Linear Control Systems	CIE 305, 306	4
Instrumentation Engineering	CIE 312	3
Signals and Systems	CIE 315	3
Control Systems Design	CIE 316	3
Computer Control Systems	CIE 318	3
Seminars	CIE 390	0
Automation Devices and Electronics	CIE 410	3
Mechatronics	CIE 412	3

Industrial Process Control	CIE 418	3
Instrumentation for Process Control	CIE 438	3
Senior Design Project	CIE 490	3
		34

(f) Electives (15 credit hours)

CIE Electives	Four CIE 4xx Courses	12
Technical Elective	One XE xxx Course	3
		15

(g) Summer Training (0 credit hours)

Students taking the summer training option must spend 8 weeks of training in a facility approved by the department. Each student needs to submit a report and make an oral presentation.

Summer Training	CIE 399	0
		0

The total number of credit hours required is **128**

Control & Instrumentation Engineering Curriculum - Summer Training Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	PHYS 102	General Physics II	3	3	4
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
ICS 104	Intro. to Programm. in Python & C	2	3	3	IAS 121	Language Foundation	2	0	2
PE 101	Health and Physical Education I	0	2	1	CHEM 101	Principles of Chemical Science I	3	4	4
	Total	12	8	15		Total	15	7	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 291	Intro. to Data Science	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
MATH 201	Calculus III	3	0	3	MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
EE 201	Electrical Circuits I	3	0	3	CIE 204	Digital Systems Design	2	3	3
ENGL 214	Academic & Professional Comm.	3	0	3	EE 203	Electronics I	3	0	3
ME 203	Thermodynamics I	3	0	3	ISE 205	Eng. Probability and Statistics	3	0	3
IAS 111	Belief & Its Consequences	2	0	2	IAS 212	Ethics and Governance	2	0	2
	Total	17	0	17		Total	16	3	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CIE 305	Linear Control Systems	3	0	3	CIE 301	Numerical Methods	3	0	3
CIE 306	Linear Control Systems lab	0	3	1	CIE 316	Control Systems Design	2	3	3
ISE 307	Eng. Economic Analysis	3	0	3	XE xxx	Technical Elective	3	0	3
CIE 312	Instrumentation Eng.	2	3	3	CIE 318	Computer Control Systems	2	3	3
IAS xxx	Islamic/Arabic Elective	2	0	2	BUS 200	Business & Entrepreneurship	3	0	3
CIE 315	Signals and Systems	3	0	3	CIE 390	Seminars	0	0	0
					CGS 392	Career Essentials	0	2	1
					EE 237	Electronic Circuits Lab	0	3	1
	Total	13	6	15		Total	13	11	17

Summer Session

Course	Title	LT	LB	Cr
CIE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CIE 410	Automat. Devices and Electronics	2	3	3	CIE 412	Mechatronics	2	3	3
CIE 490	Senior Design Project	0	9	3	CIE 4xx	Elective III	3	0	3
CIE 4xx	Elective I	3	0	3	CIE 4xx	Elective IV	3	0	3
CIE 4xx	Elective II	3	0	3	CIE 418	Industrial Process Control	3	0	3
GS xxx	GS Elective	3	0	3	CIE 438	Instrument. for Process Control	2	3	3
	Total	11	12	15		Total	13	6	15

Total Credit Hours	128

Requirements for the Bachelor of Science (BS) Degree in Control and Instrumentation Engineering

Option II: Internship

The degree requirements for the CIE program (Internship Option) can be grouped into broad sets of requirements as shown below:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (26 credit hours)		
Math	MATH 101, 102, 201, 208	14
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		26

(d) General Engineering Fundamentals (19 credit hours)		
Probability and Statistics	ISE 205	3
Engineering Economic Analysis	ISE 307	3
Electrical Circuits I	EE 201	3
Thermodynamics I	ME 203	3
Electronics	EE 203, 237	4
Numerical Methods	CIE 301	3
		19

(e) Core Requirements (34 credit hours)		
Design of Digital Systems	CIE 204	3
Linear Control Systems	CIE 305, 306	4
Instrumentation Engineering	CIE 312	3
Signals and Systems	CIE 315	3
Control Systems Design	CIE 316	3
Computer Control Systems	CIE 318	3
Seminars	CIE 390	0
Automation Devices and Electronics	CIE 410	3
Mechatronics	CIE 412	3

Industrial Process Control	CIE 418	3
Instrumentation for Process Control	CIE 438	3
Senior Design Project	CIE 490	3
		34

(f) Electives (9 credit hours)

CIE Electives	Two CIE 4xx Courses	6
Technical Electives	One XE xxx Course	3
		9

(g) Internship (6 credit hours)

Students taking the Internship option must join a 15-week long industrial training program approved by the department. Each student needs to submit a report and make an oral presentation.

Internship	CIE 398	6
		6

The total number of credit hours required is **128**

Control & Instrumentation Engineering Curriculum - Internship Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr
MATH 101	Calculus I	4	0	4
PHYS 101	General Physics I	3	3	4
ENGL 101	Intro. to Academic Discourse	3	0	3
ICS 104	Intro. to Programm. in Python & C	2	3	3
IAS 121	Language Foundation	2	0	2
PE 101	Physical Education I	0	2	1
	Total	14	8	17

Course	Title	LT	LB	Cr
MATH 102	Calculus II	4	0	4
PHYS 102	General Physics II	3	3	4
ENGL 102	Intro. to Report Writing	3	0	3
IAS 111	Belief & Its Consequences	2	0	2
CHEM 101	Principles of Chemical Science I	3	4	4
	Total	15	7	17

Sophomore Year

Course	Title	LT	LB	Cr
ISE 291	Intro. to Data Science	3	0	3
MATH 201	Calculus III	3	0	3
EE 201	Electrical Circuits I	3	0	3
ENGL 214	Academic & Professional Comm.	3	0	3
ME 203	Thermodynamics I	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3
	Total	18	0	18

Course	Title	LT	LB	Cr
COE 292	Intro. to Artificial Intelligence	3	0	3
MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
CIE 204	Digital Systems Design	2	3	3
EE 203	Electronics I	3	0	3
ISE 205	Eng. Probability and Statistics	3	0	3
IAS 212	Ethics and Governance	2	0	2
	Total	16	3	17

Junior Year

Course	Title	LT	LB	Cr
CIE 305	Linear Control Systems	3	0	3
CIE 306	Linear Control Systems lab	0	3	1
ISE 307	Eng. Economic Analysis	3	0	3
CIE 312	Instrumentation Eng.	2	3	3
IAS xxx	Islamic/Arabic Elective	2	0	2
CIE 315	Signals and Systems	3	0	3
CIE 410	Automat. Devices and Electronics	2	3	3
	Total	15	9	18

Course	Title	LT	LB	Cr
CIE 301	Numerical Methods	3	0	3
CIE 316	Control Systems Design	2	3	3
XE xxx	Technical Elective	3	0	3
CIE 318	Computer Control Systems	2	3	3
GS xxx	GS Elective	3	0	3
CIE 390	Seminars	0	0	0
CGS 392	Career Essentials	0	2	1
EE 237	Electronic Circuits Lab	0	3	1
	Total	13	11	17

Senior Year

Course	Title	LT	LB	Cr
CIE 398	Internship	0	0	6
	Total	0	0	6

Course	Title	LT	LB	Cr
CIE 412	Mechatronics	2	3	3
CIE 4xx	Elective I	3	0	3
CIE 4xx	Elective II	3	0	3
CIE 418	Industrial Process Control	3	0	3
CIE 438	Instrument. for Process Control	2	3	3
CIE 490	Senior Design Project	0	9	3
	Total	13	15	18

Total Credit Hours	128

Department of Physics

Chairman: Dr. Abdulaziz Al-Aswad

Faculty

Al-Abdullah	Al-Sunaidi	Kunwar
Al-Aithan	Al-Zahrani	Maalej
Alam	Bahlouli	Mekki, A
Al-Amri	Dastageer	Mekki, M
Al-Amoudi	Dwaikat	Naqvi
Al-Aswad	El-Said	Ndiaye
Al-Basheer	Gasmi	Raashid
Al-Jalal	Ghannam	Rao
Al-Kuhaili	Gondal	Salem
Al-Luhaibi	Haider	Yamani
Al-Marzoug	Harrabi	Ziq
Al-Matouq	Khateeb-Ur-Rehman	
Al-Sadah	Khiari	

Introduction

The Department of Physics at King Fahd University of Petroleum and Minerals is one of the distinguished departments in teaching, research, and community services. The department obtained accreditation from the National Center for Academic Accreditation and Assessment (NCAAA) in 2014. The faculty of the department includes over thirty members who are PhD holders from prestigious international universities. The department undertakes research in a variety of Physics subjects and houses research groups that carry out research in Atomic/Molecular/Optical physics, Condensed Matter physics, and Nuclear Physics. The department offers a B.S. degree for undergraduate students as well as M.S. and PhD degrees for graduate students.

Physics deals with the study of natural phenomena originating from matter, motion, and energy. It therefore represents the foundation of all scientific, technological, and engineering disciplines. The main purpose of physics is to understand and describe the apparent complexities of nature with as few unifying concepts as possible.

Vision

The physics department aspires to be one of the leading departments in teaching, research, and community services.

Mission

The Physics Department is committed to providing high quality fundamental education in physics in accordance with international standards in order to prepare creative young scientists with strong analytical, experimental, and communication skills.

Program Educational Objectives

- Prepare graduates capable of pursuing graduate studies in physics and related fields
- Prepare graduates for a successful career in industry and research laboratories
- Provide graduates with broad knowledge that allows them to be self-learners

Student Learning Outcomes

On successful completion of this program, graduates will be able to:

- Recognize the laws of classical physics at the basic and intermediate levels
- Recognize the laws of quantum physics at the basic and intermediate levels
- Recognize the laws of at least one major specialty area of physics at the basic and intermediate levels
- Solve problems in classical physics at the basic and intermediate levels
- Solve problems in quantum physics at the basic and intermediate levels
- Solve problems in at least one major specialty area of physics at the basic and intermediate levels
- Analyze and interpret experimental data as well as write concise reports
- Be a good, and ethically responsible, team player

- Use mathematical skills to solve problems in physics at the basic and intermediate levels
- Use computing tools to solve problems in physics at the basic and intermediate levels
- Search for and utilize information on topics in physics from a variety of sources
- Communicate physics concepts verbally, graphically, and in writing
- Setup and conduct experiments in order to study physical phenomena

Requirements for the B. S. Degree in Physics

The Department expects every student majoring in Physics to acquire a basic knowledge of

- Classical mechanics
- Electromagnetism, wave, and optical phenomena
- Quantum mechanics and its applications to simple physical systems
- Kinetic theory, thermodynamics, and statistical mechanics
- Experimental physics

The required courses are designed in such a way to ensure that every student graduating in physics has proficiency in all of the above areas of physics. The introductory sequence of general Physics 101, 102, 204 covers the entire subject matter of physics at an elementary level. Classical mechanics is dealt with in Physics 300 at the intermediate level. Physics 305 and 306 give the required knowledge and competency in classical electrodynamics and wave optics phenomena. Quantum mechanics and its applications is dealt with first in Physics 213 at an elementary level, followed by Physics 310, and Physics 410 at a more advanced level. Physics 430 examines the statistical and thermal descriptions of many particle systems. Students have many opportunities to learn experimental techniques in Physics 205, 309, and 403. Methods of theoretical physics are introduced in Physics 210 while electronics is dealt with in Physics 308. Students are also trained in Research skills in Physics 497.

Requirements for the BS Degree in Physics

Each student majoring in Physics must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (26 credit hours)		
Math	MATH 101, 102, 201, 202	14
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		26

(d) Core Courses (42 credit hours)		
General Physics III	PHYS 204, 205	4
Methods of Theoretical Physics	PHYS 210	3
Modern Physics	PHYS 213	3
Classical Mechanics I	PHYS 300	4
Electricity & Magnetism	PHYS 305, 306	6
Electronics	PHYS 308	4
Experimental Physics	PHYS 309, 403	4
Quantum Mechanics	PHYS 310, 410	6
Physics Seminar	PHYS 499	1
Undergraduate Research	PHYS 497	3
Thermal & Statistical Physics	PHYS 430	4
		42

(e) Electives (21 credit hours)		
Physics Electives	Two PHYS xxx Courses and Two PHYS 4xx Courses	12
Engineering Elective	One XE xxx Engineering Course (200 level or higher)	3
Technical Electives	Two XE xxx Courses (200 level or higher, Not IAS or GS Courses)	6
		21

(f) Summer Training (2 credit hours)

Students are required to spend one summer working in industry prior to the term in which they expect to graduate. They will be required to write a report and present it in a seminar at the Department. The student may also do his summer training by doing research and other academic activities.

Summer Training	PHYS 399	2
		2

The total number of credit hours required is **125**

Physics Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	ICS 104	Intro. to Programm. in Python & C	2	3	3
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
IAS 111	Belief & Its Consequences	2	0	2	MATH 102	Calculus II	4	0	4
MATH 101	Calculus I	4	0	4	PHYS 102	General Physics II	3	3	4
PE 101	Health and Physical Education I	0	2	1					
PHYS 101	General Physics I	3	3	4					
	Total	15	9	18		Total	12	6	14

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 214	Academic & Professional Comm.	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
IAS 121	Language Foundation	2	0	2	MATH 202	Elements of Differential Equations	3	0	3
MATH 201	Calculus III	3	0	3	PHYS 213	Modern Physics	3	0	3
PHYS 204	General Physics III	3	0	3	PHYS 210	Methods of Theo. Physics	3	0	3
PHYS 205	General Physics III LAB	0	3	1	XE xxx	Technical Elective I	3	0	3
ISE 291	Intro. to Data Science	3	0	3					
	Total	14	3	15		Total	15	0	15

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
IAS 212	Ethics and Governance	2	0	2	BUS 200	Business & Entrepreneurship	3	0	3
XE xxx	Engineering Elective	3	0	3	PHYS 309	Experimental Physics	1	3	2
PHYS 300	Classical Mechanics I	4	0	4	PHYS 306	Electricity and Magnetism II	3	0	3
PHYS 308	Electronics	3	3	4	PHYS 310	Quantum Mech. and Appl. I	3	0	3
PHYS 305	Electricity and Magnetism I	3	0	3	PHYS xxx	Physics Elective	3	0	3
					CGS 392	Career Essentials	0	2	1
	Total	15	3	16		Total	13	5	15

Summer Session

Course	Title	LT	LB	Cr
PHYS 399	Summer Training	0	0	2

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
IAS xxx	Islamic/Arabic Elective	2	0	2	GS xxx	GS Elective	3	0	3
PHYS 410	Quantum Mech. and Appl.-II	3	0	3	PHYS xxx	Physics Elective	3	0	3
PHYS 403	Senior Physics Lab	0	6	2	PHYS 430	Thermal & Stat. Physics	4	0	4
PHYS 499	Physics Seminar	1	0	1	PHYS 4xx	Physics Elective	3	0	3
PHYS 4xx	Physics Elective	3	0	3	XE xxx	Technical Elective II	3	0	3
PHYS 497	Undergrad. Research I	0	0	3					
	Total	9	6	14		Total	16	0	16

Total Credit Hours	125

COLLEGE OF COMPUTING & MATHEMATICS

Dean: Dr. Adel F. Ahmed

DEPARTMENTS

COMPUTER ENGINEERING
INFORMATION & COMPUTER SCIENCE
INDUSTRIAL & SYSTEMS ENGINEERING
MATHEMATICS

The College of Computing and Mathematics (CCM) was established in 1986 as Collage of Computer Science and Engineering (CCSE) and renamed to its current name in August 2021. It symbolizes the desire to make computing a centerpiece of its education and research activities in the 21st century. Its main lines of business include Computer Sciences and Engineering, Software Engineering, Computer Networks and Communications, Industrial Engineering, Mathematics, Statistics and Actuarial Science. The college also offers many service courses to the other programs of the university, this includes: Digital and Artificial Intelligence Foundation courses, Mathematics and Statistics courses.

Vision

To be a globally recognized college in Computing and Mathematics, known for its distinguished graduates and world-class research.

Mission

The College of Computing and Mathematics is committed to:

- Graduate competent professionals.
- Conduct innovative research that advances the frontiers of knowledge and addresses local and global problems.
- Engage with society in value-adding activities.

Strategic Objectives

1. Prepare competent qualified graduates in the areas of the college line of business that exceed customer requirements.
2. Provide up-to-date current academic programs that meet international standards and satisfy market needs.
3. Provide a student-focused integrated educational experience.
4. Establish the basis of Digital & Artificial Intelligence Foundation and Mathematical background for university students.
5. Build a strong, motivated, and highly committed faculty community.
6. Attract, maintain, and develop a qualified pool of undergraduate and graduate students.
7. Conduct research at the frontiers of knowledge in the areas specified in the college line of business with emphasis on areas that serve and sustain the Kingdom’s economic development.
8. Create and encourage partnership with industry, government, local/ international institutions, and alumni.
9. Continuously build and modernize the college infrastructure including computing facilities and laboratories.
10. Retrain current professionals in the workforce on emerging digital technologies and inject them back into the industry to support the digital transformation of the Kingdom.

The college maintains partnerships with information technology (IT) leaders and prestigious universities for the sake of being on the top of technology and research. Areas like Artificial

Intelligence, Cybersecurity, Arabization, Internet of Things and Embedded Systems, High Performance & Cloud Computing, Computer Networking, Big Data, Computational Analytics, and Visual Computing are among the areas of excellence. Other allied areas in the college, such as Maintenance Engineering, Quantum Computing and Supply Chain Engineering, have gained international recognition in partnership with local petroleum and petrochemical industries.

The college has acquired special computing facilities and computer networks with state-of-the-art technologies able to provide services that are compatible with capabilities and expectations of faculty and students. It also provides technical support with a team of highly qualified engineers and technicians.

The college also hosts the chain of three digital and artificial intelligence foundation service courses offered to all university students making them skilled in modern programming languages, getting them acquainted with basic data science skills, and artificial intelligence methods and tools. It also offers a set of service courses in calculus, linear algebra, differential equations, probability & random variables concepts, and engineering economics.

To serve its mission the college has four administrative departments.

1. **Computer Engineering Department (COE)**

   The department offers programs in Computer Engineering. It grants B.Sc., M.Sc., and Ph.D. degrees in Computer Engineering. The department also grants M.Sc. and M.Eng. degrees in Computer Networks. In addition, the department hosts two undergraduate concentrations in Computer Networks and Internet of Things (IoT), and four professional Masters in Computer Networks, High Performance and Cloud Computing, Internet of Things and Embedded Systems, and Robotics and Autonomous Systems.

2. **Information & Computer Science Department (ICS)**

   The department offers two B.Sc. programs in Computer Science and Software Engineering. In addition, the department hosts two undergraduate concentrations in Artificial Intelligence & Machine learning, and Cybersecurity and Blockchain. The department also grants M.Sc. degrees in Computer Science, Software Engineering, and Information Security, professional Masters in Artificial Intelligence, and Cybersecurity, and a Ph.D. degree in Computer Science.

3. **Industrial and Systems Engineering Department (ISE)**

   The department offers B.Sc., M.Sc. and PhD degrees in Industrial and Systems Engineering. The department also hosts an undergraduate concentration on Decision Analytics and a professional Master degree on Maintenance and Reliability.

4. **Mathematics Department (MATH)**

   The department offers three undergraduate programs in Mathematics, Statistics and Actuarial Sciences. The department also grants an M.Sc. degree in Mathematics, M.Sc. degree in Statistics and a Ph.D. degree in Mathematics. In addition, the department hosts two undergraduate concentrations on Computational Analytics and Data Science and

Analytics. The department also hosts four professional Master degrees in Data Science and Analytics, Computational Analytics, Quantitative Finance and Visual Computing.

These programs prepare students for challenging Science and Engineering careers in high-technology areas of computing and industrial systems.

College Requirements

Common Freshman Year

College B.Sc. programs have a common freshman curriculum similar to that of the Engineering and Science programs at KFUPM.

Common Core Subjects

Common core subjects cover courses in basic Sciences, Mathematics, English, Islamic history and culture, Arabic language and literature, Physical Education, Social and Behavioral Sciences, Digital Foundation in programming, Data Science & Artificial Intelligence, and program core subjects.

Requirements for Graduation

All university graduation requirements and academic policies apply to the college.

Department of Computer Engineering

Chairman: Dr. Aiman El-Maleh

Faculty

Abu-Amara	Barnawi	Mudawar
Adiche	Baroudi	Osais
Ahmed	Chenaoua	Raad
Al-Awami	El-Maleh	Sait
AlKharobi	El-Rabaa	Selmi
Al-Madani	Felemban	Sheltami
AlMulhem	Mahmoud, A	Tabbakh
Al-Suwaiyan	Mahmoud, M	Ul-Hasan

Introduction

The Computer Engineering Department (COE) was established in 1986. It offers a program leading to a BS degree in Computer Engineering, a program leading to an MS degree in Computer Engineering, a program leading to an MS degree in Computer Networks, and a program leading to a PhD degree in Computer Engineering.

Computer Engineering (COE) is the discipline concerned with the design, analysis, modeling and implementation of computers and networks systems. Both the software and the hardware aspects of these systems are studied in a balanced and coherent manner. As such, it is of interest and in demand locally in Saudi Arabia, regionally in the Middle East, and internationally worldwide.

The Computer Engineering program at KFUPM develops the necessary skills and competences required to design and implement computer systems and networks. The two focus areas of computer systems and computer networks are deemed as most important for the local job market (present and future). All COE core courses establish the required foundation for these two areas. Students can pursue one or a combination of these areas through electives which are all aligned with these two areas. In addition, sufficient emphasis is given to the study of computer science to provide a coherent view of computer systems and an understanding of the interdependencies of hardware and software components and their interfaces and tradeoffs. Furthermore, the COE program equips the students with many non-technical engineering skills and knowledge essential for their professional practice.

The Computer Engineering program is serving the Kingdom's critical need for computer professionals who can design and implement computer systems and networks. The graduates of the COE program are expected to play a key role in the Kingdom's transition to a *knowledge-based* economy by harnessing the benefits of IT technology in the different fields of governmental administrations, and manufacturing and service sectors.

Vision

The vision of the COE Department is to become a recognized center of excellence in providing quality education and technical services, as well as in advancing computing technologies through innovative research.

Mission

The mission of the computer engineering program at KFUPM is to develop and train the human intellect needed for meeting the continued technological advances in the discipline of computer engineering and IT-related areas. This includes graduating well-trained computer engineers to participate in the industrial development currently taking place in the Kingdom of Saudi Arabia.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **“Computer Engineering”** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Computer Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Established themselves as successful professional computer engineers with demonstrated leadership capabilities.
2. Demonstrated an ability to pursue a successful professional career.
3. Enrolled and succeeded in graduate and professional studies/programs if they chose to do so.

- **Student Outcomes (SOs)**

The ***Computer Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Computer Engineering

Option I: Summer Training

Every student majoring in Computer Engineering (Summer Training Option) must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, STAT 319, ICS 253	20
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		32

(d) Core Requirements (47 credit hours)		
COE	COE 202, 203, 241, 301, 302, 306, 344, 346, 384, 485	32
ICS	ICS 108, 202, 433	11
EE	EE 236, 237	4
		47

(e) Electives (15 credit hours)		
COE Electives	Four COE 4xx Courses	12
Free Elective	One XXX xxx Course from Department's List	3
		15

(f) Summer Training (0 credit hours)		
Summer Training	COE 399	0
		0

The total number of credit hours required is **128**

Computer Engineering Curriculum - Summer Training Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	PHYS 102	General Physics II	3	3	4
CHEM 101	Principles of Chemical Science I	3	3	4	ENGL 102	Intro. to Report Writing	3	0	3
ENGL 101	Intro. to Academic Discourse	3	0	3	ICS 108	Object Oriented Programing	3	3	4
ICS 104	Intro. to Programm. in Python & C	2	3	3	IAS 111	Belief & its Consequences	2	0	2
					PE 101	Health and Physical Education I	0	2	1
	Total	15	9	18		Total	15	8	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 291	Intro. to Data Science	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
COE 202	Digital Logic Design	3	0	3	COE 301	Computer Organization	3	3	4
COE 203	Digital Logic Design Lab	0	3	1	COE 241	Data & Comp. Communications	3	0	3
ICS 202	Data Structure & Algo.	3	3	4	STAT 319	Prob. & Stat. for Eng. & Scientists	2	3	3
MATH 201	Calculus III	3	0	3	ICS 253	Discrete Structures	3	0	3
IAS 121	Language Foundation	2	0	2					
	Total	14	6	16		Total	14	6	16

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
COE 302	Design & Modeling of Dig. Sys.	3	0	3	COE 306	Introduction to Embedded Sys.	3	3	4
COE 344	Computer Networks	3	3	4	COE 346	Computer & Netwrork Security	3	0	3
MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3	COE 384	Fundam. of Computer Eng. Design	3	3	4
EE 236	Electronic Circuits	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
EE 237	Electronic Circuits Lab	0	3	1	CGS 392	Career Essentials	0	2	1
ENGL 214	Academic & Professional Comm.	3	0	3					
	Total	15	6	17		Total	12	8	15

Summer Session

Course	Title	LT	LB	Cr
COE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ICS 433	Operating Systems	3	1	3	COE 485	Senior Design Project	1	6	3
COE 4xx	Major Elective I	3	0	3	COE4xx	Major Elective III	3	0	3
COE 4xx	Major Elective II	3	0	3	COE 4xx	Major Elective IV	3	0	3
XXX xxx	Free Elective	3	0	3	IAS xxx	Islamic/Arabic Elective	2	0	2
IAS 212	Ethics and Governance	2	0	2	GS xxx	GS Elective	3	0	3
	Total	14	1	14		Total	12	6	14

Total Credit Hours	128

Requirements for the Bachelor of Science (BS) Degree in Computer Engineering

Option II: Internship

Every student majoring in Computer Engineering (Internship Option) must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, STAT 319, ICS 253	20
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		32

(d) Core Requirements (47 credit hours)		
COE	COE 202, 203, 241, 301, 302, 306, 344, 346, 384, 485	32
ICS	ICS 108, 202, 433	11
EE	EE 236, 237	4
		47

(e) Electives (9 credit hours)		
COE Electives	Three COE 4xx Courses	9
		9

(f) Internship (6 credit hours)		
Internship	COE 398	6
		6

The total number of credit hours required is **128**

Computer Engineering Curriculum - Internship Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr
MATH 101	Calculus I	4	0	4
PHYS 101	General Physics I	3	3	4
CHEM 101	Principles of Chemical Science I	3	3	4
ENGL 101	Intro. to Academic Discourse	3	0	3
ICS 104	Intro. to Programm. in Python & C	2	3	3
	Total	15	9	18

Course	Title	LT	LB	Cr
MATH 102	Calculus II	4	0	4
PHYS 102	General Physics II	3	3	4
ENGL 102	Intro. to Report Writing	3	0	3
ICS 108	Object Oriented Programing	3	3	4
IAS 111	Belief & its Consequences	2	0	2
PE 101	Health and Physical Education I	0	2	1
	Total	15	8	18

Sophomore Year

Course	Title	LT	LB	Cr
ISE 291	Intro. to Data Science	3	0	3
COE 202	Digital Logic Design	3	0	3
COE 203	Digital Logic Design Lab	0	3	1
ICS 202	Data Structure & Algo.	3	3	4
MATH 201	Calculus III	3	0	3
IAS 121	Language Foundation	2	0	2
	Total	14	6	16

Course	Title	LT	LB	Cr
COE 292	Intro. to Artificial Intelligence	3	0	3
COE 301	Computer Organization	3	3	4
COE 241	Data & Comp. Communications	3	0	3
STAT 319	Prob. & Stat. for Eng. & Scientists	2	3	3
ICS 253	Discrete Structures	3	0	3
IAS 212	Ethics and Governance	2	0	2
	Total	16	6	18

Junior Year

Course	Title	LT	LB	Cr
COE 302	Design & Modeling of Dig. Sys.	3	0	3
COE 344	Computer Networks	3	3	4
MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
EE 236	Electronic Circuits	3	0	3
EE 237	Electronic Circuits Lab	0	3	1
ENGL 214	Academic & Professional Comm.	3	0	3
	Total	15	6	17

Course	Title	LT	LB	Cr
COE 306	Introduction to Embedded Sys.	3	3	4
COE 346	Computer & Netwrork Security	3	0	3
COE 384	Fundam. of Computer Eng. Design	3	3	4
COE 4xx	Major Elective I	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3
CGS 392	Career Essentials	0	2	1
	Total	15	8	18

Senior Year

Course	Title	LT	LB	Cr
COE 398	Internship	0	0	6
	Total	0	0	6

Course	Title	LT	LB	Cr
COE 485	Senior Design Project	1	6	3
COE 4xx	Major Elective II	3	0	3
COE 4xx	Major Elective III	3	0	3
ICS 433	Operating Systems	3	1	3
IAS xxx	Islamic/Arabic Elective	2	0	2
GS xxx	GS Elective	3	0	3
	Total	15	7	17

Total Credit Hours	128

Department of Information and Computer Science

Chairman: Dr. Hamoud Aljamaan

FACULTY

Ahmad
Ahmed, F
Ahmed, M
Alherz
Aljamaan
Al-Jasser
Al-Khatib
Alkhnbashi
Alkhodairi
Al-Muhammadi
Al-Muhtaseb
Alnammi
AlOthman
Al-Shayeb
Al-Turki
Alutaibi
Alvi
Alzaidy
Arafat
Aslam
Azzedin
Balah
Baslyman
Boudellioua
El-Alfy
El-Bassuny
Garout
Hassan
Hassan, S
Hassine
Khan
Luqman
Mahmood
Mahuzur Rahman
Mirzal
Mohammed
Muhammad
Niazi
Ramadan
Yazdani

Introduction

The Information and Computer Science (ICS) Department at KFUPM was established in September 1979 and it developed and evolved over the years to become one of the most active departments of the University in teaching, research, and service to the University. Moreover, the ICS Department is recognized throughout the Gulf region and many parts of the world for its excellence in education and research. The Department provides two 4-year undergraduate programs leading to a Bachelor of Science degree in Computer Science and a Bachelor of Science degree in Software Engineering.

The two programs can be broadly defined as the study of the phenomena surrounding computing and computers. It involves the study of the theoretical principles, design and implementation of computer systems. As computers have become part of day-to-day activities, the demand for specialized professionals in the area has increased significantly.

To help meet these demands, KFUPM has established undergraduate programs that relate directly to computer science and focus on theory, design, and applications. The programs have both academic and professional orientations. Thus, they enable graduates to meet the challenges they will face in real-life applications, research and advanced studies in computer science. The programs are designed to provide several important features:

1. Breadth and depth. The programs have a set of core courses that provide breadth in the field. Additional specialized courses and electives are chosen to provide depth in the programs.
2. Balance. Theoretical core courses and software/hardware are joined in theory and in practice through integrated lecture and laboratory sequences.
3. Flexibility. The curricula are flexible and provide opportunities for students to emphasize specific areas of interest through their choice of appropriate technical and ICS elective courses.

Vision

To be a regional leader that is recognized worldwide in education, research and professional development in the areas of Computer Science and Software Engineering.

Mission

The mission of ICS department is to:

- Provide high quality undergraduate and graduate educational programs in Computer science and Software Engineering,
- Contribute significantly to the research and the discovery of new knowledge and methods in computing,
- Offer expertise, resources, and services to the community, and
- Keep its faculty members current by providing opportunities for professional development.

Bachelor of Science (BS) IN COMPUTER SCIENCE

The Computer Science (CS) discipline covers a wide range of core aspects such as: understanding and design of computers, theory of computational processes, algorithms and data structures, programming methodologies and languages, and computer organization and architecture. Other areas include artificial intelligence, computer networking and communication, database systems, data science and machine learning, information and cyber security, parallel and distributed computation, computer graphics, operating systems, numerical and symbolic computation, and human-computer interaction. The CS discipline continues to grow with significant advancements and technologies being witnessed. It is expected that a Computer Science program shall cover all core aspects of the discipline, and emphasize on some selected areas of the discipline.

Program Mission

The mission of the computer science program is to provide high quality education in computer science that prepares students for professional careers and postgraduate education, with emphasis on data science and information security.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Computer Science"** is accredited by the **Computing Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Computer Science*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Have a successful career or pursue an advanced degree in a computing-related area;
2. Work as individuals with minimum guidance and as leaders or members in teams;
3. Follow appropriate professional practices and maintain currency through self-learning or other professional development.

- **Student Outcomes (SOs)**

The ***Computer Science*** **(BS)** students **by the time of gradation will have the ability to:**

1. Analyze a complex computing problem and to apply principles of computing and other relevant disciplines to identify solutions.
2. Design, implement and evaluate a computing-based solution to meet a given set of computing requirements in the context of the program's discipline.
3. Communicate effectively in a variety of professional contexts.
4. Recognize professional responsibilities and make informed judgments in computing practice based on legal and ethical principles.
5. Function effectively as a member or leader of a team engaged in activities appropriate to the program's discipline.
6. Apply computer science theory and software development fundamentals to produce computing-based solutions.

The CS Program

The department is offering the computer science program with two options:

Option I: Summer training.
Option II: Internship.

Requirements for the Bachelor of Science (BS) Degree in Computer Science

Option I: Summer Training

Every student majoring in Computer Science (Summer Training Option) must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, STAT 319, ICS 253	20
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		32

(d) Core Requirements (47 credit hours)		
ICS	ICS 108, 202, 321, 343, 344, 353, 381, 410, 411, 433	33
COE	COE 202, 203, 301	8
SWE	SWE 206, 363	6
		47

(e) Electives (15 credit hours)		
ICS Electives	Four ICS/SWE xxx Courses	12
Technical Elective	One XE xxx Course	3
		15

(f) Summer Training (0 credit hours)		
Summer Training	ICS 399	0
		0

The total number of credit hours required is **128**

Computer Science Curriculum - Summer Training Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
IAS 121	Language Foundation	2	0	2	IAS 111	Belief & Its Consequences	2	0	2
ICS 104	Intro. to Programm. in Python & C	2	3	3	ICS 108	Object Oriented Programing	3	3	4
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1	PHYS 102	General Physics II	3	3	4
PHYS 101	General Physics I	3	3	4					
	Total	14	8	17		Total	15	6	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
COE 202	Digital Logic Design	3	0	3	CHEM 101	Principles of Chemical Science I	3	3	4
COE 203	Digital Logic Laboratory	0	3	1	COE 301	Computer Organization	3	3	4
ISE 291	Intro. to Data Science	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
ICS 202	Data Structures & Algorithms	3	3	4	ICS 253	Discrete Structures	3	0	3
MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3	MATH 201	Calculus III	3	0	3
SWE 206	Intro. To Software Engineering	2	3	3					
	Total	14	9	17		Total	15	6	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
IAS 212	Ethics and Governance	2	0	2	BUS 200	Business & Entrepreneurship	3	0	3
ICS 321	Database Systems	3	0	3	ENGL 214	Academic & Professional Comm.	3	0	3
ICS 343	Fundament. of Cmpter. Networks	3	3	4	ICS 344	Infromation Security	3	0	3
STAT 319	Prob. & Stat. for Eng. & Scientists	3	2	3	ICS 353	Design and Analysis of Algorithms	3	0	3
SWE 363	Web Eng. & Development	3	0	3	ICS 381	Principles of Artificial Intelligence	3	0	3
					CGS 392	Career Essentials	0	2	1
	Total	14	5	15		Total	15	2	16

Summer Session					ICS 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ICS 410	Programming Languages	3	0	3	GS xxx	GS Elective	3	0	3
ICS 433	Operating Systems	3	1	3	IAS xxx	Islamic/Arabic Elective	2	0	2
ICS/SWE xxx	Major Elective I	3	0	3	ICS 411	Senior Project	1	6	3
ICS/SWE xxx	Major Elective II	3	0	3	ICS/SWE xxx	Major Elective III	3	0	3
XE xxx	Technical Elective	3	0	3	ICS/SWE xxx	Major Elective IV	3	0	3
	Total	15	1	15		Total	12	6	14

Total Credit Hours 128

Requirements for the Bachelor of Science (BS) Degree in Computer Science

Option II: Internship

Every student majoring in Computer Science (Internship Option) must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, STAT 319, ICS 253	20
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		32

(d) Core Requirements (47 credit hours)		
ICS	ICS 108, 202, 321, 343, 344, 353, 381, 410, 411, 433	33
COE	COE 202, 203, 301	8
SWE	SWE 206, 363	6
		47

(e) Electives (9 credit hours)		
ICS Electives	Three ICS/SWE xxx Courses	9
		9

(f) Internship (6 credit hours)		
Internship	ICS 398	6
		6

The total number of credit hours required is **128**

Computer Science Curriculum - Internship Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
IAS 121	Language Foundation	2	0	2	IAS 111	Belief & Its Consequences	2	0	2
ICS 104	Intro. to Programm. in Python & C	2	3	3	ICS 108	Object Oriented Programing	3	3	4
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1	PHYS 102	General Physics II	3	3	4
PHYS 101	General Physics I	3	3	4					
	Total	14	8	17		Total	15	6	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
COE 202	Digital Logic Design	3	0	3	CHEM 101	Principles of Chemical Science I	3	3	4
COE 203	Digital Logic Laboratory	0	3	1	COE 301	Computer Organization	3	3	4
ISE 291	Intro. to Data Science	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
ICS 202	Data Structures & Algorithms	3	3	4	ICS 253	Discrete Structures	3	0	3
MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3	MATH 201	Calculus III	3	0	3
SWE 206	Intro. To Software Engineering	2	3	3					
	Total	14	9	17		Total	15	6	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
GS xxx	GS Elective	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
IAS 212	Ethics and Governance	2	0	2	ENGL 214	Academic & Professional Comm.	3	0	3
ICS 321	Database Systems	3	0	3	ICS 344	Infromation Security	3	0	3
ICS 343	Fundament. of Cmpter. Networks	3	3	4	ICS 353	Design and Analysis of Algorithms	3	0	3
STAT 319	Prob. & Stat. for Eng. & Scientists	3	2	3	ICS 381	Principles of Artificial Intelligence	3	0	3
SWE 363	Web Eng. & Development	3	0	3	IAS xxx	Islamic/Arabic Elective	2	0	2
					CGS 392	Career Essentials	0	2	1
	Total	17	5	18		Total	17	2	18

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ICS 398	Internship	0	0	6	ICS 410	Programming Languages	3	0	3
					ICS 411	Senior Project	1	6	3
					ICS 433	Operating Systems	3	1	3
					ICS xxx	Major Elective I	3	0	3
					ICS xxx	Major Elective II	3	0	3
					ICS xxx	Major Elective III	3	0	3
	Total	0	0	6		Total	16	7	18

Total Credit Hours	128

Bachelor of Science (BS) IN SOFTWARE ENGINEERING

The program is broad-based and covers the main aspects of the software engineering discipline, namely requirements analysis, design, testing and project management. It also covers the computer science fundamentals such as computer architecture, operating systems and computer networks. The curriculum is designed to strengthen both the conceptual and practical talents of students, thereby equipping graduates with a solid background to take-up assignments in industry and to pursue higher education programs.

Mission

To provide high quality education in software engineering that prepares students for professional careers and postgraduate education with emphasis on application of engineering principles to software development.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Software Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Software Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Be successful in performing the duties of a software engineering related position.
2. Be successful in completing an advanced degree program.
3. Work as individuals with minimum guidance and as leaders or members in teams.
4. Follow appropriate practices within a professional, legal, and ethical framework.
5. Maintain currency through self-learning or other professional development.

- **Student Outcomes (SOs)**

The ***Software Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Software Engineering

Every student majoring in Software Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, STAT 319, ICS 253	20
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		32

(d) Core Requirements (50 credit hours)		
SWE	SWE 206, 216, 316, 326, 363, 387, 411, 412, 439	26
ICS	ICS 108, 202, 321, 343, 344, 433	21
COE	COE 233	3
		50

(e) Electives (12 credit hours)		
SWE Electives	Four SWE/ICS xxx Courses	12
		12

(f) Summer Training (0 credit hours)		
Summer Training	SWE 399	0
		0

The total number of credit hours required is **128**

Software Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3
IAS 121	Language Foundation	2	0	2
ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4
PE 101	Health and Physical Education I	0	2	1
PHYS 101	General Physics I	3	3	4
	Total	14	8	17

Course	Title	LT	LB	Cr
ENGL 102	Intro. to Report Writing	3	0	3
IAS 111	Belief & Its Consequences	2	0	2
ICS 108	Object Oriented Programing	3	3	4
MATH 102	Calculus II	4	0	4
PHYS 102	General Physics II	3	3	4
	Total	15	6	17

Sophomore Year

Course	Title	LT	LB	Cr
ISE 291	Intro. to Data Science	3	0	3
ICS 202	Data Structure & Algo.	3	3	4
MATH 201	Calculus III	3	0	3
CHEM 101	Principles of Chemical Science I	3	3	4
SWE 206	Intro. to Software Engineering	2	3	3
	Total	14	9	17

Course	Title	LT	LB	Cr
MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
COE 233	Digital Logic & Cmpter Organization	3	0	3
COE 292	Intro. to Artificial Intelligence	3	0	3
IAS 212	Ethics and Governance	2	0	2
ICS 253	Discrete Structures	3	0	3
SWE 216	Requirements Engineering	3	0	3
	Total	17	0	17

Junior Year

Course	Title	LT	LB	Cr
ICS 321	Database Systems	3	0	3
ICS 343	Fundament. of Cmpter. Networks	3	3	4
STAT 319	Prob. & Stat. for Eng. & Scientists	3	2	3
SWE 316	Software Design & Construction	3	0	3
SWE 387	Software Project Management	3	0	3
	Total	15	5	16

Course	Title	LT	LB	Cr
BUS 200	Business & Entrepreneurship	3	0	3
ENGL 214	Academic & Professional Comm.	3	0	3
ICS 344	Infromation Security	3	0	3
SWE 326	Software Testing	3	0	3
SWE 363	Web Eng. & Development	3	0	3
CGS 392	Career Essentials	0	2	1
	Total	15	2	16

Summer Session

Course	Title	LT	LB	Cr
SWE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr
IAS xxx	Islamic/Arabic Elective	2	0	2
ICS/SWE xxx	Major Elective I	3	0	3
ICS/SWE xxx	Major Elective II	3	0	3
SWE 411	Software Engineering Project I	1	6	3
SWE 439	Software Quality Eng.	3	0	3
	Total	12	6	14

Course	Title	LT	LB	Cr
GS xxx	GS Elective	3	0	3
ICS 433	Operating Systems	3	1	3
ICS/SWE xxx	Major Elective III	3	0	3
ICS/SWE xxx	Major Elective IV	3	0	3
SWE 412	Software Engineering Project II	0	6	2
	Total	12	7	14

Total Credit Hours 128

Department of Industrial and Systems Engineering

Chairman: Dr. Mujahed Al-Dhaifullah

Faculty

Abdelaal	Al-Shareef	Hassan
Al Yaqoub	Al-Turki	Kara
Al-Dhaifullah	Attia	Kolus
Al-Durgam	Baubaid	Moghathawi
Al-Ghazi	Darghouth	Mujahid
Al-Hanbli	Duffuaa	Nabhan
Al-Meraj	Hamdan	Osman
Alsawafy		

Introduction

The Industrial and Systems Engineering department offers a program in Industrial and Systems Engineering (ISE). The Industrial and Systems Engineering program is concerned with the design, improvement, and installation of integrated systems of people, materials, and equipment; it draws upon specialized knowledge and skill in the mathematical, physical, and social sciences, together with the principles and methods of engineering analysis and design; its goals are specifying, predicting, and evaluating the results to be obtained from such systems.

This Program is offered in two options: the summer training option or Internship. Internship program is implemented in many technical universities worldwide. The student usually leaves the school for one or more semesters and joins a relevant industry, where he is exposed to real life applications of what has been taught in the school. This exposure provides the student with a more mature outlook and has a significant effect on his understanding of his role as a practicing engineer.

Vision

To be the leader in the Arab region in the areas of industrial & systems engineering. To become a well-recognized worldwide center of excellence in education and research in the areas of industrial & systems engineering.

Mission

The mission of the Industrial and Systems Engineering program is to provide high-quality education, research and community services in the areas of industrial and systems engineering.

Goals

- To provide a high-quality, state-of-the-art education in Industrial and Systems Engineering that produces professionals capable of performing jobs in their fields of specialization at the highest level of quality, competitiveness and professionalism.

- To conduct research that expands knowledge in the areas of Industrial and Systems Engineering and to provide a high-quality graduate program that gives students a solid foundation in their areas of specialty.

- To provide industry with a high-quality professional training, applied projects, and consultation services in the area of Industrial and Systems Engineering that are up-to-date and competitive worldwide.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Industrial and Systems Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Industrial and Systems Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Become leading professionals in their careers by demonstrating technical expertise in Industrial and Systems Engineering and interpersonal skills.
2. Continue their professional development and learning to adapt to ever-changing environments.
3. Make positive contributions to their organizations, profession, and society at large.

- **Student Outcomes (SOs)**

The ***Industrial and Systems Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. communicate effectively with a range of audiences.

4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. acquire and apply new knowledge as needed, using appropriate learning strategies.

The main study areas involved in ISE program are:

Operations Research and Statistics
Operations Research II, Industrial Engineering in Healthcare Systems, Decision Making, Introduction to Machine Learning and Data Analytics, Special Topics in Operations Research.

Production and Quality control

Advanced Quality Methods, Sequencing & Scheduling, Industrial Information Systems, Supply Chain Systems Modelling, Logistics and Transportation Systems, Special Topics in Production and Quality Control.

Reliability and Maintenance

Maintenance Planning and Control, Reliability and Maintainability, Industrial Safety, Special Topics in Reliability and Maintenance.

Productivity and Process Improvement

Productivity Engineering and Management, Engineering Project Management, Human Factors Engineering, Industrial Process Reengineering, Industrial Safety, Special Topics in IE/OR, Industrial Strategic Planning & Balanced Scorecard.

Automation and Control

Digital Systems Design, Computer Control Systems, Industrial Automation, Digital Signal Processing, Special Topics in Automation and Control.

Requirements for the Bachelor of Science (BS) Degree in Industrial and Systems Engineering

Option I: Summer Training

The degree requirements for the ISE program (Summer Training Option) can be grouped into broad sets of requirements as shown below:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (26 credit hours)		
Math	MATH 101, 102, 201, 208	14
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		26

(d) General Engineering Fundamentals (16 credit hours)		
Engineering Graphics	CE 101	2
Electrical Circuits	EE 204	3
Probability and Statistics	ISE 205	3
Materials Science	ME 216, 217	4
Manufacturing Processes	ME 322, 323	4
		16

(e) Core Requirements (37 credit hours)		
Numerical Methods	CIE 301	3
Linear Control Systems	CIE 305	3
Operations Research I	ISE 303	3
Engineering Economic Analysis	ISE 307	3
Engineering Statistics	ISE 315	3
Optimization Methods	ISE 321	3
Quality Control &Ind. Stat.	ISE 320	3
Work and Process Improvement	ISE 324	2
Industrial Engineering Design	ISE 391	2
Production Systems and Inv. Control	ISE 402	3

Stochastic Systems Simulation	ISE 405	3
Facility Layout and Location	ISE 422	3
Senior Design Project	ISE 482	3
Seminar	ISE 499	0
		37

(f) Electives (15 credit hours)

ISE Electives	Four ISE 4xx Courses	12
Technical Elective	One XE xxx Course	3
		15

(g) Summer Training (0 credit hours)

Students taking the summer training option must spend 8 weeks of training in a facility approved by the department. Each student needs to submit a report and make an oral presentation.

Summer Training	ISE 399	0
		0

The total number of credit hours required is **128**

Industrial & Systems Engineering Curriculum - Summer Training Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	PHYS 102	General Physics II	3	3	4
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
CHEM 101	Principles of Chemical Science I	3	4	4	ICS 104	Intro. to Programm. in Python & C	2	3	3
IAS 121	Language Foundation	2	0	2	IAS 111	Belief & Its Consequences	2	0	2
PE 101	Health and Physical Education I	0	2	1	CE 101	Engineering Graphics	1	3	2
	Total	15	9	18		Total	15	9	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 291	Intro. to Data Science	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
MATH 201	Calculus III	3	0	3	MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
ME 216	Materials Science & Eng.	3	0	3	ME 322	Manufacturing Processes	3	0	3
ME 217	Materials Lab	0	3	1	ME 323	Manufacturing Lab	0	3	1
ENGL 214	Academic & Professional Comm.	3	0	3	ISE 315	Engineering Statistics	3	0	3
ISE 205	Engineering Prob. & Stats.	3	0	3	EE 204	Fundtals. of Electrical Circuits	2	3	3
					IAS 212	Ethics and Governance	2	0	2
	Total	15	3	16		Total	16	6	18

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 303	Operations Research I	3	0	3	ISE 307	Engineering Economic Analysis	3	0	3
ISE 320	Quality Control & Ind. Stat.	3	0	3	ISE 321	Optimization Methods	3	0	3
ISE 324	Work and Process Improve.	2	0	2	ISE 391	Industrial Eng. Design	1	3	2
CIE 301	Numerical Methods	3	0	3	XE xxx	Technical Elective	3	0	3
CIE 305	Linear Control Systems	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2	ISE 499	Seminars	1	0	0
					CGS 392	Career Essentials	0	2	1
	Total	16	0	16		Total	14	5	15

Summer Session

Course	Title	LT	LB	Cr
ISE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 4xx	ISE Elective I	3	0	3	ISE 422	Facility Layout and Location	3	0	3
ISE 4xx	ISE Elective II	3	0	3	ISE 4xx	ISE Elective III	3	0	3
ISE 402	Produc. Syst. & Inventory Contrl	3	0	3	ISE 4xx	ISE Elective IV	3	0	3
ISE 405	Stochastic Systems Simulation	2	3	3	GS xxx	GS Elective	3	0	3
ISE 482	Senior Design Project	1	6	3					
	Total	12	9	15		Total	12	0	12

Total Credit Hours	128

Requirements for the Bachelor of Science (BS) Degree in Industrial and Systems Engineering

Option II: Internship

The degree requirements for the ISE program (Internship Option) can be grouped into broad sets of requirements as shown below:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (26 credit hours)		
Math	MATH 101, 102, 201, 208	14
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		26

(d) General Engineering Fundamentals (16 credit hours)		
Engineering Graphics	CE 101	2
Electrical Circuits	EE 204	3
Probability and Statistics	ISE 205	3
Materials Science	ME 216, 217	4
Manufacturing Processes	ME 322, 323	4
		16

(e) Core Requirements (37 credit hours)		
Numerical Methods	CIE 301	3
Linear Control Systems	CIE 305	3
Operations Research I	ISE 303	3
Engineering Economic Analysis	ISE 307	3
Engineering Statistics	ISE 315	3
Optimization Methods	ISE 321	3
Quality Control &Ind. Stat.	ISE 320	3
Work and Process Improvement	ISE 324	2
Industrial Engineering Design	ISE 391	2
Production Systems and Inv. Control	ISE 402	3

Stochastic Systems Simulation	ISE 405	3
Facility Layout and Location	ISE 422	3
Senior Design Project	ISE 482	3
Seminar	ISE 499	0
		37

(f) Electives (9 credit hours)

ISE Electives	Two ISE 4xx Courses	6
Technical Elective	One XE xxx Course	3
		9

(g) Internship (6 credit hours)

Students taking the Internship option must join a 15-week long industrial training program approved by the department. Each student needs to submit a report and make an oral presentation.

Internship	ISE 398	6
		6

The total number of credit hours required is **128**

Industrial & Systems Engineering Curriculum - Internship Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	PHYS 102	General Physics II	3	3	4
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
CHEM 101	Principles of Chemical Science I	3	4	4	ICS 104	Intro. to Programm. in Python & C	2	3	3
IAS 121	Language Foundation	2	0	2	IAS 111	Belief & Its Consequences	2	0	2
PE 101	Health and Physical Education I	0	2	1	CE 101	Engineering Graphics	1	3	2
	Total	15	9	18		Total	15	9	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 291	Intro. to Data Science	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
MATH 201	Calculus III	3	0	3	MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
ME 216	Materials Science & Eng.	3	0	3	ME 322	Manufacturing Processes	3	0	3
ME 217	Materials Lab	0	3	1	ME 323	Manufacturing Lab	0	3	1
ENGL 214	Academic & Professional Comm.	3	0	3	ISE 315	Engineering Statistics	3	0	3
ISE 205	Engineering Prob. & Stats.	3	0	3	EE 204	Fundtals. of Electrical Circuits	2	3	3
					IAS 212	Ethics and Governance	2	0	2
	Total	15	3	16		Total	16	6	18

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 303	Operations Research I	3	0	3	ISE 307	Engineering Economic Analysis	3	0	3
ISE 320	Quality Control & Ind. Stat.	3	0	3	ISE 321	Optimization Methods	3	0	3
XE xxx	Technical Elective	3	0	3	ISE 324	Work and Process Improve.	2	0	2
CIE 301	Numerical Methods	3	0	3	ISE 391	Industrial Eng. Design	1	3	2
CIE 305	Linear Control Systems	3	0	3	ISE 402	Produc. Syst. & Inventory Contrl	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2	BUS 200	Business & Entrepreneurship	3	0	3
ISE 499	Seminars	1	0	0	CGS 392	Career Essentials	0	2	1
	Total	18	0	17		Total	15	5	17

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 398	Internship	0	0	6	ISE 405	Stochastic Systems Simulation	2	3	3
					ISE 422	Facility Layout and Location	3	0	3
					ISE 4xx	ISE Elective I	3	0	3
					ISE 4xx	ISE Elective II	3	0	3
					GS xxx	GS Elective	3	0	3
					ISE 482	Senior Design Project	1	6	3
	Total	0	0	6		Total	15	9	18

Total Credit Hours	128

Department of Mathematics

Chairman: Dr. Monther Alfuraidan

Faculty

Abbas	Al-Shammari	Khan, A
Abuihlail	Al-Smail	Khan, S
Abu-Sbeih	Al-Smail	Kroumi
AbuShoshah	Anabosi	Laradji
Ahmad	Belhaiza	Malik, M
Alanezy	Bokhari, A	Messaoudi
Alassaf	Bonfoh	Mezerdi
Alassar	Chanane	Mimouni
Al-Attas	Duman	Mustapha
Alfuraidan	Echi	Omar
Al-Garni	Elgindy	Riaz
Al-Homidan	Elmughrabi	Saleh, K
Alhumidi	Fairag	Saleh, M
Al-Khulaifi	Fukhar-ud-din	Shehadeh
Al-Kurdi	Furati	Smii
Al-Momani	Joo	Tatar, A
Al-Mutawa	Kabbaj	Tatar, N
Al-Rasasi	Kadri	Tawfiq
Al-Sabah	Kafini	Trabelsi
Al-Sawi	Khalfallah	Yousuf
Alshahrani		

Introduction

The department of Mathematics is one of the oldest major teaching & research department in the Kingdom of Saudi Arabia. It is known for offering excellent graduate and undergraduate programs in Mathematics and undergraduate programs in Actuarial Science. It is one of the largest departments of the University consisting of over 62 faculty members. The faculty research interests cover a broad range of topics including Algebra and Number Theory, Analysis, Applied & Differential Equations, Fixed Point Theory & Applications, Geometry, Topology & Graph theory, Numerical Analysis & Optimization, Statistics, Stochastic Processes & Applications, and Algebra & Number theory etc.

In addition, the department has well established collaborations with researchers belonging to world-renowned institutions. These collaborations have played a pivotal role for the department to attract highly meritorious researchers to join as adjunct faculty. The department also publishes a reputable journal “Arabian Journal of Mathematics” published by springer and indexed in Scimago of Quartile 3.

Vision

To be recognized internationally as a provider of world-class education; a conducive hub for basic, applied and multidisciplinary research; a producer of high-quality graduates for the job market; and a contributor to the societal development.

Mission

The mission of the department is threefold:

- To provide quality teaching with the aim of establishing effective and innovative undergraduate and graduate programs that will contribute to the development of the highly trained manpower in the Kingdom of Saudi Arabia.
- To enhance fundamental and applied research to a level comparable to that of the contemporary leading centers of mathematics in the world.
- To play an active role in the scientific and technological development of the University and the Kingdom of Saudi Arabia through closer inter-departmental cooperation and development of interdisciplinary programs and through its commitment to broadening and deepening the mathematical training of students in all majors and at all levels.

BS Degree in Mathematics

The Mission of BS Program in Mathematics is to provide students with strong up-to-date mathematical foundation and professional skills that lead our graduates to succeed in subsequent careers and educational programs and to serve the community and contribute in the development of the Kingdom.

Program Goals

The goals of the BS program in Mathematics are to:

1. Improve the quality of the program.
2. Ensure quality assurance in teaching and learning at the program level.
3. Promote research awareness.
4. Increase student enrollment.
5. Develop and implement a community engagement plan.

Program Educational Objectives (PEOs)

The Bachelor of Science in Mathematics is designed to develop an understanding of basic theoretical concepts of Mathematics, its applications in problems solving and where possible applying them. The educational objectives of the BS program in Mathematics within a few years of graduation are to:

1. Provide students with fundamental knowledge in mathematics for use in interdisciplinary research.
2. Enable students to pursue higher studies in mathematics and related fields.
3. Train students to take on careers through knowledge, team work and communication skills.

Requirements for the BS Degree in Mathematics

Every student majoring in Mathematics must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (29 credit hours)		
Math	MATH 101, 102, 201, 202	14
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
Science Elective	XXX xxx Science Elective	3
		29

(d) Mathematics Core Requirements (34 credit hours)		
Introduction to Sets and Structures	MATH 210	3
Introduction to Linear Algebra	MATH 225	3
Modern Algebra I	MATH 323	3
Methods of Applied Mathematics I	MATH 333	3
Advanced Calculus I	MATH 341	3
Introduction to Numerical Computing	MATH 371	3
Advanced Calculus II	MATH 441	3
Introduction to Complex Variables	MATH 445	3
Introduction to Topology	MATH 453	3
Seminar in Mathematics	MATH 490	1
Introduction to Statistics	STAT 201	3
One Course from	{MATH 451, STAT 301}	3
		34

(e) Electives (24 credit hours)		
Math Electives	Four MATH xxx Courses	12
Engineering Elective	One XE xxx Engineering Course (From approved list)	3
Technical Electives	Two XE xxx Courses (From approved list)	6
Free elective	One XXX xxx Course	3
		24

(f) Summer Training (2 credit hours)

Summer Training	MATH 399	2
		2

The total number of credit hours required is **123**

Mathematics Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	PHYS 102	General Physics II	3	3	4
ENGL 101	Intro. to Academic Discourse	3	0	3	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	ENGL 102	Intro. to Report Writing	3	0	3
MATH 101	Calculus I	4	0	4	IAS 111	Belief & Its Consequences	2	0	2
PE 101	Health and Physical Education I	0	2	1	ICS 104	Intro. to Programm. in Python & C	2	3	3
	Total	13	9	16		Total	14	6	16

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 201	Calculus III	3	0	3	MATH 202	Elements of Differential Equations	3	0	3
MATH 210	Intro. to Sets and Structures	3	0	3	MATH 225	Intro. to Linear Algebra	3	0	3
STAT 201	Intro. to Statistics	2	2	3	MATH 323	Modern Algebra I	3	0	3
ENGL 214	Academic & Professional Comm.	3	0	3	XXX xxx	Science Elective	x	x	3
BUS 200	Business & Entrepreneurship	3	0	3	IAS 121	Language Foundation	2	0	2
					ISE 291	Intro. to Data Science	3	0	3
	Total	14	2	15		Total	14	0	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 333	Methods of Applied Math I	3	0	3	MATH 441	Advanced Calculus II	3	0	3
MATH 341	Advanced Calculus I	3	0	3	XXX xxx	MATH 451 or STAT 301*	3	0	3
MATH 371	Intro. to Numerical Computing	2	2	3	MATH xxx	MATH Elective I	3	0	3
XXX xxx	Free Elective	3	0	3	XE xxx	Engineering Elective	3	0	3
COE 292	Intro. to Artificial Intelligence	3	0	3	IAS 212	Ethics and Governance	2	0	2
					CGS 392	Career Essentials	0	2	1
	Total	14	2	15		Total	14	2	15

Summer Session

MATH 399	Summer Training	0	0	2

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 445	Intro. to Complex Variables	3	0	3	MATH 453	Intro. to Topology	3	0	3
MATH xxx	MATH Elective II	3	0	3	MATH 490	Seminar in Math	1	0	1
MATH xxx	MATH Elective III	3	0	3	MATH xxx	MATH Elective IV	3	0	3
XE xxx	Technical Elective I	3	0	3	XE xxx	Technical Elective II	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2	GS xxx	GS Elective	3	0	3
	Total	14	0	14		Total	13	0	13

Total Credit Hours: 123

* MATH 451: Differential Geometry, STAT 301: Intro to Probability Theory

BS Degree in Actuarial Science and Financial Mathematics

Actuarial Science and Financial Mathematics is an area of study that manages risk in the financial and government sector and industries. Specifically, it involves analyzing risk data and making informed decisions from it. It is a multidisciplinary study that combines four major areas (Mathematics, Statistics, Finance, and Insurance) into one. A graduate of the program is able to contribute to all areas of Saudi Arabian and international financial sectors as well as the government sector where the objective of minimization of risk is the main daily focus.

An actuary is a professional who analyzes the financial consequences of risk. Actuaries use mathematics, statistics, financial theory and insurance to study uncertain future adverse events, and decrease the impact of those future loss events. Actuaries are an integral part of the management team of companies that employ them. Their work requires a combination of strong analytical skills, business knowledge and understanding of human behavior to design and manage programs that control risk. A graduate typically finds employment in private and government sectors and industry that deals with activities such as investment, insurance, pension funding, financial consulting, or healthcare funding. The actuarial profession has been rated the best career for several years in the USA (e.g. rated the best career in 2010 by the Wall Street Journal). Graduates of such programs typically find no issues in finding a good first job. With some professional exams, graduates may face a different but welcome job dilemma of choosing which company to enlist with.

The objective of the BS program in Actuarial Science and Financial Mathematics is to prepare students for a career as an actuary or financial risk manager. In addition, the program also prepares the students for international professional society examinations. The program has a good balance of theory, applications and data analysis, as well as carefully selected sequences of courses from computer science, economics, accounting, mathematics, statistics, finance, and risk management. This interdisciplinary approach is meant to make the program flexible and give the students a broad based education. The program also prepares students for further graduate study in any area of Applied Mathematics, Statistics, Actuarial Science, Finance, or Business.

Requirements for the BS Degree in Actuarial Science and Financial Mathematics

Every student majoring in Actuarial Science and Financial Mathematics must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (14 credit hours)		
Math	MATH 101, 102, 201, 208	14
		14

(d) Economics & Accounting (12 credit hours)		
Economics	ECON 101, 102	6
Accounting	ACCT 110, 210	6
		12

(e) Core Requirements (50 credit hours)		
Financial Mathematics	AS 201	3
Mathematics of Financial Derivatives	AS 251	3
Actuarial Science Problem Lab	AS 289, 389	2
Actuarial Contingencies	AS 380, 481	7
Actuarial Risk Theory and Credibility	AS 484	4
Financial Management	FIN 250	3
Investments	FIN 320	3
Islamic Finance	FIN 440	3
Intro. to Numerical Computing	MATH 371	3
Statistical Methods for Actuaries	STAT 214	4
Introduction to Probability Theory	STAT 301	3
Statistical Inference	STAT 302	3
Regression Analysis	STAT 310	3
Stochastic Processes for Actuaries	STAT 416	3
Time Series	STAT 460	3
		50

(f) Electives (9 credit hours)

AS Electives	Two AS xxx Courses	6
Technical Elective	One Course from STAT xxx, MATH xxx, FIN 3xx, FIN 4xx, ICS xxx, or ISE xxx	3
		9

(g) Internship (6 credit hours)

Internship	AS 398	6
		6

The total number of credit hours required is **125**

Actuarial Science and Financial Mathematics Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ECON 101	Principles of Microeconomics	3	0	3	ECON 102	Principles of Macroeconomics	3	0	3
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
ACCT 110	Intro. to Financial Accounting	3	0	3	ACCT 210	Intro. to Managerial Accounting	3	0	3
IAS 121	Language Foundation	2	0	2	IAS 111	Belief & Its Consequences	2	0	2
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1	ICS 104	Intro. to Programm. in Python & C	2	3	3
	Total	15	2	16		Total	17	3	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
BUS 200	Business & Entrepreneurship	3	0	3	FIN 250	Financial Management	3	0	3
AS 201	Financial Math	3	0	3	AS 289	Actuarial Science Problem Lab I	0	2	1
ISE 291	Intro. to Data Science	3	0	3	AS 251	Math of Financial Derivatives	2	2	3
IAS 212	Ethics and Governance	2	0	2	MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
MATH 201	Calculus III	3	0	3	STAT 301	Intro. to Probability Theory	3	0	3
STAT 214	Statistical Methods for Actuaries	3	2	4	ENGL 214	Academic & Professional Comm.	3	0	3
	Total	17	2	18		Total	14	4	16

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
FIN 320	Investments	3	0	3	AS 398	Internship	0	0	6
AS 380	Actuarial Contingencies I	2	2	3					
MATH 371	Intro. to Numerical Computing	2	2	3					
CGS 392	Career Essentials	0	2	1					
STAT 302	Statistical Inference	3	0	3					
STAT 310	Regression Analysis	3	0	3					
	Total	13	6	16		Total	0	0	6

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
STAT 416	Stochastic Processes for Actuaries	3	0	3	XE xxx	Technical Elective	3	0	3
AS 389	Actuarial Science Problem Lab II	0	2	1	AS xxx	AS Elective II	3	0	3
AS 484	Actuarial Risk Theory & Credibility	3	2	4	AS 481	Actuarial Contingencies II	3	2	4
AS xxx	AS Elective I	3	0	3	FIN 440	Islamic Finance	3	0	3
COE 292	Intro. to Artificial Intelligence	3	0	3	STAT 460	Time Series	3	0	3
GS xxx	GS Elective	3	0	3	IAS xxx	Islamic/Arabic Elective	2	0	2
	Total	15	4	17		Total	17	2	18

Total Credit Hours	125

COLLEGE OF DESIGN & BUILT ENVIRONMENT

Dean: Dr. Ismail M. Budaiwi

DEPARTMENTS

ARCHITECTURAL ENGINEERING
ARCHITECTURE
CITY & REGIONAL PLANNING
CIVIL & ENVIRONMENTAL ENGINEERING
CONSTRUCTION ENGINEERING & MANAGEMENT

The College of Design and Built Environmental (previously named College of Environmental Design) was established during the 1400 – 1401H (1980-1981) academic year to meet the large demand for professionals in the construction industry and related fields, resulting from the extensive ongoing construction program throughout the Kingdom of Saudi Arabia. The College was established to bring together the academic programs that are mainly concerned with the built environment to prepare students for professional practice in Architecture, Architectural Engineering, Civil Engineering, Construction Engineering and Management, and City Planning. The College has five departments: Architectural Engineering, Architecture, Civil and Environmental Engineering (recently joined CDBE in 2021), Construction Engineering & Management, and City & Regional Planning. The College offers Bachelor's degrees in Architectural Engineering, Architecture, and Master's degrees in Architecture, Architectural Engineering, Construction Engineering and Management, Civil and Environmental Engineering, and City and Regional Planning. The College also offers a Ph.D. degree in Civil and Environmental Engineering.

The Architectural Engineering Department (ARE) was established in 1975 as a part of the College of Engineering Sciences. In 1980, the program formed the nucleus of the newly established College of Environmental Design (currently the College of Design and Built Environment). The goal of the Architectural Engineering Department is to produce high-quality graduates who will significantly contribute to the professional fields of the built environment and excel in building-related industries. The Architectural Engineering undergraduate program emphasizes the importance of structural, mechanical, and environmental factors in the design of building systems. Additionally, it emphasizes building construction, operation, and maintenance. It has two options, namely summer training, and COOP training options. The graduate program in Architectural Engineering offers students in-depth study in one of the two specialized areas of Building Environmental Control Systems and Facilities Engineering and Management.

The Architecture Department (ARC) was established in 1981. It offers a Bachelor's degree in Architecture (B.Arch.) with an emphasis on Architectural Design and is fully accredited by NCAAA since 2015. Apart from architectural and general design, however, students also focus on other related areas of computer applications and computer-aided design, urban design, sustainable architectural design, and local and regional architecture. The Architecture Department has evolved into a leading school of architecture in the region. The Department offers since 2021 Masters of Science in Architecture degree with two specializations in Sustainable Architecture and Advanced Design Studies. These programs focus on innovative and sustainable methods of architectural and urban design to meet the challenges of providing livable built environment for the 21st century.

The Civil and Environmental Engineering Department (CEE) is one of the oldest Departments in the university offering a Bachelor's degree in Civil Engineering since its creation in 1963. Before merging into the College of Design and Built Environment in 2021, the CEE Department was under the College of Engineering. The Department started the Master of Science (MS) degree program in Fall 1972-73 and the Doctor of Philosophy (Ph.D.) program in Fall 1985-86. Currently, the Department has two undergraduate programs: one in Civil Engineering Science (CE) and the other in Applied Civil Engineering (ACE). In addition to the Bachelor of Science (BS) degree programs, the department also offers MS, MEng., and Ph.D. degree programs. There are four disciplinary options: structures and materials, geotechnical, water and environmental, and transportation. Each option is well-supported by courses, laboratories, required infrastructure, and human resources. Both CE and ACE programs have been accredited by ABET since 1993.

The CEE Department carries out a periodic review of its curricula to ensure currency and to keep abreast with the latest developments in science and technology. As the first major initiative to ensure the quality of its program, the Department invited the Accreditation Board of Engineering and Technology (ABET) back in 1993 to review its programs. ABET granted accreditation for both the CE and ACE programs in 1993. Since then, the accreditation has been renewed on time through a re-evaluation and re-assessment of BS programs by the ABET. The ABET has accredited the Department up to 2015. The Department is very well positioned to openly advertise and offer its expert professional services to industries, companies, and various organizations given its accumulated experience, expertise, and expanded research facilities. Among the wide range of services it offers testing materials and components, evaluation and assessment, specialized and purpose-built short courses and training programs, and specific research.

The City and Regional Planning Department was established in 1981. It offers BSc and MCRP programs in City Planning with a focus on Smart Sustainable City. The goal of this program is to provide students with a coherent understanding of contemporary planning, such as combining a good theoretical background with the dynamics of professional practices. It includes also mastering smart city management tools and developing smart mobility solutions. In addition to spatial technical skills, the program helps each student to acquire an interdisciplinary education that leads to an understanding of the physical and social environments, their problems, and their potentialities for improving the quality of life.

The Construction Engineering and Management Department was established in 1984. It offers Master of Science (MS) and Master of Engineering (MEG) degrees in Construction Engineering & Management intending to provide qualified professionals and researchers for the construction industry in Saudi Arabia. In 2009, the CEM established an additional Master's program in Engineering Management (EM) to prepare engineers to create, innovate, design, and improve the engineering solutions in the Saudi industry. The EM program assists professional engineers to integrate their academic preparation with the best engineering management practices. Engineering Management students are typically taught through a mixture of interactive lectures (some delivered by leading industry practitioners), case studies, and group and individual project work. In 2021, CEM started a professional master program in Project Management. Currently, CEM has the following graduate programs: (1) Masters of Science in Construction Engineering & Management, (2) Masters of Engineering in Construction Engineering & Management, (3) Master in Engineering Management, and (4) Professional Master in Project Management.

Mission and Philosophy

The mission of the College of Design and Built Environment are:

- Prepare professionals who provide leadership in planning, designing, and constructing sustainable physical built environment through innovative pedagogy, rigorous research, and productive outreach.
- Improve the quality of life through innovative design solutions, advanced digital technologies, and ethical environmental and economic values with the purpose of realizing the highest potential for intellectual and human development

- Drive innovation in design and technology entrepreneurship
- Meet new engineering challenges and pursue opportunities in local and global markets.

Consistent with the above mission, the educational philosophy of the College of Design and Built Environment, as its name suggests, is to develop interdisciplinary relations between professions which share a common concern for the design of the built environment. In recognition of this commonality, the College is organized as one unit with shared facilities and resources. Its philosophy is realized by enabling students, whatever their chosen specialties are, to share knowledge and classroom experience received from highly qualified instructors in these related disciplines. Each undergraduate program requires five years of study, with the first year providing preparatory English and Mathematics. The College requires all students to attend a summer session or a coop program as an introduction to professional practice.

In harmony with KFUPM as a technological university and in consideration of the present and future needs of Saudi Arabia, all the programs in the College introduce basic science courses and are heavily oriented towards the teaching of physical design principles and the application of advanced technology.

Features

The College is housed centrally inside the campus in buildings 19 and 3 with the laboratory housed in buildings 1 and 26. An important feature of the design of building 19 is the inclusion of design studios as well as offices, laboratories, and support areas.

Graduation Requirements

To qualify for the B.S. degree from one of the programs in the College of Design and Built Environment, the candidate must:

(1) complete all curricular requirements for the degree as outlined in this bulletin;
(2) achieve a cumulative GPA of 2.00 or more in all courses taken in or offered by the Major department;
(3) achieve a cumulative GPA of 2.00 or more in all credit courses taken at KFUPM as an undergraduate; and
(4) complete a summer internship/cooperative program.

Department of Architectural Engineering

Chairman: Dr. Baqer Al-Ramadan

Faculty

Abdou	Asif	Makawi
Ahmed	Budaiwi	Mohammed
Al-Hammad	Hassanain	Ouis
Al-Homoud	Kim	Qannan

Introduction

The KFUPM Architectural Engineering Department was established in 1975 under the College of Engineering Sciences. In 1980, the program formed the nucleus of the newly established College of Environmental Design. As the name implies, Architectural Engineering is related to both architecture as well as engineering. However, Architectural Engineering as a discipline is distinguished from Architecture by its emphasis on the technology and engineering aspects related to Building Design, Construction and Operation. Since its establishment, the Department has successfully supplied both government and private sectors with many high-quality Architectural Engineers.

The curriculum places strong emphasis on studies related to each of the building technology and engineering areas such as: Building Structural and Environmental Control Systems. The curriculum also requires courses in building materials, construction systems and architectural design, construction management, building economics and computer applications in building design. Within the above general framework, the student can orient his study in the senior year to concentrate on one of the following specific areas:
Building Structural Systems

1. Building Structural Systems
2. Building Environmental Control Systems
   (*i.e. Building Mechanical Systems, Electrical and Lighting Systems*)
3. Construction and Maintenance Management (i.e. *Construction/Const Mgmt*)

The emphasis is selected by the student and is made at the beginning of the senior year by which time he would have completed most of the fundamental courses in all the above areas.

The plan of study in Architectural Engineering consists of 128 credit hours of course work, which include essentially the same basic requirements as other engineering programs in the areas of physics, chemistry, mathematics, engineering science and social science and humanities. The student is offered two opportunities to gain practical experience during his study. He can spend 8 weeks during summer or he may choose to spend 15 weeks in a more intensive Internship program in the building industry. The student is expected to finish the Bachelor of Science (BS) degree in 4 years in addition to one year spent in the Orientation Program.

Vision

To be a leader in providing outstanding Architectural Engineering education, research, and community services to create sustainable built environment in Saudi Arabia and beyond.

Mission

To create sustainable build environment in Saudi Arabia and beyond through:

- A lifelong learning environment and graduating leaders in Architectural Engineering
- Conducting outstanding research
- Imparting professional services to the industry and community at large.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Architectural Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Architectural Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Capable of developing and implementing creative and sustainable building design, construction and management solutions based on sound engineering principles and ethics as demanded by the work and the profession.
2. Qualified to meet the challenges of working in a multi-disciplinary environment and assuming leadership responsibilities in diverse areas of the field of architectural engineering.
3. Engage in lifelong learning to meet evolving engineering challenges and pursue opportunities in local and global contexts to better serve society.

- **Student Outcomes (SOs)**

The ***Architectural Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. communicate effectively with a range of audiences.

4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Architectural Engineering

Option I: Summer Training

Every student majoring in Architectural Engineering (Summer Training Option) must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, STAT 319	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
Math or Science Elective	MATH xxx or Basic Science xxx	3
		32

(d) Core Requirements (50 credit hours)		
Graphics/Arch. Design	ARE 201, 202, 301	8
Bldg. Materials/Working Drawings	ARE 230, 303	7
Building Structural Systems	CE 202, 305, 315	9
Building Electrical systems and Lighting	EE 204, 312	7
Building Mechanical Systems	ARE 220, 322, 323	9
Construction/Construction Management	ARE 330, 331	6
Senior Design Project	ARE 410, 411	4
		50

(e) Electives (12 credit hours)		
ARE Electives	Two ARE 4xx Courses	6
Engineering Elective	One Eng. XXX 4xx Course	3
Free Elective	One Free XXX 4xx Course	3
		12

(f) Summer Training (0 credit hours)

Each student must undergo an eight-week training in a consulting office or construction office/site.

Summer Training	ARE 399	0
		0

The total number of credit hours required is **128**

Architectural Engineering Curriculum - Summer Training Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 101	Calculus I	4	0	4	CHEM 101	Principles of Chemical Science I	3	4	4
PHYS 101	General Physics I	3	3	4	MATH 102	Calculus II	4	0	4
ENGL 101	Intro. to Academic Discourse	3	0	3	PHYS 102	General Physics II	3	3	4
ICS 104	Intro. to Programm. in Python & C	2	3	3	ENGL 102	Intro. to Report Writing	3	0	3
IAS 111	Belief and its Consequences	2	0	2	IAS 121	Language Foundation	2	0	2
PE 101	Health and Physical Education I	0	2	1					
	Total	14	8	17		Total	15	7	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARE 201	Architectural Graphics	0	6	2	ARE 202	Architectural Design and History	1	6	3
ARE 220	Fundamentals of Thermal Science	3	0	3	EE 204	Fund. of Electrical Circuits	2	3	3
ARE 230	Bldg. Materials & Const. Systems	3	3	4	CE 202	Statics and Strength of Materials	3	0	3
MATH 201	Calculus III	3	0	3	MATH 208	Intro. Diff. Eqs. & Linear Algebra	3	0	3
ENGL 214	Academic & Professional Comm.	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
ISE 291	Intro. to Data Science	3	0	3	IAS 212	Ethics and Governance	2	0	2
	Total	15	9	18		Total	14	9	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARE 301	Architectural Design	0	9	3	ARE 303	Working Drawings	0	9	3
ARE 322	Building Mechanical Systems	2	3	3	ARE 323	Principles of HVAC	3	0	3
ARE 330	Const. Management and Estimation	3	0	3	ARE 331	Const. Economy and Equipment	3	0	3
EE 312	Electrical Systems and Lighting	3	3	4	CE 315	Reinforced Concrete I	2	3	3
CE 305	Structural Analysis I	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
					CGS 392	Career Essentials	0	2	1
	Total	11	15	16		Total	11	14	16

Summer Session

Course	Title	LT	LB	Cr
ARE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARE 410	Intro. to Senior Design Project	1	0	1	ARE 411	Senior Design Project	0	9	3
ARE 4xx	ARE Elective I	3	0	3	XE 4xx	Engineering Elective	3	0	3
ARE 4xx	ARE Elective II	3	0	3	XXX 4xx	Free Elective	3	0	3
STAT 319	Prob.& Stat. for Engineers	2	3	3	GS xxx	GS Elective	3	0	3
XXX xxx	Math or Basic Science Elective	3	0	3	IAS xxx	Islamic/Arabic Elective	2	0	2
	Total	12	3	13		Total	11	9	14

Total Credit Hours: 128

Requirements for the Bachelor of Science (BS) Degree in Architectural Engineering

Option II: Internship

Every student majoring in Architectural Engineering (Internship Option) must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, STAT 319	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
Math or Science Elective	MATH xxx or Basic Science xxx	3
		32

(d) Core Requirements (50 credit hours)		
Graphics/Arch. Design	ARE 201, 202, 301	8
Bldg. Materials/Working Drawings	ARE 230, 303	7
Building Structural Systems	CE 202, 305, 315	9
Building Electrical systems and Lighting	EE 204, 312	7
Building Mechanical Systems	ARE 220, 322, 323	9
Construction/Construction Management	ARE 330, 331	6
Senior Design Project	ARE 410, 411	4
		50

(e) Electives (6 credit hours)		
ARE Elective	One ARE 4xx Course	3
Free Elective	One Free XXX 4xx Course	3
		6

(f) Internship (6 credit hours)

Each student must participate in a 15-week program of industrial training approved by the department and must submit a comprehensive report on his work during that period.

Internship	ARE 398	6
		6

The total number of credit hours required is **128**

Architectural Engineering Curriculum - Internship Option

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MATH 101	Calculus I	4	0	4	CHEM 101	Principles of Chemical Science I	3	4	4
PHYS 101	General Physics I	3	3	4	MATH 102	Calculus II	4	0	4
ENGL 101	Intro. to Academic Discourse	3	0	3	PHYS 102	General Physics II	3	3	4
ICS 104	Intro. to Programm. in Python & C	2	3	3	ENGL 102	Intro. to Report Writing	3	0	3
IAS 111	Belief and its Consequences	2	0	2	IAS 121	Language Foundation	2	0	2
PE 101	Health and Physical Education I	0	2	1					
	Total	14	8	17		Total	15	7	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARE 201	Architectural Graphics	0	6	2	ARE 202	Architectural Design and History	1	6	3
ARE 220	Fundamentals of Thermal Science	3	0	3	EE 204	Fund. of Electrical Circuits	2	3	3
ARE 230	Bldg. Materials & Const. Systems	3	3	4	CE 202	Statics and Strength of Materials	3	0	3
MATH 201	Calculus III	3	0	3	MATH 208	Intro. Diff. Eqs. & Linear Algebra	3	0	3
ENGL 214	Academic & Professional Comm.	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
ISE 291	Intro. to Data Science	3	0	3	IAS 212	Ethics and Governance	2	0	2
	Total	15	9	18		Total	14	9	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARE 301	Architectural Design	0	9	3	ARE 303	Working Drawings	0	9	3
ARE 322	Building Mechanical Systems	2	3	3	ARE 323	Principles of HVAC	3	0	3
ARE 330	Const. Management and Estimation	3	0	3	ARE 331	Const. Economy and Equipment	3	0	3
EE 312	Electrical Systems and Lighting	3	3	4	ARE 410	Intro. to Senior Design Project	1	0	1
CE 305	Structural Analysis I	3	0	3	CE 315	Reinforced Concrete I	2	3	3
IAS xxx	Islamic/Arabic Elective	2	0	2	BUS 200	Business & Entrepreneurship	3	0	3
					CGS 392	Career Essentials	0	2	1
	Total	13	15	18		Total	12	14	17

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARE 398	Internship	0	0	6	ARE 411	Senior Design Project	0	9	3
					ARE 4xx	ARE Elective	3	0	3
					STAT 319	Prob.& Stat. for Engineers	2	3	3
					XXX 4xx	Free Elective	3	0	3
					GS xxx	GS Elective	3	0	3
					XXX xxx	Math or Basic Science Elective	3	0	3
	Total	0	0	6		Total	14	12	18

Total Credit Hours	128

Department of Architecture

Chairman: Dr. Amer Al-Kharoubi

Faculty

Abd El Fattah	Al-Mahdy	Ashmeel
Al-Abbad	Al-Najjar	Ashour
Al-Khabbaz	Al-Nazhah	Babsail
Al-Kharoubi	Al-Qawasmi	Zami

Vision

The vision of the Department is to become one of the best architectural schools in Saudi Arabia and the region and to gain international recognition as a leader in architectural education that promotes regional architecture and an interdisciplinary culture of teaching, scholarship and service.

Mission

The Architecture Department is dedicated to educating future architectural professionals who have an ethical and critical approach to architecture. The Department is committed to:

- Graduating future architects who are creative and critical designers, well versed in the discipline technical and professional knowledge and practice.
- Developing knowledge and increase awareness on social, cultural, and environmental realms of architecture for the ultimate benefit of the built environment and those who use it.

Program Goals

1. Create a supportive and productive work environment that maintains and ensures high-quality architectural education that is recognized and accredited nationally and internationally.
2. Provide a high-quality teaching and learning environment that promote creativity, critical thinking, and leadership.
3. Recruit and retain talented students and ensure a high level of satisfaction.
4. Attract and retain high caliber faculty and scholars in the discipline's various areas and ensure continuous professional development.
5. Develop and sustain high-quality learning resources, facilities, and equipment that support the program's teaching, learning, and research activities.
6. Create a supportive research environment that encourages faculty and students to be involved in impactful scholarly research activities.
7. Strengthen and sustain collaborative relationships with local communities through service-learning.

Program Educational Objectives (PEOs)

The ARC Department at KFUPM is deeply committed to ensuring that every program’s graduate meets the goals and learning objectives necessary to achieve the highest level of excellence in all their future endeavors. The program’s graduates should develop creative solutions to architecture-related problems within a greater societal context by doing the following:

1. Practice Architecture profession with confidence, global competitiveness, and superior work ethics and character.
2. Apply professional knowledge, technical skills, and integrate design, technology, entrepreneurship, social sciences, and arts to produce efficient, ethical, creative, and sustainable architectural design solutions.
3. Demonstrate high proficiency in creative and critical thinking, design thinking skills, communication, and solving complex design problems.
4. Pursue independent and life-long learning to meet evolving built environment and architectural challenges facing complex modern societies.

5. Be able to pursue advanced study and research at the graduate level.

Curriculum Emphasis

The emphasis of architecture program is on architectural design and the application of information technology in design. This emphasis is reflected in the curriculum by the offer of eight sequential semesters of Design Studios backed by lectures in the following essential subject groups:

- Theory and History of Architecture
- Structures and Building Systems
- Construction Materials, Methods, and Systems
- Mechanical and Environmental Support Systems
- Computer Aided Design
- Professional Practice

The program also offers the opportunity for minor specialization in the following areas:

- Computer Aided Design
- Urban Design
- Regional Architecture

Requirements for the BS Degree in Architecture

Every student majoring in Architecture must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (7 credit hours)		
Math	MATH 106	3
Physics	PHYS 133	4
		7

(d) Core Requirements (95 credit hours)		
Design Studios & Projects	ARC 102, 103, 204, 205, 306, 307, 402, 403	36
Architectural and Digital Communication	ARC 113, 114	6
Structure in Architecture	ARC 231, 232	6
History and Theory of Architecture	ARC 121, 122, 226, 229	10
Digital Communication and technical skills	ARC 213, 214, 345	9
Human Factors in Architecture	ARC 355	3
Principles of Sustainable Design	ARC 356	3
Urban Design	ARC 357	3
Real Estate and Housing Development	ARC 358	3
Research Skills	ARC 401	3
Professional Practice	ARC 492	3
Architectural Engineering	ARE 230, 322, 328	10
		95

(e) Electives (12 credit hours)		
ARC Electives	Two ARC xxx Courses	6
Technical Electives	Two XE xxx Courses	6
		12

(f) Summer Training (2 credit hours)		
Summer Training	ARC 399	2
		2

The total number of credit hours required is **150**

Architecture Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARC 102	Design Studio I	0	6	3	ARC 103	Design Studio II	0	6	3
ARC 113	Arch. Communication I	0	6	3	ARC 114	Arch. Communication II	0	6	3
ARC 121	History of Architecture I	3	0	3	ARC 122	History of Architecture II	3	0	3
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
PHYS 133	Principles of Physics	3	3	4	MATH 106	Applied Calculus	3	0	3
IAS 111	Belief and its consequences	2	0	2	ICS 104	Intro. to Programm. in Python & C	2	3	3
	Total	11	15	18		Total	11	15	18

Summer Session I	Course	Title	LT	LB	Cr
	IAS 121	Language Foundation	2	0	2
	PE 101	Health and Physical Education I	0	2	1

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARC 204	Arch. Design Studio III	0	10	5	ARC 205	Arch. Design Studio IV	0	10	5
ARC 213	Digital communication I	0	6	3	ARC 214	Digital communication II	0	6	3
ARC 226	Theory of Architecture I	2	0	2	ARC 229	Theory of Architecture II	2	0	2
ARC 231	Structure in Architecture I	3	0	3	ARC 232	Structure in Architecture II	3	0	3
ARE 230	Building Materials & Constr. Systems	4	3	4	ISE 291	Intro. to Data Science	3	0	3
					IAS 212	Ethics and Governance	2	0	2
	Total	9	19	17		Total	10	16	18

Summer Session II	Course	Title	LT	LB	Cr
	ENGL 214	Academic & Professional Comm.	3	0	3
	IAS xxx	Islamic/Arabic Elective	2	0	2

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARC 306	Arch. Design Studio V	0	10	5	ARC 307	Arch. Design Studio VI	0	10	5
ARC 355	Human Factors in Architecture	3	0	3	ARC 345	Working Drawings	0	6	3
ARE 322	Building Mechanical Systems	2	3	3	ARC 356	Principles of Sustainable Design	3	0	3
COE 292	Intro. to Artificial Intelligence	3	0	3	ARC 357	Urban Design	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3	ARE 328	Arch. Acoustics & Illumination	3	0	3
					CGS 392	Career Essentials	0	2	1
	Total	11	13	17		Total	9	18	18

Summer Session III	Course	Title	LT	LB	Cr
	ARC 399	Summer Training	0	0	2

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ARC 401	Senior Project Prep. & Programming	3	0	3	ARC 403	Arch. Design Studio VIII: Senior Proj.	0	10	5
ARC 402	Arch. Design Studio VII	0	10	5	ARC 492	Professional Practice & Managemt	3	0	3
ARC 358	Real Estate & Housing Development	3	0	3	ARC xxx	ARC Elective II	3	0	3
ARC xxx	ARC Elective I	3	0	3	XE xxx	Tech. Elective II	3	0	3
XE xxx	Tech. Elective I	3	0	3	GS xxx	GS Elective	3	0	3
	Total	12	10	17		Total	12	10	17

Total Credit Hours	150

Department of City and Regional Planning

Chairman: Dr. Omar E. Almahdy

Faculty

Aldosary	Alshuwaikhat	Tauhidur Rahman
Al-Naser	Alomeer	
Al-Ramadan	Kadrin	

Introduction

The field of City Planning attempts to investigate and provide solutions to planning problems with a view towards shaping the current and future urban environment. Thus, city planners develop such solutions by moving systematically through a time-related process which requires defining goals, analyzing information, formulating plans, setting priorities, and designing programs of actions.

To deal with the complex problems of the urban environment, city planners require considerable skills, knowledge and insight, plus the ability to understand the social, economic, physical, and political interrelationships, which characterize urban goals and problems. Beyond the nature of such plans, city planners must also be prepared to make day-to-day decisions that affect the well being of urban inhabitants. The ability to surmount the increasing challenges of planning can be greatly assisted by considering geographic information system (GIS) and related information technology, early in planning education.

Undergraduate city planning education leads to diverse careers through professional employment or graduate studies in the same field or related professions. In the public sector, city planners are found in municipalities and numerous government agencies. Increasingly, city planners are moving into various private sector jobs, such as consultant firms, utility companies, development companies, financial institutions, national and regional commercial corporations, research organizations, and special interest groups. Being able to work in these different areas is thus assisted by the knowledge of GIS which is an intermediary platform that mediates various disciplines and professions.

Program Objectives

The ultimate goal of this program is to provide students with a coherent understanding of contemporary planning, such as combining a good theoretical background with the dynamics of professional practices and the society at large. In addition to special technical skills, the program helps each student to acquire an interdisciplinary education that leads to an understanding of the physical and social environment, their problems, and their potentialities for enriching human life. The main objectives of the program are, therefore, to:

- Offer a program leading to the degree of Bachelor of Science in City Planning.
- Equip the prospective students with the professional capability to sustain and enhance the quality of life in cities and regions.
- Meet the growing demands in the local market for qualified graduates with GIS background.

The Program

The Department of City and Regional Planning at KFUPM offers a program leading to the degree of Bachelor of Science in "City Planning." This degree is granted after the completion of 126 credit hours. The department is offering this program with two options:

Option I: B.S. in City Planning with Summer Training.
Option II: B.S. in City Planning with Cooperative Work.

The curriculum, in each option, consists of four major requirements: General Education requirements (38 credit hours for both options), Core requirements (73 credit hours for Option I; 64 credit hours for Option II), a Summer Training (for Option I only; 0 credit hours) or Cooperative Work (for Option II only; 9 credit hours), and elective courses (14 credit hours for both options).

General Education requirement courses focus on vital basic areas such as communication skills, mathematics, and natural sciences. Core requirement courses cover planning theory and history, planning workshops, environmental planning, policies and public works, land use and transportation, sustainable development and impact assessment, analytical methods, computer applications, as well as socio-economic dynamics of urban societies.

Department of Civil and Environmental Engineering

Chairman: Dr. Shamsad Ahmad

Faculty

Adekunle	Al-Ofi	Assi
Ahmad	Al-Osta	Baig
Al-Abdul Wahhab	Al-Sghan	Chowdhury
Al-Ahmadi	Al-Shayea	Khalid
Al-Amoudi	Al-Suwaiyan	Mukhtar
Al-Dulaijan	Al-Zahrani, Mesfer	Ratrout
Al-Gadhib	Al-Zahrani, Muhammad	Vohra
Al-Gahtani		

Introduction

The Civil and Environmental Engineering Department is equipped with modern laboratories for teaching and research in the areas of geotechnical engineering, civil engineering materials, strength of materials, structural analysis, design and modeling, highway and transportation, surveying and photogrammetry, hydraulics and hydrology, and environmental engineering. Effective use of the modern computer facilities at the University's Information Technology Center and those available in the department constitutes an essential part of the civil engineering undergraduate curriculum.

Vision

To provide students with proper learning infrastructure and research environments to develop their potential with technical knowledge and professional skills. For this ultimate educational objective, all underpinnings of the department (including academic and professional partnerships with academic and industrial stakeholders) have been forged to ensure maintaining recognizable leading-stands in education, research, and public professional-services.

Mission

The department seeks to provide distinctive infrastructure and environment for education, research and public services synergistically supportive to active learning, creative thinking, developing professional skills and self-development such that graduates would be qualified for being leaders equipped with potential-skills and capabilities to provide intelligent solutions for standing and emerging professional challenges.

Bachelor of Science (BS) IN CIVIL ENGINEERING

The Civil Engineering (CE) program is multidisciplinary in nature. It covers aspects of studies that relate to the essential needs of mankind. It embodies the planning, design, construction, maintenance, and operation of facilities such as buildings, structures, geotechnical, transportation, water, wastewater and waste.

The four-year undergraduate curriculum provides basic knowledge in sciences, mathematics, and engineering in the first two years. During the third year, the student is introduced to different fields in civil engineering with the emphasis on applications and design. After the completion of his third year, the student undertakes an 8-week summer training program in industry. Appropriate electives are also offered to further enhance the student's knowledge in one or more of the areas of civil engineering. In addition, courses in humanities, social sciences and economics are integrated into the program to broaden the student's knowledge.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Civil Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Civil Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Establish themselves as leading practicing civil engineering professionals, and demonstrate distinct abilities as responsible members of professional multi-disciplinary teams;
2. Pursue career developmental activities for up-to-date professionally-technical knowledge and skills; and
3. Conduct impactful basic and applied research activities to develop efficient solutions.

- **Student Outcomes (SOs)**

The ***Civil Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Civil Engineering

Every student majoring in Civil Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, CE 318	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
Geology/Biology	GEOL/BIOL xxx	3
		32

(d) Core Requirements (44 credit hours)		
Computer Graphics	CE 216	2
Surveying	CE 261	2
Mechanics and Structures	CE 201, 203, 305, 315	12
Materials	CE 204, 206	4
Geotechnical	CE 354, 356	4
Transportation	CE 341, 343	4
Fluid Mechanics and Environmental Engineering	CE 230, 330, 335, 375	10
Construction Management and Economy	CE 422	3
Senior Design Project	CE 411	3
		44

(e) Electives (18 credit hours)		
CE Electives	Two CE xxx Courses	6
CE Design Electives	Two CE xxx Courses	6
Technical Elective (from approved list)	One XE xxx Course	3
Free Elective	One XXX xxx Course	3
		18

(f) Summer Training (0 credit hours)		
Summer Training	CE 399	0
		0

The total number of credit hours required is **128**

Civil Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	ENGL 102	Intro. to Report Writing	3	0	3
ENGL 101	Intro. To Academic Discourse	3	0	3	IAS 111	Belief & Its Consequences	2	0	2
IAS 121	Language Foundation	2	0	2	ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	PE 101	Health and Physical Education I	0	2	1
					PHYS 102	General Physics II	3	3	4
	Total	15	7	17		Total	14	8	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CE 201	Statics	3	0	3	CE 203	Structural Mechanics I	3	0	3
CE 216	Computer Graphics	1	3	2	CE 204	Civil Engineering Materials	3	0	3
CE 261	Surveying I	1	3	2	CE 206	Civil Engineering Materials Lab	0	3	1
ENGL 214	Academic & Professional Comm.	3	0	3	CE 230	Engineering Fluid Mechanics	3	0	3
ISE 291	Intro. to Data Science	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
MATH 201	Calculus III	3	0	3	MATH 208	Intro. to Diff. Eqs. & Linear Algebra	3	0	3
	Total	14	6	16		Total	15	3	16

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
BUS 200	Business & Entrepreneurship	3	0	3	GEOL/BIOL xxx	Science Elective	2	3	3
CE 305	Structural Analysis I	3	0	3	CE 315	Reinforced Concrete I	2	3	3
CE 318	Numerical & Stat.l Methods in CE	2	3	3	CE 354	Intro. to Geotechnical Engineering	3	0	3
CE 330	Environmental Eng. Principles	3	0	3	CE 356	Geotechnical Engineering Lab	0	3	1
CE 375	Environmental Chemistry Lab	0	3	1	GS xxx	GS Elective	3	0	3
IAS 212	Ethics and Governance	2	0	2	IAS xxx	Islamic/Arabic Elective	2	0	2
					CGS 392	Career Essentials	0	2	1
	Total	13	6	15		Total	12	11	16

Summer Session					CE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CE 335	Engineering Hydrology	2	3	3	CE 411	Senior Design Project	1	6	3
CE 341	Transportation Engineering	3	0	3	XXX xxx	Free Elective	3	0	3
CE 343	Transportation Engineering Lab	0	3	1	CE xxx*	CE Design Elective I	3	0	3
CE 422	Constuct. Management & Economy	3	0	3	CE xxx**	CE Design Elective II	3	0	3
CE xxx	CE Elective I	3	0	3	XE xxx	Technical Elective	3	0	3
CE xxx	CE Elective II	3	0	3					
	Total	14	6	16		Total	13	6	15

Total Credit Hours	128

*****CE 441 or 444 or 455

******CE 437 or 471

Bachelor of Science (BS) IN APPLIED CIVIL ENGINEERING

The Applied Civil Engineering (ACE) program is multidisciplinary in nature. It covers aspects of studies that relate to the essential needs of mankind. It embodies the planning, design, construction, maintenance, and operation of facilities such as buildings, structures, geotechnical, transportation, water, wastewater and waste.

The four-year undergraduate curriculum provides basic knowledge in sciences, mathematics, and engineering in the first two years. During the third year, the student is introduced to different fields in civil engineering with the emphasis on applications and design. After the completion of his third year, the student undertakes Internship training in industry. Appropriate electives are also offered to further enhance the student's knowledge in one or more of the areas of civil engineering. In addition, courses in humanities, social sciences and economics are integrated into the program to broaden the student's knowledge.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Applied Civil Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Applied Civil Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Establish themselves as leading practicing civil engineering professionals, and demonstrate distinct abilities as responsible members of professional multi-disciplinary teams;
2. Pursue career developmental activities for up-to-date professionally-technical knowledge and skills; and
3. Conduct impactful basic and applied research activities to develop efficient solutions.

- **Student Outcomes (SOs)**

The ***Applied Civil Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Requirements for the Bachelor of Science (BS) Degree in Applied Civil Engineering

Every student majoring in Applied Civil Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (32 credit hours)		
Math	MATH 101, 102, 201, 208, CE 318	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
Geology/Biology	GEOL/BIOL xxx	3
		32

(d) Core Requirements (44 credit hours)		
Computer Graphics	CE 216	2
Surveying	CE 261	2
Mechanics and Structures	CE 201, 203, 305, 315	12
Materials	CE 204, 206	4
Geotechnical	CE 354, 356	4
Transportation	CE 341, 343	4
Fluid Mechanics and Environmental Engineering	CE 230, 330, 335, 375	10
Construction Management and Economy	CE 422	3
Senior Design Project	CE 411	3
		44

(e) Electives (12 credit hours)		
CE Elective	One CE xxx Course	3
CE Design Electives	Two CE xxx Courses	6
Technical Elective (from approved list)	One XE xxx Course	3
		12

(f) Internship (6 credit hours)		
Internship	CE 398	6
		6

The total number of credit hours required is **128**

Applied Civil Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	ENGL 102	Intro. to Report Writing	3	0	3
ENGL 101	Intro. To Academic Discourse	3	0	3	IAS 111	Belief & its Consequences	2	0	2
IAS 121	Language Foundation	2	0	2	ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PHYS 101	General Physics I	3	3	4	PHYS 102	General Physics II	3	3	4
PE 101	Health and Physical Education I	0	2	1					
	Total	15	9	18		Total	14	6	16

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CE 201	Statics	3	0	3	CE 203	Structural Mechanics I	3	0	3
CE 216	Computer Graphics	1	3	2	CE 204	Civil Engineering Materials	3	0	3
CE 261	Surveying I	1	3	2	CE 206	Civil Engineering Materials Lab	0	3	1
IAS 212	Ethics and Governance	2	0	2	CE 230	Engineering Fluid Mechanics	3	0	3
ISE 291	Intro. to Data Science	3	0	3	CE 330	Environmental Eng. Principles	3	0	3
MATH 201	Calculus III	3	0	3	CE 375	Environmental Chemistry Lab	0	3	1
MATH 208	Intro. to Diff. Eqs. & Linear Algebra	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
	Total	16	6	18		Total	15	6	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CE 305	Structural Analysis I	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
CE 318	Numerical & Stat.l Methods in CE	2	3	3	CE 315	Reinforced Concrete I	2	3	3
CE 335	Engineering Hydrology	2	3	3	CE 354	Intro. to Geotechnical Engineering	3	0	3
CE 341	Transportation Engineering	3	0	3	CE 356	Geotechnical Engineering Lab	0	3	1
CE 343	Transportation Engineering Lab	0	3	1	GEOL/BIOL xxx	Science Elective	2	3	3
ENGL 214	Academic & Professional Comm.	3	0	3	GS xxx	GS Elective	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2	CGS 392	Career Essentials	0	2	1
	Total	15	9	18		Total	13	11	17

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CE 398	Internship	0	0	6	CE 411	Senior Design Project	1	6	3
					CE 422	Constuct. Management & Economy	3	0	3
					CE xxx	CE Elective	3	0	3
					CE xxx*	CE Design Elective I	3	0	3
					CE xxx**	CE Design Elective II	3	0	3
					XE xxx	Technical Elective	3	0	3
	Total	0	0	6		Total	16	6	18
						Total Credit Hours			128

*****CE 441 or 444 or 455

******CE 437 or 471

KFUPM BUSINESS SCHOOL

Dean: Dr. Hesham Merdad

DEPARTMENTS

ACCOUNTING & FINANCE
INFORMATION SYSTEMS & OPERATIONS MANAGEMENT
MANAGEMENT & MARKETING
GLOBAL STUDIES

Established in 1975, the KFUPM Business School (KBS) offers undergraduate and graduate degree programs. It offers five undergraduate programs leading to the baccalaureate degrees in Accounting, Finance, Management Information Systems, Management, and Marketing. KBS programs are accredited by the AACSB International since 2002. The KBS also offers a Master of Business Administration (MBA) and an Executive Master of Business Administration (EMBA). In addition, in 2020, KBS introduced a one-year professional Master (MX) as well as a new undergraduate concentration (CX) in Supply Chain Management. In 2021, KBS introduced two one-year professional Master (MX) in Human Resource Management (HRM) and Business Analytics (BA). In addition, a new undergraduate concentration in Business Analytics was also offered in 2021. Also, in 2021, the department of Global Studies joined KBS as a new department in order to integrate international dimension and globalization with KBS and its programs.

All programs are subjected to periodic reviews to assure currency and relevancy. The language of instruction in all programs is English. All revised programs require students to spend 15 weeks of work in the industry to apply knowledge and gain valuable skills and competencies. All programs share common learning goals and in addition each program has learning goals specific to the discipline. KBS programs are delivered by qualified faculty members, who were recruited from around the world. The College enjoys excellent facilities and learning support technologies. The College fosters mutually beneficial relations with the industry and with other universities.

Vision

To be a model business school renowned for its profound impact on society.

Mission

We graduate students with relevant knowledge, skills, and leadership potential that make them the most sought after by employers in the region. We produce high quality research that is highly regarded by business scholars. We engage the community in valuable and enriching services.

KBS Learning Goals

In addition to the learning goals specific to each major, all KBS programs have the following learning goals:

1. *Communication Abilities:* Ability to communicate business ideas effectively both orally and in writing
2. *Teamwork & Leadership Abilities:* Ability to apply interpersonal and collaborative abilities effectively as a member or a leader of a team in performing group task in business and professional organizations.
3. *Decision Making Abilities:* Students will have the analytical/quantitative abilities to make sound business decisions.
4. *Integrated and Applied Learning Skills:* Ability to develop integrative and applied learning skills.
5. *Ethics & Multicultural Diversity Skills:* Ability to recognize ethical and multicultural issues and assess their impact on organizations.

6. *General Business Knowledge:* Ability to apply concepts and theories from business functional areas appropriately.

Graduation Requirements

To graduate with a B.S. degree in the KFUPM Business School, the candidate must have

- completed a minimum of 128 credit hours,
- met the University requirement for cumulative and major GPA's, and
- met other University requirements stated in this bulletin and in the regulations.

Department of Accounting and Finance

Chairman: Dr. Naji Al-Shammasi

Faculty

Abdelhalim	Al-Sahlawi, A	Islam
Ahmed, N.	Al-Sahlawi, M	Khan
Akimaya	Al-Shammasi	Kurdi
Albinaly	Al-Subaie	Li
Al-Elg	Al-Yousef	Madani
Al-Harbi	Al-Zahrani	Merdad
Al-Hazmi	Chen	Miah
Al-Hejji	Dong	Taha
Al-Mansour	Hossain	Uthman

The Bachelor of Science in Accounting

The Bachelor of Science program in Accounting offered by the Department of Accounting and Finance was approved and launched in 1991. It educates students to function effectively in a wide range of accounting careers in all types of economic organizations. The program is designed to prepare graduates for accounting careers in industry, public accounting, government, not-for-profit organizations or for an academic accounting career. The program stresses basic conceptual knowledge in all fields of business administration as an essential foundation for an effective accounting career. The program includes financial accounting, accounting information systems, cost accounting, managerial accounting, advanced accounting, auditing, as well as practical training in accounting. The focus of the program is on the principles, concepts, and procedures of measuring, analyzing, and communicating economic information for decision making.

The Bachelor of Science in Finance

The Bachelor of Science program in Finance offered by the Department of Accounting and Finance was approved and launched in 1991. The program was initiated in response to the strong student demand and exponential growth of the financial sector in the Kingdom of Saudi Arabia. The curriculum structure of the program was developed after considerable deliberations and review of leading programs offered at reputable institutions. Continuing student interest in this major is a clear indication of the program's relevance and vitality. With the vision of 2030 and the Kingdom's transition to the new digitally economy, the importance of such program becomes more evident as it focuses on the structural changes currently underway in the Saudi economy with a greater focus on services sector supported by privatization, deregulation, diversification, and regional and global integration.

Program Learning Goals, Objectives and Outcomes

Learning Goals (AACSB) and/or Learning Objective (NCAAA)	AACSB & NCAAA Alignment: *Saudi Arabia Qualifications Framework (SAQF) domains: Knowledge, Skills, and Competences*	Learning Objectives (AACSB) and/or Learning Outcomes (NCAAA)
For the College General Education		
1. Communication Abilities Ability to communicate business ideas effectively both orally and in writing.	**Skills**	**1/S1.** Students will be able to make an effective oral presentation that is logical and clear to the target audience.
		1/S2. Students will be able to prepare a written business report that is logical, grammatically correct, and clear to the target audience.
2. Teamwork & Leadership Abilities Ability to apply interpersonal and collaborative abilities effectively as a member or a leader of a team in performing group task in business and professional organizations.	**Values**	**2/V1.** Students will be able to work effectively in group settings.
		2/V2. Students will be able to lead group work.
3. Decision Making Abilities Students will have the analytical/ quantitative abilities to make sound business decisions.	**Values**	**3/V1.** Students will be able to apply sound judgment in making choices and decisions to the relevant business problems.

4. Integrated and Applied Learning Skills Ability to develop integrative and applied learning skills.	**Skills**	**4/S1.** Students will be able to connect relevant experience and academic knowledge.
		4/S2. Students will be able to adapt and apply skills, abilities, theories, and methodologies to business.
5. Ethics & Multicultural Diversity Skills Ability to recognize ethical and multicultural issues and assess their impact on organizations.	**Knowledge**	**5/K1.** Students will be able to identify ethical issues in organizations.
	Values	**5/V1.** Students will be able to deal effectively with people from diverse social, political and economic backgrounds.
6. General Business Knowledge Ability to apply concepts and theories from business functional areas appropriately.	**Knowledge**	**6/K1.** Students will be able to identify the functional areas of business and their inter-relationships.
	Skills	**6/S1.** Students will be able to integrate functional area competencies to critically evaluate information and make decisions.
Discipline-Specific (Accounting)		
7. Accounting Knowledge Awareness and understanding of accounting principles, concepts, and theories.	**Knowledge**	**7/K1.** Students will be able to explain accounting theories, principles, concepts and techniques and their relevance to business situations.
8. Application of Accounting Knowledge Ability to apply accounting principles, concepts, theories into variety of business situations.	**Skills**	**8/S1.** Students will be able to apply accounting principles, standards and technologies to financial reporting and auditing practices locally and internationally.
		8/S2. Students will be able to apply management accounting information and techniques to a variety of planning, decision-making and financial control situations.
Discipline-Specific (Finance)		
7. Finance Knowledge Awareness and understanding of finance concepts, principles and theories.	**Knowledge**	**7/K1.** Students will be able to explain financial decision-making process under uncertainty.
		7/K2. Students will be able to explain the role of financial markets in economic development and economic efficiency.
8. Application of Finance Knowledge Ability to apply finance principles, concepts, theories into variety of business situations.	**Skills**	**8/S1.** Students will be able to use the risk-return framework to assess the suitability of investment opportunities and different business problems.
		8/S1. Students will be able to analyze the impact of different financial decisions on firm value.
		8/S3. Students will be able to apply different analytical techniques including quantitative models and qualitative analysis framework.

Requirements for the BS Degree in Accounting

Every student majoring in Accounting must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) College Core Requirements (64 credit hours)		
Math	MATH 105, 106	6
Statistics	STAT 211, 212	6
Accounting	ACCT 110, 210	6
Business Communications	MGT 210	3
Economics	ECON 101, 102, 306	9
Management	MGT 301, (311 or 313), 449	9
Management Information Systems	MIS 101, 215	4
Marketing	MKT 250	3
Financial Management	FIN 250	3
Operations Management	OM 210, 311	6
Research Methods	MGT 355	3
Business Electives	Two XXX 3/4xx Courses	6
		64

(d) Accounting Major Requirements (24 credit hours)		
Accounting Information Systems	ACCT 300	3
Intermediate Accounting I	ACCT 301	3
Intermediate Accounting II	ACCT 302	3
Auditing	ACCT 311	3
Advanced Accounting	ACCT 403	3
Cost Accounting	ACCT 410	3
ACCT Electives	Two ACCT 3/4xx Courses	6
		24

(e) Internship (6 credit hours)		
Internship	ACCT 398	6
		6

The total number of credit hours required is **128**

Accounting Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
MATH 105	Finite Mathematics	3	0	3	MATH 106	Applied Calculus	3	0	3
ACCT 110	Intro. to Financial Accounting	3	0	3	ACCT 210	Intro. to Managerial Accounting	3	0	3
ECON 101	Principles of Microeconomics	3	0	3	ECON 102	Principles of Macroeconomics	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3	ICS 104	Intro. to Programm. in Python & C	2	3	3
IAS 111	Belief and Consequences	2	0	2	MIS 215	Principles of MIS	3	0	3
MIS 101	Business Computing	0	3	1					
	Total	17	3	18		Total	17	3	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 214	Academic & Professional Comm.	3	0	3	MGT 210	Business Communication	3	0	3
FIN 250	Financial Management	3	0	3	MKT 250	Principles of Marketing	3	0	3
STAT 211	Statistics for Business I	3	0	3	STAT 212	Statistics for Business II	3	0	3
IAS 121	Language Foundation	2	0	2	OM 210	Operations Management	3	0	3
MGT 301	Principles of Management	3	0	3	ISE 291	Intro. to Data Science	3	0	3
ACCT 300	Accounting Information Systems	2	2	3	ACCT 301	Intermediate Accounting I	3	0	3
PE 101	Health and Physical Educ. I	0	2	1					
	Total	16	4	18		Total	18	0	18

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
OM 311	Business Analytics	3	0	3	MGT 311/313	Legal Environment/Int. Legal Envir.	3	0	3
COE 292	Intro. to Artificial Intelligence	3	0	3	MGT 355	Business Research Methods	3	0	3
ECON 306	Economy of Saudi Arabia	3	0	3	CGS 392	Career Essentials	0	2	1
ACCT 302	Intermediate ACCT II	3	0	3	IAS 212	Ethics and Governance	2	0	2
ACCT 311	Auditing	3	0	3	ACCT 3/4xx	ACCT Elective 1	3	0	3
					XXX 3/4xx	Business Elective 1	3	0	3
					ACCT 410	Cost Accounting	3	0	3
	Total	15	0	15		Total	17	2	18

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ACCT 398	Internship	0	0	6	MGT 449	Strategic Management	3	0	3
					IAS 418	Contemporary Fin. Trans. in Islam	2	0	2
					GS xxx	GS Elective	3	0	3
					ACCT 3/4xx	ACCT Elective 2	3	0	3
					XXX 3/4xx	Business Elective 2	3	0	3
					ACCT 403	Advanced Accounting	3	0	3
	Total	0	0	6		Total	17	0	17
						Total Credit Hours			128

Requirements for the BS Degree in Finance

Every student majoring in Finance must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) College Core Requirements (52 credit hours)		
Math	MATH 105, 106	6
Statistics	STAT 211, 212	6
Accounting	ACCT 110, 210	6
Business Communications	MGT 210	3
Economics	ECON 101, 102, 306	9
Management	MGT 301, (311 or 313), 449	9
Management Information Systems	MIS 101, 215	4
Marketing	MKT 250	3
Finance	FIN 250	3
Operations Management	OM 210, 311	6
Research Methods	MGT 355	3
Business Electives	Two XXX 3/4xx Courses	6
		52

(d) Finance Major Requirements (24 credit hours)		
Intermediate Accounting I	ACCT 301	3
Corporate Finance	FIN 315	3
Investments	FIN 320	3
Financial Modeling	FIN 425	3
Financial Policy	FIN 450	3
FIN Elective	Two FIN 3/4xx Courses	6
ECON Elective	ECON 3/4xx	3
		24

(e) Internship (6 credit hours)		
Internship	FIN 398	6
		6

The total number of credit hours required is **128**

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Finance Curriculum

Four-year Academic Plan

Digital/Business Foundation

Freshman Year

Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3
MATH 105	Finite Mathematics	3	0	3
ACCT 110	Intro. to Financial Accounting	3	0	3
ECON 101	Principles of Microeconomics	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3
IAS 111	Belief and Consequences	2	0	2
MIS 101	Business Computing	0	3	1
	Total	17	3	18

Course	Title	LT	LB	Cr
ENGL 102	Intro. to Report Writing	3	0	3
MATH 106	Applied Calculus	3	0	3
ACCT 210	Intro. to Managerial Accounting	3	0	3
ECON 102	Principles of Macroeconomics	3	0	3
ICS 104	Intro. to Programm. in Python & C	2	3	3
MIS 215	Principles of MIS	3	0	3
	Total	17	3	18

Sophomore Year

Course	Title	LT	LB	Cr
ENGL 214	Academic & Professional Comm.	3	0	3
FIN 250	Financial Management	3	0	3
STAT 211	Statistics for Business I	3	0	3
IAS 121	Language Foundation	2	0	2
MGT 301	Principles of Management	3	0	3
ACCT 301	Intermediate Accounting I	3	0	3
PE 101	Health and Physical Educ. I	0	2	1
	Total	17	2	18

Course	Title	LT	LB	Cr
MGT 210	Business Communication	3	0	3
MKT 250	Principles of Marketing	3	0	3
STAT 212	Statistics for Business II	3	0	3
OM 210	Operations Management	3	0	3
ISE 291	Intro. to Data Science	3	0	3
FIN 315	Corporate Finance	3	0	3
	Total	18	0	18

Junior Year

Course	Title	LT	LB	Cr
OM 311	Business Analytics	3	0	3
COE 292	Intro. to Artificial Intelligence	3	0	3
ECON 306	Economy of Saudi Arabia	3	0	3
ECON 3/4xx	ECON Elective	3	0	3
FIN 320	Investments	3	0	3
	Total	15	0	15

Course	Title	LT	LB	Cr
MGT 311/313	Legal Environment/Int. Legal Envir.	3	0	3
MGT 355	Business Research Methods	3	0	3
CGS 392	Career Essentials	0	2	1
IAS 212	Ethics and Governance	2	0	2
FIN 3/4xx	FIN Elective 1	3	0	3
XXX 3/4xx	Business Elective 1	3	0	3
FIN 425	Financial Modeling	3	0	3
	Total	17	2	18

Senior Year

Course	Title	LT	LB	Cr
FIN 398	Internship	0	0	6
	Total	0	0	6

Course	Title	LT	LB	Cr
MGT 449	Strategic Management	3	0	3
IAS 418	Contemporary Fin. Trans. in Islam	2	0	2
GS xxx	GS Elective	3	0	3
FIN 3/4xx	FIN Elective 2	3	0	3
XXX 3/4xx	Business Elective 2	3	0	3
FIN 450	Financial Policy	3	0	3
	Total	17	0	17

Total Credit Hours 128

Department of Information Systems and Operations Management

Chairman: Dr. Mohammed Al-Khars

Faculty

Ahmed	Al-Ojairi	Li
Al-Ahmadi	Alsubaie	Nehari-Talet
Al-Bashrawi	Al-Wahaishi	Qahwash
Al-Jabri	Fallatah	Qudrat-Ullah
Al-Khaldi	Kayal	Shawosh
Al-Khars	Khan	Yu
Al-Nasser		

The Bachelor of Science program in Management Information Systems was established to address the ever-growing digital needs of the country from the introduction of the internet to the establishment of e-governmental institutions. Our program covers the essential foundations of information systems design and development to advance areas of analytics and e-commerce. Our graduates have been the cornerstone of many governmental initiatives to digitize the economy and have led many private organizations in their digital transformation efforts.

Program Learning Goals, Objectives and Outcomes

Learning Goals (AACSB) and/or Learning Objective (NCAAA)	**AACSB & NCAAA Alignment:** ***Saudi Arabia Qualifications Framework (SAQF) domains: Knowledge, Skills, and Competences***	**Learning Objectives (AACSB) and/or Learning Outcomes (NCAAA)**
For the College General Education		
1. Communication Abilities Ability to communicate business ideas effectively both orally and in writing.	**Skills**	**1/S1.** Students will be able to make an effective oral presentation that is logical and clear to the target audience.
		1/S2. Students will be able to prepare a written business report that is logical, grammatically correct, and clear to the target audience.
2. Teamwork & Leadership Abilities Ability to apply interpersonal and collaborative abilities effectively as a member or a leader of a team in performing group task in business and professional organizations.	**Values**	**2/V1.** Students will be able to work effectively in group settings.
		2/V2. Students will be able to lead group work.
3. Decision Making Abilities Students will have the analytical/ quantitative abilities to make sound business decisions.	**Values**	**3/V1.** Students will be able to apply sound judgment in making choices and decisions to the relevant business problems.
4. Integrated and Applied Learning Skills Ability to develop integrative and applied learning skills.	**Skills**	**4/S1.** Students will be able to connect relevant experience and academic knowledge.
		4/S2. Students will be able to adapt and apply skills, abilities, theories, and methodologies to business.
5. Ethics & Multicultural Diversity Skills Ability to recognize ethical and multicultural issues and assess their impact on organizations.	**Knowledge**	**5/K1.** Students will be able to identify ethical issues in organizations.
	Values	**5/V1.** Students will be able to deal effectively with people from diverse social, political and economic backgrounds.
6. General Business Knowledge Ability to apply concepts and theories from business functional areas appropriately.	**Knowledge**	**6/K1.** Students will be able to identify the functional areas of business and their inter-relationships.
	Skills	**6/S1.** Students will be able to integrate functional area competencies to critically evaluate information and make decisions.

Discipline-Specific (MIS)		
7. MIS Knowledge Identify, analyze, design and implement information technology solutions that enhance organizational performance.	**Skills**	**7/S1**. Students will be able to analyze, design, implement, and maintain MIS applications.
		7/S2. Student will be able to plan, coordinate, monitor, and control MIS development projects.
8. Application of MIS Knowledge Identify and make decision using automation techniques and analyze big data using analytical tools.	**Knowledge**	**8/K1.** Students will be able to identify knowledge management resources and usage of collaborative systems.
	Skills	**8/S1.** Students will be able to make decisions using automation techniques and Expert Systems.
		8/S2. Students will be able to analyze big data and data analytics using predictive analysis, visual analytics, and BPM.

Requirements for the BS Degree in Management Information Systems

Every student majoring in MIS must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) College Core Requirements (64 credit hours)		
Math	MATH 105, 106	6
Statistics	STAT 211, 212	6
Accounting	ACCT 110, 210	6
Business Communications	MGT 210	3
Economics	ECON 101, 102, 306	9
Management	MGT 301, (311 or 313), 449	9
Management Information Systems	MIS 101, 215	4
Marketing	MKT 250	3
Finance	FIN 250	3
Operations Management	OM 210, 311	6
Research Methods	MGT 355	3
Business Electives	Two XXX xxx Courses	6
		64

(d) MIS Major Requirements (24 credit hours)		
Fundamentals of Computer Comms	COE 353	3
Systems Analysis & Design	MIS 301	3
Business Data Management	MIS 311	3
IS Project Management	MIS 405	3
Management Support Systems	MIS 410	3
MIS Electives	Three MIS 3/4xx Courses	9
		24

(e) Internship 6 credit hours)		
Internship	MIS 398	6
		6

The total number of credit hours required is **128**

Management Information System Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
MATH 105	Finite Mathematics	3	0	3	MATH 106	Applied Calculus	3	0	3
ACCT 110	Intro. to Financial Accounting	3	0	3	ACCT 210	Intro. to Managerial Accounting	3	0	3
ECON 101	Principles of Microeconomics	3	0	3	ECON 102	Principles of Macroeconomics	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3	ICS 104	Intro. to Programm. in Python & C	2	3	3
IAS 111	Belief and Consequences	2	0	2	MIS 215	Principles of MIS	3	0	3
MIS 101	Business Computing	0	3	1					
	Total	17	3	18		Total	17	3	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 214	Academic & Professional Comm.	3	0	3	MGT 210	Business Communication	3	0	3
FIN 250	Financial Management	3	0	3	MKT 250	Principles of Marketing	3	0	3
STAT 211	Statistics for Business I	3	0	3	STAT 212	Statistics for Business II	3	0	3
IAS 121	Language Foundation	2	0	2	OM 210	Operations Management	3	0	3
MGT 301	Principles of Management	3	0	3	ISE 291	Intro. to Data Science	3	0	3
MIS 301	Systems Analysis & Design	2	2	3	ECON 306	Economy of Saudi Arabia	3	0	3
PE 101	Health and Physical Educ. I	0	2	1					
	Total	16	4	18		Total	18	0	18

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
OM 311	Business Analytics	3	0	3	MGT 311/313	Legal Environment/Int. Legal Envir.	3	0	3
COE 292	Intro. to Artificial Intelligence	3	0	3	MGT 355	Business Research Methods	3	0	3
COE 353	Fundamentals of Comptr Comms	3	0	3	CGS 392	Career Essentials	0	2	1
MIS 3/4xx	MIS Elective 1	3	0	3	IAS 212	Ethics and Governance	2	0	2
MIS 311	Business Data Management	2	2	3	MIS 3/4xx	MIS Elective 2	3	0	3
					XXX xxx	Business Elective 1	3	0	3
					MIS 405	IS Project Management	3	0	3
	Total	14	2	15		Total	17	2	18

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MIS 398	Internship	0	0	6	MGT 449	Strategic Management	3	0	3
					IAS 418	Contemporary Fin. Trans. in Islam	2	0	2
					GS xxx	GS Elective	3	0	3
					MIS 3/4xx	MIS Elective 3	3	0	3
					XXX xxx	Business Elective 2	3	0	3
					MIS 410	Management Support Systems	2	2	3
	Total	0	0	6		Total	16	2	17
						Total Credit Hours			128

Department of Management and Marketing

Chairman: Dr. Abdullah Almashayekhi

Faculty

Al-Ashban	Al-Wuhaibi	Kazmi
Al-Ghamdi	Al-Zamel	Makkawi
Ali	Frimpong	Mansour
Al-Kahtani	Heineck	Sohail
Almashayekhi	Joyner	Tariq
Al-Shebil	Kayal	Ukil
Al-Shuridah		

The Bachelor of Science in Management

The mission of the Bachelor of Science program in Management program at KFUPM Business School, is to produce graduates who will play leading roles in managing and leading organizations they work for or function effectively in management-related positions in a variety of contexts both local and global. The program focuses on the principles, concepts, policies, guidelines and procedures needed for measuring and analyzing management information for effective decision-making, and for implementing and controlling plans for effective and efficient performance at the individual, team and overall organizational levels.

The Bachelor of Science in Marketing

The mission of the Bachelor of Science program in Marketing program is to produce graduates who will play leading roles in managing the marketing functions of organizations they work for or function effectively in marketing-related positions in a variety of contexts, both local and international. The program focuses on the principles, concepts, and procedures needed for measuring and analyzing marketing information for effective decision-making, and for implementing and controlling marketing plans for efficient market share growth and ultimate profitability.

Program Learning Goals, Objectives and Outcomes

Learning Goals (AACSB) and/or Learning Objective (NCAAA)	AACSB & NCAAA Alignment: *Saudi Arabia Qualifications Framework (SAQF) domains: Knowledge, Skills, and Competences*	Learning Objectives (AACSB) and/or Learning Outcomes (NCAAA)
For the College General Education		
1. Communication Abilities Ability to communicate business ideas effectively both orally and in writing.	**Skills**	**1/S1.** Students will be able to make an effective oral presentation that is logical and clear to the target audience.
		1/S2. Students will be able to prepare a written business report that is logical, grammatically correct, and clear to the target audience.
2. Teamwork & Leadership Abilities Ability to apply interpersonal and collaborative abilities effectively as a member or a leader of a team in performing group task in business and professional organizations.	**Values**	**2/V1.** Students will be able to work effectively in group settings.
		2/V2. Students will be able to lead group work.
3. Decision Making Abilities Students will have the analytical/ quantitative abilities to make sound business decisions.	**Values**	**3/V1.** Students will be able to apply sound judgment in making choices and decisions to the relevant business problems.
4. Integrated and Applied Learning Skills Ability to develop integrative and applied learning skills.	**Skills**	**4/S1.** Students will be able to connect relevant experience and academic knowledge.
		4/S2. Students will be able to adapt and apply skills, abilities, theories, and methodologies to business.

5. Ethics & Multicultural Diversity Skills Ability to recognize ethical and multicultural issues and assess their impact on organizations.	**Knowledge**	**5/K1.** Students will be able to identify ethical issues in organizations.
	Values	**5/V1.** Students will be able to deal effectively with people from diverse social, political and economic backgrounds.
6. General Business Knowledge Ability to apply concepts and theories from business functional areas appropriately.	**Knowledge**	**6/K1.** Students will be able to identify the functional areas of business and their inter-relationships.
	Skills	**6/S1.** Students will be able to integrate functional area competencies to critically evaluate information and make decisions.
Discipline-Specific (Management)		
7. Management Knowledge Awareness and understanding of management concepts, principles and theories.	**Knowledge**	**7/K1.** Students will be able to explain the role of management in organizations and society.
		7/K2. Students will be able to explain the principles and theories underlying modern management thinking and practice.
		7/K3. Students will be able to explain the responsibilities and challenges facing management in organizations and society at large.
8. Application of Management Knowledge Ability to apply management area concepts, principles and theories appropriately.	**Skills**	**8/S1.** Students will be able to apply the management process of planning, organizing, leading, and controlling.
		8/S2. Students will be able to draw appropriate implementation plans for the strategies
		8/S3. Students will be able to use the data available from the scientific-based research to formulate strategies and solutions to business-related problems.
		8/S4. Students will be able to design and conduct basic-level management-related research studies, evaluate, and use third-party business research studies for effective managerial decision making.
Discipline-Specific (Marketing)		
7. Marketing Knowledge Awareness and understanding of marketing concepts, principles and theories.	**Knowledge**	**7/K1.** Students will be able to explain the role of marketing in an organization and society.
		7/K2. Students will be able to explain theories and practice of modern marketing.
		7/K3. Students will be able to identify and illustrate challenges facing marketing in the organization and society.
8. Application of Marketing Knowledge Ability to apply marketing area concepts, principles and theories appropriately.	**Skills**	**8/S1.** Students will be able to identify marketing problems and draw appropriate implementation plans for the strategies.
		8/S2. Students will be able to design, conduct and evaluate basic-level marketing research studies.

Requirements for the BS Degree in Management

Every student majoring in Management must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) College Core Requirements (64 credit hours)		
Math	MATH 105, 106	6
Statistics	STAT 211, 212	6
Accounting	ACCT 110, 210	6
Business Communications	MGT 210	3
Economics	ECON 101, 102, 306	9
Management	MGT 301, (311 or 313), 449	9
Management Information Systems	MIS 101, 215	4
Marketing	MKT 250	3
Finance	FIN 250	3
Operations Management	OM 210, 311	6
Research Methods	MGT 355	3
Business Electives	Two XXX 3/4xx	6
		64

(d) Management Major Requirements (24 credit hours)		
Human Resources Management	HRM 301	3
Organization Behavior	MGT 310	3
Organizational Leadership	MGT 430	3
International Business	MGT 440	3
Management of Innovation and Change	MGT 450	3
MGT Electives	Three MGT 3/4xx Courses	9
		24

(e) Internship (6 credit hours)		
Internship	MGT 398	6
		6

The total number of credit hours required is **128**

Management Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
MATH 105	Finite Mathematics	3	0	3	MATH 106	Applied Calculus	3	0	3
ACCT 110	Intro. to Financial Accounting	3	0	3	ACCT 210	Intro. to Managerial Accounting	3	0	3
ECON 101	Principles of Microeconomics	3	0	3	ECON 102	Principles of Macroeconomics	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3	ICS 104	Intro. to Programm. in Python & C	2	3	3
IAS 111	Belief and Consequences	2	0	2	MIS 215	Principles of MIS	3	0	3
MIS 101	Business Computing	0	3	1					
	Total	17	3	18		Total	17	3	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 214	Academic & Professional Comm.	3	0	3	MGT 210	Business Communication	3	0	3
FIN 250	Financial Management	3	0	3	MKT 250	Principles of Marketing	3	0	3
STAT 211	Statistics for Business I	3	0	3	STAT 212	Statistics for Business II	3	0	3
IAS 121	Language Foundation	2	0	2	OM 210	Operations Management	3	0	3
MGT 301	Principles of Management	3	0	3	ISE 291	Intro. to Data Science	3	0	3
MGT 311/313	Legal Environment/Int. Legal Envir.	3	0	3	HRM 301	Human Resources Management	3	0	3
PE 101	Health and Physical Educ. I	0	2	1					
	Total	17	2	18		Total	18	0	18

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
OM 311	Business Analytics	3	0	3	CGS 392	Career Essentials	0	2	1
COE 292	Intro. to Artificial Intelligence	3	0	3	IAS 212	Ethics and Governance	2	0	2
ECON 306	Economy of Saudi Arabia	3	0	3	MGT 355	Business Research Methods	3	0	3
MGT 3/4xx	MGT Elective 1	3	0	3	MGT 3/4xx	MGT Elective 2	3	0	3
MGT 310	Organization Behavior	3	0	3	XXX 3/4xx	Business Elective 1	3	0	3
MGT 430	Organizational Leadership	3	0	3	MGT 440	International Business	3	0	3
	Total	18	0	18		Total	14	2	15

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MGT 398	Internship	0	0	6	MGT 449	Strategic Management	3	0	3
					GS xxx	GS Elective	3	0	3
					IAS 418	Contemporary Fin. Trans. in Islam	2	0	2
					MGT 3/4xx	MGT Elective 3	3	0	3
					XXX 3/4xx	Business Elective 2	3	0	3
					MGT 450	Mgt. of Innovation & Change	3	0	3
	Total	0	0	6		Total	17	0	17

Total Credit Hours	128

Requirements for the BS Degree in Marketing

Every student majoring in Marketing must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) College Core Requirements (64 credit hours)		
Math	MATH 105, 106	6
Statistics	STAT 211, 212	6
Accounting	ACCT 110, 210	6
Business Communications	MGT 210	3
Economics	ECON 101, 102, 306	9
Management	MGT 301, (311 or 313), 449	9
Management Information Systems	MIS 101, 215	4
Marketing	MKT 250	3
Finance	FIN 250	3
Operations Management	OM 210, 311	6
Research Methods	MGT 355	3
Business Electives	Two XXX 3/4xx	6
		64

(d) Marketing Major Requirements (24 credit hours)		
Marketing Research	MKT 345	3
Product & Brand Management	MKT 360	3
Integrated Marketing Communications	MKT 370	3
Consumer Behavior	MKT 410	3
Strategic Marketing	MKT 450	3
Digital Marketing	MKT 485	3
MKT Electives	Two MKT 3/4xx	6
		24

(e) Internship (6 credit hours)		
Internship	MKT 398	6
		6

The total number of credit hours required is **128**

Marketing Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Intro. to Report Writing	3	0	3
MATH 105	Finite Mathematics	3	0	3	MATH 106	Applied Calculus	3	0	3
ACCT 110	Intro. to Financial Accounting	3	0	3	ACCT 210	Intro. to Managerial Accounting	3	0	3
ECON 101	Principles of Microeconomics	3	0	3	ECON 102	Principles of Macroeconomics	3	0	3
BUS 200	Business & Entrepreneurship	3	0	3	ICS 104	Intro. to Programm. in Python & C	2	3	3
IAS 111	Belief and Consequences	2	0	2	MIS 215	Principles of MIS	3	0	3
MIS 101	Business Computing	0	3	1					
	Total	17	3	18		Total	17	3	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 214	Academic & Professional Comm.	3	0	3	MGT 210	Business Communication	3	0	3
FIN 250	Financial Management	3	0	3	MKT 250	Principles of Marketing	3	0	3
STAT 211	Statistics for Business I	3	0	3	STAT 212	Statistics for Business II	3	0	3
IAS 121	Language Foundation	2	0	2	OM 210	Operations Management	3	0	3
MGT 301	Principles of Management	3	0	3	ISE 291	Intro. to Data Science	3	0	3
MGT 311/313	Legal Environment/Int. Legal Envir.	3	0	3	ECON 306	Economy of Saudi Arabia	3	0	3
PE 101	Health and Physical Educ. I	0	2	1					
	Total	17	2	18		Total	18	0	18

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
IAS 212	Ethics and Governance	2	0	2	CGS 392	Career Essentials	0	2	1
COE 292	Intro. to Artificial Intelligence	3	0	3	OM 311	Business Analytics	3	0	3
MGT 355	Business Research Methods	3	0	3	MKT 3/4xx	MKT Elective 1	3	0	3
MKT 360	Product & Brand Management	3	0	3	XXX 3/4xx	Business Elective 1	3	0	3
MKT 370	Integrated Marketing Comm.	3	0	3	MKT 345	Marketing Research	3	0	3
MKT 410	Consumer Behavior	3	0	3	MKT 485	Digital Marketing	3	0	3
	Total	17	0	17		Total	15	2	16

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
MKT 398	Internship	0	0	6	MGT 449	Strategic Management	3	0	3
					IAS 418	Contemporary Fin. Trans. in Islam	2	0	2
					GS xxx	GS Elective	3	0	3
					MKT 3/4xx	MKT Elective 2	3	0	3
					XXX 3/4xx	Business Elective 2	3	0	3
					MKT 450	Strategic Marketing	3	0	3
	Total	0	0	6		Total	17	0	17

Total Credit Hours	128

Department of Global Studies

Chairman: Dr. Shafi Aldamer

Faculty

Abdelrheem	Alqurtuby	Khogali
Albylwi	Althubaiti	Magliveras
Aldamer	Bendania	Moftah
Aldawsari	Estrada	Mughal
Almadkhali	Flynn	Saeed
Almatrodi	Isani	

In 2021, the department of Global Studies joined KFUPM Business School in order to bring a global dimension to its programs. Starting with the development of new concentrations (CXs), master's programs, and the re-development of the GS courses, the department is intending to enrich the overall education of KBS curricula. Moreover, the Department represents an important part of the overall education of all students at the University. The department seeks to expand and enrich the educational experience of KFUPM engineering, science, and business majors through a global studies curriculum.

The Department of Global Studies offers courses in the areas of Anthropology History, International Relations, Psychology, and Sociology. The educational goal of the curriculum is for students to gain substantive knowledge in these fields of study, and in the process to develop their thinking, communication, and creative abilities. It is important for students to understand human behavior and the social, political, cultural, and historical processes that impact individuals and societies. Such understanding enhances critical thinking, sound judgment, and the more effective performance of occupational roles. The learning objectives of Global Studies courses can be divided into three categories:

I. Gaining understanding and substantive knowledge about principles of human behavior, processes and outcomes of social organization, social institutions, social forces shaping the modern world, international relations, other cultures, regional histories.

II. Development of intellectual abilities:

- Broaden students' perspectives on themselves, their society, and the world.
- Develop analytical skills and strategic thinking, by analyzing social problems in the real world.
- Develop critical thinking, by examining issues from different social, cultural, and political perspectives.
- Develop communication skills, by encouraging discussion and presentation of ideas (in verbal and written form).
- Encourage creativity in addressing social problems.
- Emphasize that learning is a life-long process and encourage students to continue to be informed, to learn, and to grow.
- Develop research skills and skills in evaluating and presenting information.

III. Global Studies curriculum and academic objectives of the University:

- Fulfill graduation requirements pertinent to General Education requirements.
- Support other university departments by offering courses that compliment scientific specializations.
- Contribute to the "university competencies and capabilities" requirements for academic accreditation, by the accreditation organizations such as Saudi National Academic Accreditation and Assessment (SNAAA) and Accreditation Board for Engineering and Technology (ABET), and Association to Advance Collegiate Schools of Business (AACSB).

Vision

To be an outstanding multidisciplinary global studies department that substantially contributes to KFUPM's tradition of excellence in high-quality teaching, impactful research, and vibrant community services.

Mission

To produce and provide world-class courses that complement KFUPM students' education, through a diverse program of global studies which enhances their knowledge and proficiency.

To produce superior multidisciplinary research that contributes to the advancement of Saudi society and improves global understanding.

To provide service to the community and actively assist its advancement.

Strategic Objectives

- Create a dynamic environment for learner success.
- Recruit and retain highly qualified and committed academic faculty.
- Provide KFUPM students with broader social science knowledge.
- Develop essential academic and professional skills that would enhance the education of KFUPM students.
- Produce superb research that is nationally and internationally well recognized.
- Interact with the community with highly quality services.

COLLEGE OF PETROLEUM ENGINEERING & GEOSCIENCES

Dean: Dr. Abdulaziz O. Al-Kaabi

DEPARTMENTS

GEOSCIENCES
PETROLEUM ENGINEERING
CENTER FOR INTEGRATIVE PETROLEUM RESEARCH

Vision of the College

To be a global leader in the integration of petroleum engineering and geosciences education and research relevant to the discovery and recovery of hydrocarbon resources, with minimum impact on the environment.

Mission

- To ensure that undergraduate and graduate programs of the College keep pace with the inexorable increase in the basic sciences underlying our understanding of Petroleum Engineering and Geosciences, and in the technological advances of exploration and production of oil and gas.

- To prepare graduates of the College to contribute to humankind's knowledge of discovery and recovery with the ability to solve the difficult technical, industrial, and civic problems of tomorrow.

- To help secure the economic future of Saudi Arabia and the world by increasing the role of the world's largest oil-producing country as a generator of new science, new technology, and tech-based start-up companies of direct relevance to the growth and development of the oil and gas industries.

Philosophy

The College of Petroleum Engineering & Geosciences (CPG) leverages the educational and research capacity of KFUPM to contribute to industry-relevant research and to develop industry-ready graduate professionals across the Petroleum Engineering and Geosciences spectrum. Its distinguishing approach is driven by quality integrative research, high-level industry engagement, and an extensive collaborative curriculum.

CPG is an integral part of KFUPM but with features that distinguish it markedly from other KFUPM Colleges:

- The Center for Integrative Petroleum Research (CIPR): This Center is home of the College's academic research enterprise, supporting curiosity-driven research, as well as performing challenge-driven contract research for both government and industry. A substantial increase in College-based research activity will support a rapid increase in enrollment in research-oriented doctoral programs over the next decade. The CIPR has a strong presence in the Dhahran Techno Valley (DTV), and this opens the opportunity for additional engagement between DTV industrial partners and CPG in research and education.

- High level of industry engagement: The College leverages, and expands on, KFUPM's long history of close engagement with industry in DTV, in the Kingdom, and worldwide. The College, and particularly the CIPR, includes programs to draw industry interns, visiting industry executives, and visiting industry researchers and practitioners to the College to contribute to, and learn from, the College and its research activities.

- Integrated, collaborative curriculum: A critical role of the College is to develop talented undergraduate and graduate students into petroleum professionals characterized by the highest standards of technical expertise, innovation, and teamwork. During the early years of the College, classroom, laboratory, and experiential aspects of the core curricula have been revised to provide world-class interdisciplinary and integrative degree programs for students graduating from the College.

College Programs

Undergraduate programs of the CPG provide students with a range of educational opportunities by which they will achieve competence in major branches of Petroleum Engineering and Geosciences. A key parameter of the curriculum at CPG is the fact that the undergraduate educational experience is an integrated one, in that all students take courses in petroleum engineering and geosciences, regardless of their ultimate major. Equipped in this way with the knowledge of physics, mathematics, geology, geophysics, petroleum engineering, computational techniques, statistical analysis, AI & data science, business & entrepreneurship, the CPG graduate can engage in creative design and construction, synthesis of systems, and in research and development. Thus, CPG graduates are well equipped to seek jobs in a range of professions, in either industry or academia. CPG continues to provide flexibility in different programs through a spectrum of electives and concentrations, which allows the graduate to exercise a limited choice in tailoring his program to fit his personal goals, whether for immediate employment or for graduate work.

All undergraduate programs of the College of Petroleum Engineering & Geosciences have received either national or international accreditation. The BS in Petroleum Engineering program is accredited by the Engineering Accreditation Commission of ABET, while the BS in Geology and BS in Geophysics programs are accredited by the National Commission for Academic Accreditation and Assessment (NCAAA).

Graduation Requirements

In order to qualify for graduation in Petroleum Engineering and Geosciences (Bachelor of Science) students must:

1. Complete all required and elective courses in the selected degree program with a cumulative GPA of 2.00 or better,
2. Achieve a major GPA of 2.00 or better, and
3. In the summer after the second or third year, successfully complete an 8-week program working in industry.

Department of Geosciences

Chairman: Dr. John D. Humphrey

Faculty

Abdulrahman	Bin Waheed	Makkawi
Al-Lehyani	El-Husseiny	Mora
Alramadan	Eltom	Osman
Alshuhail	Humphrey	Reijmer
Al-Shuhail	Kaka	Sidle
Ayranci	Kaminski	Soupios
Baalousha	Koeshidayatullah	Tawabini
Bertotti	Mahmoud	Whattam

Introduction

Geosciences, which include Geology and Geophysics, are an integral part of the basic science education in most colleges and universities worldwide. Realizing their importance in the development and advancement of Saudi Arabia, KFUPM established the Department of Geology in 1963. With the addition of a Geophysics option in 1976, the name was changed to the Department of Earth Sciences. Recently, the Earth Sciences Department along with Petroleum Engineering Department move to newly established college called the College of Petroleum Engineering and Geosciences (CPG). The Earth Sciences was renamed the Geosciences Department.

Vision

To be a global leader in the integration of geoscience education and research relevant to discovery and development of natural resources focusing on hydrocarbons, with minimum impact on the environment

Mission

- Lead innovation in science and technology in the field of geosciences, and disseminate knowledge to the broader community;
- Prepare graduates who employ multidisciplinary approaches in geology and geophysics for the discovery and sustainable recovery of natural resources, with minimum impact on the environment; and,
- Help sustain the economic future of the Kingdom of Saudi Arabia and contribute to world energy security.

Employment Opportunities

Most geoscientists are employed by government agencies and industries related to oil and gas, mining and minerals, environmental consulting, and water resources. Depleting energy, mineral, and water resources, along with increasing concerns about the environment and natural hazards, have created added opportunities and challenges for geoscientists. In addition, demand for geologists in faculty positions, both at school and university levels, has steadily been increasing for the last few decades.

In Saudi Arabia, a majority of the geoscience graduates find employment with Saudi Aramco, oilfield service companies (e.g., Schlumberger, Baker Hughes, Haliburton, ARGAS and others), and government agencies including the Saudi Geological Survey, the Ministry of Environment, Water and Agriculture, Ministry of Energy, Industry, and Mineral Resources, Ministry of Defense, Ministry of Education, and King Abdulaziz City for Science and Technology (KACST). In a fast-developing country like Saudi Arabia, expanded exploration and exploitation efforts for hydrocarbons, economic and industrial mineral deposits, groundwater resources, city and highway planning, and environmental pollution control will require the services of a growing number of geoscientists in the future.

Bachelor of Science (BS) IN GEOLOGY

Program Mission

The Geology program is committed:

- To prepare graduates who are empowered with basic knowledge, skills, values, and confidence to take a leadership role in the fields of geology;
- To prepare graduates to carry out research that contributes to the knowledge and sustainable development of the Kingdom in diverse aspects of geology, with emphasis on petroleum-related topics; and,
- To provide a stimulating campus environment to foster life-long learning, through seminars, professional short courses, and public forums.

Program Educational Objectives (PEOs)

The educational objectives of Geology undergraduate program are for the graduates to attain the following within a few years of graduation:

1. Attain employment in governmental or private sector, or engage in entrepreneurship.
2. Advance their careers by demonstrating leadership and interpersonal skills including teamwork and communication skills.
3. Pursue their professional development through self-learning or pursue advanced degrees.

Requirements for the BS Degree in Geology

Every student majoring in Geology must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (27 credit hours)		
Math	MATH 101, 102	8
Physics	PHYS 101, 102	8
Chemistry	CHEM 101, 102	8
Laboratory Science Elective	One XXX xxx Course	3
		27

(d) Core Requirements (41 credit hours)		
Principles of Geology	GEOL 102, 103	3
Introduction to the Petroleum Industry	PETE 101	2
Essentials of Geophysics	GEOP 102	2
Integrated Design I, II	CPG 498, 499	3
Earth History and Paleontology	GEOL 213	3
Mineralogy and Optical Mineralogy	GEOL 217	3
Petrology	GEOL 220	3
Sedimentology and Stratigraphy	GEOL 270	3
Structural Geology	GEOL 305	3
Petroleum Geology	GEOL 315	3
Regional Geology	GEOL 318	3
Computational Methods in Geology	GEOL 354	3
Geology Seminar	GEOL 499	1
Subsurface Geology	GEOL 465	3
Seismic Data Interpretation	GEOP 416	3
		41

(e) Electives (18 credit hours)		
CPG Electives	Three XXX xxx Courses (From approved list)	9
Free Electives	Three XXX xxx Courses (From approved list)	9
		18

(f) Summer Sessions (8 credit hours)

Each student must complete the following courses during three summer sessions.

Summer Camp	CPG 199	1
Summer Training	GEOL 399	1
Field Geology	GEOL 430	6
		8

The total number of credit hours required is	**128**

Geology Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr
GEOL 102	Principles of Geology	2	0	2
GEOL 103	Principles of Geology – Lab	0	3	1
PETE 101	Introduction to Petroleum Industry	2	0	2
MATH 101	Calculus I	4	0	4
PHYS 101	General Physics I	3	3	4
ENGL 101	Intro. to Academic Discourse	3	0	3
PE 101	Health and Physical Education I	0	2	1
	Total	14	8	17

Course	Title	LT	LB	Cr
GEOP 102	Essentials of Geophysics	2	0	2
MATH 102	Calculus II	4	0	4
PHYS 102	General Physics II	3	3	4
CHEM 101	Principles of Chemical Science I	3	4	4
ENGL 102	Intro. to Report Writing	3	0	3
	Total	15	7	17

Summer Session I

Course	Title	LT	LB	Cr
CPG 199	Summer Camp	0	0	1

Sophomore Year

Course	Title	LT	LB	Cr
GEOL 213	Earth History and Paleontology	2	3	3
GEOL 217	Mineralogy and Optical Min.	2	3	3
CHEM 102	Principles of Chemical Science II	3	4	4
IAS 121	Language Foundation	2	0	2
ICS 104	Intro. to Programm. in Python & C	2	3	3
	Total	11	13	15

Course	Title	LT	LB	Cr
GEOL 220	Petrology	2	3	3
GEOL 270	Sedimentology and Stratigraphy	2	3	3
BUS 200	Business & Entrepreneurship	3	0	3
IAS 111	Belief and its Consequences	2	0	2
ENGL 214	Academic & Professional Comm.	3	0	3
	Total	12	6	14

Summer Session II

Course	Title	LT	LB	Cr
GEOL 399	Summer Training	0	0	1

Junior Year

Course	Title	LT	LB	Cr
GEOL 305	Structural Geology	2	3	3
GEOL 354	Computational Methods in Geology	2	3	3
XXX xxx	Laboratory Science Elective	2	3	3
XXX xxx	CPG Elective I	3	0	3
ISE 291	Intro. to Data Science	3	0	3
	Total	12	9	15

Course	Title	LT	LB	Cr
GEOL 315	Petroleum Geology	3	0	3
GEOL 318	Regional Geology	3	0	3
IAS 212	Ethics and Governance	2	0	2
COE 292	Intro. to Artificial Intelligence	3	0	3
XXX xxx	CPG Elective II	3	0	3
CGS 392	Career Essentials	0	2	1
	Total	14	2	15

Summer Session III

Course	Title	LT	LB	Cr
GEOL 430	Field Geology	0	18	6

Senior Year

Course	Title	LT	LB	Cr
CPG 498	Integrated Design I	0	3	1
GEOL 499	Geology Seminar	1	0	1
GEOP 416	Seismic Data Interpretation	3	0	3
GEOL 465	Subsurface Geology	3	0	3
XXX xxx	CPG Elective III	3	0	3
XXX xxx	Free Elective I	3	0	3
	Total	13	3	14

Course	Title	LT	LB	Cr
CPG 499	Integrated Design II	0	6	2
GS XXX	GS Elective	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2
XXX xxx	Free Elective II	3	0	3
XXX xxx	Free Elective III	3	0	3
	Total	11	6	13

Total Credit Hours	128

Bachelor of Science (BS) IN GEOPHYSICS

Program Mission

The Geophysics program is committed:

- To prepare graduates who are empowered with basic knowledge, skills, values, and confidence to take a leadership role in the fields of geophysics;
- To prepare graduates to carry out research that contributes to the knowledge and sustainable development of the Kingdom in diverse aspects of geophysics, with emphasis on petroleum-related geophysics; and,
- To provide a stimulating campus environment to foster life-long learning, through seminars, professional short courses, and public forums.

Program Educational Objectives (PEOs)

The educational objectives of Geophysics undergraduate program are for the graduates to attain the following within a few years of graduation:

1. Attain employment in governmental or private sector, or engage in entrepreneurship.
2. Advance their careers by demonstrating leadership and interpersonal skills including teamwork and communication skills.
3. Pursue their professional development through self-learning or pursue advanced degrees.

Requirements for the BS Degree in Geophysics

Every student majoring in Geophysics must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		**Credit Hours**
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (30 credit hours)		
Math	MATH 101, 102, 201, 202	14
Physics	PHYS 101, 102, 204, 205	12
Chemistry	CHEM 101	4
		30

(d) Core Requirements (42 credit hours)		
Principles of Geology	GEOL 102, 103	3
Introduction to the Petroleum Industry	PETE 101	2
Essentials of Geophysics	GEOP 102	2
Integrated Design I, II	CPG 498, 499	3
Introduction to Seismology	GEOP 204	3
Computational Geophysics	GEOP 205	3
Introduction to Seismic Exploration	GEOP 215	3
Gravity and Magnetics Exploration	GEOP 304	3
Seismic Data Processing	GEOP 320	3
Electrical and Electromagnetic Exploration	GEOP 353	3
Seminar	GEOP 499	1
Structural Geology	GEOL 305	3
Integrated Petroleum Geology	GEOL 345	4
Methods of Theoretical Physics	PHYS 210	3
Electricity and Magnetism I	PHYS 305	3
		42

(e) Electives (15 credit hours)		
CPG Electives	Three XXX xxx Courses (From approved list)	9
Free Electives	Two XXX xxx Courses (From approved list)	6
		15

(f) Summer Sessions (6 credit hours)

Each student must complete the following courses during three summer sessions.

Summer Camp	CPG 199	1
Summer Training	GEOP 399	1
Geophysics Field Camp	GEOP 490	4
		6

The total number of credit hours required is	**128**

Geophysics Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
GEOL 102	Principles of Geology	2	0	2	GEOP 102	Essentials of Geophysics	2	0	2
GEOL 103	Principles of Geology – Lab	0	3	1	MATH 102	Calculus II	4	0	4
PETE 101	Introduction to Petroleum Industry	2	0	2	PHYS 102	General Physics II	3	3	4
MATH 101	Calculus I	4	0	4	CHEM 101	Principles of Chemical Science I	3	4	4
PHYS 101	General Physics I	3	3	4	ENGL 102	Intro. to Report Writing	3	0	3
ENGL 101	Intro. to Academic Discourse	3	0	3					
PE 101	Health and Physical Education I	0	2	1					
	Total	14	8	17		Total	15	7	17

Summer Session I

Course	Title	LT	LB	Cr
CPG 199	Summer Camp	0	0	1

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
GEOP 215	Intod. To Seismic Exploration	3	0	3	GEOP 204	Intro. To Seismology	3	0	3
ICS 104	Intro. to Programm. in Python & C	2	3	3	BUS 200	Business & Entrepreneurship	3	0	3
MATH 201	Calculus III	3	0	3	PHYS 210	Methods of Theoretical Physics	3	0	3
PHYS 204	General Physics III	3	0	3	IAS 111	Belief and its Consequences	2	0	2
PHYS 205	General Physics III Lab	0	3	1	ENGL 214	Academic & Professional Comm.	3	0	3
IAS 121	Language Foundation	2	0	2	MATH 202	Elements of Differential Equations	3	0	3
	Total	13	6	15		Total	17	0	17

Summer Session II

Course	Title	LT	LB	Cr
GEOP 399	Summer Training	0	0	1

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
GEOP 205	Computation al Geophysics	3	0	3	GEOP 304	Gravity and Magnetic Exploration	3	0	3
GEOL 305	Structural Geology	2	3	3	GEOP 320	Seismic Data Processing	2	3	3
GEOL 345	Integrated Petroleum Geology	3	3	4	GEOP 353	Electrical and Electromagnetic Exploration	3	0	3
ISE 291	Intro. to Data Science	3	0	3	IAS 212	Ethics and Governance	2	0	2
PHYS 305	Electricity and Magnetism I	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
					CGS 392	Career Essentials	0	2	1
	Total	14	6	16		Total	13	5	15

Summer Session III

Course	Title	LT	LB	Cr
GEOP 490	Geophysics Field Camp	0	9	4

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CPG 498	Integrated Design I	0	3	1	CPG 499	Integrated Design II	0	6	2
XXX xxx	CPG Elective I	3	0	3	GEOP 499	Seminar	1	0	1
XXX xxx	CPG Elective II	3	0	3	XXX xxx	Free Elective I	3	0	3
GS xxx	GS Elective	3	0	3	XXX xxx	Free Elective II	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2	XXX xxx	CPG Elective III	3	0	3
	Total	11	3	12		Total	10	6	12

Total Credit Hours	127

Department of Petroleum Engineering

Chairman: Dr. Dhafer Al-Shehri

Faculty

Abdulraheem	Al-Majed	Haq
Abu-Khamsin	Al-Ramadan	Ibrahim
Al-Shehri	Awotunde	Liao
Al-Afnan	Azad	Mahmoud
Al-Arifi	Elkatatny	Patil
Al-Jawad	Gajbhiye	Sultan
Al–Kaabi	Glatz	Weijermars

Introduction

Petroleum engineering involves the application of basic sciences for the development, recovery and field processing of oil and gas resources. Due to the complex nature of petroleum reservoirs, various petroleum engineering specialties have emerged over time. Among these are drilling engineering, formation evaluation, completion and workover, surface processing, and reservoir engineering. It should be emphasized, however, that modern petroleum production operations require a team effort in which all specialties of petroleum engineering as well as geology, geophysics, and computer technologies are involved.

In the Petroleum Engineering program, the student is educated in the principles, procedures, and practices of drilling, formation evaluation, reservoir studies, production, environmental protection, and economic analysis. The aim of the first two years of the curriculum is to provide the student with the necessary background in physics, chemistry, geology, mathematics, and engineering subjects such as fluid mechanics, thermodynamics, strength of materials and electric circuits. The curriculum introduces the students to basic petroleum engineering subjects too. The third and the fourth years are dedicated to petroleum engineering courses which cover the core areas of drilling engineering, production engineering, formation evaluation, and reservoir engineering.

The job of petroleum engineers starts after the discovery of a structure suitable for oil and gas accumulation. Exploration wells are first drilled and tested to evaluate the economic aspects of the discovery and to obtain the necessary data for the planning and development of the field. Petroleum reservoir engineers are normally responsible for determining the optimum number and locations of the wells and for establishing the production and recovery methods to achieve maximum recovery in the most economical manner. This involves the utilization of basic and advanced sciences and computer technology.

The role of petroleum production engineers comes next. These engineers, with the information provided by the reservoir engineers, are responsible for the design and implementation of well completions and subsurface and surface production facilities, which are needed to extract hydrocarbons and to treat the produced fluids to convert to oil and gas with the specifications needed for transportation and refining operations. Petroleum drilling engineers are responsible for the design, planning, and supervision of the well drilling activities.

Vision

The vision of the Department of Petroleum Engineering at KFUPM is to make it an institution that is recognized worldwide as a center of excellence in education and research in the area of petroleum engineering.

Mission

The mission of the Department of Petroleum Engineering at KFUPM is to have a high-quality program in petroleum engineering that stresses innovation, integration, team work, high ethical standards, and awareness of industry needs in addition to advanced research capabilities.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **“Petroleum Engineering”** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Petroleum Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. established careers in petroleum engineering and related geosciences that enable them to compete in the global energy industry,
2. demonstrated professional and technical development through self-learning and formal training, and
3. shown adherence to professional ethics, compliance with HSE guidelines and practice of social responsibility.

- **Student Outcomes (SOs)**

The ***Petroleum Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.

2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.

3. communicate effectively with a range of audiences.

4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.

7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Strategy

To achieve the program objectives, the Department of Petroleum Engineering endeavors to execute the following measures:

1. Attract and retain top quality faculty members and administrative staff, and invite experienced industry professionals to partake in teaching and research.
2. Attract high quality students, especially those with top university entrance scores, to the petroleum engineering program.
3. Continually improve and update the quality and scope of the program through periodic curriculum revisions and amendments.
4. Adopt and apply advanced educational technologies to improve the teaching and learning environment.
5. Formalize program assessment tools and procedures and make them an integral part of the educational process.
6. Upgrade and expand laboratory facilities and strive to employ qualified laboratory staff.
7. Acquire modern computer software in all areas of petroleum engineering, especially in reservoir simulation, pressure test analysis, and drilling engineering.
8. Promote ties between the department and the local petroleum industry, especially with Saudi Aramco and oil service companies, to expose faculty and students to technical developments and capture research opportunities. Strengthen the role of the department's Industrial Advisory Committee.
9. Strengthen relations between the department and professional societies, such as the Society of Petroleum Engineers (SPE) and its local section, and encourage student involvement in such societies.
10. Foster interdisciplinary cooperation with allied KFUPM units such as the Department of Earth Sciences and the Center for Petroleum and Minerals.
11. Foster collaboration with top petroleum engineering schools, such as the ones at Stanford University, Colorado School of mines, and Texas A&M University, on all aspects of undergraduate education including student and faculty exchange programs.

Requirements for the Bachelor of Science (BS) Degree in Petroleum Engineering

Every student majoring in Petroleum Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (26 credit hours)		
Math	MATH 101, 102, 201, 208	14
Physics	PHYS 101, 102	8
Chemistry	CHEM 101	4
		26

(d) General Engineering Fundamentals (6 credit hours)		
Statics & Strength of Materials	CE 202	3
Fluid Mechanics	CHE 204	3
		6

(e) Core Requirements (49 credit hours)		
Principles of Geology	GEOL 102	2
Introduction to the Petroleum Industry	PETE 101	2
Essentials of Geophysics	GEOP 102	2
Integrated Design I	CPG 498	1
Integrated Design II	CPG 499	2
Phase Behavior	PETE 202	3
Rock and Fluid Properties	PETE 206	4
Reservoir Engineering	PETE 301	3
Well Completion	PETE 302	3
Well Testing	PETE 306	3
Drilling Engineering	PETE 311	4
Well Logging	PETE 313	3
Reservoir Description	PETE 315	4
Reservoir Simulation	PETE 402	3
Petroleum Production Engineering	PETE 403	3
Petroleum Economics	PETE 407	3
Geology	GEOL 345	4
		49

(f) Electives (12 credit hours)

PETE Electives	Two PETE 4xx Courses	6
GEOL Elective	One GEOL 3xx Course	3
GEOP Elective	One GEOP xxx Course	3
		12

(g) Summer Sessions (1 credit hour)

Each student must complete the following courses during two summer sessions.

Summer Camp	CPG 199	1
Summer Training	PETE 399	0
		1

The total number of credit hours required is **128**

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Petroleum Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ENGL 101	Intro. to Academic Discourse	3	0	3	CHEM 101	Principles of Chemical Science I	3	4	4
GEOL 102	Principles of Geology	2	0	2	ENGL 102	Intro. to Report Writing	3	0	3
MATH 101	Calculus I	4	0	4	GEOP 102	Essentials of Geophysics	2	0	2
PE 101	Health and Physical Education I	0	2	1	MATH 102	Calculus II	4	0	4
PETE 101	Intro. to the Petroleum Industry	2	0	2	PHYS 102	General Physics II	3	3	4
PHYS 101	General Physics I	3	3	4					
	Total	14	5	16		Total	15	7	17

Summer Session I				
	CPG 199	Summer Camp	0	0	1

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CE 202	Statics & Strength of Materials	3	0	3	CHE 204	Fluid Mechanics	3	0	3
GS xxx	GS Elective	3	0	3	ENGL 214	Academic & Professional Comm.	3	0	3
IAS 121	Language Foundation	2	0	2	ISE 291	Intro. to Data Science	3	0	3
ICS 104	Intro. to Programm. in Python & C	2	3	3	IAS 111	Belief & its Consequences	2	0	2
MATH 201	Calculus III	3	0	3	MATH 208	Intro. to Diff. Eq. & Linear Algebra	3	0	3
PETE 202	Phase Behavior	3	0	3	PETE 206	Rock & Fluid Properties	3	3	4
	Total	16	3	17		Total	17	3	18

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
GEOL 345	Integrated Petroleum Geology	3	3	4	PETE 302	Well Completion	3	0	3
IAS 212	Ethics and Governance	2	0	2	COE 292	Intro. to Artificial Intelligence	3	0	3
PETE 301	Reservoir Engineering	3	0	3	PETE 315	Reservoir Description	3	3	4
PETE 311	Drilling Engineering	3	3	4	PETE 306	Well Testing	3	0	3
PETE 313	Well Logging	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
					CGS 392	Career Essentials	0	2	1
	Total	14	6	16		Total	15	5	17

Summer Session II				
	PETE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CPG 498	Integrated Design I	0	3	1	CPG 499	Integrated Design II	0	6	2
GEOL 3xx	Geology Elective	2	3	3	PETE 403	Petroleum Production Engineering	3	0	3
PETE 402	Reservoir Simulation	2	3	3	PETE 4xx	PETE Elective I	3	0	3
PETE 407	Petroleum Economics	3	0	3	PETE 4xx	PETE Elective II	3	0	3
GEOP xxx	Geophysics Elective	3	0	3	IAS xxx	Islamic/Arabic Elective	2	0	2
	Total	10	9	13		Total	11	6	13

Total Credit Hours: 128

COLLEGE OF CHEMICALS & MATERIALS

Dean: Dr. Abdulaziz Alsaadi

DEPARTMENTS

BIOENGINEERING
CHEMICAL ENGINEERING
CHEMISTRY
MATERIALS SCIENCE & ENGINEERING

The College of Chemicals and Materials provides programs in the Chemical Sciences, Chemical Engineering, Materials Science & Engineering and Bioengineering for both at the undergraduate and graduate levels. The College also offers chemistry service courses for all students enrolled in other colleges of KFUPM. The College includes the Departments of Bioengineering, Chemical Engineering, Chemistry and Material Science & Engineering. The programs in the College are carefully designed to produce skillful and enthusiastic scientists and engineers who can respond thoughtfully to learning opportunities and effectively tackle the existing national and global challenges. Education in the College seeks to transform students into life-long learners and empowered citizens. We offer multiple educational opportunities that span in a wide range of disciplinary programs. Imparting substantial and meaningful education through first-hand experiences is one of the objectives. Students are encouraged to develop an academic plan that entails studying abroad, internships in the fields of interest, independent research and extracurricular experiences that complement learning in their chosen major.

The College has admiringly responded to the major transformation as per the vision 2030 by enabling female participation in the higher education through their enrolments in some undergraduate and graduate programs. New undergraduate programs of unique nature in Materials Science & Engineering and in Bioengineering disciplines have been recently launched. To encounter the Industrial Revolution 4.0 trend, the College has introduced new one-year master programs in the specialized areas such as Industrial Catalysis, Petrochemical Engineering, Bioengineering, Flow Assurance, and Polymer Science & Engineering. In alignment to these disciplines, new interdisciplinary concentrations have also been introduced under the programs of the College.

The quality assurance processes in the College has been put orderly under the University’s Academic Quality Assurance Framework (AQAF) to ensure effective management of its programs. This is to strengthen the College’s commitment to produce quality graduates whose degrees are accredited by both national and international accrediting bodies. The College has secured its BS Chemistry program accredited by NCAAA and BS Chemical Engineering program accredited by ABET.

Department of Bioengineering

Chairman: Dr. Jameel Althagfi

Faculty

Ahmad Al-Thukair	Khalil	Nazila

Introduction

The Bioengineering Department was recently stablished to provide crucial knowledge and experiences in the emerged field of biology, engineering and other related fields, as well as to introduce research in multidisciplinary fields related to natural, environmental, engineering, biotechnology and biomedical sciences. Prompt developments in bioengineering related industries are opening up new research and commercial prospects. The department is in the process of offering a BS degree in bioengineering in collaboration with other science and engineering departments. In addition, the department offers master of sciences and bioengineering master degrees and provides courses such as microbiology, virology, biotechnology, cellular and molecular biology, ecology and evolution, biochemistry, and toxicology. The research focuses in fields related to ecology, marine, microbial, environmental, animal, pharmaceutical, molecular and plant biology.

Vision

To be a distinguished department in teaching and learning, fundamental and applied research and community services.

Mission

Provide outstanding higher education for preparing professional graduates with exceptional knowledge, long-life learning skills; carry out cutting-edge research and positively contribute to social developments by offering community services.

Program Educational Objectives

- Prepare graduates having knowledge and experiences to pursue graduate studies in the field of bioengineering and associated disciplines.
- Prepare leader graduates to excel in industry and research laboratories of multidisciplinary fields of biomedical, biotechnology and biochemical industries, and other related fields
- Prepare innovative, self-dependent and long-life learner graduates for a fruitful career in academic and industry

Learning Outcomes

The Bioengineering program have the following Student Learning Outcomes:

- Able to identify, formulate, and resolve multifaceted problems by applying principles of science and engineering.
- Develop new ideas and perceive innovative research in the fields of bioengineering.
- Able to work in multi-disciplinary environment to recognize, analyze, and resolve real life problems in bioengineering.
- Able to conduct applicable research, analyze and interpret data, and use bioengineering knowledge to design and complete a project.

- Recognize, acquire and apply innovative knowledge by using appropriate learning strategies.
- Recognize and observe professional and ethical responsibilities of scientific research and career.

Department of Chemical Engineering

Chairman: Dr. Hassan M. Baaqueel

Faculty

Abdul Jameel
Abdur Razzak
Abo-Ghander
Abussaud
Adamu
Ahmed
Al-Asiri
Al-Bhagli
Al-Harthi
Al-Juhani
Al-Jundi
Al-Mubaiyedh
Al-Mutairi
Al-Saifi
Al-Shammari
Al-Yousef
Baaqeel
Ba-Shammakh
Chrystie
Farooq
Fouad
Hussain
Khalafalla
Malaibari
Onaizi
Shehzad
Siddiquee
Zahid

Introduction

Chemical Engineering is defined as the profession of development, design, and operation of chemical plants as well as safe, economic, sustainable industrial production. It employs chemical and physical principles for the design of processes and the conversion of raw materials into valuable products to improve life for the average person. The chemical conversions involve the preparation of useful products in large quantities using basic thermodynamics and chemical kinetics, which govern reactions. Physical conversions utilize unit operations, fluid dynamics, heat transfer, and mass transfer to separate the reactant products into useful pure chemicals. All these subjects are used in the design of chemical plants and refineries.

Vision

The Department of Chemical Engineering will be the Department of choice and will be recognized as one of the top research and graduate chemical engineering departments in the Kingdom and abroad.

Mission

The mission of the Department of Chemical Engineering at King Fahd University of Petroleum & Minerals is 'to contribute to the thriving economy and vibrant society by offering an innovative, challenging and flexible educational programs'. Chemical Engineering programs are designed to provide high level academic and professional skills by promoting lifetime learning, planning, communication, problem solving and leadership.

Bachelor of Science (BS) IN CHEMICAL ENGINEERING

The undergraduate chemical engineering curriculum has been systematically revised over the years to reflect the emergence of chemical engineering as a modern discipline and its changing role in society. The modern curriculum includes such diverse topics as process control, use of simulation packages, and chemical plant design, with electives in diverse areas.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Chemical Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Chemical Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Achieve a successful career in the oil, gas, petrochemical, desalination, energy and other process industries.
2. Integrate their academic preparation with chemical engineering practice, innovation and technology development.
3. Pursue a graduate degree in chemical engineering or other related fields.
4. Pursue leadership roles in industry, business, and governmental agencies.

- **Student Outcomes (SOs)**

The ***Chemical Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.
5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.

6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Program Strategy

The strategy of the Department of Chemical Engineering to achieve our objectives is to:

1. Attract high-quality students, especially those with top university entrance scores, to the chemical engineering program.
2. Continually improve and update the chemical engineering curriculum.
3. Adopt and apply advances in educational technologies to improve teaching and the learning environment.
4. Develop a strong senior capstone design project course. Annual awards are presented by the Saudi Arabian Section of the American Institution of Chemical Engineers and Saudi Arabia Basic Industries Corporation (SABIC) for the best presented projects.
5. Acquire modern computerized laboratory experiments to update our laboratory program in chemical engineering.
6. Attract and retain high-quality faculty and support staff.
7. Continually improve the program through the advice of the Industrial Advisory Committee.
8. Promote a strong environmental engineering elective program as per the request of our Industrial Advisory Committee.
9. Promote the study of corrosion in industry through our SABIC-funded chair professorship.
10. Assess the program through surveys of graduating seniors, faculty, alumni, and their employers for improvement.

Requirements for the Bachelor of Science (BS) Degree in Chemical Engineering

Every student majoring in Chemical Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (33 credit hours)		
Math	MATH 101, 102, 201, 202, STAT 319	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101, 102	8
		33

(d) Advanced Chemical Sciences Requirements (10 credit hours)		
Chemistry	CHEM 201, 311	8
Material Science	ME 207	2
		10

(e) Core Requirements (39 credit hours)		
Principles of Chemical Engineering	CHE 200	3
Introduction to Chem. Eng. Computing	CHE 212	2
Transport Processes	CHE 204, 300, 304	9
Thermodynamics	CHE 303	3
Separation Processes	CHE 306	3
Chemical Engineering Laboratories	CHE 309, 409	4
Numerical Methods in Chemical Eng.	CHE 360	3
Process Dynamics & Control	CHE 401	3
Kinetics & Reactor Design	CHE 402	3
Plant Design	CHE 405, 412	6
		39

(f) Electives (12 credit hours)		
CHE Electives	Two CHE 4xx Courses	6
Engineering Elective	One XE xxx Engineering Course	3
Free Elective	One XXX xxx Free Course	3
		12

(g) Summer Training (0 credit hours)

Each student must participate in an eight-week program of industrial experience and submit a formal report.

Summer Training	CHE 399	0
		0

The total number of credit hours required is	**128**

Chemical Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	CHEM 102	Principles of Chemical Science II	3	4	4
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Introduction to report writing	3	0	3
IAS 121	Language Foundation	2	0	2	ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1	PHYS 102	General Physics II	3	3	4
PHYS 101	General Physics I	3	3	4					
	Total	15	9	18		Total	15	10	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHE 200	Principles of Chem. Engineering	3	2	3	CHE 204	Fluid Mechanics	3	0	3
CHEM 201	Organic Chemistry I	3	4	4	CHE 212	Intro. to Chem Engg. Comp.	1	3	2
IAS 111	Belief & Its Consequences	2	0	2	COE 292	Intro. to Artificial Intelligence	3	0	3
ISE 291	Intro. to Data Science	3	0	3	ENGL 214	Academic & Professional Comn.	3	0	3
MATH 201	Calculus III	3	0	3	MATH 202	Elements of Differential Equations	3	0	3
					ME 207	Materials Science for CHE	2	0	2
	Total	14	6	15		Total	15	3	16

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHE 300	Heat Transfer	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
CHE 303	Chemical Engineering Therm.	3	0	3	CHE 306	Separation Processes	3	0	3
CHE 304	Mass Transfer	3	0	3	CHE 309	Chem. Engg Lab I	0	6	2
CHEM 311	Physical Chemistry II	3	4	4	CHE 360	Numerical Methods in Chem. Engg	3	0	3
IAS 212	Ethics and Governance	2	0	2	STAT 319	Probability & Stats. for Engrs.	2	3	3
					CGS 392	Career Essentials	0	2	1
	Total	14	4	15		Total	11	11	15

Summer Session

Course	Title	LT	LB	Cr
CHE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHE 401	Process Dynamics and Control	3	0	3	CHE 409	Chem. Engg Lab II	0	6	2
CHE 402	Kinetics & Reactor Design	3	0	3	CHE 412	Integrated Design Course	1	6	3
CHE 405	Process Design & Econ.	3	0	3	CHE 4xx	Chem. Engg. Elective II	3	0	3
CHE 4xx	Chem. Engg. Elective I	3	0	3	GS xxx	GS Elective	3	0	3
XE xxx	Engineering Elective	3	0	3	IAS xxx	Islamic/Arabic Elective	2	0	2
					XXX xxx	Free Elective	3	0	3
	Total	15	0	15		Total	12	12	16

Total Credit Hours 128

Bachelor of Science (BS) IN APPLIED CHEMICAL ENGINEERING

The undergraduate applied chemical engineering curriculum has been systematically revised over the years to reflect the emergence of chemical engineering as a modern discipline and its changing role in society. The modern curriculum includes such diverse topics as process control, use of simulation packages, and chemical plant design, with electives in diverse areas.

- **Program Accreditation**

The undergraduate program **Bachelor of Science (BS)** in **"Applied Chemical Engineering"** is accredited by the **Engineering Accreditation Commission** of **ABET** (https://www.abet.org).

- **Program Educational Objectives (PEOs)**

The undergraduate program of **Bachelor of Science (BS)** in ***Applied Chemical Engineering*** is designed to graduate students **who are expected to attain (within a few years) of graduation the following PEOs:**

1. Achieve a successful career in the oil, gas, petrochemical, desalination, energy and other process industries.
2. Integrate their academic preparation with chemical engineering practice, innovation and technology development.
3. Pursue a graduate degree in chemical engineering or other related fields.
4. Pursue leadership roles in industry, business, and governmental agencies.

- **Student Outcomes (SOs)**

The ***Applied Chemical Engineering*** **(BS)** students **by the time of gradation will have the ability to:**

1. identify, formulate, and solve complex engineering problems by applying principles of engineering, science, and mathematics.
2. apply engineering design to produce solutions that meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors.
3. communicate effectively with a range of audiences.
4. recognize ethical and professional responsibilities in engineering situations and make informed judgments, which must consider the impact of engineering solutions in global, economic, environmental, and societal contexts.

5. function effectively on a team whose members together provide leadership, create a collaborative and inclusive environment, establish goals, plan tasks, and meet objectives.
6. develop and conduct appropriate experimentation, analyze and interpret data, and use engineering judgment to draw conclusions.
7. acquire and apply new knowledge as needed, using appropriate learning strategies.

Programs Strategy

The strategy of the Department of Chemical Engineering to achieve our objectives is to:

1. Attract high-quality students especially those with top university entrance scores to the chemical engineering program.
2. Continually improve and update the quality of the chemical engineering curriculum.
3. Adopt and apply advances in educational technologies to improve teaching and the learning environment.
4. Develop a strong senior capstone design project course. Annual awards are presented by the Saudi Arabian Section of the American Institution of Chemical Engineers and Saudi Arabia Basic Industries Corporation (SABIC) for the best presented projects.
5. Acquire modern computerized laboratory experiments to update our laboratory program in chemical engineering.
6. Attract and retain high-quality faculty and support staff.
7. Continually improve the program through advice of Industrial Advisory Committee.
8. Promote a strong environmental engineering elective program as per the request of our Industrial Advisory Committee.
9. Promote Study of corrosion in industry through our SABIC-funded chair professorship.
10. Assess the program through surveys of graduating seniors, faculty, alumni, and their employers for improvement.

Requirements for the Bachelor of Science (BS) Degree in Applied Chemical Engineering

Every student majoring in Applied Chemical Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (33 credit hours)		
Math	MATH 101, 102, 201, 202, STAT 319	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101, 102	8
		33

(d) Advanced Chemical Sciences Requirements (10 credit hours)		
Chemistry	CHEM 201, 311	8
Material Science	ME 207	2
		10

(e) Core Requirements (39 credit hours)		
Principles of Chemical Engineering	CHE 200	3
Introduction to Chem. Eng. Computing	CHE 212	2
Transport Processes	CHE 204, 300, 304	9
Thermodynamics	CHE 303	3
Separation Processes	CHE 306	3
Chemical Engineering Laboratories	CHE 309, 409	4
Numerical Methods in Chemical Eng.	CHE 360	3
Process Dynamics & Control	CHE 401	3
Kinetics & Reactor Design	CHE 402	3
Plant Design	CHE 405, 412	6
		39

(f) Electives (6 credit hours)		
CHE Elective	One CHE 4xx Course	3
Free Elective	One XXX xxx Free Course	3
		6

(g) Internship (6 credit hours)

Each student must participate in a 15-week program of industrial experience and submit a formal report.

Internship	CHE 398	6
		6

The total number of credit hours required is	**128**

Applied Chemical Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	CHEM 102	Principles of Chemical Science II	3	4	4
ENGL 101	Intro. to Academic Discourse	3	0	3	ENGL 102	Introduction to report writing	3	0	3
IAS 121	Language Foundation	2	0	2	ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1	PHYS 102	General Physics II	3	3	4
PHYS 101	General Physics I	3	3	4					
	Total	15	9	18		Total	15	10	18

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHE 200	Principles of Chem. Engineering	3	2	3	CHE 204	Fluid Mechanics	3	0	3
CHEM 201	Organic Chemistry I	3	4	4	CHE 212	Intro. to Chem Engg. Comp.	1	3	2
ENGL 214	Academic & Professional Comn.	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
IAS 111	Belief & Its Consequences	2	0	2	IAS 212	Ethics and Governance	2	0	2
ISE 291	Intro. to Data Science	3	0	3	MATH 202	Elements of Differential Equations	3	0	3
MATH 201	Calculus III	3	0	3	ME 207	Materials Science for CHE	2	0	2
	Total	17	6	18		Total	14	3	15

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHE 300	Heat Transfer	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
CHE 303	Chemical Engineering Therm.	3	0	3	CHE 306	Separation Processes	3	0	3
CHE 304	Mass Transfer	3	0	3	CHE 309	Chem. Engg Lab I	0	6	2
CHEM 311	Physical Chemistry II	3	4	4	CHE 360	Numerical Methods in Chem. Engg	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2	GS xxx	GS Elective	3	0	3
STAT 319	Probability & Stats. for Engrs.	2	3	3	XXX xxx	Free Elective	3	0	3
					CGS 392	Career Essentials	0	2	1
	Total	16	7	18		Total	15	8	18

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHE 398	Internship	0	0	6	CHE 401	Process Dynamics and Control	3	0	3
					CHE 402	Kinetics & Reactor Design	3	0	3
					CHE 405	Process Design and Econ.	3	0	3
					CHE 409	Chem. Engg Lab II	0	6	2
					CHE 412	Integrated Design Course	1	6	3
					CHE 4xx	Chem. Engg. Elective I	3	0	3
	Total	0	0	6		Total	13	12	17
						Total Credit Hours			128

Department of Chemistry

Chairman: Dr. Khalid R. Alhooshani

Faculty

Abulkibash	Badawi	Maung
Al-Arfaj	Chanbasha	Mazumder
Al-Barri	El-Ali	Morsy
Al-Betar	Fettouhi	Muallem
Al-Harbi	Forner	Musa
Alhooshani	Hamdan	Oweimreen
Al-Saadi	Imam	Saleh
Al-Suwaiyan	Isab	Siddiqui
Al-Thagfi	Kawde	Ullah
Asrof	Khaled	Wazeer

Introduction

The Department of Chemistry at KFUPM is one of the premier chemistry programs in the Middle East. Our department is recognized for its innovative research and for producing highly trained graduates.

The chemist is a professional scientist who specializes in some specific area of chemistry. He can either be involved in research or in the utilization of our natural resources. As a research chemist, he studies the ways in which matter changes and how to develop new materials to improve our living conditions. The chemist may be an analytical chemist who performs a variety of tasks such as, to analyze water, air, or petroleum samples, to determine the composition of a newly discovered substance, or to identify the materials in a crime investigation. An inorganic chemist synthesizes and characterizes materials like alloys, semiconductors, superconductors, glasses, catalysts, and inorganic pharmaceuticals. An organic chemist is concerned with the syntheses of new materials such as plastics, pharmaceutical products, or other commercial chemicals from various other chemicals or from natural resources and he studies the chemical properties of various carbon compounds. A physical chemist applies physics principles to the structure of matter and the process of chemical changes. An environmental chemist can investigate the conditions of pollution, monitor pollutants and assess hazardous effects. There are many other branches of chemistry, such as petroleum chemistry, biochemistry, nanochemistry and electrochemistry.

Chemistry graduates are expected to contribute to the academic, civil service and industrial development of the Kingdom by working in educational institutions, in government and in private institutions responsible for public health and safety of the environment, or in one of the many industries whose products or processes involve chemical technology. These areas include: schools and technical colleges, water authorities, desalination plants, agencies for environment protection, the standards and specifications bureau; the vast petroleum, petrochemical and mining industries scattered all over the Kingdom; as well as the many smaller industries whose products or processes involve chemical technology. Chemistry graduates are also expected to form the backbone of the various research centers that are emerging in the Kingdom whether related to government organizations such as agriculture, health, petroleum, commerce (standards and quality control) or to private organizations. Industrial research centers, in particular, are envisaged to supplement huge industrial complexes to utilize manpower trained under the above programs of studies.

Vision

The Chemistry Department at KFUPM aspires to excel in chemical education, research and services.

Mission

The Chemistry Department is committed to prepare competitive and professional graduates within an innovative and intellectually stimulating environment, support other academic programs at KFUPM by offering quality chemistry learning experiences, conduct basic and applied research of national and international impact, build proactive partnerships with industry and offer effective training and educational and technical services to the society.

Goals

1. Enhance the quality of the chemistry and industrial chemistry programs.
2. Enhance the basic and applied research framework in the Chemistry Department.
3. Increase enrollment in the chemistry programs.
4. Enhance services to the community.
5. Build partnerships with the industry to achieve the department goals.

Program Mission

The B.S. program in chemistry prepares students for successful careers in private or government sectors or for pursuing graduate studies in chemistry. The program provides quality theoretical and practical learning experiences in various areas of chemistry enriched with diverse research opportunities.

Program Educational Objectives (PEOs)

The chemistry program aims at preparing graduates who will be:

1. leading professionals in private or government sectors,
2. able to pursue higher studies,
3. practicing safety measures,
4. life-long learners with strong interpersonal skills, and
5. responsible, ethically driven, and productive members of the society,
6. able to promote creativity and analytical thinking conducive for novel discoveries and invention of processes and methods in chemical sciences.

Requirements for the BS Degree in Chemistry

Every student majoring in Chemistry must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (22 credit hours)		
Math	MATH 101, 102, 201	11
Physics	PHYS 101, 102	8
Math/Stat Elective	MATH xxx or STAT xxx (MATH 202, MATH 208, MATH 225 or STAT 319)	3
		22

(d) Core Requirements (48 credit hours)		
General Chemistry	CHEM 101, 102	8
Analytical Chemistry	CHEM 221, 222, 324, 325	7
Biochemistry	CHEM 363	3
Inorganic Chemistry	CHEM 335, 336, 337	6
Organic Chemistry	CHEM 201, 202, 204, 305	9
Physical Chemistry	CHEM 212, 213, 311, 312	8
Materials Chemistry	CHEM 458, 459	4
Research Skills	CHEM 479, 488	3
		48

(e) Electives (18 credit hours)		
Chemistry Electives (A course containing a lab is strongly recommended)	Two CHEM xxx Courses	6
Technical Electives (Not from GS or IAS)	Two XE xxx Courses	6
Engineering Elective	One XE xxx Engineering Course	3
Free Elective	One XXX xxx Course	3
		18

(f) Summer Training (0 credit hours)

Each student must spend two months in a chemical laboratory (analytical laboratory, hospital, clinic, etc.) or a period of two months of industrial employment in appropriate industries or firms. Summer training could also be conducted in a university or a research institution/center.

Summer Training	CHEM 399	0
		0

The total number of credit hours required is **122**

Chemistry Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن
King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	3	4	CHEM 102	Principles of Chemical Science II	3	4	4
ENGL 101	Intro. to Academic Discourse	3	0	3	ICS 104	Intro. to Programm. in Python & C	2	3	3
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1	PHYS 102	General Physics II	3	3	4
PHYS 101	General Physics I	3	3	4	IAS 121	Language Foundation	2	0	2
	Total	13	8	16		Total	14	10	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 201	Organic Chemistry I	3	0	3	CHEM 204	Organic Chemistry II	3	0	3
CHEM 202	Organic Chemistry Laboratory	0	4	1	CHEM 212	Physical Chemistry I: Chemical Thermodynamics	3	0	3
CHEM 221	Quantitative Chemical Analysis	2	0	2	CHEM 213	Chemical Thermodynamics Lab.	0	4	1
CHEM 222	Quantitative Chemical Analysis Lab.	0	4	1	ENGL 214	Academic & Professional Comm.	3	0	3
ENGL 102	Intro. to Report Writing	3	0	3	XXX xxx	Math/STAT Elective	3	0	3
MATH 201	Calculus III	3	0	3	IAS 111	Belief & Its Consequences	2	0	2
BUS 200	Business & Entrepreneurship	3	0	3					
	Total	14	8	16		Total	14	4	15

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 311	Physical Chemistry II: Kinetics and Spectroscopy	3	0	3	CHEM 305	Organic Syn. and Chara. Lab	0	8	2
CHEM 312	Kinetics and Spectroscopy Lab	0	4	1	CHEM 363	Biochemistry	3	0	3
CHEM 335	Fund. of Inorg. Chem.	3	0	3	CHEM 336	Adv. Inorganic Chem.	2	0	2
ISE 291	Intro. to Data Science	3	0	3	CHEM 337	Inorganic Syn & Charac. Lab	0	4	1
IAS 212	Ethics and Governance	2	0	2	COE 292	Intro. to Artificial Intelligence	3	0	3
CHEM 324	Instrumental Chem. Analysis	3	0	3	XE xxx	Technical Elective I	3	0	3
CHEM 325	Instru. Chem. Analysis Lab	0	4	1	CGS 392	Career Essentials	0	2	1
	Total	14	8	16		Total	11	14	15

Summer Session

Course	Title	LT	LB	Cr
CHEM 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM xxx	Chemistry Elective I	3	0	3	CHEM 458	Materials Chemistry	3	0	3
XE xxx	Engineering Elective	3	0	3	CHEM 459	Material Synth. Char. Lab	0	4	1
CHEM 488	Undergraduate Research	0	8	2	CHEM 479	Chemistry Seminar	1	0	1
GS xxx	GS Elective	3	0	3	XE xxx	Technical Elective II	3	0	3
XXX xxx	Free Elective	3	0	3	CHEM xxx	Chemistry Elective II	3	0	3
					IAS xxx	Islamic/Arabic Elective	2	0	2
	Total	12	8	14		Total	12	4	13

Total Credit Hours	122

Department of Materials Science and Engineering

Chairman: Dr. Turki N. Baroud

Faculty

Al-Sayoud	Nouari	Al Zahrani
Mahmoud	Al Faraidi	

Introduction

Materials Science and Engineering (MSE) department was established in July 2021 to offer both graduate and undergraduate degrees in the field of Materials Science and Engineering (MSE). The MSE department is the first department in the Kingdom and in the Gulf region to offer a bachelor degree in Materials Science and Engineering. Materials Science and engineering is an interdisciplinary field that studies the interrelationships between the structure, processing, properties and performance of wide range of materials (i.e. metals and alloys, polymers and plastics, ceramics and glasses, composites and hybrids). MSE has become a key discipline in the competitive global economy and is recognized as one of the technical disciplines. Graduates from the MSE programs contain the knowledge to characterize, process and manipulate these relationships in order to enhance the performance of existing materials as well as create innovative new materials.

Vision

The MSE Department aspires to be a leader in providing world-class Materials Science and Engineering education and research.

Mission

The Department of Materials Science and Engineering is committed to providing the highest quality education in materials science and engineering, to conduct world-class basic and applied research, to address the evolving needs of industry and society, and to support the development of more competitive, and new, industry in the Kingdom of Saudi Arabia.

Bachelor Degree

MSE Curriculum has been designed to provide graduates with carefully balanced needs covering basic science, engineering principles, and contemporary techniques. The first year of the program is designed to build competency in the basic sciences and to introduce engineering as a profession. The following two years are intended to allow the student to learn the essential elements of the field using experimental, computational, and statistical methods. The final year shall allow the students to get specialized in an area of interest by selecting appropriate elective courses in addition to two-semester capstone senior design project. The four elective courses offer an opportunity to satisfy a concentration requirement in line with the KSA vision and industry needs. This enables students to tackle materials related challenges in the petroleum, gas, petrochemical and basic industries. The MSE elective courses are grouped in five areas: Computational Materials Design, Corrosion and Degradation, Nonmetallic, Metallurgy and Mining, Energy and Water. The program offers mandatory digital enabling courses like artificial intelligence (AI) and data sciences/analytics as well as a business course to introduce students to the basics of business and entrepreneurship for possible spin-off companies.

Program Educational Objectives

The educational objectives of the Materials Science and Engineering (MSE) Undergraduate Program are for the graduates to attain the following within a few years of graduation:

i. attain employment in governmental or private sector, or engage in entrepreneurship.
ii. pursue their professional development through self-learning or pursue advanced degrees.
iii. advance their careers by demonstrating leadership and interpersonal skills including teamwork and communication skills.

Requirements for the BS Degree in Materials Science and Engineering

Every student majoring in Materials Science and Engineering must complete the following curriculum:

(a) General Studies Requirements (22 credit hours)		Credit Hours
English	ENGL 101, 102, 214	9
Islamic & Arabic Studies	IAS 111, 121, 212, xxx	8
Global Studies	GS xxx	3
Career Essentials	CGS 392	1
Physical Education	PE 101	1
		22

(b) Digital/Business Foundation (12 credit hours)		
Intro. to Programm. in Python & C	ICS 104	3
Introduction to Data Science	ISE 291	3
Intro. to Artificial Intelligence	COE 292	3
Business & Entrepreneurship	BUS 200	3
		12

(c) Math & Science Requirements (33 credit hours)		
Math	MATH 101, 102, 201, 208, STAT 319	17
Physics	PHYS 101, 102	8
Chemistry	CHEM 101, 102	8
		33

(d) Core Requirements (49 credit hours)		
Statics & Strength of Materials	CE 202	3
Electronic Circuits	EE 236, 237	4
Introduction to Materials	MSE 201	3
Materials Lab	MSE 202	1
Thermodynamics of materials	MSE 203	3
Materials Structure and Defects	MSE 204	3
Diffusion & Kinetics	MSE 205	3
Materials Characterization	MSE 206	3
Engineering Metallic Materials	MSE 301	3
Polymeric Materials	MSE 302	3
Materials Synthesis Lab	MSE 303	1
Engineering Ceramics	MSE 304	3
Composite Materials	MSE 305	3
Failure of Mater. & Prevention	MSE 306	3
Materials Process & Proper Lab	MSE 307	1
Electronic, Optical & Mag. Prop	MSE 401	3
Materials Selection & Design	MSE 402	3
Senior Design Project	MSE 411, 412	3
		49

(e) Electives (12 credit hours)

MSE Electives	Two MSE 4xx Courses	6
Technical Elective	One XE xxx Course	3
Free Elective	One XXX xxx Course	3
		12

(f) Summer Training (0 credit hours)

Summer Training	MSE 399	0
		0

The total number of credit hours required is	**128**

Materials Science and Engineering Curriculum

Four-year Academic Plan

Digital/Business Foundation

جامعة الملك فهد للبترول والمعادن

King Fahd University of Petroleum & Minerals

Freshman Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
CHEM 101	Principles of Chemical Science I	3	4	4	ENGL 102	Introduction to report writing	3	0	3
ENGL 101	Intro. to Academic Discourse	3	0	3	CHEM 102	Principles of Chemical Science II	3	4	4
MATH 101	Calculus I	4	0	4	MATH 102	Calculus II	4	0	4
PE 101	Health and Physical Education I	0	2	1	PHYS 102	General Physics II	3	3	4
PHYS 101	General Physics I	3	3	4	IAS 121	Language Foundation	2	0	2
	Total	13	9	16		Total	15	7	17

Sophomore Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ICS 104	Intro. to Programm. in Python & C	2	3	3	CE 202	Statics & Strength of Materials	3	0	3
ENGL 214	Academic & Professional Comn	3	0	3	MATH 208	Intro. Diff. Equa. and Lin. Algebra	3	0	3
MATH 201	Calculus III	3	0	3	IAS 111	Belief & Its Consequences	2	0	2
MSE 201	Introduction to Materials	3	0	3	MSE 204	Materials Structure and Defects	3	0	3
MSE 202	Materials Lab	0	3	1	MSE 205	Diffusion & Kinetics	3	0	3
MSE 203	Thermodynamics of materials	3	0	3	MSE 206	Materials Characterization	2	3	3
	Total	14	6	16		Total	16	3	17

Junior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
ISE 291	Intro. to Data Science	3	0	3	BUS 200	Business & Entrepreneurship	3	0	3
EE 236	Electronic Circuits	3	0	3	COE 292	Intro. to Artificial Intelligence	3	0	3
EE 237	Electronic Circuits Lab	0	3	1	CGS 392	Career Essentials	0	2	1
IAS 212	Ethics and Governance	2	0	2	MSE 304	Engineering Ceramics	3	0	3
MSE 301	Engineering Metallic Materials	3	0	3	MSE 305	Composite Materials	3	0	3
MSE 302	Polymeric Materials	3	0	3	MSE 306	Failure of Mater. & Prevention	3	0	3
MSE 303	Materials Synthesis Lab	0	3	1	MSE 307	Materials Process & Proper Lab	0	3	1
	Total	14	6	16		Total	15	5	17

Summer Session

Course	Title	LT	LB	Cr
MSE 399	Summer Training	0	0	0

Senior Year

Course	Title	LT	LB	Cr	Course	Title	LT	LB	Cr
STAT 319	Prob.& Stat. for Engineers	2	3	3	GS xxx	GS Elective	3	0	3
IAS xxx	Islamic/Arabic Elective	2	0	2	MSE 412	Senior Design Project II	0	6	2
MSE 401	Electronic, Optical & Mag. Prop	3	0	3	MSE 4xx	MSE Elective II	3	0	3
MSE 402	Materials Selection & Design	3	0	3	XE xxx	Technical Elective	3	0	3
MSE 411	Senior Design Project I	1	0	1	XXX xxx	Free Elective	3	0	3
MSE 4xx	MSE Elective I	3	0	3					
	Total	14	3	15		Total	12	6	14

Total Credit Hours 128

ACADEMIC COURSES

KFUPM COURSE ABBREVIATIONS

ACCT	Accounting
AE	Aerospace Engineering
ARC	Architecture
ARE	Architectural Engineering
AS	Actuarial Science
BIOE	Bioengineering
BIOL	Biology
BUS	Business
CE	Civil Engineering
CGS	College of General Studies
CHE	Chemical Engineering
CHEM	Chemistry
CIE	Control and Instrumentation Engineering
COE	Computer Engineering
CP	City Planning
CPG	College of Petroleum Engineering and Geosciences
ECON	Economics
EE	Electrical Engineering
ENGL	English
ENTR	Entrepreneurship
FIN	Finance

GEO	Geosciences
GEOL	Geology
GEOP	Geophysics
GS	Global Studies
HRM	Human Resources Management
IAS	Islamic and Arabic Studies
ICS	Information and Computer Science
ISE	Industrial and Systems Engineering
MATH	Mathematics
ME	Mechanical Engineering
MGT	Management
MIS	Management Information Systems
MKT	Marketing
MSE	Materials Science and Engineering
OM	Operations Management
PE	Physical Education
PETE	Petroleum Engineering
PHYS	Physics
PYP	Preparatory Year Program
STAT	Statistics
SWE	Software Engineering

NOTES

- The parenthesized numerals, such as (3-3-4) in the following course descriptions indicate the weekly lecture hours, the weekly laboratory hours, and the credit hours for each course, respectively.

- Prerequisites/Corequisites are separated by commas. The following examples show how lists of prerequisites/corequisites should be interpreted.

  Example 1: The prerequisites of CE 230 written as “CE 201, MATH 102” should be interpreted as: A student may take CE 230 if he has already taken both CE 201 and Math 102.

  Example 2: The prerequisites of MATH 336 written as “MATH 202 or MATH 208” should be interpreted as: A student may take MATH 336 if he has already taken either Math 202 or Math 208.

  Example 3: The prerequisites of ME 322 “CE 101 or ME 210, ME 216, ME 217” should be interpreted as: A student may take ME 322 if he has already taken all the courses in any of the following two combinations:

  - CE 101 and ME 216 and ME 217
  - ME 210 and ME 216 and ME 217

  Example 4: The prerequisites of MATH 323 “MATH 210 or (ICS 253, ICS 254)” should be interpreted as: A student may take MATH 323 if he has already taken all the courses in any of the following two combinations:

  - MATH 210
  - ICS 253 and ICS 254

- Additional notes/restrictions, if any, are indicated at the end of course description.

ACCOUNTING

ACCT 110 Introduction to Financial Accounting (3-0-3)

Provides an introduction to financial accounting, with emphasis on the content, interpretation, and uses of accounting reports according to the International Financial Reporting Standards (IFRS). Develops students' skills underlying the preparation and analysis of financial statements of a business enterprise. Discusses accounting principles as they relate to the recognition of revenues and expenses, and the valuation of assets and liabilities. Ethics in accounting is incorporated in the presentation of financial statements.

ACCT 210 Introduction to Managerial Accounting (3-0-3)

Continuation of ACCT 110 with a focus on uses of accounting information for managerial decision making to aid planning and control activities of managers in business enterprises. Topics include methods for determining the costs of products and services, cost behavior analysis, assessing product and project profitability, cost-volume-profit analysis, budgeting, cost control using standard costing and variance analysis.

Prerequisites: (ACCT 110, BUS 200 for KBS) or (ACCT 110 for non-KBS)

ACCT 300 Accounting Information Systems (2-2-3)

Provides a broad perspective on concepts and applications of Accounting Information Systems (AIS) which record, control, report transactions, and enhance decision making in organizations. Highlights the concepts and applications related to internal control in manual and computerized accounting systems. Introduces the understanding of Enterprise Resource Planning (ERP) software as it applies to modern AIS at an enterprise level. Topics include: Transaction processing and ERP, databases, control and AIS (COSO, COBIT, and ERM frameworks), systems reliability, auditing computer-based AIS, and control applications in Accounting cycles. Provides hands-on experience with Database Management Systems (DBMS), Spreadsheet programs, Systems documentation tools and ERP software. Cases, class discussion, field trips and group projects emphasize independent thinking, group processes, and communication.

Prerequisite: ACCT 210

ACCT 301 Intermediate Accounting I (3-0-3)

Emphasizes objectives of financial statements, and their preparation. In-depth study of accounting principles with concentration on the valuation techniques and procedures underlying the financial statements. Features several conceptual and theoretical issues that face the accounting profession. Accounting for current assets and current liabilities. Accounting for acquisition and disposition of plant assets including depreciation and depletion. Accounting for intangible assets. Study of ethics in accounting. The course also refers to International Accounting Standards (IFRS) and standards issued by the Saudi Organization for Certified Public Accountants (SOCPA).

Prerequisite: ACCT 210

ACCT 302 Intermediate Accounting II (3-0-3)

Engages students in the study of stockholders' equity including issuance and reacquisition of capital stock, dividends and retained earnings. Topics of coverage also include accounting for short-term and long-term investments in securities, revenue recognition and long-term contracts, study of cash flows, capital leases, and interpretation and analysis of financial statements. Involves use of cases and study of ethics in accounting. And computer applications in financial accounting. The course also refers to International Accounting

Standards (IFRS) and standards issued by the Saudi Organization for Certified Public Accountants (SOCPA).
Prerequisite: ACCT 301

ACCT 305 Accounting for Governmental and Non-Profit Entities (3-0-3)
Examines accounting concepts and techniques for governmental operations including fund accounting. Topics of coverage also includes financial reporting and disclosure problems of governmental and non-profit organizations, and budgetary control procedures for governmental and non-profit entities such as universities, hospitals, and charities.
Prerequisite: ACCT 210

ACCT 307 Islamic Financial Jurisprudence (3-0-3)
Teaches fundamentals of commercial law, the Islamic principles of property rights, contracts, capital, types of ownership, sale contracts, commercial papers and bankruptcy. Secured transactions, and concepts of agency, estate, and trust under Islamic Sharia Law are also included in the course coverage.

ACCT 311 Auditing (3-0-3)
Discusses generally accepted auditing standards (GAAS) and procedures used by the external auditor. Topics include professional ethics, professional responsibility, and legal liability of the external auditor. Audit concepts such as auditor's independence, fair presentation, and due professional care are emphasized. Internal control evaluation and design of audit programs; collection of audit evidence including statistical sampling and analytical review; evaluation of audit evidence; arriving at audit opinions. Development of working papers and audit reports. Assurance services. Uses of the computer as an audit tool. Utilization of generalized audit software packages. Information Technology and the audit process. The course will also refer to International Auditing Standards (IAS) and standards issued by the Saudi Organization for Certified Public Accountants (SOCPA).
Prerequisite: ACCT 300

ACCT 314 Computer Control and Audit (3-0-3)
Focuses on auditing of computer-based information systems. Topics include audit environment and information systems controls, theory of internal control and the application of audit procedures in a computerized environment, and techniques for evaluating applications, data integrity, general operations, security, systems software and maintenance. Provides hands-on use of Computer Assisted Tools & Techniques (CATT) software application.
Prerequisite: ACCT 300

ACCT 398 Internship (0-0-6)
The Accounting Internship provides the student with the opportunity to gain valuable practical business experience and insights in an organizational environment for a continuous period of 16 weeks to explore career interests while applying knowledge, competency, and skills learned in the classroom. The internship performance and responsibilities are evaluated by a faculty Internship advisor and a work-site supervisor through student’s submission of progress reports, employer’s feedback, final report, and presentation.
Prerequisites: ENGL 214, at least 85 credit hours

ACCT 403 Advanced Accounting (3-0-3)

Examines some of the more complex albeit common contemporary financial accounting and reporting issues as part of a post-intermediate financial accounting course. The primary topics include accounting for business combinations, investments in common stocks, consolidated financial statements, joint ventures, foreign currency transactions, accounting for derivatives, financial instruments, and share-based payments. The course also alludes to international accounting standards (IFRS) and standards issued by the Saudi Organization for Certified Public Accountants (SOCPA). The subject is designed to provide students, who are majoring in accountancy, with professional, theoretical and practical knowledge that is needed by accountants in understanding and discharging their responsibilities as professional accountants. This includes the legal, professional and ethical requirements.

Prerequisite: ACCT 302

ACCT 406 Internal Auditing (3-0-3)

Focuses on development and evolution of the internal auditing profession; scope and objectives of internal auditing; standards of professional practice; control concepts; techniques of internal auditing; internal auditing and internal control. Topics of coverage also include the internal audit process; developing and executing the audit plan; reporting and communication of internal audit findings; managing internal audit departments and quality assurance; internal auditor's independence; relationships between internal and external auditors and audit committees; ethics in internal auditing; distinguishing the types of audits, including financial, operational, efficiency, and management audits; risk-based versus compliance audits; and the impact of automation and digitalization in internal auditing.

Prerequisite: ACCT 210

ACCT 407 Financial Statement Analysis (3-0-3)

Develops basic skills required for a structured analysis of financial statements; forecasting of income and cash flows; pro-forma financial statements; firm valuation using discounted cash flows and discounted residual income methods; comparative valuation analysis, and credit analysis. The course also covers the study of the potential effects of International Financial Reporting Standards (IFRS) financial statement analysis, valuation techniques and outcomes, and Concepts of earnings quality and management of earnings.

Prerequisite: ACCT 210

ACCT 408 Zakat and Business Tax Accounting (3-0-3)

Provides a study of the fundamentals, rules, and objectives of taxation under Saudi Arabian tax and zakat regulations. Equips students with the skills necessary to compute and assess income tax and zakat base for business entities. In addition, students become familiar with the business income tax and zakat rates, and the General Authority of Zakat and Tax (GAZT) functions.

Prerequisite: ACCT 210

ACCT 409 International Business Taxation (3-0-3)

Introduces students to international taxation. Topics of coverage include tax principles and rationale for taxation; corporate income tax; direct and indirect income tax; Value Added Tax (VAT); corporate income tax and zakat in KSA; international taxation. Legal & ethical issues will be considered.

Prerequisite: ACCT 210

ACCT 410 Cost Accounting (3-0-3)

Emphasizes contemporary topics in strategic cost management through an understanding of the underlying concepts and fundamental techniques involved in cost accounting for manufacturing and service companies. Stresses on how cost management systems, with their performance evaluation and reward systems, encourage efforts to achieve an organization's strategic goals. Topics include activity-based costing; decision making; pricing and profitability analysis; the balanced scorecard and performance management, joint and common cost allocation; cost of quality and continuous improvement; responsibility accounting, performance measurement and reward systems; transfer pricing and capital investment decisions.

Prerequisite: ACCT 210

ACCT 411 Cost Management & Management Control (3-0-3)

Examines advanced and contemporary issues in cost management and management control with emphasis on industrial and business practices. Topics of coverage includes behavioral and organizational foundations of managerial accounting; strategic cost management; operational efficiency and business process performance; planning, budgeting and forecasting; performance management; responsibility centers and performance measures; decision analysis and risk management; quality and environmental cost management; and cost and management accounting practices. Uses case studies with ethical considerations for managerial accounting.

Prerequisite: ACCT 410

ACCT 421 Oil & Gas Accounting (3-0-3)

Familiarize students with accounting practices in the Oil & Gas industry. Provide an overview of the industry with a detailed focus on certain aspects of the Successful Efforts and the Full Cost Methods of accounting. Petroleum accounting issues specific to the industry are also discussed. Topics covered include oil and gas reserves, the standardized measure, supplemental disclosures, and depreciation, depletion, and amortization of exploration and development costs. Financial statement presentation issues are analyzed to gain an appreciation for the unique impact of IFRS in the petroleum industry.

Prerequisite: ACCT 302

ACCT 495 Special topics in Accounting (3-0-3)

Topics and issues to be advised, covering contemporary developments in financial and managerial accounting, such as corporate financial reporting, strategic management accounting, management control systems and regulation of financial reporting.

Prerequisite: ACCT 210

AEROSPACE ENGINEERING

AE 211 Fundamentals of Thermo-Fluids (3-0-3)

This course introduces the fundamental concepts and practical applications of thermodynamics and fluid mechanics. The topics cover the concept and application of control mass and control volume; thermodynamic properties; first and second laws of thermodynamics; introductory cycle analysis; entropy generation; fluid flow kinematics and dynamics; continuity, momentum, and energy equations; dimensional analysis; and differential and integral flow analysis.

Prerequisites: MATH 102, PHYS 102

AE 221 Introduction to Aerospace Engineering (2-3-3)

Introduction to overview of aerospace engineering, airplane, and the atmosphere. Basic aerodynamics and gas dynamics of incompressible flows, airfoils and wings, lift, drag, moments, circulation, boundary layers, and skin friction. Performance of aircraft, level flight, climb, range, endurance, and take-off and landing. Introduction to stability and control; structures and materials; propulsion of flight vehicles; and space flight (astronautics). This course will be supported by lab sessions on basic fluid dynamics and aerodynamics.

Prerequisite: PHYS 102

AE 228 Introduction to AE Structures and Materials (3-0-3)

Introduces students to the fundamentals of Aerospace structures and materials. Topics include: types of load and support; inertia loads in aerospace structures; statistically determinate and indeterminate structures; beam shear and bending moment diagrams; concept of stress and strain; stress-strain relationships; bending and shear analysis of beams; torsion of thin-walled beams; combined stresses; metallic and non-metallic materials and their properties; failure of materials; fatigue and creep; aluminium alloys classes, properties, and uses in web-stiffener aerospace structures; composite materials classes, properties, and uses in aerospace structures.

Prerequisite: PHYS 101

AE 230 AE Vehicle Performance (3-0-3)

Introduces basic elements of airplane performance calculation and optimization including take-off, cruise, landing, thrust and power required, range, endurance, stability and control. The students are required to work in teams to accomplish the final project.

Prerequisites: MATH 102, PHYS 102

AE 312 Fundamentals of AE Design (1-0-1)

Introduction to engineering design. Literature survey. Formulation and analysis of aerospace engineering problems. Process of Engineering design. Development of design concepts and products. Feedback of design concepts. Implementation into hardware and software components. Design verification against requirements. Release of the design through report, presentation, and prototype.

Prerequisite: Junior Standing

AE 313 AE Systems and Control (2-3-3)

Introduction to automatic flight control systems, Modeling and analysis of linear dynamic systems; Feedback control system design using root-locus and frequency response techniques; Introduction to modern control theory and pole placement technique; Aerospace control applications.

Prerequisites: ME 201, MATH 208

AE 325 Gas Dynamics I (3-0-3)

Fundamentals of compressible fluid flow in nozzles and diffusers, friction and heat interaction. Fanno, Rayleigh line, and isothermal flow, combustion waves (deflagration, explosion, and detonation waves), normal and oblique shock waves, Extended diffusers and supersonic airfoils. Applications to flow through pipelines, Subsonic, sonic, and supersonic flights, turbo machinery and combustion.

Prerequisite: AE 221

AE 328 Flight Structures I (3-0-3)

Statistically determinate and indeterminate structures; aerodynamics and inertia loads, load factors, stresses in beams, shear flow in thin webs, closed section box beams; deflection analysis of structural systems; introduction to buckling; application to wing and fuselage stress analysis; Rayleight-Ritz and introduction to the finite element method; elasticity of structures stress-strain relationships; vehicle materials; fatigue; strength-weight comparisons of materials; and sandwich construction including composite materials.

Prerequisites: AE 228, MATH 201

AE 333 Aerodynamics I (3-0-3)

General fluid flow equation, potential parallel flow theory with some applications of aerodynamics, thin airfoil theory and finite wing in incompressible inviscid flow. Introduction to viscous flow and boundary layers.

Prerequisite: AE 221

AE 357 AE Numerical Methods Lab (0-3-1)

Numerical and analytical simulation of physical problems in Aerospace engineering using applied methods. Developing numerical techniques for engineering problems described by nonlinear algebraic equations, ordinary and partial differential equations. Computer programming in MATLAB or a similar language is required.

Corequisite: MATH 371

AE 398 Internship (0-0-6)

A period of 16 weeks of industrial employment for Aerospace Engineering students to work in appropriate industries or firms. Students are evaluated on their performance on the job and are required to submit an extensive formal report on their experience.

Prerequisites: ENGL 214, AE 221, Approval of Department

AE 399 Summer Training (0-0-0)

A continuous period of 8 weeks of summer training spent in the industry working in any of the fields of Aerospace Engineering. The training should be carried out in an organization with an interest in one or more of these fields. On completion of the program, the student is required to submit a formal written report of his work.

Prerequisites: ENGL 214, Approval of Department

AE 401 Aerospace Systems and Maintenance (2-3-3)

Aviation maintenance regulation, records, and documents; servicing procedures and ground operation, aviation material. Hydraulic, electrical avionic, ignition, environmental, and fuel systems, engine overhaul. Installation and repair; heat exchangers; inspection testing; weight

and balance computation. Aerospace maintenance and its management with economical considerations; including visits to the field.
Prerequisite: Junior Standing

AE 402 Aerospace Avionics (2-3-3)
Theory of operation and utilization of various types of avionic equipment. Radio wave propagation, VHF communication, and VOR navigation system; instrument landing systems ILS; automatic direction finder; distance measuring equipment; transponders. Weather radars and area navigation systems. Integration of avionics system and flight control. Avionics equipment troubleshooting and repair; The course includes a field trip.
Prerequisite: Junior Standing

AE 403 Aerospace Materials (3-0-3)
Structure of materials; Mechanical properties of materials; Diffusion and heat treatment; Solidification and strengthening; Aluminum alloys, titanium alloys, nickel alloys, super alloys and their applications in aircraft structure and engine; Composite and ceramic material; Environmental effects and corrosion; Material behavior and selection processes for aerospace engineering systems applications. Visit to the field.
Prerequisite: Senior Standing

AE 410 Astronautics (3-0-3)
Solar system; rocket propulsion and staging of power trajectories; dynamics and control of spacecraft; satellite altitude control; astrodynamics; lunar and interplanetary trajectories; re-entry and heating consideration; aerospace plane.
Prerequisites: PHYS 102, MATH 208

AE 412 Senior Design (2-0-2)
Considers design of a complete project or system including establishment of objectives and criteria, formulation of the problem statements, preparation of specifications, consideration of alternative solutions, feasibility considerations, and detailed engineering designs. The design should take into consideration appropriate multiple realistic constraints such as economic factors, safety, reliability, ethics and environmental and social impact. Mature design need to be verified against the requirements before release in the form of a written report, a presentation, and if possible, a prototype. Team design projects, where appropriate, are highly encouraged.
Prerequisite: AE 312

AE 414 Flight and Air Traffic Control (3-0-3)
Introduction to air traffic control system; Navigation, communication and surveillance systems; Air traffic control procedures and organizations; Air traffic control at airport operation area; Aircraft separation techniques (non-radar and radar); Human factors in air traffic control operations; Air traffic safety and management; Term project.
Prerequisite: Senior Standing

AE 415 Flight and Aviation Safety (3-0-3)
Regulatory organizations and their responsibilities; Basics of safety; Review of aviation safety statistics; Human factors in flight and ground safety; Aircraft safety systems; Principles of aircraft accident investigation; Aviation safety management system; Aircraft accident prevention; Risk management; Aviation and airport security.
Prerequisite: Senior Standing

AE 416 Flight and Aviation Management (3-0-3)

Air transportation regulations; Economic characteristics of airlines; Airline organization and management. Functional departments of airlines; Flight scheduling and fleet planning. Airline pricing strategies and airline marketing; Freight and cargo operations; Airline financing; Airport design and operations; Airport planning and administration; Field project.

Prerequisite: Junior Standing

AE 417 Flight and Aviation Law (3-0-3)

Legal environment of aviation; Federal Aviation Regulations; Basic principles of liability; Aircraft accident investigation law; Airline liability; Aircraft transactions; Airport and airspace law; Aviation security laws; International laws and treaties affecting aviation; Case studies.

Prerequisite: Junior Standing

AE 418 Flight and Aviation Economics (3-0-3)

The aviation industry; International regulatory framework; Airline cost structures; Demand of the airline service; Airline pricing and revenue; Air cargo; Airport economics; Airport operations; Economics of charter operation; Financial challenges facing the air transport industry; Case studies.

Prerequisite: Junior Standing

AE 421 Aerospace Engineering Lab (0-3-1)

Laboratory experiments related to three fields of Aerospace Engineering: flight dynamics and control, flight propulsion and flight structures and materials; including demonstration and familiarization with basic components of flight demonstration wind tunnel for performance stability (neutral point location and trim curves), reciprocating and gas turbine engines (performance of compressor & turbine) and strain analysis system (bending, torsion and combined loads on wing and I beam). The course utilizes statistical and reliability techniques for instrument data analysis.

Prerequisite: Senior Standing

AE 422 Flight Propulsion I (3-0-3)

Introduction to Joule-Brayton cycle. Aerodynamics of aerospace vehicles' engines, combustion, thrust and efficiency. Gas turbine engines: Turbojet, turbofan, turboprop; ramjet and scramjet, typical engine performance. Aerothermodynamics of inlets, combustors and nozzles. Introduction to propellers, turbo-compressors and turbines. Introduction to rocket engines and their performance. Chemical and electrical driven rocket engines.

Prerequisite: AE 211

AE 426 Flight Dynamics I (3-0-3)

Introduces fundamental concepts of flight dynamics and control. Topics include equations of motion for a rigid body aircraft, linearization/small perturbation methods, static and dynamic stability derivatives estimation, longitudinal and lateral motions and an introduction to flight control systems and automatic stabilization, Satellite attitude dynamics and control, including; torque free motion and attitude control thrusters.

Prerequisite: AE 221, AE 313

AE 427 Aerospace Vehicle Design (3-0-3)

Integration of theory, background and methods of aerospace vehicle design (e.g. aircraft, rockets, and spacecraft); including requirements and specifications of design, trade off

studies, integration of aerodynamics, structure, propulsion, and flight dynamics and control; performance analysis and prediction; and a complete project of aerospace vehicle design.
Prerequisite: AE 328, AE 333, Senior Standing

AE 428 Flight Structures II (3-0-3)
Theory and analysis of structures of flight vehicles, plate theory, thermal stresses, buckling and failure, introduction to structural dynamics; analysis of aeroelastic phenomena and flutter; composite materials; crack-growth calculation and wear out models.
Prerequisite: AE 328

AE 429 Gas Dynamics II (3-0-3)
Linearized flow; method of characteristics, conical flow. Experimental methods in gas dynamics.
Prerequisite: AE 325

AE 433 Aerodynamics II (3-0-3)
Viscous flow and Navier-stokes equations; laminar and turbulent boundary layer; transition flow; unsteady flow; flow instabilities. High speed aerodynamics and aerodynamic heating. Introduction to hypersonic flow. Experimental methods in aerodynamics.
Prerequisite: AE 333

AE 442 Flight Propulsion II (3-0-3)
Rocket and power plants performance, dynamics, and control of turbo-engines. RAM/SCRAM jets engines. Blades element theory for propellers; turbo-compressors, turbines; chemical, nuclear, and electrical propulsion rockets. Introduction to space propulsion system.
Prerequisite: AE 422

AE 446 Flight Dynamics II (3-0-3)
Fundamentals of atmospheric flight; stability and control analysis; matrix approach to the general motion and transfer function; elastic flight vehicle; automatic flight control. Introduction to space flight dynamics; application to missile, spacecraft, and satellite attitude controls.
Prerequisite: AE 426

AE 448 Fundamentals of Helicopter (3-0-3)
Introduction to helicopters; Its various configurations and rotor types; Hovering theory; Vertical and forward flight performance analysis; Dynamics and control of rotor; Helicopter stability in hovering and forward flight; Helicopter vibration analysis during flight; Design of basic helicopter components.
Prerequisite: ME 201, MATH 208

AE 449 Fundamentals of Unmanned Aerial Systems (3-0-3)
This course presents students with the basic fundamentals of unmanned aerial vehicles (UAVs). Coverage includes UAVs components, configurations, classifications, communication frameworks, fundamentals of flight, regulations, safety, and future challenges. Also, the course covers performance, mathematical modeling and system dynamics of UAVs, and common control techniques to improve system’s stability and performance with more emphasis on multirotor UAVs. Students shall apply basic knowledge on a real system, i.e. drones.

Prerequisites: PHYS 102, MATH 202 or MATH 208

AE 454 UAS Design and Integration (3-0-3)

Introduction to unmanned aerial systems (UAS), of-the-shelf aerial sensors and supporting platforms. Custom design, integration and calibration of new UAS sensory systems, hybrid power systems and hybrid/non-hybrid civil/military UAS. Physical/aerodynamic design limitations, data quality/accuracy versus speed of UAS function, basic autonomous, swarm intelligence and cooperation strategies. Design ethics, standards and engineering collective consciousness. General Optimization of UAS function and intelligent control.

Prerequisite: Senior Standing

AE 490 Special Topics in Aerospace Engineering I (3-0-3)

Topics are selected from the broad area of Aerospace Engineering to provide students with the knowledge of recent advancements in the analysis and design in Aerospace Engineering and in aviation including optimization of Aerospace System Design, Aerodynamics, Gas Dynamics, Aerospace Structures and Materials, Flight Dynamics and Control, Propulsion, Helicopter Flight, Avionics, Navigation and Guidance, Aircraft Maintenance, Flight and Aviation Safety, Air Traffic Control, Aviation Law, Astronautics, and other related fields such as Marine Engineering.

Prerequisite: Approval of Department.

AE 491 Special Topics in Aerospace Engineering II (3-0-3)

Topics are selected from the broad area of Aerospace Engineering to provide students with the knowledge of recent advancements in the analysis and design in Aerospace Engineering and in aviation including optimization of Aerospace System Design, Aerodynamics, Gas Dynamics, Aerospace Structures and Materials, Flight Dynamics and Control, Propulsion, Helicopter Flight, Avionics, Navigation and Guidance, Aircraft Maintenance, Flight and Aviation Safety, Air Traffic Control, Aviation Law, Astronautics, and other related fields such as Marine Engineering.

Prerequisite: Approval of Department.

AE 497 Undergraduate Research (3-0-3)

Selection of a research topic, development of research topic, writing a successful proposal, manage and carrying out research tasks, setting up bench scale setup or prototype for lab work or software for modeling-based research, communicating the research findings, writing effective reports.

Prerequisite: Approval of Department

ARCHITECTURE

ARC 102 Design Studio I (0-6-3)

Principles and elements of design and visual thinking as design tools. Small 2D and 3D design-based exercises. Design vocabularies, concepts, and organizational principles. Proportion, scale, rhythm, balance, harmony, texture, repetition, movement, and other spatial, formal, and relational properties using various materials and media. Design process and diagrammatic thinking techniques and evaluation of 2D and 3D compositions.

Corequisite: ARC 113

ARC 103 Design Studio II (0-6-3)

Various forms and methods of 3D design through a range of design applications of different sizes. Visual and graphical thinking and design processes to produce non-functional 3D compositions. The design of simple architectural projects. Formal and functional aspects of architecture. The role of design ideas (concepts) in generating innovative design solutions.

Prerequisites: ARC 102, ARC 113

Corequisite: ARC 114

ARC 105 Engineering Graphics (2-3-3)

Introduction to basic engineering graphics skills, equipment, and applications (manual and digital), including sketching, multi-view (or orthographic) drawings, pictorial drawings, sectional and auxiliary views, lettering, dimensioning, and other engineering drawing standards, and annotation. Introduction in computer-aided engineering drafting.

Note: Cannot be taken by Architecture Majors

ARC 113 Architectural Communication I (0-6-3)

Drawings and architectural communication techniques and skills, including orthographic, orthogonal, pictorial perspective, and freehand drawings. Essential methods of manual architectural drawings. Production of 2D and 3D graphics, including floor plans, site plans, elevations, sections, axonometric, and one-point and two-point perspective drawings. Basic technical rendering and essential shade and shadow techniques for enhanced architectural drawings.

Corequisite: ARC 102

ARC 114 Architectural Communication II (0-6-3)

Various design media as means for architectural design presentation. Rendering and presentation techniques using a range of design media, including color pencil, markers, ink, graphite charcoal, among others. Presenting and communicating architectural design ideas and concepts. Physical representation media using various materials and methods. 2D and 3D architectural presentations production, including physical models. Shade and shadow techniques and accurate freehand perspectives.

Prerequisite: ARC 113

Corequisite: ARC 103

ARC 121 History of Architecture I (3-0-3)

The development of architecture from pre-history to the mid-seventh century, including Ancient near East, Egyptian, Aegean, Greek, Roman, Byzantine, and Romanesque. Structural systems development, materials, construction, and other building systems, and focusing on the Middle and Near East. The eastern Architecture of the Indian, Chinese and Japanese civilizations. The impact of the social and cultural factors that contribute to the development of various cultures' unique architecture.

ARC 122 History of Architecture II (3-0-3)

The development of architecture from the mid-seventh century to the mid-nineteenth century. The rise of the Islamic period through the Gothic, Renaissance, and Baroque until the beginning of the Industrial Revolution. Structural systems development, materials, construction, and other building systems. The impact of the social and cultural factors that contribute to the development of various cultures' unique architecture.

Prerequisite: ARC 121

ARC 204 Architectural Design Studio III (0-10-5)

Architectural design process and analytical approaches to problem-solving. Small-scale architecture design projects. Form, massing, space, spatial relationships, material, texture, function, user experience, and needs. Conceptual thinking, visual thinking, problem identification, problem-solving processes, and related analysis and synthesis techniques and skills.

Prerequisite: ARC 103

ARC 205 Architectural Design Studio IV (0-10-5)

The interrelationship of form, function, and context using increasingly complex data sets. Multiple design projects of different sizes focusing on formal, tectonic, programmatic aspects of the design and their relationships to the site's physical and social context. Site analysis and precedents (case studies) analysis as analytical tools and sources. Generate concepts and guidelines for design solutions. Methodological and procedural concerns, including analysis, research, critical thinking, conceptualization, theory application, and issue-based thinking.

Prerequisite: ARC 204

ARC 213 Digital Communication I (0-6-3)

Developing digital communication skills by application of local architecture design tools in BIM, visualization, and fabrication to create, study, present and build architectural designs. Demonstrations and practical exercises of digital techniques in 2D drawing, 3D modeling, rendering and fabrication by using relevant digital tools and rapid prototyping technology.

Prerequisite: ARC 114 or Approval of Instructor

ARC 214 Digital Communication II (0-6-3)

Using digital media as a design creation, exploration, manipulation, and communicative tool. Further development of digital communication skills in emerging topics of three-dimensional modeling, parametric design, real-time visualization, and presentation techniques.

Prerequisite: ARC 213 or Approval of Instructor

ARC 226 Theory of Architecture I (2-0-2)

The path of the principal architectural thoughts and events led to the development of major architectural design theories, starting from the industrial revolution until the end of modernity (1850-1960 AD). The theories behind the origin of the modern movement emphasizing the various interpretations of functionalism and its opposition, such as art deco and classicism. Critical analysis of the concepts of architectural space, form, vocabulary, and significant town planning and urban design concepts and theories within these periods.

Prerequisite: ARC 122

ARC 229 Theory of Architecture II (2-0-2)

The theories foundations of the twentieth Century trends in architecture in the light of worldwide historical developments and their social and technological influences (1960 – to date). Exploration of the Modern Movement and recent developments to the Post-Modem aspects of architectural aesthetics. Analysis of twentieth-century architecture through a critical examination of architectural works and theoretical writings to locate the formative conditions, duration, and effect of the principles of Modernism on the discipline of architecture. Styles, technologies, urbanisms, regionalisms, functions, and reform of postmodern movement, deconstruction, and digital morphogenesis trend to address the diverse forces that have shaped contemporary architecture.

Prerequisite: ARC 226

ARC 231 Structure in Architecture I (3-0-3)

The static behaviors of structures through the analysis of systems, determinacy, stability hierarchy and order of sub-systems, and the elements which compose a structural framework such as trusses, beams, columns, frames, and floor systems, including the spanning concept. Governing structure principles including external loads and their types, fundamental concepts of structural behavior, the strength of materials, introduction to and analysis of simple structural systems, internal forces and unit stress, and force equilibrium calculation. Formulas and graphical techniques to analyze bending, shear, and moment of beams, columns, and slabs.

Prerequisite: PHYS 133

ARC 232 Structure in Architecture II (3-0-3)

The analysis and design of steel and reinforced concrete structures. Computational analysis of steel and RC beams, columns, and slabs. The concepts and procedures for the design, manufacture, and construction of structural components (e.g., walls, columns, beams, slabs) using steel and concrete. Experimental work (shear and moment tests) on RC and steel members.

Prerequisite: ARC 231

ARC 306 Architectural Design Studio V (0-10-5)

Medium to large-scale buildings design using advanced application of program analysis, spatial development, design language, structure and material selection, advanced technological and aesthetic principles, and the interface between these aspects. Digital media and digital fabrication as tools to generate form, explore, and evaluate design alternatives. Issues related to site developments including site planning, landscape design, vehicular and pedestrian movement, and car parking.

Prerequisites: ARC 205

ARC 307 Architectural Design Studio VI (0-10-5)

Complex design problems within context through medium to large-scale design projects situated in an urban context. Examine and respond creatively and responsibly to Saudi society's needs and particularities. Addressing client needs, human factors, symbolism, and the interrelated socio-cultural factors as an integral part of the building design process, program, site, and form. Produce and develop region-sensitive design solutions considering local codes and detailed design solutions through working drawings.

Prerequisites: ARC 229, ARC 306

ARC 316 Digital Architectural Photography (1-4-3)

Exploring different types of digital cameras, photographic art theory, and techniques. Advanced computer applications and printing. Visual abilities to create and communicate ideas, art, and architectural works. Aspects of cameras and photography devices' functions, characteristics of lenses, lighting, movement, creative environmental control, color management, theme selection, and photo composition.

ARC 319 Special Topics in Computer Applications (1-4-3)

Exploring emerging ideas and techniques in design computing, visualization and the application of information technology and digital media in design and architectural practice. The specific content and format of the course vary.

ARC 345 Working Drawings (0-6-3)

Construction documentation divisions and standardized language. Preparation of a full working drawings package using 2D CAD programs for a small to medium-scale building. Development of technically precise working drawings with proper sequence and languages of different components in buildings including floor plans, sections, elevations, and detailing.

Prerequisite: ARE 230

ARC 354 Landscape Design (2-2-3)

The principles of landscape architectural design and techniques. Projects at the scale of site design, such as open spaces and building surroundings. The optimum and correct use of land development, local plant materials and irrigation systems.

ARC 355 Human Factors in Architecture (3-0-3)

Fundamental concepts and theories related to the interaction of people with their natural and built environments. Foundational anthropological, sociology, psychological, critical theory, and philosophy of technology frameworks to understand the relationship of the human beings with the spatial and cultural dimensions of the built environment. Privacy, perception, cognition, proxemics, personal space, territoriality, technology, symbolism, social and cultural aspects of the environment, and their influence on architectural theory and practice.

ARC 356 Principles of Sustainable Design (3-0-3)

Fundamentals of sustainable design concepts, methods, and applications within the built environment. Environmental control systems and their emphasis on building energy and user comfort. Factors that contribute to the occupants' comfort and wellbeing in buildings. Passive and active strategies for reducing the energy consumption in buildings. The use of computer applications to assess sustainable measures in design.

ARC 357 Urban Design (3-0-3)

Introduction to the theories of urban design and their historical backgrounds. The history of the city and the influential urban design theories and trends in modern and post-modern times. The visual, perceptual, social, morphological aspects of urban public spaces. Researching and analyzing urban form to understand its elements and its underlying organizing principles considering streetscape and public realm.

ARC 358 Real Estate and Housing Development (3-0-3)

Introduction to housing theory, socio-economic aspects related to housing, alternative approaches to housing policy and housing problems in developing countries. Traditional housing settlements and real estate in Saudi Arabia. Current issues in the formulation and implementation of housing programs including housing concept, analysis of housing design, classification of housing types, data gathering on housing, neighborhood theory as a real estate, design procedure of a housing community, structure of housing areas, construction technologies, materials, costs, climatic conditions, and code issues.

ARC 360 Advanced Topics in Sustainable Architecture (3-0-3)

Selected advanced topics in sustainable architecture and urbanism not covered in the related core courses, such as: design solutions to improve indoor environmental quality, green building materials and their environmental impact, net-zero energy building, the use of renewable energy systems at building and site levels, sustainable rating systems, green building codes, and case study analysis. Building performance modeling utilized to examine the introduced topics using available computer tools.

Prerequisite: ARC 356

ARC 399 Summer Training (0-0-2)

Professional training for eight weeks during summer in a professional architectural consulting firm. Firsthand expert training in the building design and construction industry under the supervision of a faculty coordinator. Upon the completion of the summer internship, students should submit a portfolio outlining their individual contribution.

Prerequisites: ARC 345, ENGL 214, Junior Standing

ARC 401 Senior Project Preparation and Programming (3-0-3)

Preparation of a comprehensive report for the final senior project. Literature review, client objectives, functional relationships, the basic techniques of architectural programming and space requirement development, site development requirements, site selection criteria, and analysis, prioritizing functions, spatial restrictions, and budget constraints. Research on chosen building type and location, acquiring necessary departmental and governmental approvals, site visits, obtain essential maps, contour information, street locations, and photographs.

Prerequisite: ARC 307

ARC 402 Architectural Design Studio VII (0-10-5)

Comprehensive architectural design using research and integrative design processes. Large-scale design project urban building that explores sustainability framework, including context, program, constructability, integration of major building systems, material innovations, sustainability, and contemporary social issues. Construction documents, specification writing, and use of local building codes.

Prerequisites: ARC 214, ARC 232, ARC 307, ARC 345

ARC 403 Architectural Design Studio VIII: Senior Project (0-10-5)

Individual design based on the architectural programming document developed in ARC 401. Creation of an architectural solution for a project with appropriate scope, sophistication, and complexity. Integrative approach toward design. Readiness and ability to engage responsibly, critically, and creatively in the profession of architecture. A comprehensive mastery of architectural design, reflecting the knowledge and skills acquired during the study in the architecture program.

Prerequisites: ARC 401, ARC 402

ARC 419 Parametric Design (1-4-3)

Parametric design in architectural design process and practices. Parametric design fundamentals, advanced tools, techniques and methods, history and development, parametric, leading-edge typologies of practice, technology, and associative parametric design techniques.

Prerequisite: ARC 214

ARC 455 Critical and Creative Thinking for Designers (3-0-3)

Procedures and concerns about the nature of both critical and creative thinking processes as related to design. Expanding the understanding of creative and critical thinking techniques and processes to improve the processes in identifying and reframing design problems and opportunities and developing design solutions.

ARC 461 Special Topics in Islamic Architecture (3-0-3)

Contemporary topics of Islamic principles founded in tradition and social sciences enhance the critical contribution of Islam in shaping the current built environment and society. Potential of developing Islamic architectural theory and its relevance to contemporary architectural issues. Islamic cities, Islamic urban ethics, mosque architecture, and other Muslim frameworks, institutions, and building typologies and their historical development and relevance to contemporary society and architecture.

ARC 462 Special Topics in Local and Regional Architecture (3-0-3)

Localism and Regionalism in architecture as historical and contemporary global phenomena. Analysis of local and regional architecture as situated in place, time, and context, drawing upon local traditions in response to present-day conditions. Examination of pertinent issues and themes such as Contextualism, heritage, third space, identity, authenticity, critical regionalism, critical vernacular, inventions, and technology. Introduction to the vernacular architecture of Saudi Arabia, including both traditional and contemporary, while considering its various regions. Exploration of theories and approaches that aim to utilize vernacular traditions in the contemporary context.

ARC 463 Architectural Conservation (3-0-3)

Detailed analysis of historical background of conservation theories (from the end of XVIII century to nowadays), different conservation strategies, contemporary preservation policies considering the local and international experience and recommendations. Different documentation techniques used to identify and record historic structures and heritage sites, various methods used to diagnose and assess historic buildings' damage and how to determine and prioritize the different required interventions. Real-time case studies on local and international levels.

ARC 480 Creative Design Workshop (1-4-3)

Interdisciplinary exploration of design fields broken away from the narrow themes, methodologies, and approaches definitions to enrich creative thinking and design practice. Exploration of various topics related to spatial, furniture, interaction, user experience, service, fusion, advertising, and graphic design. Highlighting the difference in scale, focus, methodology, and use of technology, as well as pointing out the possibility of mutual borrowing and integration of different perspectives and approaches.

ARC 481 Introduction to Interior Design (3-0-3)

Introducing principles, elements, and methods of interior design and their applications in different types of buildings. Exploring concepts, style, space planning and functions, materials and textures, floor, ceilings, stairs, furniture, lighting, textiles, color, and accessories. Addressing relationships between interior design and human needs, technical, economic, and social considerations to maintain a balance between aesthetics and functional applications.

ARC 492 Professional Practice and Management (3-0-3)

Architectural practice in the marketplace from individual approaches to the different architectural related fields of employment. The related practices in Saudi Arabia compared with the best international practices. The role of architects in societies with background on architecture profession including ideological structure, obligations to society, and the career path and professional ethics of practicing as architects. The organization and management of architectural firms, and the requirements to run an Architectural practice. Management and construction-related procedures, including cost estimating and building economics, bidding documents and procedures, types of contract, specifications, and project time planning and control.

Prerequisite: Junior Standing

ARC 499 Special Topics in Architecture (3-0-3)

Selected advanced topics in the areas of architecture, urban, landscape, interior, or the built environment. Variated topics from semester to semester; information available during registration.

Prerequisite: Senior Standing or Approval of Instructor

ARCHITECTURAL ENGINEERING

ARE 201 Architectural Graphics (0-6-2)

Introduction to Architectural Engineering; Graphical methods and techniques in architectural design and presentation; drawing tools and materials; architectural drafting conventions; orthographic projections and views, their types and use in building presentation. Shades and shadows techniques. Freehand sketching and model-making techniques. Computer graphics using simple software tools, 2D- drawings, 3D-modeling, rendering, and image processing. Major CAD drafting, and presentation software tools will be used with emphasis on the production, management, and presentation of project information.

ARE 202 Architectural Design and History (1-6-3)

The course includes two inter-related parts: Part-I: The social and cultural factors and use of materials that contributed to the development of the unique architecture such as Egyptian, Greek, Roman, Gothic, Renaissance, Baroque, Islamic, Industrial Revolution and Contemporary architecture. Part-II: The process of architectural design in the form of phases, objectives, activities, and parties involved. Models for design problem-solving utilizing graphic thinking are exercised through both abstract sketches and definitive designs to tackle simple design problems. The building function, construction materials and systems, cultural and environmental constraints, and climatic influences are emphasized.

Prerequisite: ARE 201

ARE 220 Fundamentals of Thermal Science (3-0-3)

Introduction to Thermal Science, basic concepts of Thermodynamics, First and second laws of thermodynamics, application to system control, volume, internal energy and enthalpy. Fluid Mechanics, properties of fluids, forces and motion, fluid hydrostatic, dynamic equations of continuity, energy, and linear momentum with application to flow situations and measurements. Heat Transfer fundamentals and their application in buildings.

Prerequisites: MATH 102, PHYS 102

ARE 230 Building Materials and Construction Systems (3-3-4)

Introduction to building materials and construction systems. Properties and usage of building materials such as wood, steel, masonry, cement, concrete, glass, plastics and others. Modern and smart building materials. Construction systems including sub and super structural, wall, floor and roof systems. Building water, vapor proofing and thermal insulation. Innovative and emerging construction systems and methods. The course lab covers conducting standard tests on the properties and behavior of samples of various building materials.

Prerequisite: Sophomore Standing

ARE 301 Architectural Design (0-9-3)

Continuation of higher-level practice of the design process through the design of more complex buildings and larger project sites. The concept of building design in a multi-disciplinary and integrative approach is adopted. Basic elements of architectural form and space and how they can be manipulated, organized in the development of architectural design concept and their visual implications are explored. The integration and interfaces of the inter-related and mutual impact of building structural and environmental control systems within the building design concept, function, form and spatial organization is emphasized.

Prerequisite: ARE 202

ARE 303 Working Drawings (0-9-3)

Introduction to construction documents, divisions, and graphical standards developed to clearly communicate architectural designs for their proper execution. Students are required to produce a full set of working drawings drawn in 2D using proper CAD software, for a small or medium-scale building. The drawing set focuses on presenting technically precise architectural working and shop drawings with proper sequence and graphical standards covering the different components of the building such as layout (site plan), floor plans, sections, elevations and necessary architectural details as well as required door and window schedules. Management of drawings in the workplace and Building Information Modeling (BIM) issues are introduced.

Note: Not to be taken for credits with ARC 345.

Prerequisites: ARE 230, ARE 301

ARE 322 Building Mechanical Systems (2-3-3)

Introduction to the basic concepts, terminology and design methods for building mechanical systems. Thermal comfort, building thermal performance, and heating and cooling load calculation procedures. Fire protection systems and smoke control. Water supply and distribution systems; Waste and drainage systems. Vertical transportation systems. Computer applications.

Prerequisite: ARE 220 or PHYS 133

ARE 323 Principles of Heating, Ventilating, and Air-Conditioning (3-0-3)

Fundamental principles and engineering procedures for the design of Heating, Ventilating, and Air-Conditioning systems (HVAC); HVAC system characteristics; system and equipment selection; duct design and layout. Energy conservation techniques. Computer applications.

Prerequisite: ARE 322

ARE 330 Construction Management and Estimating (3-0-3)

Construction management fundamentals, preparing the bid package, general conditions, special conditions and contract specifications and documents, issues during construction phase, construction contracts, construction labor, materials management, cost estimating, including determination of materials, labor, equipment, overhead, profit, and other construction costs, cost controls. Project planning and scheduling, project cash flow and funding, and construction safety.

Prerequisite: ARE 230 or CE 204

ARE 331 Construction Economy and Equipment (3-0-3)

Basic concepts of building economics including time value of money, life cycle costing, cost and benefit ratio analysis, depreciation, and depletion. Fundamental concepts of equipment economics and cost: the owning and operating costs of equipment and determining the economic life of equipment. Estimating productivity of the different categories of the construction equipment such as: excavating and lifting, loading and hauling, compacting and finishing, Evaluation and selection of equipment. Construction engineering design within economic constraints including design of temporary support systems. Computer Applications.

Prerequisite: ARE 330

ARE 398 Internship (0-0-6)

A continuous period of fifteen weeks is spent in the industry to acquire practical experience in the field of Architectural Engineering under the supervision and

guidance of the employer and the academic advisor. During this period the student gains an in-depth exposure and appreciation of the Architectural Engineering profession. The student is required to write a technical report and conduct an oral presentation about his practical work experience. The report should emphasize duties assigned and completed by the student and the gained skills, abilities and values.
Prerequisites: ENGL 214, Junior Standing, Departmental Requirement

ARE 399 Summer Training (0-0-0)
A continuous period of eight weeks of summer working in the building industry to gain exposure and appreciation of the Architectural Engineering profession. On-the-job training needs to be acquired in one of the areas related to architectural engineering. The student is required to write a brief report and conduct an oral presentation about his practical work experience. The report should emphasize duties assigned and completed by the student and the gained skills, abilities and values.
Prerequisites: ENGL 214, Junior Standing, Departmental Requirement

ARE 410 Introduction to Senior Design Project (1-0-1)
Introduction to the approach and procedure of system, component, or process design to meet desired needs; types and impact of design constraints; requirements of the senior design project; topic selection, scope and limitations; collection of data, literature review; codes and standards identification; computing essentials, recognition of ethical responsibilities of the professional practice. A technical report and public oral presentation documenting the proposal of the senior project are fundamental requirements for completing the course. Teamwork is emphasized and greatly encouraged.
Prerequisites: ENGL 214, Junior Standing

ARE 411 Senior Design Project (0-9-3)
A capstone course integrating various components of the curriculum in a comprehensive engineering design project. The project includes integrative design and analysis techniques in the curriculum areas of Building Structures, Building Mechanical Systems, Building Electrical Systems, and Construction/Construction Management. Students are required to reach the synthesis level in one of these four curriculum areas, the application level in a second area, and show comprehension of the remaining two areas. The design of a system, component, or process to meet desired needs should be within proper and realistic constraints. The use of software tools, applicable codes and standards is essential. A technical report and public oral presentation addressing the final design are required. Teamwork is emphasized and greatly encouraged.
Prerequisite: ARE 410

ARE 416 Planning and Design of Structural Systems (3-0-3)
Fundamental concepts in the planning, design, and construction of complete structures. Design philosophies and criteria. The nature of loads and probabilistic determination of design loads. Selection of structural systems for buildings. Approximate analysis for preliminary design. Utilization of computers in structural engineering. Special problems in tall building.
Prerequisite: CE 305 or ARC 232

ARE 417 Innovative Building Structures (3-0-3)
Innovation in architectural and structural design. Architectural form and structural function; interpretation of basic and advanced structural principles with an intuitive graphical method.

Case studies; biomimetics; bioinspired structures to increase structural efficiency. Innovative structural materials: the use of glass as structural material, innovative reinforcements for composite structures, smart and nanostructured materials; kinetic architecture. Innovations in digital media and factors contributing to innovative structural solutions. Recent developments in the field of adaptive structures.
Prerequisite: CE 305 or ARC 232

ARE 418 Structural Design of High-Rise Buildings (3-0-3)
Concepts and design of complex structures including high-rise buildings, long-span structures and advanced seismic systems. Functional requirements, technologies and processes used in high-rise building construction. Foundation systems; typical vertical and horizontal loads on high-rise buildings, structural steel and reinforced concrete construction. Planning, system selection, modeling, analysis and design of high-rise buildings. The design process of a typical high-rise building project. design procedures, codes of practice and computer software to design steel and concrete high-rise buildings. Sustainability features in modern high-rise buildings.
Prerequisite: CE 315 or CE 408

ARE 420 Solar Energy in Buildings (3-0-3)
Concepts and design of complex structures including high-rise buildings, long-span structures and advanced seismic systems. Functional requirements, technologies and processes used in high-rise building construction. Foundation systems; typical vertical and horizontal loads on high-rise buildings, structural steel and reinforced concrete construction. Planning, system selection, modeling, analysis and design of high-rise buildings. The design process of a typical high-rise building project. design procedures, codes of practice and computer software to design steel and concrete high-rise buildings. Sustainability features in modern high-rise buildings.
Prerequisite: Senior Standing or Department’s Approval

ARE 421 Building Energy Analysis (3-0-3)
Concepts and design of complex structures including high-rise buildings, long-span structures and advanced seismic systems. Functional requirements, technologies and processes used in high-rise building construction. Foundation systems; typical vertical and horizontal loads on high-rise buildings, structural steel and reinforced concrete construction. Planning, system selection, modeling, analysis and design of high-rise buildings. The design process of a typical high-rise building project. design procedures, codes of practice and computer software to design steel and concrete high-rise buildings. Sustainability features in modern high-rise buildings.
Prerequisite: Senior Standing

ARE 422 Advanced Building Envelopes (3-0-3)
Concepts and practices of advanced building envelopes. Engineering materials used in the building envelope, mechanical, chemical and physical properties, and durability performance. Components of building envelopes, dynamic and interactive facades. Environmental-response and adaptive facades. “Glass walls” technologies, chromogenic, mechanical, thermal collecting and power producing, thermal storage and insulation, active coating. Innovative technologies for building skins, New and smart materials for intelligent building envelopes, architectural membranes, and phase change material. Eco-materials for a sustainable building skin. Integrating photovoltaics and solar thermal technologies into facades. Double skin and

cavity facades. Kinetic skins, biomimicry and biomimetics. Intelligent sensing and control. High-tech lightweight building envelopes. Green walls and roofs.
Prerequisite: Senior Standing or Department's Approval

ARE 423 Building Performance Evaluation (3-0-3)
Building performance, definition and aspects of evaluation. Feedback to building designers and operators. ASHRAE's Performance Measurement Protocols (PMP). Performance of measured energy, water, and indoor environmental quality: thermal comfort, indoor air quality (IAQ), visual comfort, and acoustical comfort. Acceptable levels of building service for the building occupants. Measure category and level: objectives of the measurement, metrics to be used, available instrumentation and spatial resolution and units of measure. Analysis procedures. Performance evaluation and benchmarks. Measurement and Verification (M&V) Protocol.
Prerequisite: Senior Standing or Department's Approval

ARE 424 Indoor Air Quality and Ventilation (3-0-3)
Sources, properties, transport and fate, human exposure, and adverse responses to indoor air pollutants. Factors affecting the levels of air pollutants in the indoor environment. Indoor Air Quality (IAQ) control strategies and engineered technologies to mitigate impacts of gaseous and particulate phase of air pollutants indoors. The impact of equipment, floor coverings, furnishings, cleaning practices, and human activities on IAQ including carbon dioxide, VOCs, re-suspended dust, and airborne molds and fungi. Principles of ventilation in buildings. The influence of different ventilation strategies on IAQ in Buildings.
Prerequisite: ARE 322 or Department's Approval

ARE 425 Architectural Acoustics (3-0-3)
Introduction to architectural acoustics, basic theory; sound behavior; sound quantities, units and measurements; noise sources; sound absorption, sound reflection, transmission; sound isolation methods, design and control techniques, room acoustics, quality indicators, principles of room design for good hearing and freedom from noise in buildings. Digital technologies in sound measurements, computer utilization in acoustical modeling and simulation. Emerging technologies and contemporary issues.
Prerequisite: Senior Standing or Department's Approval

ARE 426 Room Acoustics (3-0-3)
Sound propagation in rooms and reverberation. Requirements for the acoustical design of space for speech, and/or music, (e.g. studios, auditorium and multipurpose halls). Acoustical indicators and techniques for evaluating room acoustics quality. Sound Reinforcement Systems (SRS), functions, basic components and types. Functional diagrams and loudspeaker systems. Microphone analysis and microphone types. Other sound sensors, transducers and devices. SRS layouts. Calculations for an efficient SRS in enclosures. Electronic background masking systems. Modeling and simulation of room acoustics.
Prerequisite: Senior Standing or Department's Approval

ARE 427 Noise Control in Buildings (3-0-3)
Noise sources and their effect. Transmission of noise in buildings; air-borne and structure-borne noise. Sound isolation and sound insulating construction. Mechanical systems noise and vibration. Active and passive noise control techniques. Vibration control methods. Digital technology and computer utilization in noise control in buildings.
Prerequisite: Senior Standing or Department's Approval

ARE 428 Design of Pluming and Fire Suppression Systems (3-0-3)

Plumbing systems components including water treatment, heating and pumping equipment, plumbing fixtures, plumbing piping, and installation materials. Design standards and plumbing codes and specifications. Fire suppression systems, components including standpipes and hose systems, gaseous fire suppression systems, wet sprinkler systems, pumping equipment, piping, and installation. Design standards using NFPA codes and specifications. The design of fire sprinkler system, layout and specifications using computer applications.

Prerequisite: ARE 322

ARE 429 Safety and Security Systems in Buildings (3-0-3)

Building perimeter protection, attack alarm systems, alarm transfer systems (equipment fault and lift alarms), video surveillance (CCTV) monitoring systems, access control systems, fire detection and warning systems, sprinkler systems and smoke exhaust and control systems. Intrusion detection system. Data communication systems, emergency lighting and signage systems. Time tracking, UPS systems, PA and audio evacuation systems. Safety issues in the design of escape exits, safe design of staircases and horizontal circulations (pathways and corridors). Building Management Systems (BMS). Innovative technologies. Case Studies.

Prerequisite: Senior Standing or Department's Approval

ARE 430 Contracts and Specifications (3-0-3)

Contract documents, divisions of specifications, types of specifications, technical divisions options and alternatives, contracts, time and money, changes bonds liens, government contracts, general conditions, special conditions, proposal form, instruction to bidders, invitations to bid, checking, interpretation of specifications, and computerized specifications. Saudi standard public works contract.

Prerequisite: Senior Standing

ARE 432 Construction Planning and Scheduling (3-0-3)

Planning, scheduling, and control of construction projects using: Critical Path Method (CPM), The precedence diagram method (PDM), Project Evaluation and Review Technique (PERT); and scheduling of repetitive projects (LOB), Resource leveling and allocation, Scheduling with limited resources; and Time-cost trade-off and Integrated project time and cost control (Earned value).

Prerequisite: ARE 330

ARE 433 Building Cost Estimation (3-0-3)

The cost estimate, overhead and contingency, labor, equipment, excavation, concrete, masonry, metals, wood, thermal and moisture protection, doors and windows, finishes, electrical, plumbing, heating, ventilating and air-conditioning, profit.

Prerequisite: ARE 330

ARE 434 Building Economy (3-0-3)

Life cycle costing, applications of economic evaluation methods and risk analysis techniques, selection of building designs and building components, decision to accept or reject a project, decisions on building location, lease or buy decisions, allocating limited budgets among competing projects, decisions on timing of equipment replacements, selecting combinations of interdependent systems.

Prerequisite: ARE 331

ARE 435 Construction Safety (3-0-3)

Fundamentals of construction safety; causes of accidents; accident investigation; techniques of safety management; the safety policy; risk assessment, monitoring and control; the health and safety plan; training; safety meetings; construction hazards; construction health and safety law; the use of virtual / augmented reality, wearable sensors / IoT and virtual construction / BIM (Building Information Modeling) for construction safety; applications of machine learning and data analytics for construction safety.

Prerequisite: Senior Standing

ARE 436 Fire Safety Management (3-0-3)

Fire safety objectives; fire inception and propagation in buildings; factors controlling fire severity; the role of fire protection engineers; fire detection and notification systems; fire suppression systems; means of egress and evacuation systems; smoke management and ventilation techniques; hazard and risk assessment procedures; fire stopping; fire proofing and fire retardant treatments; fire resisting elements separating buildings or compartments within buildings; fire hazards common in the workplace; post-fire activities in the workplace; fire problems in high-rise buildings; IoT-based architecture for fire prevention; potentials of IoT technologies for fire prevention in smart buildings and cities: hazardous source monitoring and early fire warnings, on-site situational assessment, management of fire safety equipment; case studies.

Prerequisite: Senior Standing

ARE 437 Decision Analysis and Modeling (3-0-3)

Introduction to decision analysis, the application of structured techniques for organizing and analyzing complex decisions to assist decision makers. Modeling and structuring decisions. The techniques and methods used in multi-criteria decision analysis including the law of comparative judgment, pairwise comparison, decision trees, influence diagrams, value of information, sensitivity analysis, and Monte Carlo simulation, the Analytic Network Process (ANP), Analytic Hierarchy Process (AHP), Multi-Attribute Utility Theory (MAUT), Simple Multi-attribute Rating Technique (SMART). Examples and case studies covering multi-criteria decision problems in architectural engineering with multiple non-conflicting and/or conflicting objectives. “Decision Support” calculators and software tools.

Prerequisite: Senior Standing

ARE 438 Facilities Planning and Management (3-0-3)

Overview of facilities planning and management, facilities management (FM) skills and functions, operation and maintenance management, building performance, outsourcing FM services, space management and utilization, business continuity during facility renovations, facilities obsolescence and refurbishment, facilities quality management, asset management, human resource management, FM information systems, benchmarking performance, risk management, facilities resource efficiency.

Prerequisite: Senior Standing

ARE 439 Introduction to Building Maintenance Management (3-0-3)

Introduction to basic concepts of building maintenance management. Classification of maintenance types, Work order types, Planning and scheduling of maintenance works using arrow notation, Maintenance contract documents and types, Maintenance Management Systems, Estimating maintenance manpower requirements, Computerized Maintenance Management Systems.

Prerequisite: ARE 230 or CE 204

ARE 442 Building Energy Analysis (3-0-3)

Introduction to building energy systems, building thermal and energy performance parameters; design methods for improving building energy efficiency, application of thermal sciences to the evaluation of building envelope and energy systems including HVAC system; energy estimation methods. Application of software tools for building energy analysis.

Prerequisite: Senior Standing

ARE 445 Artificial Lighting Systems Design (3-0-3)

Introduction to lighting systems. Lighting requirements under different working conditions. Detailed understanding of artificial lighting sources. Quantity and quality of light for various architectural spaces. Polar curves for various artificial lighting sources. Design of artificial lighting systems for avoiding glare. Lighting control techniques. Artificial lighting design of outdoor spaces. Computer applications.

Prerequisite: EE 312 or Department’s Approval

ARE 446 Daylighting Analysis and Design (3-0-3)

Introduction to daylighting. Sources of daylighting. Solar spectrum and its relationship to daylight availability. Weather phenomenon and daylighting. Concepts of cloudiness and design sky. Performance of building materials with respect to daylighting such as reflectivity and absorption. Detailed study of daylight transmission through openings with shading devices. Solar geometry and design of sun-shading devices. design of openings in desert areas with respect to glare and overheating. Computer and lab methods for the study of daylight in buildings.

Prerequisite: EE 312 or Department’s Approval

ARE 447 Automation and Control of Building Systems (3-0-3)

Introduction to building automation systems, (BAS). BAS hardware, sensors and control devices. Surveillance systems, fire alarm systems, access control systems. Control of HVAC system. Control of electrical and lighting systems. Automation of building systems integration and the construction process. Energy management systems. Common BAS protocols. BAS upgrading and management. Post occupancy evaluation and emerging automation trends.

Prerequisite: ARE 322 or Department’s Approval

ARE 460 Green and Sustainable Buildings (3-0-3)

The concept of sustainability in the building sector. Green and sustainable buildings (GSBs), definitions, objectives, elements and characteristics of GSBs. Sustainability implications of the practice of engineering solutions in the built environment. Environmental, social and economic benefits of GSB. Occupant health, comfort, productivity, energy efficiency, pollution reduction. Active vs. passive design strategies. Sustainable and integrated building design (SIBD). Examples of GSBs practices. Green building materials and systems. GSBs local and international organizations, standards. Assessment, rating systems and certification of GSBs. Case studies. Introduction and preparation towards the LEED Green Associate (GA) Exam.

Prerequisite: Senior Standing

ARE 461 Applications of AI in Smart Buildings (3-0-3)

The concept of smart buildings, definition and characteristics. Automation technologies, cognitive automation (CA), digital direct controls (DDC) and Artificial Intelligence (AI) - their capabilities, future potential, and application to smart building design, construction and

operation. IoT and ML in smart space design, construction and operation. AI utilization in sustainable energy management; safety and security. Inter-building/space communication and collaboration. Occupant comfort, personalization and interactions. Obstacles to change and adoption of IoT and AI solutions. Best practices and strategies to bring IoT and AI into smart buildings. The impact of AI and ML on the future of buildings, communities and cities. Case studies, lessons learned, challenges, and future directions of research in the field.
Prerequisite: COE 292

ARE 463 Sustainable Energy Solutions (3-0-3)
Fundamentals of sustainable and smart energy systems. Energy Efficiency (EE), definition, importance, and critical factors. Sustainable energy solutions for energy-efficient buildings. Energy auditing; testing, and measurements. Building management systems. Energy retrofitting. Maintenance and commissioning. Renewable energy sources. Solar and wind power solutions for buildings. Assessment of renewable energy systems. Smart meters. Hybrid energy systems. Energy performance and renewable energy modeling tools. Sustainable energy policies.
Prerequisite: Senior Standing

ARE 465 Construction Processes and Methods (3-0-3)
Current construction processes; construction material selection; construction methods, materials and equipment; current field practice and safety considerations; Planning and scheduling of construction operations; project cost estimation and control; project contracts and specifications; claims and dispute resolution.
Prerequisite: Senior Standing

ARE 490 Special Topics in Architectural Engineering (3-0-3)
Variable contents. State-of-the-art advanced topics in the field of Architectural Engineering.
Prerequisite: Senior Standing

ARE 492 Mosque Systems and Operation (3-0-3)
Introduction to mosque functional requirements and Indoor Environmental Quality (IEQ); mosque standards, and design Criteria; Heating , Ventilation and Air-Conditioning (HVAC) systems, requirements for intermittent operation, mosque zoning; Air quality and ventilation; Energy efficiency measures; Sound quality and acoustical guidelines; Safety issues; Mosque lighting systems, lighting control; Exterior and interior finishes and furniture; Ablution area; Operational strategies, Assessment of existing mosques.
Note: Not Credited for ARE Students
Prerequisite: Senior Standing or Department's Approval

ARE 497 Undergraduate Research (1-6-3)
Selection and development of a research topic in one of the curriculum areas of Architectural Engineering, namely Building Structures, Building Mechanical Systems, Building Electrical Systems, and Construction/Construction Management, developing a successful proposal, including research objectives and methodology, managing and carrying out research tasks, communicating the research findings via effective technical report.
Prerequisite: Department's Approval

ACTUARIAL SCIENCE

AS 201 Financial Mathematics (3-0-3)

Theory of compound interest and the mathematics of investment and credit. Measurement of interest, annuities certain (level, non-level, and continuous), amortization schedules, sinking funds, investment yield rates, and valuation of bonds and other securities. Methods of loan measurement and payments (Islamic and Conventional) are illustrated in amortization and sinking fund schedules. Islamic views on interest and investments.

Prerequisite: MATH 102

AS 251 Mathematics of Financial Derivatives (2-2-3)

Mathematical models of Forwards and Futures, Options and Related Strategies. Arbitrage opportunities. Mathematical pricing of derivative securities and exotic options (Asian, barrier, compound, gap, and exchange). Discrete time models. Lognormal distribution and continuous time pricing models. Option Greeks, Risk Management (with delta-hedging method). Actuarial applications of derivatives. Other SOA IFM exam topics. Spreadsheet programming software.

Prerequisites: AS 201, STAT 214

AS 289 Actuarial Science Problem Lab I (0-2-1)

Preparation for the second Society of Actuaries and Casualty Actuarial Society professional examination, FM (Financial Mathematics). Society approved calculators. Review exam logistics and exam-taking strategies.

Prerequisite: AS 201

AS 380 Actuarial Contingencies I (2-2-3)

Introduction to life insurance mathematics based on a stochastic approach. Life insurance, annuities, benefit premiums, and net reserves. Parallel treatment of topics based on Takaful system.

Prerequisites: AS 201, STAT 301

AS 389 Actuarial Science Problem Lab II (0-2-1)

Preparation for the first Society of Actuaries (SOA) and Casualty Actuarial Society (CSA) professional examination, Exam P (Probability). Society approved calculators. Review exam logistics and exam-taking strategies.

Prerequisite: STAT 301

AS 398 Internship (0-0-6)

A continuous period of 14 weeks of industrial employment for Actuarial Science and Financial Mathematics students to work in appropriate industries or firms. The student is evaluated on his job performance and is required to submit and present an extensive formal report on his work experience.

Prerequisites: AS 251, MATH 371, STAT 301, STAT 310, ENGL 214

AS 450 Risk Modeling (2-2-3)

Types of Risks faced by an organization; Risk Modelling, its evaluation and Analysis; Techniques used in quantifying financial and non-financial risks. Covers value at risk (VaR), extreme value theory (EVT), scenario and stress testing, risk aggregation techniques including use of correlation, integrated risk distributions and copulas. Approaches for managing risk.

Prerequisites: AS 201, STAT 214

AS 460 Enterprise Risk Analysis (2-2-3)

Enterprise risk management (ERM) framework and process. Importance of the of ERM function. Risk Management tools and techniques. Capital Management. Data Issues. Application of risk Analytics, from risk identification to treatment, on six actuarial fellowship fields: (1) Retirement Benefits, (2) Individual Life and Annuities, (3) Group and Health, (4) Investment, (5) General Insurance, and (6) General Corporate ERM.

Prerequisite: AS 450

AS 470 Models for Risk Managing Financial Options and Derivatives (2-2-3)

Option Greeks and Elasticity. Risk management techniques (with delta-hedging method). Properties of Options. Cash flow characteristics and pricing of exotic options (Asian, barrier, compound, gap, and exchange). Real Options. Diffusion process for stock prices.1-dimensional Itô’s lemma. Interest rate models. Vasicek and Cox-Ingersoll-Ross bond price models. Black-Derman-Toy binomial model. Simulation of stock prices.

Prerequisites: AS 250, STAT 301

AS 476 Survival Models for Actuaries (2-2-3)

Introduction to survival models. Estimation and testing of models with various types of survival data; Non-parametric Estimation (Kaplan-Meier, Nelson-Aalen). Parametric survival models. Regression models for survival data; proportional hazards and Cox regression model. Techniques for estimating mortality rates. Graduation. Model Selection. A statistical/actuarial computing software will be used.

Prerequisites: STAT 302, STAT 310

AS 481 Actuarial Contingencies II (3-2-4)

A continuation of Life Contingencies I. Development is based on a stochastic approach to life insurance models. Major topics include benefit premiums and reserves, and multi-life and multiple-decrement models. Parallel treatment of topics based on Takaful system. Application of such area in life insurance and property.

Prerequisite: AS 380

AS 484 Actuarial Risk Theory and Credibility (3-2-4)

Claims Distributions (Severity, frequency, and aggregate). Risk Measures. Aggregate loss models (individual and collective Risk models). Parametric model Estimation. Introduction to credibility theory (limited fluctuation, greatest accuracy, Buhlmann, Buhlman-Straub, Empirical Bayes models). Introduction to Simulation. A statistical/actuarial computing software will be used.

Prerequisite: STAT 302

AS 490 Topics in Actuarial Science and Financial Mathematics I (3-0-3)

Variable content. Presents a special topic in Actuarial Science or various insurance fields parallel to advancements as recognized by the Society of Actuaries.

Prerequisite: Junior Standing

AS 491 Topics in Actuarial Science and Financial Mathematics II (3-0-3)

Variable content. Presents a special topic in Financial Mathematics, Financial Modeling, or Enterprise Risk Management fields parallel to advancements as recognized by the Society of Actuaries.

Prerequisite: Junior Standing

BIOENGINEERING

BIOE 475 Cell Biology and Bioelectricity (3-0-3)

Fundamentals of cell biology, biomolecules, cell structure and function, enzymes, biological redox chemistry and metabolism, respiration and photosynthesis, flow of genetic information from DNA to RNA to protein, bioelectric signals in the cell, Ion channels, membrane and action potential, brain, heart and neuro-muscular system physiology in relation with bioelectric signals and their propagation, sensory processes in animal involving stimuli, sensor-reception, electrical signal and brain processing, and examples of bioelectricity in other organisms.

Prerequisite: Senior Standing

BIOLOGY

BIOL 101 Introduction to Biology (3-3-4)
Structural organization of cells and metabolic activities of some of the cellular components, basic principles of genetics, biological diversity and the major kingdoms of life.

BIOL 102 Ecology and Environment (3-0-3)
Population and community ecology, with emphasis on growth and distributions of populations, interaction between species, structure, dynamics, and functions of communities and ecosystems; structure and systems analysis of the earth from a biological perspective, with emphasis on biogeochemical cycles and global change. At least one field trip required.
Prerequisite: BIOL 101 or Consent of the Instructor

BIOL 201 Microbiology (3-3-4)
The course covers structures, functions, and diversity of microbes with respect to basic views related to microorganisms. It highlights different metabolic diversities, advances in molecular phylogeny, diversification and biogeochemical cycling of elements in different environments. It studies interaction among viruses, bacteria and macro organisms with objective views of beneficial vs. harmful effects of microorganisms on environment, human health and society.
Prerequisite: BIOL 102

BIOL 202 Physiology (3-3-4)
An introductory human physiology. The course will concentrate on basic mechanisms underlying human life process including cells and membranes; nervous and muscle function cardiovascular, respiratory, and renal and gastrointestinal physiology; metabolism, endocrinology and reproduction.
Prerequisite: BIOL 101

BIOL 233 Biology for Engineers (2-3-3)
Basic understanding of the fundamental principles of biology. Basic information in chemical context of life, cell structure, cell function, energy production and transfer, cell division (mitosis and meiosis) and DNA Technology and its engineering applications, basic information about microorganisms (microbiology) and viruses. Emphasis on topics of relevance to engineering applications.

BIOL 301 Biochemistry (3-0-3)
Studies of biomolecules such as sugars, polysaccharides, hemoglobin and amino acids and on the structural studies of proteins. Enzymes in biological tissues with emphasis on mechanism and catalytic reactions. Metabolism and transport in biological systems. Study of structure of nucleic acids as well as the DNA molecule.
Prerequisites: CHEM 201, BIOL 101

BUSINESS

BUS 200 Business & Entrepreneurship (3-0-3)

Overview of the fourth industrial revolution; opportunity cost, comparative advantage, supply and demand; ownership structures, legal system, contracting; business ethics, socio-cultural factors; managerial functions, business strategies, organizational structures; consumer behavior, segmentation, targeting, positioning, marketing mix; financial statements, financial statement analysis; financial markets, time value of money, risk and return; entrepreneur, entrepreneurial process, innovation, opportunities, business model, customer validation, entrepreneurial team and funding, digital entrepreneurship.

CIVIL ENGINEERING

CE 101 Engineering Graphics (1-3-2)

An introductory course on the "language of engineering" and the use of drafting instruments and machines. Topics include freehand sketching, graphic geometry, orthographic projection, sectional and auxiliary views, dimensioning, intersections, developments, and introduction to working drawings and an overview of computer graphics.

Note: Not open for CE students

CE 201 Statics (3-0-3)

Basic concepts and principles of mechanics; algebraic vector operations on action and reaction vectors; equilibrium of particles in two and three dimensions; definitions of moment and couple; reduction of system of forces; equilibrium of rigid bodies; statically determinate structures including beams, trusses, frames and machines; analysis of internal forces; shear and bending moment diagram for beams; static friction forces and engineering applications; center of gravity of masses, and centroid of lines, areas, and volumes; area moment of inertia and radius of gyration.

Prerequisite: PHYS 101

CE 202 Statics & Strength of Materials (3-0-3)

Basic concepts and principles of mechanics; equilibrium of particles in two dimensions; definition of moment and couple; reduction of systems forces; equilibrium of rigid bodies in two dimensions; analysis of truss-type structures and internal forces; geometric properties of cross-section area; centroid and moments of inertia; shear and bending moment diagrams in beams; stress, Stress-strain relationships; stress and deformation of axially loaded members; stress-concentration; thermal stresses; pressure-vessels; torsion-stress and deformation; elastic bending and shear stresses in beams; compound stresses; stress transformation.

Note: Not open for CE students, Not to be taken for credits with CE 201 or CE 203

Prerequisite: PHYS 101

CE 203 Structural Mechanics I (3-0-3)

Concepts of stress, strain, and constitutive relations; stress and deformation of axially loaded members, thermal stresses, pressure vessels, energy concepts, torsion of circular and thin-walled sections, shear and bending moment diagrams in beams, elastic bending, shear stress in beams, compound stresses, stress transformation, deflection of beams, and introduction to the concept of singularity functions.

Prerequisite: CE 201

CE 204 Civil Engineering Materials (3-0-3)

Introduction; hydraulic cements; water; aggregates for Portland cement and asphalt concrete mixes; admixtures; design of concrete mixtures; production, handling and placement of concrete; properties of fresh concrete; curing of concrete; properties of hardened concrete; asphalt types, physical properties, grading systems and usage of asphalt; asphalt concrete mix design; engineering properties and usage of structural steel. Laboratory sessions on tests of concrete constituents, fresh and hardened concrete, aggregate gradation and mix design; flexure behavior of reinforced concrete beams; physical properties and testing of asphalt binders, asphalt concrete mix design; hardness test, tensile and torsion tests on metals, measurement of Poisson's ratio and stress concentration and bending tests on steel beams.

Prerequisite: CE 201

Corequisite: CE 206

CE 206 Civil Engineering Materials Laboratory (0-3-1)

Laboratory sessions on tests of concrete constituents using standard procedures generally ASTM standards, fresh and hardened concrete, aggregate gradation and mix design; flexure behavior of reinforced concrete beams; physical properties and testing of asphalt binders, asphalt concrete mix design; hardness test, tensile and torsion tests on metals, measurement of Poisson's ratio and stress concentration and bending tests on steel beams.

Corequisite: CE 204

CE 216 Computer Graphics (1-3-2)

The course focus on the following topics: Introduction to Computer Aided Design and Drafting, (CADD), 2D Drawings with AutoCAD includes Multiview Projection, Dimensions, Sections, Auxiliary Views, Free Hand Sketching, Mining and Civil Engineering Problems, Metallic Members and their Connections, Bearing and Slope of Lines and Planes, AutoCAD Civil 3d, Contour Map Lines, Cut and Fill, Blue Print Reading, and 3D Drawings.

CE 230 Engineering Fluid Mechanics (3-0-3)

Properties of fluids, hydrostatics with applications to manometers, forces on plane and curved surfaces, bouncy, equations of continuity, energy and linear momentum with applications, dimensional analysis, dynamic similarity, open channel flow, and conduit flow.

Prerequisites: CE 201, MATH 102

CE 261 Surveying I (1-3-2)

Introduction to measuring units; direct distance measurement with tapes; tape corrections; electronic distance measurement; levels and leveling; longitudinal profiles and cross sections; contouring; area and volume computations; the theodolite and angular measurements; optical distance measurements; rectangular coordinates; traverse surveys and computations; mapping; introduction to GPS and GIS.

CE 305 Structural Analysis I (3-0-3)

Shear force and bending moment diagrams for frames; influence lines for beams and trusses; displacement analysis for beams; Virtual Work Method for beams, frames and trusses; Castigliano's Theorem; analysis of statically indeterminate structures; the Force Method; the Slope-Deflection Method, the Moment Distribution Method; introduction to the Stiffness Method for beams and frames, the use of structural analysis software.

Prerequisite: CE 203

CE 315 Reinforced Concrete I (2-3-3)

Behavior and design of reinforced rectangular and T-sections in flexure; doubly reinforced sections; behavior and design of beams for shear; bond and development length including splices and cut-off points; design of one-way solid and joist floor slabs; design of short columns; design of isolated footings; introduction to prestressing and precast construction; use of appropriate computer software in design; completion of a design project; interpretation of blueprints; site visits.

Prerequisite: CE 305

CE 318 Numerical & Statistical Methods in Civil Engineering (2-3-3)

Introduction to numerical methods; error analysis; solution of system of linear and nonlinear equations; numerical integration; numerical solutions of ordinary differential equations; curve fitting and interpolation; statistical methods, descriptive statistics, probability distributions, analysis of variance and regression; introduction to linear programming and optimization

problems; development and application of computer programs to case studies derived from civil engineering practices.
Prerequisites: ICS 104, MATH 208

CE 330 Environmental Engineering Principles (3-0-3)
Introduction to water treatment along with physical operations and chemical processes; Introduction to wastewater treatment and reuse along with preliminary, primary, secondary, and tertiary treatment; municipal solid and hazardous waste management and disposal.
Prerequisite: CHEM 101
Corequisite: CE 375

CE 335 Engineering Hydrology (2-3-3)
The hydrologic cycle, precipitation; evaporation and transpiration; infiltration; streamflow; hydrograph analysis including unit hydrograph; hydrologic flood routing; introduction to flood frequency analysis; occurrence of groundwater; fundamentals of groundwater flow including Darcy's law and its applications; steady and unsteady flow to wells.
Prerequisite: CE 230

CE 341 Transportation Engineering (3-0-3)
Transportation system in Saudi Arabia; transportation planning and evaluation; vehicle characteristics; human factors; geometric design of highways and intersections; basis of pavement design; introduction to capacity analysis of highways and intersections; introduction to airport planning and design; application of transportation related softwares.
Prerequisite: PHYS 101
Corequisite: CE 343

CE 343 Transportation Engineering Lab (0-3-1)
Transportation system in Saudi Arabia; transportation planning and evaluation; vehicle characteristics; human factors; geometric design of highways and intersections; basis of pavement design; introduction to capacity analysis of highways and intersections; introduction to airport planning and design; laboratory sessions on Field studies of speed; traffic volume, and delay; capacity analysis; geometric design of highways, intersections, and parking facilities; traffic signal design; pavement material testing and design; flexible pavement design; application of transportation related software; application of transportation related software.
Prerequisite: CE 206
Corequisite: CE 341

CE 354 Introduction to Geotechnical Engineering (3-0-3)
Soil formation and identification; index and classification properties of soils; clay minerals; soil compaction; capillarity, swelling, shrinkage and effective stresses; flow of water in soils; compressibility and consolidation; stress in soils; shear strength of cohesive and cohesionless soils; introduction to lateral earth pressure and shallow foundation.
Prerequisite: CE 203
Corequisites: CE 230, CE 356

CE 356 Geotechnical Engineering Laboratory (0-3-1)
Conduct and report on experiments in geotechnical engineering, including: specific gravity; moisture content; sieve analysis; hydrometer analysis; Atterberg limits; compaction; field

density; permeability; consolidation; direct shear; unconfined compression; California bearing ratio; triaxial shear.
Corequisite: CE 354

CE 375 Environmental Chemistry Laboratory (0-3-1)
Introductory environmental chemistry laboratory sessions for water & wastewater treatment; Standard solutions; Elementary concepts in solution & colloidal chemistry including chemical equilibrium, kinetics, precipitation; pH measurement; Dissolved-oxygen analysis; Alkalinity analysis; Water-hardness analysis; Turbidity and solids characterization; Total organic carbon (TOC) & Chemical oxygen demand (COD) analysis; Biochemical oxygen demand (BOD) analysis; Total coliforms analysis; Residual chlorine analysis; Jar Test; Adsorption.
Corequisite: CE 330

CE 398 Internship (0-0-6)
A continuous period of one semester is spent in the industry to acquire practical experience in civil engineering professional practice under the supervision and guidance of the employer and the academic advisor. During this period the student gains an in-depth exposure and appreciation of the civil engineering profession. The student is required to write detailed reports about his training period under regulations of the CE department.
Prerequisites: ENGL 214, Junior Standing, Approval of the Department

CE 399 Summer Training (0-0-0)
A continuous period of eight weeks of summer working in the industry to gain exposure and appreciation of the civil engineering profession. On-the-job training can be acquired in one of the four specialties of civil engineering. The student is required to write a brief report about his industrial experience. The report should emphasize duties assigned and completed by the student.
Prerequisites: ENGL 214, Junior Standing, Approval of the Department

CE 401 Concrete Technology (2-3-3)
In-depth study of cement composition, hydration of cement; structure and properties of hardened cement paste; volumetric changes in concrete; properties of concrete related to durability such as water absorption, water permeability, chloride permeability, and chloride diffusion; use of mineral admixtures; advanced concretes and reinforcing bars; requirements and specifications for producing durable concretes suiting the local conditions.
Prerequisite: CE 204

CE 402 Durability, Evaluation and Repair of Concrete Structures (3-0-3)
Durability problems of concrete structures such as reinforcement corrosion, sulfate attack, cement-aggregate reactions, salt weathering, efflorescence, acid attack, and environmental cracking; factors causing severe deterioration problems in the Arabian Gulf; condition survey, diagnosis and evaluation of deterioration damage in concrete structures; repair materials and methods; preventive measures such as protective coatings, cathodic protection, de-chlorination, and re-alkalinization.
Prerequisite: CE 204

CE 404 Climate Engineering (3-0-3)
Introduction to geoengineering; the economics of climate change; response to climate change: mitigation and adaptation techniques; impacts, adaptation, and vulnerability; plan to keep carbon in check; carbon capture, utilization and storage; climate intervention strategies and

technologies; solar radiation management; carbon dioxide removal; weather modification; using the oceans to engineer the climate.
Prerequisite: Senior Standing

CE 405 Structural Analysis II (3-0-3)
Review of matrix algebra and solution of simultaneous equations; flexibility (force) method analysis; stiffness (displacement) method of analysis; 2-D trusses, beams and frames; development of computer programs using the stiffness method; use of available computer packages for applications in structural analysis; introduction to the Finite Element Method; introduction to structural stability.
Prerequisite: CE 305

CE 406 Structural Mechanics II (3-0-3)
Bending of beams of non-symmetrical sections; shear center; energy concepts including Rayleigh-Ritz method; use of classical and energy methods in the analysis of curved beams; torsion of prismatic members; beams on elastic foundations; use of finite element methods in solid mechanics, including introduction to use of FEM software; column buckling and introduction to beam-columns; failure theories and fracture mechanics.
Prerequisite: CE 203

CE 408 Steel Design I (2-3-3)
Properties of structural steel; steel sections and introduction to Load Resistance Factor Design (LRFD), design of tension members, compression members and capacity calculations; laced columns width-thickness ratios; design of beams with and without lateral supports; design of members under combined axial and bending loads; design and details of simple bolted and welded connections, and an introduction to common building connections; use of software for design of elements and overall design of frames.
Prerequisite: CE 305

CE 411 Senior Design Project (1-6-3)
Students undertake a civil engineering design project under the supervision of a faculty member with the aim of achieving a comprehensive design experience through a coherent study of all applicable principles, strategies and methodologies of design, including construction operation, and maintenance as and when applicable. The project should also take into consideration other appropriate factors such as alternative designs, economic feasibility and social and environmental impacts. The student chooses the project in the field in which he is most familiar through his co-op work experience or summer training. The student is required to make an oral and written presentation of the design project to an examining committee.
Prerequisite: Senior Standing

CE 415 Reinforced Concrete II (2-3-3)
Design of two-way slabs using ACI 'direct design method'; design of continuous beams; behavior and design of columns under axial load and bending moment including slenderness effect; design of beam column joints; design of shear wall and load bearing wall system; simple design of stairs; introduction to various types of foundations; lateral resistivity, design of wall footings and combined footings; design of retaining walls; simple design of prestressed precast elements; appropriate computer software in design; completion of a multistory design project.
Prerequisite: CE 315

CE 418 Steel Design II (3-0-3)

Introduction to elastic-plastic material behavior, plastic analysis and design of beams and simple frames using Load Resistance Factor Design (LRFD), design of built up beams and plate girders, optimum proportioning of I-beam, design of composite girders, design of rigid connections, design for torsion, computer applications to design rigid frames and steel buildings.

Prerequisite: CE 408

CE 422 Construction Management and Economy (3-0-3)

An overview of construction industry; professional responsibilities, ethics, liabilities and licensing; contracts and project delivery systems; business ownership; project planning and scheduling; cost estimation, cost control, resource leveling, introduction to construction economics, equipment productivity and selection; construction productivity and safety; construction types, equipment, materials, and foundation; concrete form design; contemporary issues in Construction Engineering; field projects and life-long learning.

Prerequisite: Junior Standing

CE 433 Groundwater Engineering (3-0-3)

Introduction and definitions; Groundwater Aquifers of Saudi Arabia; groundwater storage and supply; Darcy's law and its applications; Dupuit approximation; steady and unsteady flows in confined and unconfined aquifers; radial flow towards wells; storage coefficient and safe yield in a water-table aquifer; design of wells; methods of drilling and construction; development of maintenance of wells.

Prerequisite: CE 335

CE 436 Open Channel Hydraulics (3-0-3)

Analysis and characteristics of flow in open channels; channel design considerations including uniform flow; flow measuring devices; gradually varied flow; flood routing; rapidly varied flow; hydraulic factors for the design of reservoirs, dams, spillways and stilling basins.

Prerequisite: CE 335

CE 437 Applied Hydraulic Engineering (3-0-3)

Application of the basic laws of fluid mechanics to hydraulic problems. Analysis and design of water supply, sanitary and storm sewer systems and their components; open channel flow hydraulics; hydraulic structures; computer applications in the design and analysis of hydraulic systems.

Prerequisite: CE 335

CE 439 Civil Engineering Systems Analysis (3-0-3)

Techniques commonly associated with systems engineering; new techniques applicable to design and operations of civil engineering systems; linear optimization, linear programming, transportation and assignment problems, network analysis; simulation techniques; decision analysis; nonlinear optimization; critical path method.

Prerequisite: CE 318

CE 440 Highway and Airport Materials (3-0-3)

Construction materials; asphalt cement; emulsified asphalt; foamed asphalt; Portland cement asphalts; cement; aggregates and asphalt additives; specifications; material selection and evaluation; tests of asphalts and aggregates, mix design procedures for hot and cold asphalt

mixes, including Marshall and SuperPave; mix design for Portland cement concrete mixes for rigid pavements; characterization techniques; modulus of resilience; fatigue and rutting performance prediction; field quality control procedures; Computer applications in materials evaluation and design.
Prerequisite: CE 204

CE 441 Design of Pavement (3-0-3)
Pavement types and design factors; stresses and strains in flexible and rigid pavements; traffic analysis and design considerations; material characterization; performance evaluation; reliability aspects in design and construction; structural thickness design of highway and airport pavements using different methodologies; pavement evaluation; Computer application in pavement design.
Corequisite: CE 341

CE 442 Construction and Maintenance of Highways and Airports (3-0-3)
Selection and processing of construction materials; asphalt concrete mix design; asphalt plants operation; material placement and compaction methods; quality control; earthwork, highway drainage and roadside requirements; construction standards; pavement performance and evaluation; pavement distress identification; surface treatments; techniques; application and design; overlay design; pavement recycling techniques; computer applications.
Prerequisite: Junior Standing

CE 444 Traffic Engineering and Roadway Safety (3-0-3)
Vehicle, roadway and driver characteristics; traffic engineering and safety studies; highway capacity analysis; traffic control methods and devices; intersection signalization and signal timing; fundamentals of intersection design; parking facilities; introduction to attenuation devices; intelligent transportation systems; computer applications.
Prerequisite: CE 341

CE 454 Soil Stabilization and Site Improvement (3-0-3)
General survey of soil types and their behavior and the available techniques for improvement; shallow and deep mechanical modifications; modifications by admixtures and grouting; modifications by inclusions; the use of geosynthetic material in filtration, seepage control, separation, reinforcement and water retention; hydraulic modifications; and treatment of marginal soils.
Prerequisite: CE 354

CE 455 Foundation and Earth Structure Design (3-0-3)
Site investigation, including determination of soil properties for design; bearing capacity theory of shallow foundation; settlement of building foundations; design and analysis of retaining walls, sheet piles and braced excavations; design of pile and pier foundations.
Prerequisite: CE 354

CE 457 Advanced Geotechnical Engineering (3-0-3)
Fundamental relations of elasticity and plasticity in soil masses; unsaturated soils behavior; deformation properties of cohesionless and cohesive soils; advanced strength concepts in soils and stress path; slope stability analysis; introduction to soil dynamics.
Prerequisite: CE 354

CE 462 Advanced Building Materials and Systems (3-0-3)

Introduction to advanced and sustainable materials, definition of interactive and smart materials and systems, properties, types and classifications, their applications, merits and demerits. Examples of current and emerging smart building materials and systems. Biomimetric Materials. Phase-Change Materials. Nano technology applications in the building envelope. Assessment of the suitability and sustainability of smart materials and systems for building and construction projects. Selection criteria based on performance, international-standard practices and certification. Integration strategies of advanced materials and future trends. Site visits to relevant laboratories and materials-manufacturing facilities.

Prerequisite: Senior Standing

CE 464 Project Surveying (3-0-3)

Route survey; horizontal curves; vertical curves; spirals; construction surveys; applications of Total Stations; topographic surveying and mapping; introduction to Global Positioning System (GPS) and Geographic Information Systems.

Prerequisite: CE 261

CE 471 Water and Wastewater: Treatment and Reuse (3-0-3)

Water treatment including pre-design issues, desalination, lime softening, sedimentation, filtration, membrane systems, ion exchange, adsorption, and disinfection technologies; Wastewater treatment including fundamentals of reactor design, activated sludge system, membrane bioreactor, trickling filter, and secondary clarifier; Natural wastewater treatment technologies for smaller and remote communities; Wastewater reuse including water scarcity issues, legal issues, health issues, technical issues & methodologies, areas of application, and case studies.

Prerequisite: Senior Standing

CE 473 Design and Operation of Water and Wastewater Treatment Plants (3-0-3)

Theory and practice in sanitary engineering including the concepts of processing, design, economic evaluation and computer analysis; class projects incorporating practical considerations in the design and operation of treatment units and the combining of unit processing in water and wastewater treatment plants; field trips will be organized to visit various types of treatment plants in operation.

Prerequisite: CE 330

CE 474 Municipal Solid Waste Management (3-0-3)

Problems, regulations, collection, handling, recycling and disposal issues related to municipal solid wastes; Characterization of municipal solid wastes including physical, chemical, and biological characteristics; Integrated municipal solid waste management practices including resource recovery, composting, incineration, and landfill design.

Prerequisite: Senior Standing

CE 476 Industrial Hazardous Waste Management & Treatment (3-0-3)

Theory and design of several industrial hazardous waste management and treatment aspects including regulations, environmental audits, pollution prevention, risk assessment, chemical & biological process fundamentals, and industrial hazardous waste separation, handling, treatment, & disposal techniques.

Prerequisite: Senior Standing

CE 478 Climate Resilient Infrastructure and Adaptation (3-0-3)

Vulnerability, adaptation, and adaptive capacity; adaptation and equitable development; climate impacts on urban vulnerability; risk and vulnerability assessments; climate adaptation planning and options; participation and community-based adaptation; role of engineering infrastructure on climate adaptation; multi-disciplinary infrastructure for sustainable development; effects of climate change on the multi-disciplinary infrastructure; issues for climate adaptation and climate resilient infrastructure; case studies on selected multi-disciplinary infrastructure.

Prerequisite: Senior Standing

CE 479 Air Quality in Building and Construction Sites (3-0-3)

Introduction to air quality, its determinants; construction site layout planning, pollutants types and sources; problem indicators and factors affecting air quality in buildings and construction sites; particulate matters, dusts, gasses, hazardous processes and exposures in construction sites; air quality audit, measurements and testing technique; airflow and contaminant transport in buildings; construction site contaminants, workers and air safety, health and productivity; organization and management in construction, renovation and project neighbourhoods; legislations, standards and legal issues; modelling and simulation tools; smart monitoring sensors and control instruments; IT applications, data acquisition and transmission; case studies.

Prerequisite: Senior Standing

CE 491 Special Topics in Civil Engineering (3-0-3)

The course covers a special topic with emphasis on recent developments or to explore much deeper into one of the following civil & environmental engineering areas: structural, water resources, transportation, geotechnical and environmental engineering. A detailed syllabus of the course is announced one semester in advance.

Prerequisite: Senior Standing, Approval of the Department

CE 497 Undergraduate Research (1-6-3)

Selection of a research topic, development of research topic, writing a successful proposal, manage and carrying out research tasks, setting up bench scale setup or prototype for lab work or software for modeling based research, communicating the research findings, writing effective reports.

Prerequisite: Approval of the Department

COLLEGE OF GENERAL STUDIES

CGS 392 Career Essentials (0-2-1)

Essential Skills: Creative & critical thinking, problem solving. Essential Preparation: Job search, application, interview. Essential Knowledge: Corporate structure & culture, performance metrics, ongoing professional development.

Prerequisite: ENGL 214

CHEMICAL ENGINEERING

CHE 200 Principles of Chemical Engineering (3-0-3)

Basic principles and techniques used for calculations of material balances in chemical engineering processes. Material balance for reactive and nonreactive processes. Simple chemical engineering processes and complex systems including recycle. The first law of thermodynamics, concepts of energy, enthalpy, heat effects, conservation of energy, mechanical work. Standard heats of reaction, formation and combustion and heat effects of industrial reactions. Combined mass and energy balances.

Prerequisite: PHYS 102

Corequisite: CHEM 102

CHE 204 Fluid Mechanics (3-0-3)

The course introduces principles governing fluid flow for Newtonian and non-Newtonian fluids in laminar and turbulent flows. Mass, energy, momentum balances, dimensional analysis and simulation are used as tools to analyze flows: in pipes, in packed beds, around particles and surfaces, fluidized beds and flow meters. The course also covers: hydrostatics, exact solution of Navier-Stokes equations, constitutive equations for stresses, viscous effects and boundary layer flows.

Prerequisite: CHE 200 or PETE 101

Corequisite: MATH 202 or MATH 208

CHE 212 Introduction to Chemical Engineering Computing (1-3-2)

Programming chemical engineering calculations and problem solving, Data acquisition and processing, computer assisted design and simulation of chemical engineering problems using appropriate commercial software packages.

Prerequisites: CHE 200, ICS 104

CHE 300 Heat Transfer (3-0-3)

Modes of heat transfer. Differential equations of energy transport. Steady and transient heat conduction. Free and forced convection in laminar and turbulent flows. Momentum and heat transfer analogies. Boiling and condensation. Radiation heat transfer. Application to the design of process heat transfer equipment.

Prerequisites: CHE 212, CHE 204

CHE 303 Chemical Engineering Thermodynamics (3-0-3)

This course presents the theory and applications of chemical engineering thermodynamics. Topics covered include: review 1st and 2nd laws of thermodynamics, equations of state, thermodynamics of flow processes, steam power plants, thermodynamic relations, thermodynamics properties of pure fluids, vapor-liquid equilibria, phase diagrams, solution thermodynamics, thermodynamics properties of fluid mixtures, and chemical-reaction equilibria. Computer simulation to thermodynamic systems is applied in this course.

Prerequisites: CHE 212, MATH 202

CHE 304 Mass Transfer (3-0-3)

This course covers fundamentals of mass transfer, differential equations of mass transfer, steady-state and unsteady-state molecular diffusion, convective mass transfer, interface mass transfer, mass transfer theories, mass transfer equipment, absorption and humidification operations.

Prerequisite: CHE 204

CHE 306 Separation Processes (3-0-3)

Review vapor-liquid equilibria. Flash distillation. Column binary distillation. McCabe-Thiele and Ponchon-Savarit methods. Exact and short cut methods for multicomponent distillation. Batch distillation. Staged and packed column design. Absorption and stripping. Immiscible extraction. Computer simulation will be used to solve different type of distillation problems throughout the course.

Prerequisite: CHE 303

CHE 309 Chemical Engineering Laboratory I (0-6-2)

This laboratory emphasizes concepts presented in the transport phenomena courses. A safety session is given at the commencement of the course. Safe practices are strictly adhered to throughout the course. Students carry out selected experiments in fluid mechanics, heat transfer, thermodynamics and diffusional mass transfer. Data collected are analyzed and compared to applicable theories.

Prerequisites: CHE 300, CHE 304, ENGL 214

CHE 360 Numerical Methods in Chemical Engineering (3-0-3)

Applications of numerical methods to interpolation, differentiation, integration, and the solution of systems of linear, nonlinear, and differential equations in chemical engineering.

Note: Not be taken for credits with MATH 371 or CISE 301

Prerequisite: CHE 303

CHE 398 Internship (0-0-6)

In this course the student will spend a period of one semester of industrial employment in industry. Students are required to write a detailed formal report on their experience. Evaluation by the employer will be counted towards the grade given for this course.

Prerequisite: CHE 309

CHE 399 Summer Training (0-0-0)

A period of 12 weeks of industrial employment in appropriate industries or firms. Students are evaluated on their performance, and are required to submit a report and offer a seminar about their experience before receiving a grade of Pass or Fail for the course.

Prerequisite: CHE 309

CHE 401 Process Dynamics and Control (3-0-3)

The intent of this course is to present the fundamental principles in modeling and control of chemical processes. The topics covered in this course include: modeling of chemical processes, Laplace transfer and state-space models, approximation of complicated models, dynamics and simulation of different systems, feedback controllers, PID tuning, design and instrumentation of closed-loop control systems, control block diagrams, frequency response analysis, Bode and Nyquist stability criteria.

Prerequisites: CHE 306, CHE 360

CHE 402 Kinetics and Reactor Design (3-0-3)

Introduction to kinetics of reactions. Techniques for experimentally determining rate laws for simple and complex chemical reactions. Design and operation of isothermal batch and flow reactors. Nonisothermal reactor design and operation. Introduction to catalysis and catalytic reactors. Computer simulation of reaction systems will be implemented.

Prerequisites: CHE 303, CHEM 311

CHE 404 Hydrogen production and storage (3-0-3)
The aim of this course to provide insight into the alternative resources and technologies for hydrogen production and to discuss the present options of hydrogen storage and future needs.
Prerequisite: CHE 303 or ME 204

CHE 405 Process Design and Economics (3-0-3)
Introducing the Process flow diagrams and plant layout, conceptual design and synthesis of process flow diagrams, understanding the process conditions, technical analysis of chemical processes and use of heuristics in design and analysis, and use of simulation in equipment design and process synthesis. Engineering economic analysis of chemical processes with particular emphasis on estimation of capital cost, estimation of cost of manufacturing, time value of money, depreciation, cash flow, profitability and financial analysis, methods for decision making among alternatives.
Prerequisite: CHE 306
Corequisite: CHE 402

CHE 409 Chemical Engineering Laboratory II (0-6-2)
A laboratory to complement the theoretical derivations in stagewise operations, process dynamics and control, and kinetics and reactor design. A safety session is given at the commencement of the course. Safe practices are strictly adhered to throughout the course. Two environmental engineering reaction experiments are included. Students carry out selected experiments, analyze data collected referring to applicable theories and present their findings in formal reports.
Prerequisite: CHE 309
Corequisites: CHE 401, CHE 402

CHE 412 Integrated Design Course (1-6-3)
Development of general engineering skills and judgment needed in the solution of open-ended problems from a technical-economic viewpoint are the major goals of this course. The design of a project from conception to implementation including preliminary feasibility study, preparation of process, flow diagram, process design, pre-construction cost estimate, equipment sizing (design), selection of materials of construction, and analysis of project. Applications will be in areas such as petroleum, petrochemicals, emerging chemical industries and water desalination. Design topics will be assigned to teams of students.
Corequisite: CHE 405

CHE 422 Properties of Fluids (3-0-3)
Study on several methods for the estimation of physical, thermodynamic and transport properties of fluids commonly used in industry. Study of literature sources where property information is available. Application of these properties to process design is emphasized to give the students a complete picture of the use and importance of good property estimation.
Prerequisite: CHE 303

CHE 424 Fundamentals of Renewable Energy Processes (3-0-3)
Binary geothermal cycles. Compressed air energy storage. Wind power systems. Hydrogen fuel cells. Solar thermal collectors. Photovoltaic power systems. Biomass thermo-chemical conversion.
Prerequisite: CHE 303 or ME 204

CHE 430 Rate-Based Separation Processes (3-0-3)
The intent of this course is to present advances separation techniques practiced in chemical and petrochemical industry. Dynamics of the distillation column involving the column internals and column diameter calculations will be covered. Emphasis will be on the unit operations of multi-component gas absorption, humidification, evaporation, adsorption and ion exchange, reverse osmosis, permeation, dialysis, electrodialysis, and pervaporation.
Prerequisite: CHE 306

CHE 431 Membrane Processes Technology (3-0-3)
Membrane fundamentals and practical applications of membrane processes; membrane classifications, materials, properties and characterization, and preparation; transport through membranes, concentration polarization and membrane fouling, membrane permeability with special emphasis on membrane modules and process design; gas separation, pervaporation, ultrafiltration, reverse osmosis, and membrane reactors.
Prerequisite: CHE 304

CHE 432 Principles of Heat Exchanger Design (3-0-3)
Description and applications of different heat exchangers in process industries. Design of double pipe heat exchanger (including extended surfaces). Detailed design procedures for shell and tube heat exchanger for single phase flow. Detailed design procedures for air coolers. Selection criteria for heat exchangers. Descriptive discussion of condensers, evaporators and reboilers, novel heat exchangers and other types of heat exchangers.
Prerequisite: CHE 300 or ME 315

CHE 440 Catalysis & Catalytic Processes (3-0-3)
Basic definitions and classification of catalysts, nature and mechanism of catalytic reactions, adsorption processes, catalyst preparation and catalyst characterization. Mass and heat transport effects in catalysis. Catalyst deactivation. Design principles of heterogeneous catalytic reactors such as fixed- and fluidized-bed reactors. Industrial catalytic processes with emphasis on existing processes in Saudi Arabia.
Corequisite: CHE 402

CHE 444 Fuel Cells, Batteries and Supercapacitors (3-0-3)
Fuel cell thermodynamics and electrochemistry. Charge transport in polymer and ceramic electrolytes. Gas phase transport in fuel cells (diffusion and fluid mechanics). Energy balance and heat management. Flux balance for fuel cells. Electrochemical energy storage including batteries and supercapacitors. Power management strategies for hybrid storage systems.
Corequisite: CHE 303 or ME 204

CHE 449 Biochemical Engineering (3-0-3)
Descriptive treatment of key concepts on biochemistry. The kinetics of enzyme-catalyzed reactions and its applications. Kinetics of substrate utilization, transport phenomena in microbial systems. Design and analysis of biological reactors. Analysis of multiple interacting microbial populations in applications.
Prerequisite: CHE 304
Corequisite: CHE 402

CHE 453 Mathematical Methods in Chemical Engineering (3-0-3)
This course introduces the selection, construction, solution, and interpretation of mathematical models applicable to the study of chemical engineering problems. Topics

covered include: introduction to mathematical modeling, analytical solution of ordinary differential equations, special functions, analytical solution of partial differential equations, numerical solution of nonlinear algebraic systems, and numerical solution of systems of first order ODE's.
Prerequisites: CHE 300, CHE 304

CHE 455 Chemical Process Simulation (3-0-3)
The intent of this course is to emphasize the application of computer simulation and flowsheeting, optimization, and process synthesis techniques to the design and operation of chemical processes and equipment. Students will learn how to simulate various process units and processes, and what is in the black box of a simulator program. The topics covered in this course include: concepts of structure and information flow and tasks in the design and analysis of chemical processes, basic solution strategies in flowsheeting computations, computation sequence in solving set of equations, concept of flowsheet partitioning and tearing, steady-state unit operation models in simulator packages such as Aspen Plus, HYSYS and UniSim Design, selection of thermodynamics and physical property models, and heuristics for process synthesis. Each student will be assigned an individual process to simulate under steady-state conditions using available process simulators.
Prerequisite: CHE 306

CHE 456 Industrial Process Control (3-0-3)
Review of feed back control, cascade control, Ratio, override, selective, feed-forward, and multivariable process control. Dynamic simulation of control systems using SIMULINK and other commercial software packages. Instrumentation, design case studies and tuning case studies.
Prerequisite: CHE 401

CHE 458 Process Safety Engineering (3-0-3)
Applications of engineering principles to process safety and hazards analysis, mitigation, and prevention, with special emphasis on the chemical process industries. Includes source modeling for leakage rates, dispersion analysis, relief valve sizing, fire and explosion damage analysis, hazards identification, risk analysis, accident investigations, etc.
Prerequisites: PHYS 102, Senior Standing

CHE 461 Petroleum Refining (3-0-3)
General review of refining processes of crude oil. Shortcut methods for practical design calculations. Design of atmospheric, vacuum, and pressure columns for petroleum fractionation, including auxiliary furnaces and condensers. Recent developments in heavy oil processing.
Prerequisite: CHE 306

CHE 462 Petrochemical Industries (3-0-3)
Process technologies used in petrochemical industries, such as thermal and catalytic cracking will be introduced. Basic, intermediate and final petrochemicals are studied. These include synthesis gas and derivatives, ethylene, propylene, butene, BTX, and their derivatives. Competing technologies will be assessed from the chemical engineering point of view.
Prerequisite: CHE 306

CHE 463 Polymer Technology (3-0-3)

Structure and physical properties of polymers. Homogeneous and heterogeneous polymerization processes. The chemical, mechanical, and engineering properties of polymers as well as polymer processing and rheology are emphasized in this course.

Prerequisite: ME 205 or ME 207 or ME 2016 or CE 204 or CHEM 458 or Equivalent

CHE 464 Refining and Petrochemicals Technology and Economics (3-0-3)

The characteristics of the industry in terms of feed stocks and products interaction, processes and technologies, and Economics are introduced. Petroleum fractionation and general review of refining processes of crude oil are introduced. Important petrochemical products are introduced with emphasis on those produced in Saudi Arabia. The basic unit processes such as hydrotreating, cracking, reforming, dehydrogenation, oxidation etc., are introduced along with their applications in the industry. The economics and cost of production is discussed whenever relevant. The course will emphasize the basic concepts and principles of the industry and will avoid unnecessary and descriptive process details. Integration of the Petrochemical and Petroleum Refining industries will be highlighted whenever applicable.

Prerequisite: CHE 306

CHE 465 Process Integration and Optimization (3-0-3)

This course presents recent advances in chemical process integration and synthesis. The course presents systematic and state-of-the-art techniques for understanding the global insights of mass and energy flows within a process and how these integrated insights can be used to optimize process performance. A variety of mathematical and visualization tools are presented. In particular, emphasis is given to fundamental integration and synthesis methodologies along with their applications to the process industries.

Prerequisite: CHE 306

CHE 470 Process Air Pollution Control (3-0-3)

Sources and effects of air pollution; air quality, atmospheric reactions and scavenging processes. Meteorological setting for dispersion of air pollutants. Theory of atmospheric dispersion modeling. Air pollution control concepts, selection, evaluation and application of control devices for emission and control from chemical and petrochemical industries. Sustainability and minimization of environmental impact.

Prerequisite: Senior Standing

CHE 471 Process Water Pollution Control (3-0-3)

Water quality and pollution, industrial wastewater characterization, classification of wastewater processes. Modeling and design of biological waste treatment processes. Analysis of chemical and physical processes for wastewater treatment in process industries. Sustainability and minimization of environmental impact.

Prerequisite: CHE 304

CHE 472 Corrosion (3-0-3)

Study of corrosion mechanisms and techniques used in prevention and control. Electrochemistry and its application to corrosion. Material selection for different environments.

Prerequisite: CHEM 311

CHE 473 Desalination (3-0-3)
Description of methods of water analysis and treatment. Study of properties of water and aqueous solutions. Detailed discussion and analysis of design, maintenance, energy requirements and economics of the major processes of desalination such as distillation, reverse osmosis, and electrodialysis.
Prerequisites: CHE 303, CHE 304

CHE 475 Climate Change Effects and Mitigation (3-0-3)
Natural resources and conservation; resources under stress; effects of climate change on water resources; effects of climate change on agriculture; effects of climate change on forest resources; effects of climate change on air quality; climate change coping strategies, adaptation and mitigation; disaster and vulnerability; tools for reducing vulnerability; model based predictions of the effects of climate change.
Prerequisites: Senior Standing

CHE 477 Materials Evaluation and Selection (3-0-3)
This course is designed to acquaint students with the theoretical reasoning and experimental methods used in evaluating both crystalline and non-crystalline materials covering metallic, polymeric and ceramic materials. The principles involved in their selection based on mechanical properties, resistance to degradation, and wear, and special properties are illustrated in the practical examples from process industries.
Prerequisite: ME 207

CHE 480 Energy Technology (3-0-3)
Statistics on global energy use, supply and demand of energy, energy generation from fossil and non-fossil fuels. Energy transportation and storage, energy from low-calorific value fuels, energy conservation and economics, and energy management.
Prerequisite: CHE 303

CHE 484 Polymer Composites and Applications (3-0-3)
Polymer Compounding & Additives for Polymers. Polymer Blends & Composites. Polymer Material Selection for specified applications. Polymer Products Processing Techniques. Application of Polymer Products. Polymers in Building & Construction. Petroleum Industry. Pipe & Cable Industry. Polymers in Automobile & Aerospace Sector. Fiber, Textile, Paint & Adhesive Technology. Polymer Composites Degradation. Polymer Composites Recycling. Additives.
Prerequisite: ME 205 or ME 207 or ME 216 or CHEM 458 or CE 303 or CE 204

CHE 485 Fundamentals of Radioactive Waste Management and safety (3-0-3)
This course is designed to provide the students about the technology of the general management of the radioactive waste generated during the operation of nuclear power plant and nuclear fuel cycle facility including the treatment and disposal of the wastes. Background information on the sources of the gaseous, liquid and solid radioactive waste, and process and treatment facilities, solidification and volume reduction technology, packaging and transportation, storage methods of the wastes and spent nuclear fuel, design, safety and construction of the waste repositories, migration of the radionuclide at the subsurface, environmental monitoring and protection, repository safety assessment, decontamination and decommissioning, and the management of spent nuclear fuel will be covered.
Prerequisites: MATH 102, PHYS 102

CHE 490 Special Topics in Chemical Engineering I (3-0-3)
Selected topics from the broad area of chemical engineering. The specific contents of the course is published one semester in advance.
Prerequisite: Approval of the Department

CHE 492 Special Topics in Chemical Engineering II (3-0-3)
Selected topics from the broad area of chemical engineering. The specific contents of the course is published one semester in advance.
Prerequisite: Approval of the Department

CHE 497 Chemical Engineering Undergraduate Research (3-0-3)
Selection of a research topic, development of research topic, writing a successful proposal, manage and carrying out research tasks, setting up bench scale setup or prototype for lab work or software for modeling-based research, communicating the research findings, writing effective reports.
Prerequisite: Approval of the Department

CHEMISTRY

CHEM 101 Principles of Chemical Science I (3-3-4)
Matter, atomic structure and the periodic table, chemical bonding, stoichiometry of pure substances, reaction in aqueous solutions, states of matter (gases, liquids, and solids), mixtures (with emphasis on some physical aspects of solutions), and thermochemistry.
Laboratory: Qualitative and quantitative aspects of general chemistry.

CHEM 102 Principles of Chemical Science II (3-4-4)
Chemical equilibria (gases, acids and bases, and solubility equilibria), chemical kinetics, spontaneity of reactions, coordination chemistry, nuclear chemistry, electrochemistry, chemistry of selected representative elements, organic structure and reactions, chemistry of materials.
Laboratory: Qualitative and quantitative aspects of general chemistry
Prerequisite: CHEM 101

CHEM 105 General Chemistry for Engineers (3-3-4)
Matter, atomic structure and the periodic table, chemical bonding, stoichiometry, energy and chemistry, chemical equilibria, chemical kinetics, spontaneity of reactions, electrochemistry and applications to engineering problems.
Laboratory: Experiments in general chemistry relevant to engineering problems.

CHEM 111 Basics of Environmental Chemistry (2-0-2)
Elements, compounds, chemical equations, and gas laws, spontaneity of reactions, chemical kinetics, chemical equilibria (gases, acids and bases, redox and complexation reactions), organic structures and reactions, carbohydrates, proteins and fats, pesticides and organic pollutants, colloids.
Note: Not to be taken for credits with CHEM 102
Prerequisite: CHEM 101

CHEM 201 Organic Chemistry I (3-0-3)
Structure, nomenclature, bonding, isomerism, stereochemistry and properties of organic compounds. Synthesis and reactions of alkanes, alkenes, alkynes, alcohols, ethers, alkyl halides and aromatics. Mechanism of addition, elimination, substitution, radical and electrophilic aromatic substitution reactions.
Prerequisite: CHEM 102
Corequisite: CHEM 202

CHEM 202 Organic Chemistry Laboratory (0-4-1)
Micro-scale laboratory techniques, basic characterizations, separations, purifications and synthesis of organic compounds.
Corequisite: CHEM 201

CHEM 204 Organic Chemistry II (3-0-3)
Spectroscopic identification of organic compounds. Synthesis and properties of carboxylic acids and derivatives, aldehydes, ketones, amines, hetereocycles, carbohydrates and amino acids. Conjugate additions, reactions of carbon nucleophiles, pericyclic reactions.
Prerequisite: CHEM 201

CHEM 212 Physical Chemistry I: Chemical Thermodynamics (3-0-3)
Basic gas laws, laws of thermodynamics, chemical equilibria, ideal and real solutions, phase equilibria, electrolytic solutions and electrochemistry, kinetic theory of gases.
Prerequisites: CHEM 102, MATH 102, PHYS 102
Corequisite: CHEM 213

CHEM 213 Chemical Thermodynamics Laboratory (0-4-1)
Experiments in physical chemistry including techniques of physical measurements, error analysis and statistics, heat capacity, Joule-Thompson experiment, calorimetry, vapor pressure, fractional distillation, Ebullioscopic molecular weight, Temperature-Composition (T-X) diagrams for ideal and real solutions, Temperature-Composition (T-X) diagram for a solid solution.
Corequisite: CHEM 212

CHEM 221 Quantitative Chemical Analysis (2-0-2)
Introduction to quantitative and qualitative analyses, analytical processes and validation of analytical methods, data handling and statistical concepts, gravimetric methods of analysis, volumetric analysis. Acid-base, precipitation and complex formation titrations. Redox reactions, electrode potential and electrochemical cells, potentiometry, voltammetry, solvent extraction, chromatographic methods.
Note: Not to be taken for credits with CHEM 321
Prerequisite: CHEM 102
Corequisite: CHEM 222

CHEM 222 Quantitative Chemical Analysis Laboratory (0-4-1)
Experiments in analytical chemistry, selected methods such as calibration of analytical instruments, volumetric, potentiometric and conductometric titrations, analysis by ion selective electrodes, back titration, complexation and gravimetric analysis.
Corequisite: CHEM 221

CHEM 305 Organic Synthesis and Characterization Laboratory (0-8-2)
Laboratory synthesis, purification and characterization of organic compounds. Introduction to multi-step synthesis experiments. Utilization of spectroscopic and wet chemical techniques to determine structures of unknown organic compounds.
Corequisite: CHEM 204

CHEM 311 Physical Chemistry II: Kinetics and Spectroscopy (3-0-3)
Reaction rates and mechanisms, temperature dependence of rate constant. Lindemann mechanism, catalysis, adsorption isotherms, photochemistry, transport properties, the Schrodinger equation, quantum mechanical postulates, a particle in a box, vibration-rotation spectroscopy of diatomic molecules, ensembles and molecular partition functions.
Prerequisite: CHEM 212 or CHE 303 or ME 203
Corequisite: CHEM 312

CHEM 312 Kinetics and Spectroscopy Laboratory (0-4-1)
Experiments in physical chemistry including chemical kinetics, transport properties of gases and liquids, and vibrational and electronic spectroscopy.
Corequisite: CHEM 311

CHEM 313 Introduction to Computational Chemistry (2-4-3)

Overview of molecular mechanics, semiempirical and quantum mechanical approaches, basic theory and algorithms behind common computational chemistry methods. Emphasis will be placed on molecular modeling and its applications to interpret physicochemical properties of chemical systems. Implementation of selected software to solve chemical and numerical problems.

Laboratory: Projects dealing with energy minimization, conformational analysis, reaction mechanisms, spectroscopic analysis and others topics for selected chemical systems.

Prerequisite: CHEM 311

CHEM 315 Chemical Kinetics and Reaction Mechanisms (3-0-3)

Determination of kinetic order and rate constants, catalysis, isotope effects, medium effects, fast reactions, chemical interpretations of the transition state, structure-reactivity relationships, methodology of mechanistic organic/inorganic chemistry, reactive intermediates, kinetics of homogeneous and heterogeneous catalysis.

Prerequisite: CHEM 311

CHEM 321 Instrumental Analysis for Engineers (2-4-3)

Modern instrumental techniques in chemical analysis including electrochemical, spectroscopic and separation methods. Discussing the theoretical concepts, the components of the instruments, handling the data, calibration, optimization and output interpretation. Similarities and differences between various techniques will be emphasized.

Laboratory: Experiments related to analysis using advanced instrumental techniques.

Note: Not open for Chemistry students

Prerequisite: CHEM 102

CHEM 324 Instrumental Chemical Analysis (3-0-3)

A survey of modern instrumental techniques in chemical analysis including electrochemical, spectroscopic and separation methods, covering instruments handling, calibration, optimization and output interpretation. Similarities and differences between various techniques will be emphasized.

Prerequisite: CHEM 221 or CHEM 321

Corequisite: CHEM 325

CHEM 325 Instrumental Chemical Analysis Laboratory (0-4-1)

Experiments related to qualitative and quantitative chemical analysis using advanced instrumental techniques such as potentiometry, conductometry, ion selective electrodes, electrogravimetry, molecular absorption, atomic absorption, atomic emission, inductively coupled plasma (I.C.P), mass spectrometry, ion-exchange chromatography, gas-chromatography (G.C) and High-performance liquid chromatography (HPLC).

Corequisite: CHEM 324

CHEM 327 Environmental Chemistry (3-0-3)

Environmental chemistry in global perspective, chemistry of earth's atmosphere, chemistry of urban and indoor atmospheres, global climate, chemistry of the hydrosphere, aquatic systems, water pollution, wastewater analysis and treatment chemistry, environmental chemistry of colloids and surfaces, microbiological processes, solid wastes, organic biocides.

Prerequisite: CHEM 102 or CHEM 111

CHEM 335 Fundamentals of Inorganic Chemistry (3-0-3)

Atomic structure and bonding, symmetry and group theory, molecular orbitals, acid-base and donor acceptor chemistry, coordination chemistry, theories and experimental evidences of electronic structure, reactions and mechanisms.

Prerequisite: CHEM 102

CHEM 336 Advanced Inorganic Chemistry (2-0-2)

Topics related to modern inorganic chemistry such as selected physical techniques in inorganic chemistry, organometallic chemistry, bonding, reactions and applications to catalysis, f-block chemistry, bioinorganic chemistry and inorganic chemistry in medicine.

Prerequisite: CHEM 335

Corequisite: CHEM 337

CHEM 337 Inorganic Synthesis & Characterization Laboratory (0-4-1)

Synthesis and characterization of inorganic compounds using different synthetic and characterization techniques including main group, coordination, organometallic and bioinorganic compounds.

Corequisite: CHEM 336

CHEM 363 Biochemistry (3-0-3)

Structures and functions of proteins, carbohydrates, nucleic acids, lipids and membranes, enzyme kinetics, mechanisms and regulation, bioenergetics, metabolic pathways, oxidation, reduction and electron transfer reactions, DNA and information transfer.

Prerequisite: CHEM 201

CHEM 399 Summer Training (0-0-0)

A period of two months of industrial employment in appropriate industries or firms. Summer training could also be conducted in a university or a research institution/center. Students are evaluated on their performance, and are required to submit a report and present a seminar about their experience before receiving a grade for this course.

Prerequisites: ENGL 214, Junior Standing, Approval of the Department

CHEM 401 Special Topics (3-0-3)

State-of-the-art topics in Chemistry.

Prerequisite: Permission of the Instructor

CHEM 402 Structure and Mechanisms in Organic Chemistry (3-0-3)

Chemical bonding and structure, stereochemical principles, conformational and steric effects, methods of mechanistic study, nucleophilic substitution, polar addition and elimination, carbanions, carbonyl compounds, aromatic substitution, concerted reactions, other interesting reaction types.

Prerequisite: CHEM 204

CHEM 403 Synthetic Organic Chemistry (3-0-3)

Organic reaction types, less common functional groups, reaction mechanisms, basic synthetic methods, retrosynthesis and selected total synthesis of natural products.

Prerequisite: CHEM 204

CHEM 406 Spectroscopic Identification of Organic Compounds (3-0-3)

Identification and structural analysis of organic compounds by nuclear magnetic resonance, infrared and ultraviolet spectroscopy, and mass spectrometry. Introduction to instrumentation,

sample handling and basic theory of each technique with emphasis on their practical applications for structure determination.
Prerequisite: CHEM 204

CHEM 415 Molecular Spectroscopy (3-0-3)
General review of wave mechanics in relation to molecular systems, vibrational and rotational energies of molecules, absorption and emission of radiation, molecular symmetry and group theory, electronic spectra of diatomic and polyatomic molecules.
Prerequisite: CHEM 311

CHEM 416 Photochemistry (3-0-3)
A study of the fundamental photochemical and photophysical processes which follow absorption of radiation by molecules and the techniques used to study these processes.
Prerequisite: CHEM 311

CHEM 418 Quantum Chemistry (3-0-3)
Transition from classical mechanics to quantum mechanics, review of quantum mechanical postulates, the hydrogen atom, angular momentum, perturbation theory, chemical bonding, molecular structures and symmetries, atomic spectra and atomic structure, molecular rotations and vibrations.
Prerequisite: CHEM 311

CHEM 427 Quality Assurance in Chemical Laboratories (3-0-3)
Introduction to quality assurance in the analytical chemistry laboratory, principles of valid analytical measurements (VAM), different approaches to ensure quality of analytical measurement results, quality control measures such as control charts, use of certified reference materials and inter-laboratory trials. Measurement uncertainty, method validation, metrological traceability, accreditations to good laboratory practice (e.g. ISO 17025 and OECD).
Prerequisite: CHEM 321 or CHEM 324

CHEM 428 Separation Science and Applications (3-0-3)
Separation techniques used in various analytical applications, separation techniques principles, operation, design, problems, optimization and interpretation. Modern techniques to be covered include gas chromatography, high-performance liquid chromatography, ion chromatography, capillary electrophoresis and two dimensional separation methods. Recent developments in chromatographic techniques and applications of analytical separations in oil industry, petrochemicals, biomedical, food and environmental chemistry.
Prerequisite: CHEM 321 or CHEM 324

CHEM 436 Application of Group Theory to Chemistry (3-0-3)
Introduction, symmetry elements and symmetry operations, introduction to groups, symmetry point groups, class structure, representations and character tables, chemical applications of symmetry, bonding and spectral interpretation from group theory.
Prerequisite: CHEM 335

CHEM 451 Polymer Chemistry (3-0-3)
Basic concept of polymer chemistry, fundamental bases for understanding the principles associated with the polymerization reactions using a number of traditional and contemporary polymerization techniques (step-growth polymerization, radical polymerization, ionic

polymerization, ring-opening polymerization, polymerization by transition metal catalysts) with an emphasis on the mechanisms, kinetics, stereochemistry, structure, structure-property relationships and resulting properties of polymers.
Note: Not to be taken for credits with CHEM 537
Prerequisite: Senior Standing

CHEM 452 Polymer Chemistry Laboratory (0-4-1)
Practical experience in polymer chemistry, synthesis of polymers, kinetics and mechanisms of polymerization reactions, structural analysis, characterization and properties of polymers.
Corequisite: CHEM 451

CHEM 454 Chemistry of Corrosion (3-0-3)
Electrochemical corrosion processes and variables, anodic and cathodic corrosion, corrosion acceleration versus passivation, electrochemical thermodynamics: the Gibbs function, electrochemical reactions and equilibrium potentials, kinetics of electrode processes, electrochemical corrosion-rate measurements, localized corrosion, corrosion protection, inhibition and materials selection.
Prerequisite: CHEM 311

CHEM 455 Industrial Inorganic Chemistry (3-0-3)
A study of inorganic chemicals and products with emphasis on industrial processes. The focus is on sulfur and sulfuric acid, ammonia and its derivatives, cement, glasses, ceramics, electrolytic processes, chlor-alkali industries, phosphorous industries, fertilizer chemicals and metallurgical processes.
Prerequisite: CHEM 335

CHEM 456 Industrial Organic Chemistry (3-0-3)
A study of the organic chemicals and products derived mainly from sources other than petroleum. Special emphasis is on oils and fats, pharmaceuticals, agrochemical, fermentation products, surface coatings, explosives, detergents, and pollution and waste management.
Prerequisite: CHEM 201

CHEM 457 Polymer Characterization and Analysis (3-0-3)
Polymer characterization and analysis using various qualitative and quantitative analytical instruments. Principles, applications, and limitations of the classical analytical techniques required for analysis and characterizing of different kinds of polymers. Analysis of molecular weight, mechanical properties, thermal properties, in addition to spectral analysis. Interpretation of data collected using different techniques of polymer analysis.
Prerequisite: CHEM 451 or CHE 463

CHEM 458 Materials Chemistry (3-0-3)
Solid state chemistry, classification of materials, modern methods of synthesis and fabrication, characterization and applications. The topics include ceramics, glasses, metals, semiconductors, polymeric materials, nanomaterials and modern methods of materials characterization.
Prerequisite: Senior Standing
Corequisite: CHEM 459

CHEM 459 Material Synthesis & Characterization Laboratory (0-4-1)
Experiments in the synthesis and characterization of selected materials such as zeolites, metal-organic frameworks, superconductors, semiconductors, quantum dots, nano-catalysts, polymers, materials for energy application, glasses and cementitious materials with hands-on experience on modern methods of characterization.
Corequisite: CHEM 458

CHEM 461 Fundamentals of Petrochemical Industry (3-0-3)
This course deals with the raw materials, natural gas, associated gases and crude oils and their physical and chemical properties, composition, and processing. The course explains, through the chemistry of petrochemical reactions, the transformation of natural gas, associated gases, crude oil and further processing of paraffins, olefins and aromatics to petrochemicals. Petrochemical industry has grown enormously in Saudi Arabia.
Prerequisite: CHEM 201

CHEM 462 Spectroscopy in Catalysis (3-0-3)
This course describes absorption and resonance spectroscopy and interaction between electromagnetic radiation and catalysts. Overview of characterization methods of homogeneous and heterogeneous catalysts. Literature studies of cases from homogeneous and heterogeneous catalysis. Introduction to the mechanistic studies of some catalytic reactions.
Prerequisite: CHEM 311

CHEM 463 Industrial Catalysis (3-0-3)
Fundamentals of homogenous catalysis; homogeneously catalyzed industrial processes such as Oxo and Wacker processes; fundamentals of heterogeneous catalysis; catalyst production and characterization; role of environmental catalysis in green chemistry; electrocatalysis; photocatalysis; and phase transfer catalysis. Important catalytic processes in Saudi Arabia.
Prerequisites: Senior Standing

CHEM 479 Chemistry Seminar (1-0-1)
Students will participate with faculty members in giving and attending seminars of general chemical interest. Topics cover both reviews of current literature and discussion of research in progress. The course includes also a guide to the use of traditional and automated methods for storage and retrieval of chemical information.
Prerequisite: Senior Standing

CHEM 488 Undergraduate Research (0-8-2)
Each student is introduced to research through a specific research project under guidance of a faculty member. The students are exposed to the fundamentals of basic research where they gain experience in experimental techniques, data analysis, and interpretation of results with focus on the process of scientific discovery. Submission of a final report is required at the end of this course.
Prerequisite: Senior Standing

CONTROL AND INSTRUMENTATION ENGINEERING

CIE 201 Introduction to Control and Instrumentation (1-0-1)
This course introduces students to Control and Instrumentation Systems Engineering concepts and methodology. The course also gives a broad picture of the career, curriculum, and engineering application in Control and Instrumentation Systems Engineering applications.
Prerequisite: MATH 102

CIE 204 Digital Systems Design (2-3-3)
Binary arithmetic, Boolean algebra, Boolean functions and their simplification. Implementation of Boolean functions using Logic Gates, SSI, MSI, and LSI chips, Analysis and Design of Combinational circuits, Sequential Logic: Flip-Flops, Counters, and Registers, Analysis and Design of sequential circuits, Basic elements of digital Computers: Register-transfer, Micro operations, Instruction codes, Processor organization Arithmetic Logic Unit, ADC and DACS.
Note: Not to be taken for credits with EE 200
Prerequisite: PHYS 102

CIE 209 Introduction to Information Technology (2-0-2)
This course introduces fundamentals of information technology and systems; their structures and components and current trends, such as the Internet, wireless communication, pervasive computing and IT Enterprise applications to improve business performance. The course emphasizes on industrial automation applications of IT, process system and process control, protocol architectures with several case studies.
Prerequisite: CIE 201 or approval of the department

CIE 301 Numerical Methods (3-0-3)
Roots of nonlinear equations. Solutions of systems of linear algebraic equations. Numerical differentiation and integration. Interpolation. Least squares and regression analysis. Numerical solution of ordinary and partial differential equations. Introduction to error analysis. Engineering case studies.
Prerequisites: ICS 104, MATH 201

CIE 305 Linear Control Systems (3-0-3)
Linear systems, Modeling of physical systems, Modeling of Inventory Control, Production and Financial Systems, Ordinary Differential equations models, Laplace Transform, transfer functions, block diagram manipulation. Open loop and close loop systems, time domain analysis, response of systems to different test signals, steady state analysis, concept of stability, Routh-Hurwitz criteria, controller design, and simple root locus analysis and controller design.
Prerequisites: MATH 208, EE 204 or EE 201

CIE 306 Linear Control Systems (0-3-1)
This course consists of set of lab experiments for students to gain hands-on experience with modeling, analyzing and controlling linear control systems. They also develop proficiency in using MATLAB and SIMULINK software for simulating such systems.
Corequisite: CIE 305

CIE 312 Instrumentation Engineering (2-3-3)

General measurement systems; static and dynamic characteristics, two port networks and loading effects, signals and noise; error and uncertainty analysis, modeling of sensing elements such as resistive, inductive, electromagnetic, thermoelectric, elastic, piezo-electric, electromechanical, optical etc.; signal conditioning elements, D.C. and A.C. bridges, compensation by linearization, feedback, operational amplifiers, modulation/ demodulation; signal processing elements, microcomputer-based instrumentation, I/0 devices, interfaces, data display units, examples of measurement systems such as flow, pressure, level, temperature, etc.

Prerequisite: EE 203

CIE 315 Signals and Systems (3-0-3)

Basic models of continuous and discrete systems, Major characteristics of signals (energy, power and peak amplitude), Properties of LTI systems, Fourier analysis of continuous and discrete systems, Basic concept of signal modulation, signal sampling and reconstruction. Basic time and frequency characterization of signals and systems and basic concept of transfer function. Basic random signal analysis. Application of signal and system concepts to linear control system and digital signal processing.

Note: Not to be taken for credits with EE 207

Prerequisite: Junior Standing

CIE 316 Control Systems Design (2-3-3)

Transient and Steady State analysis and design specifications. Root locus, Design using Root locus. Frequency Response Techniques, Bode plot, Nyquist plot, principle of Specifications and controller Design in the Frequency domain. State-space model, analysis of the state-space model, Controllability and Observability, pole placement, and robust Control.

Prerequisite: CIE 305

CIE 318 Computer Control Systems (2-3-3)

Elements of Computer Control Systems, A/D and D/A, Sampling theorem, signal conditioning, anti-alias filters, sensors, actuators. Discrete time systems, digital control design, digital PID control. Programmable logic controllers, computer control technology including distributed computer control, fieldbus technology, and OLE for process control.

Prerequisite: CIE 315

CIE 390 Seminars (0-0-0)

The purpose of this course is to raise students' awareness of contemporary issues in their discipline and otherwise. The student has to attend a required number of seminars, workshops, professional societal meetings or governmental agency conferences; at least half of these should address issues in his discipline. The student has to attend a required number of industrial visits.

Prerequisite: Junior Standing

CIE 398 Internship (0-0-6)

A 28-week program of industrial training approved by the department. The student must submit a comprehensive report on his work during that period.

Prerequisites: Completion of 85 Credit Hours, Attainment of CGPA and major GPA of 2.0, Fulfillment of Departmental Requirements include ENGL214, CIE 312, CIE390 and at least two of CIE316, CIE314 and CIE418

CIE 399 Summer Training (0-0-0)

An 8-week program of industrial training approved by the department. The student must submit a report on his work during that period.

Prerequisite: ENGL 214

CIE 410 Automation Devices and Electronics (2-3-3)

Basic concept of switching, different input-output switching devices and designing automation systems using PLCs. Power-electronic switching devices, DC and AC power control using SCR, TRIAC, power transistors, etc. Concept of actuation, linear and rotary actuators of electrical and fluidic types. Principle of operation and modeling of electro-mechanical devices, and various types of DC, AC and Stepper motors, and their speed-control through power-electronic switching circuits.

Prerequisite: EE 203

CIE 412 Mechatronics (2-3-3)

Mechatronics is the synergistic integration of mechanism, electronics, and computer control to achieve a functional system. Fundamentals of interfacing of modern mixed electrical, mechanical, and computers systems. Sensors, Signal Conditioning, Electro-Mechanical Actuation, Basic System Modeling, Essentials of Dynamic Systems, Data Acquisition and Virtual Instrumentation, and PC-Based and Embedded Controllers. Physical properties, mathematical modeling for computer simulation. Applications illustrated by numerically and experimentally generated results.

Prerequisite: CIE 410

CIE 418 Industrial Process Control (3-0-3)

Modeling of processes, Mass balance, and Energy balance, Models of representative processes, Dynamic response, and Linearization. Process identification using time and frequency domain techniques. Time delay, Smith predictor. Basic and advanced control strategies, e.g. PID, Feed forward, Internal model, and supervisory control. Time domain controller design, Controller tuning. Controller design in the frequency domain, Optimization Techniques and Supervisory Control. Case studies.

Prerequisite: CIE 305

CIE 421 Simulation and Control for Process Industry (3-0-3)

Review of the Fundamental laws, mathematical modeling; model and simulation of typical processes. Computer simulation tools, Virtual Instruments, MMI. Systems identification, IMC, Predictive control, DMC, Neural Network modeling and control. Students will work out simulation and control projects, using DYNSIM process dynamic simulation and Simulink, of typical processes, e.g., CSTR, Gas Surge Drum, Isothermal Chemical Reactor, Vaporizer, Binary Column, Heat Exchanger, etc.

Prerequisite: Senior Standing

CIE 422 Intelligent Controllers (3-0-3)

The course offers an introductory material to advanced control strategies such as fuzzy and neural network based controllers. The need for model–free control, linguistic based control, foundations of fuzzy set theory. Main approaches of fuzzy control, design issues, fundamental of neural networks, neural networks architecture, neural networks based controller design, and hybrid fuzzy-neural control. Case studies in industrial intelligent control systems including process control, aerospace and robotics.

Prerequisite: Senior Standing

CIE 423 Model Predictive Control (3-0-3)
The course introduces the concept of model predictive control (MPC), their importance in process industry, implementation issues and application examples. The course covers: model based predictive control, generalized MPC, constrained MPC, some commercial MPC, issues in implementation in industrial control systems and case studies.
Prerequisite: CIE 316

CIE 424 Identification of Linear Systems (3-0-3)
Dynamical systems and their mathematical models, random variables and signals, The system identification procedure. Guiding principles behind least-squares parameter estimation, statistical properties of estimates. Identification of the transfer function of linear systems in continuous time. Models for discrete-time linear systems: FIR, AR, ARX, ARMA. Various methods for recursive estimation. Experiments for data acquisition and their design.
Prerequisite: CIE 301, CIE 401

CIE 431 Industrial Automation (3-0-3)
Industrial instrumentation: measurement techniques in industrial processes. Computer data acquisition. NC and CNC machine tools. Computer process interfacing and control. Feedback control systems. Group technology. Flexible manufacturing systems. Automated assembly. Industrial robots. Computer-aided inspection and testing. Automated factories. Case studies.
Prerequisite: Senior Standing

CIE 432 Digital Signal Processing (3-0-3)
Need for, advantages and basic structure of DSP systems. Basic concepts of discrete-time signals and systems. Z-Transform, discrete Fourier Transform (DFT) and frequency analysis of signals and systems. Efficient implementation of DFT: Fast Fourier Transform (FFT) algorithms. Implementation issues of discrete-time systems. Digital filter design techniques. Applications of DSP systems.
Prerequisite: CIE 315

CIE 433 Condition-based Maintenance (3-0-3)
Condition-based maintenance process. Data collection and Analysis process. Decision making. Condition-based monitoring components sensors and software programs. CMMS. Hazard and reliability functions. Models for CBM. Reliability improvement. Integration of CBM into the control design and operation. Engineering case studies.
Prerequisite: CIE 305 or approval of the department

CIE 434 Computer Numerical Control (3-0-3)
Review of DC motors, optical encoders, precision control of DC motors, Stepper motors, control of stepper motors, micro-step control, gearboxes, belts, motor torque and power sizing, programming motion using G-code. Basic structure and functions of milling machines and lathes. Motion simulation, CAD/CAM system. Robot arms construction, analysis, and motion programming. Case study of retrofitting conventional machines with Computer Numerical Control.
Prerequisites: Senior Standing, CIE 401

CIE 435 Distributed Computer Control Systems (3-0-3)
Hierarchy of plant communication systems, field equipment, DCS systems, SCADA systems, Supervisory control and production control, Man-Machine Interface (MMI). Local area networks, OSI network architectures, serial communications, IEEE 802.xx standards, Local

area networks for industrial applications, Field buses, Hart protocol, Foundation Field Bus, Profibus, CAN bus, etc. Smart instruments. Examples of industrial DCS systems.
Prerequisite: CIE 312

CIE 438 Instrumentation for Process Control (2-3-3)
Process and Instrumentation diagrams. Signal conditioning: 4-20 mA circuits, E/I transducers, bridges (AC and DC), design of bridges, operational amplifier circuits, filters (LP & HP), power supplies, reference voltages. Instrumentation for temperature and flow measurement in process industry. Ultrasonic and Infrared measurements. Introduction to fieldbus, Plant network hierarchy and DCS systems. LABVIEW, virtual instrumentation, Visual programming, and Human Machine Interface.
Prerequisite: CIE 312 or Consent of the Instructor

CIE 439 Special Topics in Instrumentation (3-0-3)
A course in an area of instrumentation reflecting current theory and practice.
Prerequisite: Approval of the Department

CIE 441 Linear Optimal Control (3-0-3)
Review of state variable models, Review of basic matrix algebra, Static optimization, Formulation of optimal control problems, Principle of optimality. The linear quadratic regulator problem, properties of the algebraic Riccati equation (ARE) The minimum principle and time optimal control problems. Output feedback design. Homework assignments include design and simulation using MATLAB or other similar software packages.
Prerequisite: CIE 316

CIE 442 Stochastic Control (3-0-3)
Probability, Random Variables and distributions, correlation, MA, AR, and ARMA systems, power spectrum, Spectral factorization, Weiner-Hopf filter. Stochastic control systems, Minimum variance control, State-variable forms, Kalman filter, LQG feedback systems. Cases studies from published work.
Prerequisite: CIE 316

CIE 443 Introduction to Robust Control (3-0-3)
This course introduces the concepts of uncertainty and Modeling Error in Control System Analysis and Design. Review the basic methods and tools of Classical Control. Robust stabilization, Loop shaping, Introduction to H_∞ Optimal Control Analysis and Synthesis. Design examples.
Prerequisite: CIE 316

CIE 449 Special Topics in Control (3-0-3)
A course in an area of control reflecting current theory and practice.
Prerequisite: Approval of the Department

CIE 451 Introduction to Biomedical Engineering (3-0-3)
Basics of anatomy and biological science. Fundamentals of engineering applications in biomedicine. Biomedical instrumentation and information technology, control and communication in biomedicine. eHealth and telemedicine.
Prerequisite: Senior Standing

CIE 452 Theory of Stochastic Systems (3-0-3)

Review of basic Probability, Statistical Independence, Conditional Expectation and Characteristic Function. Introduction to Stochastic Processes, Stationarity and Ergodicity. Markov Chains and Poisson Processes. Linear Models of Continuous and Discrete Stochastic Processes. Engineering Applications.

Prerequisites: Senior Standing, ISE 205

CIE 453 Methodology for Large Scale Systems (3-0-3)

An overview of large-scale problems and the framework for Systems Engineering. Graphic tools for Systems Engineering. Interaction matrices and graphs, interpretive structure modeling. Spare matrix and decomposition techniques. Model reduction techniques. Case studies.

Prerequisite: Senior Standing

CIE 454 Computer-Aided Manufacturing and Robotics (2-3-3)

High volume discrete parts production systems. Fundamentals of CAD/CAM. Computers in manufacturing. Computer process monitoring. Systems for manufacturing support. Group technology and integrated manufacturing systems. Case studies for robots in industry. CAD/CAM using computer graphics laboratory.

Prerequisite: Senior Standing

CIE 455 Advanced Instrumentation (3-0-3)

Micro-machined sensors, Fiber optical sensors, Gas chromatography, Gas detectors, Environment monitoring systems, NMR, Soft-sensing techniques.

Prerequisite: CIE 312

CIE 456 Safety and Reliability of Control Systems (3-0-3)

DCS systems, Intrinsic safety, Emergency shutdown ESD systems, reliability of instruments and control systems, MTBF, Redundant systems, Safety standards, Classification of industrial process, Safety integrity levels (SIL), Quantitative risk assessment (QRA), Safety and control networks, Fieldbus for safety systems, Cost benefit analysis, Best practices.

Prerequisite: Senior Standing

CIE 457 Industrial Communication Systems (3-0-3)

The course introduces the students to the latest trends in industrial communications systems in a practical theme. The course starts by previewing the main topics in communications systems such as modulation and coding. The course then covers the main communication network standards used in industry. The course covers mainly all data layers from the field instruments to the TCP/IP and world-wide web and even latest wireless data exchange techniques. Case studies of industrial DCS and CIM and their integration with the enterprise networks.

Prerequisite: CIE 401 or Consent of the Instructor

CIE 458 Advanced Process Modeling and Control (3-0-3)

Fundamental laws, mathematical modeling; modeling and simulation of typical processes, e.g., CSTR, Gas phase CSTR, , binary column, multi-component distillation columns, heat exchangers, boilers, compressor-turbine units, etc., and model linearization. Review of time domain analysis, feedback control, PID tuning, feed- forward, cascade control, ratio control, process decoupling, discrete systems, systems identification, IMC, Model predictive control, DMC.

Prerequisite: CIE 418 or Approval of the Department

CIE 459 Special Topics in Automation (3-0-3)

A course in an area of automation reflecting current theory and practice.
Prerequisite: Approval of the Department

CIE 460 Monitoring and Detection (3-0-3)

Dynamic Systems models; FIR, AR, ARX, ARMA, State space, Multiple models, nonlinear models, System performance evaluation, abnormality / loss of performance detection. Detection techniques; Filtering, whiteness test, parity checks, residuals autocorrelation tests. Applications and case studies.
Prerequisite: CIE 315 or Approval of the Department

CIE 461 Intelligent Instrumentation Systems (3-0-3)

Principles of intelligent measurement devices. Signal conditioning; typical measurement systems; temperature, pressure, force, and motion sensors; Sensors for oil logging, Resistivity measurements, neutron absorption, gamma ray methods, photo electric methods, acoustic methods; sensors networking; sensor fusion, soft sensing, sensor communications; wireless sensors networks.
Prerequisites: (CIE 209, CIE 312) or Approval of the Department

CIE 462 Safety Instrumented Systems (3-0-3)

Maintainability, fault trees and failure mode analysis. Combinatorial reliability; series, parallel and r-out-of-n configuration; general computation techniques. Catastrophic failure models: hazard rate models. System reliability: Safety Integrity Level (SIL). Safety standards IEC 61508, IEC 61511 & ISA 84.01, basic process control system (BPCS) and Safety Instrumented System (SIS), functional safety, analysis of safety integrity level (SIL), case studies of SIS design.
Prerequisite: Approval of the Department

CIE 463 Guided Systems Control (3-0-3)

Dynamic equations of rigid bodies; missile dynamic equations; introduction to missiles aerodynamics; linearization of the equations of motion; gain scheduling techniques; longitudinal equations of motion, longitudinal autopilot; missiles lateral dynamics; lateral autopilot; inertia cross coupling; advanced control systems; measurement of missile motion, gyros, laser gyros; guidance systems techniques and design, UAV system components and control issues.
Prerequisite: CIE 314 or Approval of the Department

CIE 464 Industrial Internet of Things (3-0-3)

Internet of Things (IoT) technology and Industrial Control Systems (ICS) for Industry 4.0, IoT/IIoT reference architectures and data flow, industrial communication technologies and networking protocols, highly distributed system architectures and computing platforms, digital twins, ICS security, predictive analytics, maintenance, and system optimization. Embedded intelligence in end devices to perform local analytics and optimization. Applications of IIoT in various areas such as energy sector, manufacturing, and smart cities.
Prerequisite: CIE 318 or COE 344 or ICS 343 or EE 400

CIE 468 Introduction to Convex Optimization (3-0-3)

This course covers modeling, analysis, and design of cooperative control systems. Topics include continuous and discrete-time evolution models, formation control and maintenance, flocking, collision, collective motion with direct and indirect communication, localization and Potential field, approach for navigation and control. Applications include ground wheeled robots and quadrotors.

Prerequisites: CIE 316, ICS 104

CIE 470 Soft Computing for Control and Automation (3-0-3)

Introduction to soft computing for Control and Automation, Neural models and network architectures; basic and advanced architectures and algorithms. Neural networks for control and identification, Adaptive neuro-control. Fuzzy systems, Construction of fuzzy inference systems; Objective vs. subjective fuzzy modeling and fuzzy rule generation, examples, Fuzzy control and identification, Stability analysis and design of fuzzy control system, Hybrid soft computing, construction of a hybrid soft computing system, Application of hybrid soft computing to control systems and automation, Case studies and projects in control and automation.

Prerequisite: CIE 305 or Approval of the Department

CIE 480 Introduction to Robotics & Autonomous Systems (3-0-3)

Introduction to the fundamentals of mobile robots, spanning the mechanical, motor, sensory, perceptual, and cognitive layers the field comprises. Overview of the mechanisms for locomotion, dynamic modelling, forward and inverse dynamics, sensing. Concepts of localization and motion planning control theory, signal analysis, computer vision.

Prerequisite: CIE 305 or AE 313 or EE 380 or ME 410 or CHE 401 or Equivalent

CIE 481 Applied Control for Robotic Systems (3-0-3)

Interplay between control and robotics. Kinematic and dynamic models of robot manipulators, mobile robots, and multi-rotor drones, design intelligent controls for robotic systems and explore modeling analogies between these systems. Learn linear/nonlinear, single and multiple input/output closed loop control, stability theories, feedback linearization, and robust control design. Basic system identification techniques and the concept of autopilot design for aircrafts and UAVs.

Prerequisite: CIE 480

CIE 482 Path Planning and Navigation for Mobile Robot (3-0-3)

Key concepts, algorithms and design of robot motion and navigation in the presence of obstacles and static and dynamic environments with uncertainty. Real-time feedback control to track the planned motion, C-space obstacles, grid-based motion planning, randomized sampling-based planners, and virtual potential fields. Motion and force control, flying robot trajectory design, UAV’s trajectory.

Prerequisite: CIE 480 or AE 449 or Equivalent

CIE 483 Artificial Intelligence and Machine Learning for Robotics (3-0-3)

Application of Artificial Intelligence (AI) and Machine Learning (ML) for robotic systems. Intelligent Agents (IA), blind/uninformed and informed search algorithms for path planning. Relational and associative navigation, behavior coordination, uncertainty, and probabilistic reasoning. Knowledge representation methods. Different types of IA architectures (operational, systems and technical) and layers (behavioral, deliberative, interface) within a canonical operational architecture of an intelligent robot. Logical agents, deductive and

practical reasoning agents, reactive and hybrid agents, rational agents and how to use such techniques for creating autonomous robots/agents. Fundamentals and practical usage of Machine Learning (ML) algorithms, including supervised, unsupervised, reinforcement and evolutionary learning paradigms for implementing autonomous robots/agents.
Prerequisite: Senior Standing

CIE 486 Autonomy and Decision Making (3-0-3)
This course introduces decision making under uncertainty from a computational perspective and provides an overview of the necessary tools for building autonomous and decision-support systems. Following an introduction to probabilistic models and decision theory, the course will cover computational methods for solving decision problems with stochastic dynamics, model uncertainty, and imperfect state information. Topics include Bayesian networks, influence diagrams, dynamic programming, reinforcement learning, and partially observable Markov decision processes.
Prerequisites: (ISE 205 or STAT 211 or STAT 319), Senior Standing or Approval of the Department

CIE 490 Senior Design Project (0-9-3)
A design course that should be taken by all coop and non-coop students, which draws upon various components of the undergraduate curriculum. The project; typically contains problem definition, analysis, evaluation and selection of alternatives. Real life applications are emphasized where appropriate constraints are considered. Oral presentation and a report are essential for course completion. The work should be supervised by faculty member(s). Team projects are acceptable wherever appropriate.
Prerequisite: CIE 390

COMPUTER ENGINEERING

COE 202 Digital Logic Design (3-0-3)

Introduction to information representation and number systems. Boolean algebra and switching theory. Canonical forms: minterms and maxterms. Manipulation and minimization of completely and incompletely specified Boolean functions. Propagation delay, timing diagrams. Primitive and complex gates. Combinational circuits design. Multiplexers, decoders, encoders, comparators, adders. Sequential circuit analysis and design, basic flip-flops, clocking and timing diagrams. Registers, counters. Introduction to Verilog.

Note: Not to be taken for credits with CISE 204.
Prerequisite: PHYS 102

COE 203 Digital Logic Design Lab (0-3-1)

Introduction to information representation, Signals and bits, Logic implementation using discrete logic components (TTL, CMOS). Introduction to Field Programmable Logic Arrays (FPGAs) design flow: design capture (schematic capture, HDL design entry, design verification and test, implementation (including some of its practical aspects), and debugging. Use of CAD tools to design, simulate and implement digital logic circuits on FPGA prototyping boards. Introduction to Verilog.

Corequisite: COE 202

COE 233 Digital Logic & Computer Organization (3-0-3)

Number systems. Boolean Algebra and Minimization of Boolean functions. Combinational circuits analysis and design: multiplexers, decoders, adders, and the ALU. Sequential circuits analysis: flip-flops, Registers. MIPS instruction set architecture. Assembly language: selection and repetition structures. Single cycle and pipelined processor design. Memory hierarchy. ROM, RAM, and cache memories. Evaluation of processor and cache performances.

Note: Not to be taken for credits with COE 301, Not open for COE students.
Prerequisite: ICS 104

COE 241 Data and Computer Communications (3-0-3)

Introduction to data communication. Brief overview of the OSI model. Frequency response, bandwidth, filtering, and noise. Fourier series and transform. Introduction to the Z-transform. Information theory concepts such as Nyquist theorem, Shannon theorem, and Sampling theorem. Analog and digital modulation techniques. Pulse Code Modulation (PCM). Communication systems circuits and devices. Data encoding. Physical Layer Protocols. Data Link Control (point to point communication; design issues; link management; error control; flow control). Multiplexing Techniques.

Prerequisite: MATH 102

COE 292 Introduction to Artificial Intelligence (3-0-3)

Introduction to AI; Agents and environments. Uninformed vs. informed search. Constraint satisfaction. Probabilistic inference; conditional probability and independence. Supervised learning using Nearest Neighbor and SVM. Clustering with mean-shift algorithm. Overview of Neural Networks and training. Overview of deep learning and applications. Feature extraction techniques in Computer Vision. Applications in reinforcement learning. Ethical concerns in AI.

Prerequisite: ISE 291

COE 301 Computer Organization (3-3-4)

Introduction to computer organization, machine instructions, assembly language programming, addressing modes, control flow, assembly-language procedures, translating high-level language constructs into assembly, floating-point arithmetic, CPU performance and metrics, CPU design, datapath and control, pipelined instruction execution, pipeline hazards, memory hierarchy, cache memory.

Note: Not to be taken for credits with COE 233.

Prerequisites: COE 202, ICS 104

COE 302 Design and Modeling of Digital Systems (3-3-4)

Digital design methodology. Review of combinational and sequential circuit design. Design of digital systems composed of data path and control units. Hardware description language-based modeling of digital systems. Synthesis and optimization of digital systems. Digital system design using field-programmable gate arrays (FPGAs).

Prerequisite: COE 202 or CISE 204

COE 306 Introduction to Embedded Systems (3-3-4)

Introduction to Embedded Systems, Embedded system design methodologies, Microcontroller Hardware, ARM Processor, Memory and I/O, Interfacing: Parallel and Serial Communication, Pulse Width Modulation, A/D and D/A conversion, Designing robust software for embedded systems, RTOS features.

Prerequisites: COE 301 or COE 233, EE 236

COE 344 Computer Networks (3-3-4)

Introduction to computer networks. Application layer design issues and protocols. Transport layer design, protocols, and congestion control. Socket programming. Network layer services, routing algorithms, and routing in the Internet. Link layer and multiple access protocols. Local area networks devices. Wireless links/networks.

Note: Not to be taken for credits with ICS 343.

Prerequisites: (COE 241 or EE 207 or CISE 315), (STAT 319 or EE 315 or ISE 205)

COE 346 Computer & Network Security (3-0-3)

Introduction to computer security (concepts, threats, attacks, assets, scope, trends). Cryptographic protocols and standards. Integrity verification mechanisms. Network security and associated protocols. Software tools to apply security in user environments. Access control models and mechanisms. Intrusion detection systems, firewalls. Malicious software, DoS attacks, trusted computing and multilevel security. Hardware security (design, threats, safeguards).

Note: Not to be taken for credits with ICS 444.

Prerequisite: COE 344 or ICS 343 or EE 400

COE 353 Fundamentals of Computer Communications (3-0-3)

Digital communications fundamentals. Voice and data transmission equipment. Communications channels. Data coding and modulation. Multiplexing. Modems. Transmission media. Data transmission codes and protocols. Software packages. Data networks. Planning and design of communication networks.

Note: Not to be taken for credits with COE 241, Not open for COE students.

Prerequisite: Junior Standing

COE 384 **Fundamentals of Computer Engineering Design** **(3-3-4)**
The general engineering design process as exercised by professional computer engineers. Formulation of practical engineering problems. Customer needs analysis. Brainstorming in design projects. Essential design concepts and skills, problem-solving and decision-making, team work and project management, conceptual modeling, evaluation of economic feasibility, and proper project/work documentation. New emerging computer engineering technologies. Through projects, students utilize computer engineering technologies to design and implement effective solutions for the industry.
Prerequisite: COE 292

COE 398 **Internship** **(0-0-6)**
A continuous period of 15 weeks spent in industry with the purpose of acquiring practical experience in different areas of Computer Engineering. During this period, a student is exposed to the profession of Computer Engineering by working in the field. Students are required to submit a final report and give a presentation about their experience and the knowledge they gained during their cooperative work.
Prerequisites: ENGL 214, Junior Standing

COE 399 **Summer Training** **(0-0-0)**
The aim of the summer training is to provide students with direct on-the-job experience working with professionals in the field. This training provides an opportunity to expose students to the reality of professional practice. Students are required to submit a report and make a presentation on their summer training experience and the knowledge gained.
Prerequisites: ENGL 214, Junior Standing

COE 401 **Modeling and Simulation of Computer and Network Systems** **(3-0-3)**
Computation as a scientific method. Simulating probabilities, random variables, and stochastic processes. Discrete-event simulation. Performance laws. Event graphs. Random number and variate generation. Monte Carlo methods. Output analysis. Case studies.
Prerequisites: Senior Standing

COE 402 **Computer System Performance Evaluation** **(3-0-3)**
Introduction to computer system performance analysis and evaluation. Review of basic probability distributions and basic concepts of statistics. Performance measures and measurement techniques. Simulation and modeling of computer systems. Experimental and analytical approaches. Introduction to queuing network modeling. Case studies.
Prerequisites: STAT 319 or EE 315 or ISE 205

COE 403 **Computer Architecture** **(3-0-3)**
Introduction to parallel computer architecture. Power, cost, performance. Pipelined CPU cores and dynamic instruction execution. Hardware multithreading and synchronization. Vector and SIMD processing. Multilevel cache hierarchy and cache coherence. Perspectives on parallel programming. Server and storage architecture.
Prerequisite: COE 301 or COE 233 or EE 390 or CISE 414

COE 408 **Reconfigurable Computing** **(3-0-3)**
Review of Digital System Design and Hardware Description Languages. FPGA Architectures. FPGA Design Flow. Software-Hardware partitioning. SW/HW interfacing (PCIe). FPGA design patterns. Computing models and applications. Soft processors.
Prerequisite: COE 302

COE 409 Special Topics in Comp. Arch. & Dig. Sys. Design (3-0-3)

Special topics in issues related to computer architecture and digital systems design. Topics and specifics will be announced well before the course starting date.

Prerequisite: Senior Standing

COE 420 Parallel Computing (3-0-3)

Introduction to parallel computing. Parallel architectures: MIMD, SIMD, communication, and mapping. Performance measures, speedup, efficiency, and limitations of parallel processing. Problem decomposition and parallel algorithm design. Basic communications. Modeling of parallel programs: granularity, scalability, and execution time. Parallel programming: message-passing and threads. Examples of parallel algorithms and applications: matrix, sorting, graph, and search. New trends in parallel computing.

Prerequisite: COE 301 or COE 233 or EE 390 or CISE 414

COE 421 Fault Tolerant Computing (3-0-3)

Introduction to fault tolerant computing. Fault classification. Types of redundancy. Basic measures of fault tolerance. Hardware and software fault tolerance. Information redundancy. Fault-tolerant networks. Checkpointing. Fault detection in cryptographic systems. Case studies.

Prerequisite: Senior Standing

COE 422 Real Time Systems (3-0-3)

Introduction to real-time systems. Uniprocessor scheduling of independent tasks, hard versus soft real time, reference model, dynamic scheduling, utilization-based scheduling, demand-based scheduling, static priority systems, deadlines, and fairness. Basic operating-system functions needed for real-time computing, real-time and non-real-time operating systems. Advanced scheduling: preemptive versus non-preemptive scheduling, dynamic versus static priorities, synchronous versus asynchronous job releases. Multiprocessors and distributed systems, priority ceiling protocol and end-to-end scheduling.

Prerequisite: COE 306 or EE 390 or CISE 414

COE 423 Distributed Systems (3-0-3)

Theory and practice in the design and implementation of distributed computing systems; including inter-process communication, remote procedure calls, distributed file systems, synchronization, distributed transactions, replicated data, security and specifications for distributed programs. Distributed technologies (sockets). Real-world distributed systems case studies and examples.

Note: Not to be taken for credits with ICS 437.

Prerequisite: Senior Standing

COE 424 Introduction to Smart Cards & RFID Technology (3-0-3)

An overview of different types of smart cards both contact & contactless. State of the art advances in NFC (Near Field Communication). RFID concepts and fundamentals including components of RFID systems, RFID middleware. Passive vs Active RFID. RFID related standards. RFID tag features: tag sensitivity, RSSI, impedance match. Anti-collision techniques. RFID security: EPC mutual authentication pros & cons.

Prerequisite: Junior Standing

COE 425 Data Management Systems (3-0-3)

Introduction to the fundamental theories and practices of Data Acquisition, Distribution and Warehousing. Generic Structure of IT systems in Production oriented and Service oriented Organizations. Industrial and Business Automation Levels. Differences in Computer Architecture, Operating systems, Languages, Network protocols and Databases between Industrial Automation and Office Automation Domains. Most commonly used standards and Technologies. Case studies.

Prerequisites: Junior Standing

COE 426 Data Privacy (3-0-3)

Data privacy: definition and terminologies. Difference between data security and privacy. Data privacy attacks. Data privacy laws and regulations. Privacy risk and impact assessment. Privacy engineering, management, and evaluation. Data anonymization. Statistical privacy. Differential privacy. Cryptographic privacy. Homomorphic encryption. Secure multi-party computation. Secure data outsourcing. Data hiding and steganography. Anonymous networks. Trusted execution environment. Applications of privacy preserving technologies in computer systems and applications.

Prerequisites: Senior Standing

COE 429 Special Topics in Parallel and Distributed Systems (3-0-3)

Special topics in issues related to parallel and distributed systems. Topics and specifics will be announced well before the course starting date.

Prerequisites: Senior Standing

COE 441 Local Area Networks (3-0-3)

Introduction to local area networks (LANs). Classes of LANs and LAN design issues. LAN topologies and LAN transmission media. LAN medium Access Control (MAC) and logic link control (LLC) protocols. LAN performance modeling and analysis. Internetworking: bridges, switches, routers, and gateways. Virtual LANs. LAN reliability, availability, survivability, and security. High speed wireless and Ethernet LANs. Emerging Gigabit, Terabit, and Photonic networks. Case studies and future directions.

Prerequisite: COE 344 or ICS 343 or EE 400

COE 444 Network Design (3-0-3)

Introduction to types of computer networks: LANs, VLANs, and WANs. STP and PVST protocols, in addition to ACL (Standard and Extended) to be covered. IPv4 and IPv6 sub netting and routing. Network development life cycle. Network analysis and design methodology. Link topology and sizing; Routing; Reliability. Data in support of network design. Data center design and implementation. Introduction to Packet tracer simulator/emulator or other network simulation tools.

Note: Not to be taken for credits with ICS 443.

Prerequisite: COE 344 or ICS 343 or EE 400

COE 446 Mobile Computing (3-0-3)

Introduction to mobile computing, which are wireless randomly moving devices with/without administration center. Studying exciting infrastructure/infrastructure-less wireless protocols in order to design computer networks. Quality of Service (QoS) issues and performance evaluation of various wireless protocols using simulation programs.

Prerequisite: COE 344 or ICS 343 or EE 400

COE 449 Special Topics in Computer Comm. and Networking (3-0-3)

Special topics in issues related to computer communication networks. Topics and specifics will be announced well before the course starting date.

Prerequisite: Senior Standing

COE 450 Introduction to Smart Systems (3-0-3)

Introduction to smart systems. Sensors and actuators: working principles, classifications, performance, characteristics, interfacing with feedback control, and data acquisition. Embedded systems: architecture, types, and interfacing. Real-time operating systems: components, requirements, configuration, and scheduling. Embedded software: development, software stack, hardware abstraction, and tools. Power management and energy harvesting for embedded systems.

Prerequisite: EE 203 or EE 236

COE 453 Cloud and Edge Computing (3-0-3)

Internet and web protocols and technologies (HTTP). Basics of web development: frontend, backend, and full-stack (HTML, CSS, Javascript, Node.js). Web services and RESTful APIs. Introduction to utility computing: Cloud and Edge computing. Cloud Service-oriented architecture and microservices. The XaaS pyramid. Serverless computing. Cloud resource management. Virtualization and containerization (Docker and Kubernetes). Cloud data storage: BigTable, Dynamo, and Cassandra. Batch cloud processing: MapReduce and Hadoop, Spark, BigTable. Cloud-native applications. Security of Cloud computing. Hands-on activities and project.

Prerequisite: COE 344 or ICS 343 or EE 400

COE 454 Internet of Things (3-0-3)

IoT systems design and architecture: elements of IoT system, potentials, constrains, and applications. IoT access technologies. IoT networking protocols such as 6LoWPAN. IoT application layer protocols, Wireless Personal Area Network (WPAN) such as ZigBee. Low Power Wide Area Network (LPWAN) such as LoRaWAN, Machine-to-Machine (M2M) and Machine to-Cloud (M2C) communication. IoT network architecture: cloud, fog, and edge layers. IoT system security. Data analytics for IoT.

Prerequisite: COE 344 or ICS 343 or EE 400

COE 456 Wireless Sensor Networks (3-0-3)

Basic concepts in Wireless Sensor Networks (WSN). Introduction to deployment, localization, synchronization, medium access control, sleep scheduling, energy-aware protocols and data aggregation. Wireless sensor network platforms: hardware and software. Communication architecture and protocols for WSN.

Prerequisite: COE 344 or ICS 343 or EE 400

COE 458 Internet of Drones (3-0-3)

Introduction to Unmanned Aircraft System (UAS) basics. Students will be introduced to fundamental concepts underlying technologies such as: UAS networking, mobility models, ad hoc networking, anti-collision and routing protocols, medium access protocols, power aware protocols, basic security, and how computers represent numbers, text, images, and sound.

Prerequisite: COE 344 or ICS 343 or EE 400

COE 461 Principles of VLSI Design (3-0-3)

Introduction to Semiconductors; doping, mobility, and currents. MOS Transistors; operation and limitations. CMOS digital logic circuits, static & dynamic logic, combinational and sequential circuits, propagation delay. Circuit design and transistor sizing. Spice Simulations. MOS IC fabrication, layout and design rules, stick diagrams. IC Design and Verification Tools. Subsystem design and case studies, and practical considerations.

Prerequisite: EE 203 or EE 236

COE 462 Design Automation of VLSI Circuits (3-0-3)

Introduction to EDA (Electronic Design Automation). Design approaches. Levels of Abstraction, Design phases, and corresponding DA problems and tools. Physical design (partitioning, floor planning, placement, global routing and detailed grid and channel routing). Introduction to non-deterministic algorithms to solve hard VLSI physical design problems. Optimization for area, power, and performance. Modeling and simulation of digital systems using HDLs. Cell libraries. Layout generation problem and solutions. Symbolic layout, layout editors and compaction. Silicon compilation.

Prerequisite: EE 203 or EE 236

COE 464 Testing of Digital Circuits (3-0-3)

Introduction to the testing problem, fault modeling, stuck-at, bridging, transistor-open, transistor-short and delay faults. Fault simulation, gate-level testing, automatic test pattern generation (ATPG) algorithms. Testing of sequential circuits. Fault Diagnosis. Design-for-testability (DFT). Built-in Self-Test. Test compaction and compression.

Prerequisite: Senior Standing

COE 465 VLSI System Design Methodology (3-0-3)

CMOS VLSI system design options; Full-custom and semicustom designs. Design flows of ASICs; front-end and back-end design flows. Design & verification CAD tools. Chip Layout, place and route, and design rules checking. Concepts and tools in floor planning, placement and routing, layout generation and design synthesis. The course stresses hands-on experience of VLSI design using CAD tools.

Prerequisite: COE 302

COE 466 Quantum Architecture and Algorithms (3-0-3)

An introduction to the model of quantum computation, quantum hardware, quantum processors, quantum circuits and instruction sets, quantum programming languages, quantum Fourier transform, quantum error correction, quantum algorithms, and applications of quantum computing.

Prerequisites: (COE 292 or ICS 102 or ICS 103), (MATH 208 or PHYS 210 or MATH 225)

COE 469 Special Topics in VLSI and Design Automation (3-0-3)

Special topics in issues related to VLSI and Design Automation. Topics and specifics will be announced well before the course starting date.

Prerequisite: Senior Standing

COE 482 Pervasive and Ubiquitous Computing (3-0-3)

Introduction to ubiquitous and pervasive computing. Designing, building and evaluating ubiquitous computing technologies in order to create novel user experiences. Capturing and disseminating context information through sensors and sensor networks. Sensor network coverage, localization, synchronization, sleep scheduling, connectivity, routing, energy

efficiency, data centric and transport protocols, Context-aware applications and intelligent objects and applications.
Prerequisite: COE 344 or ICS 343 or EE 400

COE 484 Introduction to Robotics (3-0-3)
Taxonomy of robots, robot arms, autonomous robots, robotic sensor networks, Internet robotics and applications. Kinematics, linear algebra, motion coordination, singularities, and multiple solutions. Modeling robots using state-space representation, linearization, LTI systems, internal stability, input-output stability, output and state feedback. Controller design techniques using pole-placement, controllability, and observability matrices. Motion planning, Bug, Dijkestra, A*, D* algorithms, probabilistic sampling. Robot vision, essential image processing filters, camera models, image motion and tracking, visual servoing.
Prerequisite: Senior Standing

COE 485 Senior Design Project (1-6-3)
Various design phases leading to a practical engineering solution. Feasibility study, preparation of specifications, and the methodology for the design. Detailed design and implementation, testing, debugging, and documentation.
Prerequisite: Senior Standing

COE 487 Computer Vision Processing (3-0-3)
Introduction to vision processing. Illumination and imaging techniques. Planar and stereo-vision, pixel representation, preprocessing, smoothing, enhancement, and equalization. Edge detection, gradient, Laplacian, and thresholding. Segmentation, linear, polygonal, and Fourier descriptors. Introduction to 3D structures. Shape matching, search approaches, interpretation, and recognition.
Note: Not to be taken for credit with ICS 483 or EE 410.
Prerequisite: Senior Standing

COE 497 Undergraduate Research (3-0-3)
The course is intended to expose the student to the process of scientific research. The student is expected to acquire research skills and methodologies including formulation of a research plan, organization of a literature review, selection of appropriate research methodologies, design and implementation, assessment, analysis, and presentation. By the end of the course, students will complete a technical paper and will be encouraged to participate in conferences and present their work.
Prerequisite: Junior Standing, minimum GPA of 3 out of 4

COE 499 Special Topics in Computer Engineering (3-0-3)
Special topics in issues related to computer engineering. Topics and specifics will be announced well before the course starting date.
Prerequisite: Senior Standing

CITY PLANNING

CP 101 Introduction to City Planning (3-0-3)

Objectives of planning, forming the goals, defining the approaches and methods in the context of socio-economic activities and historical development of Cities and Regions.

CP 201 Planning Theory (3-0-3)

Introducing planning theories as instruments and rational decision making activity to bring physical and social changes to achieve a set of goals through recognized models: comprehensive incremental; advocate; descriptive; predictive etc.

CP 202 Planning Laws and Legislation (3-0-3)

An overview of planning laws and legislation and a short history of planning process. Methods, techniques and instruments for implementing plans through decrees and administrative acts, the basis for urban and regional planning and its relation to Shariah Law as well as the structure and organization of Saudi public planning administration. Discussion of zoning procedures, subdivision review practices and budget preparation and execution.

Corequisite: CP 101

CP 203 Introduction to Spatial Database Management Systems (3-0-3)

Introduction to spatial DBMS, relational databases, relational algebra, SQL, entity relationship Model. Theory of database design, physical database design, examples of DBMS.

Corequisite: ICS 101 or ICS 102 or ICS 103

CP 204 Land Use Planning (3-0-3)

Land use distribution of urban and regional functions. Location theory, infrastructure systems and municipal and Regional Models.

Prerequisite: CP 101

CP 205 Urban Economics (3-0-3)

Microeconomics principles to understand the economic nature of urban areas. Urban growth in the context of location theory. Agglomeration economies in relation to land use pattern and transportation cost. Urban economics problems within the context of the theory of public goods.

CP 206 GIS I (2-3-3)

GIS definition, history, and functional elements. Data input and output, data management and data analysis. Introduction to most commonly used GIS packages. Hands-on experience on selected GIS software. GIS applications in planning. GIS planning and implementation. Case studies of GIS adoption and application in Saudi Arabia and abroad are presented.

Corequisite: ICS 101 or ICS 102 or ICS 103

CP 210 Planning Workshop I (1-9-4)

Introduction of students to methodology of collecting and analyzing data about a local study area to examine the relative problem solving in situations of functional and normative requirements. Integration of analysis, programming, implementation, and presentation of phases of the planning process. The workshop includes graphical presentation of the project. Each student chooses a distinct local study area as his project.

Prerequisites: CP 101, ARC 100

CP 301 Urban Survey Methods (3-0-3)

Design of surveys, including the preliminary planning of surveys, selection of survey methods, sampling procedures, survey instrument (questionnaire) design, pilot surveys, administration of surveys, and data processing. Computer applications in surveys, including internet-based surveys will also be covered.

Prerequisite: STAT 211

CP 302 Introduction to Environmental Planning (2-0-2)

Effects of planning on the natural environment. Planning tools and skills to protect, preserve, sustain, and restore environmental resources. Introductory aspects of environmental assessment and sustainable development.

CP 303 Introduction to Cartography & Remote Sensing (2-3-3)

Cartographic concepts and principles, map design, thematic mapping, computer-aided mapping, symbolization, and map coordinate systems and projections. Basis of remote sensing; photogrammetric systems; space borne sensors and platforms; fundamentals of analyzing remotely sensed data, data integration. Methodology for surveying and analyzing geographical phenomena. Various sensor families such as LANDSAT, Spot, IKONOS and other remote sensing satellites.

Prerequisite: CE 262

CP 306 Quantitative Methods in Planning (3-0-3)

Application of different quantitative methods in city planning, including analysis of variance, correlation analysis, regression analysis, time series, Bayesian decision-making, extrapolation techniques, and forecasting methods.

Prerequisite: STAT 211

CP 307 Transportation Planning (3-0-3)

Urban transportation planning process, travel demand modeling, data needs, trip generation, trip distribution, modal choice, and network assignment. Local case studies will be emphasized, and specialized software packages will be utilized.

CP 308 GIS II (2-3-3)

Spatial data models, GIS Analysis Functions, System Configuration and Data Communications. Internet GIS, User Requirement Analysis (URA), Metadata Requirements, and Spatial data standards. Advanced GIS software will be used. Students will carry out a comprehensive GIS-related project by utilizing knowledge acquired in this course and previous GIS-related courses.

Prerequisite: CP 203

CP 310 Planning Workshop II (1-9-4)

All the students participate in the project and integrate their projects in Planning Workshop I to the City scale. In this project, students should define the functions of the city and the social and economical activities of the city and their manifestation and realization in space.

Prerequisite: CP 210

CP 315 Planning Workshop III (1-9-4)
Several options are offered each year, such as regional planning, housing, metropolitan planning, and urban design. All students participate in the project through an inter-disciplinary approach based on the experience gained in previous courses.
Prerequisite: CP 310

CP 350 Begin Cooperative Work (0-0-0)
See contents in CP 351.
Prerequisites: Same as in CP 351

CP 351 Cooperative Work (0-0-9)
A continuous period of 28 weeks spent in industry with the purpose of acquiring practical experience in different areas of city planning. During this period, a student is exposed to the profession of city planning by working in the field. Students are required to submit a final report and give a presentation about their experience and the knowledge gained during their cooperative work.
Prerequisites: Junior Standing, ENGL 214

CP 352 End Cooperative Work (0-0-0)
See contents in CP 351.
Prerequisites: Same as in CP 351

CP 399 Summer Training (0-0-0)
The aim of summer training is to provide students with direct on-the-job experience working with professional in the field. This training, which lasts for minimum of eight weeks, provides an opportunity to expose students to the reality of professional practice. Students are required to submit a report and make a presentation on their summer training experience and the gained knowledge.
Prerequisites: Junior Standing, ENGL 214

CP 401 Senior Planning Project Preparation (1-0-1)
This course is designed to help the senior student to prepare his proposal for the final project in CP 499. In this course the student will carry out research on a selected topic in the area of city planning of his choice and approved by the course instructor. The student will write a complete proposal including statement of the problem, objectives of the project and its justification, methodology, data collection and project outline.
Prerequisite: CP 315

CP 402 Sustainable Development (2-0-2)
Development with the most efficient utilization of natural resources. Balance between market, social, and environmental values throughout the process.
Prerequisite: CP 302

CP 410 Planning Workshop IV (1-9-4)
This course is an exercise on applied professional planning. Utilizing a local study area the course focuses on the applications of city planning theories, concepts, and methods to the solutions of actual planning problems including data collection, analysis, preparation of development plans, policies, and recommendations; computer applications will be made when appropriate.

Corequisite: CP 401

CP 421 Urban Infrastructure Systems (3-0-3)

Introduction to transportation systems, transportation costs, and effect on landuse planning. Other elements of the general plan: electricity, gas, and communications services systems. Storm drainage, sewage and waste disposal. Introduction to standards and control regulations.

Prerequisite: Senior Standing

CP 422 Public Works Administration (3-0-3)

An analysis of the administrative structure and administrative practices with emphasis on finance, personnel, public safety, utilities, and public infrastructure.

Prerequisite: Senior Standing

CP 423 Development Impact Assessment (3-0-3)

Principles of impact assessment, development impact assessment methods; cost-benefit analysis, environmental impact assessment, and balance sheet.

Prerequisite: Senior Standing

CP 424 Evaluation and Appraisal (3-0-3)

Techniques and methods for assessment of different plans, programs, and public policies. Cost effectiveness, goal achievement, cost benefit, and cost revenue analysis. Pre and post implementation evaluation.

Prerequisite: Senior Standing

CP 425 Urban Modeling (3-0-3)

Location theory, geographical and gravitational models, population projection, travel behavior and transportation systems, regional models and economic base models.

Prerequisite: Senior Standing

CP 426 Internet GIS (3-0-3)

Introduction to Internet GIS; applications of Internet GIS in City and Regional Planning; use of software to create applications for the web that have interactive GIS functionality; advantages of using Internet GIS in public and private sectors.

Prerequisite: CP 203

CP 427 Analysis and Modeling (3-0-3)

Concepts and principles of analysis and modeling of spatial data. Students will gain knowledge of different spatial data modeling techniques used in GIS through lecture, assignments and computer exercises. Student will be able to design, implement and solve a given spatial problem utilizing GIS.

Prerequisite: CP 203

CP 428 GIS in Space Syntax (3-0-3)

Introduction to space syntax concepts; application packages; use of Axwoman and Isovist analyst extensions in ArcView GIS; pedestrian and vehicular systems; modeling and analysis of urban areas and building interiors; integration of syntactic models with other GIS spatial models; techniques of reporting findings; other quantification techniques applicable to GIS concepts.

Prerequisite: CP 203

CP 429 Geo-statistical Analysis (3-0-3)

Role of computers in geographic analysis. Data sampling and descriptive and inferential statistical techniques for analyzing geographic data. Graphic techniques, tests of hypothesis, simple regression, and the analysis of variance. Interpretation and presentation of appropriate spatial and non-spatial statistics.

Prerequisite: CP 203

CP 430 GIS in Transportation (2-3-3)

GIS applications in various areas within transportation (GIS-T), including transportation planning, transportation engineering, mass transit, railroads, and intelligent transportation systems (ITS). Linear referencing systems and dynamic segmentation data model will be thoroughly discussed.

Prerequisite: CP 203

CP 431 GIS in Utilities Management (3-0-3)

GIS management of utilities: electric, phone, water, and sewer networks. Automated Mapping/Facilities Management (AM/FM).

Prerequisite: CP 203

CP 432 Special Topics in GIS (3-0-3)

Topics of this course are to be selected from special topics in GIS.

Prerequisite: CP 203

CP 490 Special Topics in City Planning (3-0-3)

Topics of this course are to be selected from the broad areas of City planning.

Prerequisite: Senior Standing

CP 499 Senior Planning Project (1-9-4)

The senior student will be required to work on a planning project of the topic developed during CP 401 Senior Planning Project Preparation. The objective of the course to demonstrate the student knowledge and skills acquired during his four years of city planning studies. At the end of the semester, the student is expected to submit a complete and detailed planning project of high quality utilizing planning tools, techniques and methods.

Prerequisite: CP 401

COLLEGE OF PETROLEUM ENGINEERING AND GEOSCIENCES

CPG 199 Summer Camp (0-0-1)
Eight-week summer camp. Oilfield applications experience. Exposure to some geological, geophysical, and petroleum engineering field activities. Camping at geologic sites. Visits to drill sites. Visits to oil and service-company head offices.
Prerequisites: GEOL 101, GEOP 102, PETE 101

CPG 498 Integrated Design I (0-3-1)
Use of geoscientific data, knowledge and skills as well as reservoir and well data to build a geological model of a hydrocarbon trap. Uncertainties associated with petrophysical and field data. Work is achieved by a team of petroleum-engineering and geoscience students.
Prerequisite: GEOL 315 or GEOP 320 or PETE 315

CPG 499 Integrated Design II (0-6-2)
Continuation of CPG498. Evaluation of various development plans for the hydrocarbon trap utilizing all petroleum engineering tools and skills. Selection of the best plan based on technical and economic feasibility within environmental and legal constrains following the industry's standards and practices. A detailed technical report with presentation.
Prerequisite: CPG 498

ECONOMICS

ECON 101 Principles of Microeconomics (3-0-3)
Provides the fundamentals of microeconomics. It introduces the roles of the market price system in managing the use of society's resources and in rationing available supplies. The efficiency of resource management is examined in the light of a variety of more or less competitive market environments. Topics include consumer behavior, consumer and market demand, concepts of elasticity, cost, production and factor pricing in perfect and imperfect competition, monopoly, monopolistic competition, oligopoly, regulation and economic policy, economic efficiency and productivity, social costs and benefits, and public goods and externalities.

ECON 102 Principles of Macroeconomics (3-0-3)
Introduces the basic principles of macroeconomics from a market economics perspective with a focus on current macroeconomic policy issues and data. National income accounts, business cycles, unemployment and inflation, money and banking, fiscal and monetary policies, government debt and policies, economic growth and development, and international trade.
Prerequisite: ECON 101

ECON 301 Intermediate Microeconomic Theory (3-0-3)
Studies the efficiency of choices made by individuals, including consumers, workers, firms' owners, and social planners, who have limited resources, and the relationship between their individual interests. Topics covered include theory of consumer behavior; demand and supply analysis; theory of cost and production; pricing theory in factor markets; different market structures such as perfect competition, monopoly, monopolistic competition, and oligopoly; general equilibrium analysis; elements of game theory; microeconomic policy; social costs and benefits, and regulation.
Prerequisite: ECON 102

ECON 302 Intermediate Macroeconomic Theory (3-0-3)
Studies aggregate economic performance, including both long-run growth and short-run fluctuations. The various measures of national output in closed and open economies. Aggregate demand and aggregate supply analysis; Keynesian general equilibrium analysis; consumption function, investment function, government expenditure, aggregate production function; economic stabilization, monetary and fiscal policy analysis; alternative macroeconomic paradigms – Classical, Keynesian, Monetarist, Neo-Classical, Neo-Keynesian, and Real Business Cycle; international trade, exchange rate, and balance of payments analysis; income and employment determination, unemployment and inflation, introduction to international financial and development organizations.
Prerequisite: ECON 102

ECON 305 Money and Banking (3-0-3)
Covers history of money and its role; the role of money in macroeconomic policies; monetary policy and the role of money in the determination of output, prices, and interest rates; theories of supply of and demand for money; overview of the banking system; role of the central bank in the financial system and as executor of monetary policy; monetary policy tools and practices; analysis of inflation and unemployment; international monetary system. The Saudi Arabian financial and monetary system.
Prerequisite: ECON 102

ECON 306 Economy of Saudi Arabia (3-0-3)

Analyzes economic structures, policies, and performance of the Saudi Arabian economy, in its evolutionary phases and current challenges. Topics covered include national income accounting; aggregate demand and its component parts. The labor market and the issue of Saudization; key sectors of the economy including crude oil, agriculture, manufacturing, and services, with particular reference to the evolving capital and financial markets. International trade, public finance, fiscal and monetary policies, the role of economic planning in Saudi development, the SME sector and privatization.

Prerequisite: ECON 102

ECON 330 Labor Economics (3-0-3)

Introduces basic concepts, theories, and analytical techniques in labor economics. Topics covered in this course include an overview of the labor market in general and the Saudi labor market in particular; labor demand and its elasticities; Saudi supply of labor, foreign supply of labor in the Saudi labor market; compensating wage differentials; investment in human capital (education & training); worker mobility – migration & labor turnover; wage determination; inequality in earnings; types of unemployment; inflation; and policy implications.

Prerequisite: ECON 102

ECON 401 Managerial Economics (3-0-3)

Applies economic theory and decision science methods to solve managerial problems. Topics include demand analysis; demand estimation; cost and production analysis; optimization methods, linear programming applied to managerial decision-making problems; market structures and managerial decisions, pricing practices, business investment decisions; present value and cost-benefit methods; risk and uncertainty; capital budgeting process, and the role of government in the market economy.

Prerequisite: ECON 102

ECON 405 Introduction to Econometrics (3-0-3)

Focuses on practical and conceptual issues involved in substantive applications of econometric techniques. Estimation and inference procedures are formally analyzed for simple econometric models and illustrated by empirical case studies using real-life data. The course covers linear regression models, time series models, and panel data models.

Prerequisites: ECON 102, STAT 212

ECON 410 International Economics (3-0-3)

Focuses on international economic issues and policies based on international trade and monetary theories. Special references will be made to the Saudi Arabian economy. The course covers the classical theories of international trade; Heckscher-Ohlin and modern theories; tests of trade models; tariffs and protection; economic integration; current international economic issues; introduction to international finance and balance of payments; theories of balance of payments and exchange rates; international monetary systems; foreign exchange market; international parity conditions; managing foreign exchange risk; optimum currency areas.

Prerequisite: ECON 102

ECON 415 Public Finance (3-0-3)
Analyzes taxation and government expenditure policies. Public budgeting; different types of market imperfections and failures; role of the public sector; cost-benefit analysis; principles of public expenditure analysis and evaluation; social security and income transfer programs.
Prerequisite: ECON 102

ECON 420 Islamic Economics (3-0-3)
Discusses the importance of Islamic Economics, its ideological and philosophical foundations, the approach to economic problems and solutions from the Islamic perspectives as compared to other schools of thought. Property and distribution, taxation in terms of equity and efficiency, general principles about interest, money and its nature, functions and the verdict in Islam, modern money, and financial system from an Islamic viewpoint, Islamic monetary policy reforms.
Prerequisite: ECON 102

ECON 425 Economic Development (3-0-3)
Introduces economic development theory and applies it to the unique problems facing developing economies of Asia, Africa, and Latin America. Understanding the different types of growth and developmental theories, compare and contrast between different economies, identify the role of population growth, education, healthcare, and other parameters in the development process. Mathematical and graphical tools used in the measurement and analysis of development. Political economy, international trade, and fiscal policies for development.
Prerequisite: ECON 102

ECON 450 Introduction to Energy Economics (3-0-3)
Analyzes energy resources (such as petroleum, coal, gas, electricity, and renewable resources). Analysis of demand for and supply of energy sources (oil in particular, under the assumption of the theory of cartels, such as a dominant firm and OPEC). Analysis of short- and long-run costs of investments in resources under uncertainty. Energy, environment and climate change issues. Energy futures and options markets for managing risks. Energy and its derivatives; economics of energy security. Case study on the energy sector of the Saudi Economy.
Note: Not to be taken for credits with ECON 475
Prerequisite: ECON 102

ECON 475 Introduction to Energy Markets, Policies, and Regulations (3-0-3)
Provides an introduction to economic decision-making and analysis to different markets and pricing of energy source (oil and electricity in particular) both qualitatively and quantitatively using available international energy database. The effect of a government intervention in the market is examined to provide insights on market behavior and welfare. Energy, environment and climate change issues as well as renewable energy. Case study on the energy sector of the Saudi Economy.
Note: Not to be taken for credits with ECON 450, Co-listed with ECON 575
Prerequisites: MATH 102 or MATH 106, Junior Standing

ECON 495 Special Topics in Economics (3-0-3)
Focuses on advanced, contemporary, and specialized areas in economics not covered extensively in other courses.
Prerequisite: ECON 102

ELECTRICAL ENGINEERING

EE 201 Electric Circuits I (3-0-3)

Basic laws: Ohm's, KVL, KCL. Resistive circuits. Circuit analysis techniques. Network theorems: Thevenin's Norton's, Source transformation, Superposition, Maximum power transfer. Op Amps. Energy storage elements. First and second order circuits. Phasor techniques for steady-state sinusoidal circuits.

Prerequisites: MATH 102, PHYS 102

EE 203 Electronics I (3-0-3)

Opamp Linear Applications. PN junction and zener diode. Diode basic circuit analysis and diode applications (rectifier and limiters). MOSFET and BJT (DC, small signal analysis). Amplifier configurations and characteristics. CMOS digital circuits.

Prerequisite: EE 201

EE 204 Fundamentals of Electrical Circuits (2-3-3)

Basic laws: Ohm’s law, KVL, KCL. Resistive networks. Circuit analysis techniques: node-voltage and mesh-current. Network theorems. Inductance and capacitance. Sinusoidal analysis and phasor methods. Power concepts of AC circuits. Polyphase circuits.

Note: For non-EE Students

Prerequisites: MATH 102, PHYS 102

EE 207 Signals and Systems (3-0-3)

Introduction to Signals and Systems. Time-Domain Analysis. Convolution. Fourier Series and Applications. Fourier Transform and Applications. Laplace Transform and Applications. Discrete-Time Signals and Systems. Sampling. Difference Equations and Z-Transform. Introduction to Discrete Time Fourier Transform and its applications.

Note: Not to be taken for credits with CISE 315

Prerequisite: EE 201

EE 212 Electrical Circuits Laboratory (0-3-1)

The course consists of a set of laboratory experiments for students to gain hands-on experience in electrical circuits so that they are able to put theoretical concepts into practice. The experiments are designed to help students understand the basic principles of electric circuits as well as giving them insight on design, simulation and hardware implementation of circuits.

Note: For non-EE Students

Corequisite: EE 201

EE 213 Electrical Circuits II (2-0-2)

Important power concepts of AC circuits. Three phase circuits. s-domain analysis. Frequency selective circuits. Two-port networks. Transformers.

Prerequisite: EE 201

EE 234 Electronics and Microcontrollers (3-0-3)

Introduction to Electrical Engineering, Basic laws: Ohm’s Law, KVL, KCL. Resistive Circuits. Circuit analysis techniques. Network Theorems: Nodal and Mesh Analysis. Superposition. Thevenin’s and Norton’s theorems. Maximum power transfer. Energy storage elements. Sinusoidal excitation. Phasor approach. Power in AC Circuits. Number systems. Digital primitives. Logic circuits and minimization techniques. Sensing and Quantization.

ADCs. Microcontrollers. PN junction diode. Ideal and piecewise-linear diode models. Basic diode circuit analysis. Diode applications: rectifiers, regulators, clampers and clippers. Ideal Op-Amps. Amplifier configurations and characteristics.
Note: For non-EE Students
Prerequisites: MATH 102, PHYS 102

EE 235 Electronics and Microcontrollers Lab (0-3-1)
The course consists of a set of laboratory experiments to enhance students understanding of the EE 234 course material in addition to providing them with a hands-on experience of dealing with different equipment and components in electrical engineering. The students will be exposed to a complete spectrum of components and system blocks required to build a complete application-driven electronic system and will also have an opportunity to implement several microcontroller-based applications.
Note: For non-EE Students
Corequisite: EE 234

EE 236 Electronic Circuits (3-0-3)
Electric quantities: charge, current, voltage, power, and energy. Basic electric circuit components: voltage and current sources, resistors, capacitors, and inductors, dependent sources. Basic laws: Ohm's, KVL, KCL, and power calculations. Network theorems: Thevenin's Norton's source transformation, superposition. Operational Amplifiers: inverting and non-inverting amplifiers, summing and difference amplifiers. PN junction and Zener diode. Diode basic circuit analysis and diode applications (rectifier and limiters). MOSFET (DC, small signal analysis). Amplifier configurations and characteristics. CMOS digital circuits. Sensing and Quantization.
Note: For non-EE Students
Prerequisites: MATH 102, PHYS 102

EE 237 Electronic Circuits Lab (0-3-1)
The course consists of a set of laboratory experiments for students to gain hands-on experience of dealing with different equipment and components in electrical and electronic circuits and systems. The students will be exposed to a range of electronic devices, such as diodes, transistors and op-amps, and will implement them in a range of important applications, such as rectification, amplification and digital logic.
Note: For non-EE Students
Corequisite: EE 203 or EE 236

EE 271 Electrical Circuits II Lab (0-3-1)
Introduction to Electric Circuits Simulation and Testing & Lab Safety Measures and Guidelines, Electric Circuits Fundamentals Laws, Voltage & Current Dividers and Superposition Principle, Equivalent Source Models and Maximum Power Transfer, The Oscilloscope and Function Generator, Sinusoidal AC Circuit Analysis, Transient Circuit Analysis, Frequency Selective Circuit Analysis, Two-Port Network, and Design project.
Corequisite: EE 213

EE 272 Analog and Digital Electronics Lab (0-3-1)
Getting Started with Laboratory Equipment, Building Logic Functions Using Traditional ICs, Sequential Logic Circuits Design, Introduction to Verilog HDL and Simulation Using Webpack, Digital Project I: A sequential circuit to utilize both the FPGA and digital ICs with 7 segments display, Digital Project II: A sequential circuit to utilize both the FPGA and

digital ICs with 7 segments display, Linear Applications of Operational Amplifier, Semiconductor Diodes Characteristics and Applications, DC Power Supply, Transistor Characteristics, Biasing, CE amplifier, and MOS I-V Characteristics, Biasing and CS amplifier.
Prerequisite: COE 202
Corequisite: EE 203

EE 303 Electronics II (3-0-3)
Differential amplifiers. Multistage amplifiers. Amplifier frequency response (for single stage, multistage and opamp). Passive and Active filters. Feedback: Circuit topologies and analysis. Oscillators. Introduction to A/D and D/A.
Prerequisite: EE 203

EE 304 Electronics II Lab (0-3-1)
Simulation Analysis using SPICE and Multisim, BJT Differential Amplifier, Frequency Response of the Common Source Amplifier, Frequency Response of Multistage Amplifier (CE-CC), Frequency response of op amp based amplifiers, Applying Negative Feedback on Amplifiers and Rectifiers, Various types of first-order active filters and their applications, Second-order active filters, Sinusoidal Oscillators, and Signal Generators.
Prerequisite: EE 272
Corequisite: EE 203

EE 306 Electromechanical Devices (2-3-3)
Magnetic circuits. Transformers. Concepts of electric machines. DC generators and motors operation. Three-phase Induction motors. Motor starting. Synchronous machines. Parallel operation. Fractional Horsepower Motors.
Note: For non-EE Students
Prerequisite: EE 204

EE 311 Fundamentals of EE Design (3-0-3)
Introduction to engineering design. The engineering design cycle. Carrying a literature survey. Formulation of practical engineering problems. Customer needs analysis. Brainstorming in design projects. Arduino programming in engineering design projects. Modeling, implementation, and evaluation in engineering design. Report writing, presentation skills, professional ethics, and teamwork.
Prerequisite: EE 272

EE 312 Electrical Systems & Lighting (3-3-4)
Introduction to building wiring systems: design elements, design procedures, and calculation, and National Electrical Code requirements. Types and determination of the number of branch circuits required. Basic electrical system design and load calculation for residential, office and commercial buildings. Concept of light, vision, and color. Luminaries and lamps. Lighting system design procedures; calculation and measurement techniques, evaluation of interior lighting quality, and day-lighting. The course features an electrical design project where students are required to develop and present a basic set of electrical design documents for a medium-size building. Computer applications in artificial and day-lighting analysis and design. The course also includes a lab that provides hand-on experiences that supplement the topics presented in the course.
Note: For ARE Students Only
Prerequisite: EE 204

EE 315 Probabilistic Methods in Electrical Engineering (3-0-3)

Fundamentals of probability theory: single and two discrete and continuous random variable. Probability density function. Gaussian and other distributions. Functions of one and two random variables. Joint and conditional probabilities. Moments and statistical averages. Central limit theorem. Introduction to random process. Concept of stationarity and ergodicity. Correlation function. Power spectrum density. Response of linear systems to random signals.

Note: Not to be taken for credit with STAT 319

Prerequisite: EE 207

EE 340 Electromagnetic Waves and Applications (3-0-3)

Time varying fields: Faraday's Law, Displacement current, Maxwell's equations, The Wave Equation, Helmholtz Equation, Plane wave propagation. Wave Polarizations, Poynting vector, Reflection and Refraction. Introduction to transmission lines, Rectangular Waveguides, antennas, Introduction to Basic Optical Fiber Communication System.

Prerequisite: PHYS 305

EE 341 Electromagnetics Lab (0-3-1)

Electric Field & Potential Inside Parallel Plate Capacitors, Capacitance & Inductance of Transmission Lines, Simulation of Electric Field and Potential Inside Capacitors, Magnetic Field Outside a Straight Conductor, Magnetic Field of Coils, Magnetic Force on a Current Carrying Conductor, Magnetic Induction, EM wave demonstration, Radiation, & Radiation Pattern of a Horn Antenna and EM Wave Transmission and Reflection.

Corequisite: EE 340

EE 360 Electric Energy Engineering (3-0-3)

Fundamentals of electric energy systems. Electric energy conversion. Components of electric energy systems. Transformers (1 and 3 phases). AC machine fundamentals. Synchronous and Induction machines. DC machine fundamentals. Overhead transmission lines and underground cables.

Prerequisite: EE 213

EE 361 Electric Energy Engineering Lab (0-3-1)

Introduction to CASSY Lab & Lab Safety Measures and Guidelines, Three Phase and Two-Wattmeters Method, Magnetic Circuits Characteristics, Equivalent Circuit and Performance Evaluation of Single-Phase Transformer, Three Phase Transformers, DC Generator Characteristics, DC Motor Characteristics, Determination of Parameters of Three Phase Synchronous Generators and Equivalent Circuit, Performance, and Torque-Speed Characteristics of 3-phase Induction Motors.

Prerequisite: EE 271

Corequisite: EE 360

EE 370 Communications Engineering (3-0-3)

Review of signal and linear systems. Amplitude modulation (AM, DSB, SSB, VSB). Angle modulation (FM, PM). Sampling, Quantization, PCM, DPCM, DM. Multiplexing. Line coding and baseband transmission. Bandlimited channels and ISI. Digital carrier modulation (PSK, ASK, FSK, and M-ary). Examples of modern communication systems.

Prerequisite: EE 207, EE 203

EE 371 Communications Engineering Lab (0-3-1)

Safety measures and guidelines. Getting familiar with the hardware kit. Representation of signals & systems. Simulation of communication systems in time and frequency domains. Working with speech signals. Implementation of Analog modulation & demodulation techniques: AM, QAM, and FM. PCM encoding and decoding. Line coding. Experimenting with digital modulation techniques like ASK, PSK and FSK.

Prerequisite: EE 272

Corequisite: EE 370

EE 380 Control Engineering I (3-0-3)

Introduction to feedback control systems. Block diagram and signal flow graph representation. Mathematical modeling of physical systems. Stability of linear control systems. Time-domain and frequency-domain analysis tools and performance assessment. Lead and lag compensatory design. Proportional, integral, and derivative control.

Prerequisite: EE 207

EE 381 Control Engineering I Lab (0-3-1)

Introduction to the computer aided design package MATLAB & Lab Safety Measures and Guidelines, Introduction to SIMULINK and simulation of a speed control system, Servo-Trainer: Familiarization, Experimental Determination of the servo-trainer DC Motor Model, Model-based Investigation of the Effect of Tuning Parameters on a Servo Motor Response and Mode Transition, Speed Control Servo with Proportional + Integral Control, Servo Motor Position Control Using Position and Speed feedback, Position Control Servo-system Error Cancellation Using Proportional-Integral (PI) Controllers and Effect of lead and lag RC-circuits on the performance of Servo-motor.

Corequisite: EE 380

EE 390 Digital Systems Engineering (3-0-3)

Microcontroller and microprocessor architectures. Assembly language programming and debugging. Memory, input/output mapping and interfacing. Interrupts. ADC/DAC, Programming in C.

Prerequisites: ICS 104, COE 202

EE 391 Digital Systems Engineering Lab (0-3-1)

Lab Safety Measures and Guidelines, Introduction to the microcontrollers/microprocessors, Assembly and C language programming, Data Transfer Instructions for Registers and Memory, Instructions for Jump, Loop, and Call operation, The Addressing Modes, Arithmetic, Logical and Rotate Instructions, Use of Timers, Counters and Interrupts, Applications of microcontrollers, Design project.

Corequisite: EE 390

EE 398 Internship (0-0-6)

A continuous period of 18 weeks spent in the industry working in any of the fields of electrical engineering. During this training period, the student is exposed to the profession of electrical engineering through working in many of its fields. The student is required to submit, and present, a formal written report of his work.

Prerequisites: Fulfill University Requirements, Fulfill EE Department Requirements

EE 399 Summer Training (0-0-0)

A continuous period of 8 weeks of summer training spent in the industry working in any of the fields of electrical engineering. The training should be carried out in an organization with an interest in one or more of these fields. On completion of the program, the student is required to submit a formal written report of his work.

Prerequisites: ENGL 214, EE 311

EE 400 Telecommunication Networks (3-0-3)

Network Architectures. Network Layers: OSI Model and TCP/IP Model. End-to-End Connectivity and Transport Layer Protocols: TCP and UDP. Elements of Reliable Communication. Network Layer Protocols and Addressing Schemes. Packet Switching and Circuit Switching. Routing in Packet Switching Network Architectures. Data Link Layer Protocols. Medium Access Control systems. Physical Layer Protocols, Digital Transmission Fundamentals, and Error Control Mechanisms.

Note: Not to be taken for credit with COE 344

Prerequisites: EE 315, EE 370

EE 402 Control Engineering II (3-0-3)

Review of stability criteria and techniques. Linear feedback system design and compensation methods. Introduction to nonlinear control systems: the describing function and phase plane analysis. Stability criteria for nonlinear systems. On-off control systems and optimum switching. Introduction to optimal control theory. Simulations.

Prerequisite: EE 380

EE 405 Microwave Transmission (3-0-3)

Characteristics of HF transmission lines. Lossless and lossy transmission lines. Microstrip transmission lines. Smith chart. Impedance matching techniques. Theory of waveguides (rectangular and circular). Microwave components and cavity resonators. Klystrons, Magnetrons and traveling wave tubes. Introduction to radio wave propagation. Introduction to software design tools.

Prerequisite: EE 340

EE 406 Digital Signal Processing (3-0-3)

Discrete time signals and systems. Linear shift-invariant systems response, difference equations, convolution, and frequency response. Discrete Fourier transform. FFT algorithms. Discrete time Fourier transform and applications. Sampling and aliasing. Finite impulse response (FIR). Filter design techniques, Infinite impulse response (IIR) Filter Design.

Note: Not to be taken for credit with CISE 432

Prerequisite: EE 207

EE 407 Microwave Engineering (3-0-3)

Review of Transmission line theory, Planar Transmission lines, Microstrip lines and components, Microwave Network Analysis, Microstrip Capacitors, Resistors and Inductors, Microstrip Passive devices (Coupler, Power divider, Filter, Circulator, Phase shifter and Patch antenna), Microstrip Active devices (Diode, Transistor, Amplifier, Oscillator, Mixer and Demodulator), Introduction to Microwave Integrated Circuits.

Prerequisite: PHYS 305 or EE 340

EE 408 Exploration Seismic Signal Processing (3-0-3)

Introduction to exploration geophysics and the seismic surveying method. Theory of elasticity, the wave equation, and seismic wave types. Propagation effects on seismic wave amplitudes. Ray paths in layered media and reflection geometry in layered media. Characteristics of reflection seismic events and accompanying noise. Spectral analysis of seismic data and useful transforms. Sampling theory of seismic data. Seismic applications of digital filtering theory. Fundamentals of digital optimum filtering, seismic deconvolution, and seismic wavelet processing.

Prerequisite: EE 207

EE 409 Image Processing for Seismic Interpretation (3-0-3)

Introduction to exploration seismic. Seismic data interpretation. Seismic image enhancement in the spatial domain. Seismic image enhancement in the spectral domain. Seismic attributes. Color display of seismic images. Seismic image segmentation.

Prerequisite: EE 207

EE 410 Digital Image Processing (3-0-3)

Digital image fundamentals. Image sensing and acquisition. Image enhancement. Intensity transformation. Spatial and frequency domain filtering. Processing color images. Image compression. Basics of image segmentation. Image restoration and reconstruction. Applications of digital image processing.

Note: Not to be taken for credit with COE 487

Prerequisite: EE 207

EE 411 Senior Design Project (1-6-3)

A team work project that integrates various components of the curriculum in a comprehensive engineering design experience. Design of a complete project including establishment of objectives and criteria, formulation of design problem statements, preparation of engineering designs, incorporating appropriate engineering standards and multiple constraints. The design may involve experimentation, realization and/or computer project.

Prerequisites: EE 311, Senior Standing

EE 413 Applied Digital Signal Processing (3-0-3)

Fundamentals of Machine Learning (ML), Python programming language and the ML framework in Python. Concepts of classical and contemporary ML approaches including deep learning. Concepts of real-world problems related to speech, image processing, seismic processing, and medical signal processing. Concepts of using DSP and ML to solve these real-world problems.

Prerequisite: EE 207

EE 416 Introduction to Radar (3-0-3)

Fundamentals of radar system engineering. Radar range equation. Radar transmitters, antennas, and receivers. Concepts of matched filtering, pulse compression, and the radar ambiguity function. Radar target detection in a noise background. Target radar cross-section models. Propagation and clutter. MTI and pulsed Doppler processing. Range, angle, and Doppler resolution/accuracy. Tracking. Imaging radar. Range and cross-range resolution; Image formation and characteristics. Backscatter. Modern techniques for electromagnetic sensing.

Prerequisite: EE 207 or CISE 315 or Equivalent

EE 417 Modern Digital Communication Systems (3-0-3)

Review of digital representation of analog signals. Baseband transmission of digital signals. Matched filter detection. Performance of digital communication systems in the presence of noise. Signal-space analysis. Optimum receivers. Band-pass transmission of digital signals. Modulation schemes: ASK, FSK, PSK, OFDM. Introduction to entropy, channel capacity, and forward error control. Emerging topics in digital communication systems.

Prerequisites: EE 315, EE 370

EE 418 Introduction to Satellite Communications (3-0-3)

Overview of satellite systems. Orbits and launching methods. Communication satellite subsystems. Modulation schemes and satellite multiple access (FDMA, TDMA, and CDMA). Space link analysis. Satellite antennas. Applications of satellites.

Prerequisite: EE 370

EE 419 Wireless Communication (3-0-3)

The cellular concept, propagation modelling, cellular frequency planning, link control, handoffs, power control, traffic capacity, digital transmission techniques, fading mitigation, multiple access techniques, current and future wireless standards.

Prerequisites: EE 315, EE 370

EE 420 Optical Fiber Communications (3-3-4)

Optical fiber waveguides: ray and mode theories. Step-index and graded-index fibers. Transmission characteristics of optical fibers: losses and dispersion. Methods of manufacturing optical fibers and cables. Connections of optical fibers. Measurements of attenuation, dispersion, refractive index profile, numerical aperture, diameter and field. Optical sources: semiconductor lasers and light emitting diodes. Optical detectors. Optical fiber systems. Digital and analog systems. Design of a simple optical fiber communication link.

Prerequisite: PHYS 305 or EE 340

EE 421 Photonics and Optical Engineering (3-0-3)

Review of basics of optics including photon-matter interaction, interference, diffraction, coherence, polarization, etc. Introduction to geometrical optics. Light sources and transmitters. Optical detectors and receivers. Optical waveguides and optical fibers. Optical devices: amplifiers, filters, isolators, diffraction gratings, switches, polarization controllers and modulators. Operating principles of optical multiplexers and demultiplexers. A survey on some contemporary topics in photonics and optics.

Prerequisite: PHYS 305

EE 422 Antenna Theory (3-0-3)

Introduction to antennas. Review of HF transmission lines. Fundamental parameters of antennas. Transmission formula and radar range equation. Radiation integrals. Linear wire antennas. Antenna arrays. Synthesis of far field patterns by array factors. Design of Dolph-Chebyshev arrays. Broadband antennas and matching techniques. Microstrip antennas. Introduction to smart antenna. Methods of antenna measurements. Antenna design using commercial software.

Prerequisite: EE 340

EE 425 Integrated Circuits Analysis and Design (3-0-3)
Mixed mode integrated circuit devices and concepts. Advanced modeling and 2nd order effects of transistors and single stage amplifiers. Current mirrors and sources. Design of transconductance amplifier. Design of input stages, differential pairs, active loads, gain stages and level shifting. Output stages, power dissipation. Low voltage design, low power design. Fully differential operation. High performance amplifier design. Analysis and design of typical opamp circuits. Voltage and current references. Noise Analysis. Distortion analysis.
Prerequisite: EE 303

EE 426 Mixed Mode Signal Processing Circuits (3-0-3)
Advanced filter design. Tuning circuits. S/H circuits. Delay elements. Clock generation circuits. Switched capacitor circuits. OTA design. Design of comparators. A/D and D/A convertors.
Prerequisites: EE 207, EE 303

EE 427 Bioelectronics (3-0-3)
Basics of bioelectronics, measurement constraints, and biostatistics. Displacement measurement: resistive sensors, inductive sensors and capacitive sensors. Operation of various sensors: PZT, temperature, optical sensors and electrochemical sensors. Conditioning circuits for biosignals. Design examples of physiological signals and their measurements. Use of CAD tools in bioelectronics system design.
Prerequisite: EE 203 or EE 234 or EE 236

EE 430 Information Theory and Coding (3-0-3)
Concept of information and its measurement. Entropy and source coding and Huffman codes, LZW codes. Channel coding theorem and channel capacity. Linear codes. Block codes: detection and correction. Cyclic codes, Hamming codes, BCH codes, encoding, and decoding algorithms. Convolutional codes. Advances in codes: LDPC, Turbo codes.
Prerequisites: EE 315, EE 370

EE 432 Digital Control Systems (3-0-3)
This course provides an introduction to digital control and discrete transform (z-transform). Discrete and hybrid Signal Flow Graphs (SFG)s. Solutions of discrete-time state space. System discretization, Modified z-transform. Time-response and characteristic equations. Stability concepts in discrete-systems. The root locus method, Nyquist method, and Bode plots. Digital lead-lag compensators applied to digital systems, PID Control.
Prerequisite: EE 380

EE 433 Applied Control Engineering (3-0-3)
Introduction to process control. Theoretical modeling of simple chemical processes. Transfer function and linearization of nonlinear processes. Empirical modeling for first and second order processes with time delay using step response data. Empirical modeling using frequency response data. PID and digital PID control. Controller design using direct synthesis method and internal model control. PID tuning. Feedforward control. Multivariable processes.
Prerequisite: EE 380

EE 434 Industrial Instrumentation (3-0-3)
Introduction (Classification of sensors and actuators, sensing and actuating strategies, general requirements for interfacing and actuation, sensing, transduction, actuation). Performance

Characteristics of Sensors and Actuators. Different types of pf sensors: Optical sensors, Magnetic and Electromagnetic Sensors, and Actuators, Mechanical Sensors, Acoustic Sensors and Actuators, Chemical sensors, Radiation Sensors, MEMs (Micro-Electro-Mechanical) Sensors, and Smart Sensors. Interfacing Methods and Circuits. Interfacing with microcontrollers.
Prerequisite: EE 303

EE 436 Introduction to Micro and Nano-Electronics (3-0-3)
Introduction to microfabrication techniques (photo-lithography, etching, deposition, thermal processes, etc.). CMOS manufacturing from old to current technologies, including challenges and future developments. Introduction to Micro Electro Mechanical Systems (MEMS), Nanotechnology and Nanomaterials. Innovative technologies (Flexible/Stretchable electronics, Energy Micro- and Nano-harvesters).
Prerequisites: CHEM 101, EE 203

EE 437 Energy Harvesting Circuits and Systems (3-0-3)
Review the physics and operation of several ambient energy harvesters such as photovoltaic cells (PV), thermoelectric generators (TEGs), piezoelectric cantilevers (PZTs) and electromagnetic generators. Circuit models for PV, TEG, PZT and RF harvesters. Power management circuit (PMC) design for energy harvesting using boost/buck converters and low power rectifiers. Self-starting Dickson voltage multiplier. Impedance matching and maximum power point tracking (MPPT) principle. Applications of energy harvesting.
Prerequisite: EE 303

EE 439 Micro/Nanotechnology and Biosensors (3-0-3)
Introduction to microfabrication and characterization techniques (photolithography, etching, deposition, thermal processes, SEM, TEM, AFM, XRD). CMOS manufacturing from old to current technologies. Introduction to Micro Electro-Mechanical Systems (MEMS) and BioMEMS. Biosensors' fundamentals and applications. Nanotechnology and Bio-nanotechnology. Emerging technologies in Bioelectronics (Wearable electronics for Healthcare applications, Microbial Fuel Cells, etc.).
Prerequisite: EE 203 or EE 234 or EE 236

EE 441 RF and Microwave Transceivers Design and Analysis (3-0-3)
Tx and Rx architectures, RF link and RF budget, Noise analysis, Linearity analysis, System level design, Microwave measurements for transmitters characterization, CAD tools with application to system level design and analysis, Linear amplifier design (power and LNA), Design case studies.
Prerequisite: EE 340

EE 445 Industrial Electronics (3-0-3)
Power Switches (SCRs, Diacs, Triacs and IGBT) and Triggering Devices (UJT and PUT). Operational Amplifiers, Instrumentation Amplifier, Comparator, and Opamp Applications. Timers and Oscillators. Industrial Rectifier Circuits and applications. Power Inverters and DC-To-DC Converters. Motor Control Devices (DC Motors Types, DC Drives, and Stepper Motors). Programmable Logic Controllers: The structure of programmable logic controllers: I/O, relays, counters and timers. Ladder diagram concepts. PLC's intermediate and advanced functions. PLC's industrial applications in the process control.
Prerequisite: EE 303

EE 456 Digital Communication Electronics (3-0-3)

Functional blocks of digital communication systems: PAM, PWM, PPM and PCM. Design of S/H circuits, A/D and D/A converters, and timing (clock generator) circuits. Circuit design using PLL, VCO, and multipliers. Design of PAM, PPM, PWM and PCM transmitters and detectors. Special circuits for phase shift keying.

Prerequisites: EE 303, EE 370

EE 458 Hydrogen and Electricity Infrastructures (3-0-3)

Energy-chain analysis of hydrogen and its competing alternative fuels for transport. Hydrogen mobility powertrain, efficiency, and storage. Fundamentals of optimization and economic analysis. Hydrogen and renewable energy. Large-scale hydrogen storage and its interactions with electric power infrastructure. Fuel cells as distributed energy resources in a smart energy grid.

Prerequisite: CHE 303 or ME 204

EE 459 Electrical Energy Efficiency (3-0-3)

Fundamental principles, concepts, contexts, issues, applications and future developments of energy efficiency and demand side management (DSM). Benefits of energy efficiency and DSM. Energy economics and markets. Efficiency of generation, transmission and distribution systems. Energy efficiency policies, standards and regulations. International practices in energy efficiency and demand side management. Future sustainable energy systems and smart grids.

Prerequisite: EE 202 or EE 204 or EE 234

EE 460 Power Electronics and Power Quality (3-0-3)

Power electronic devices. DC and AC power electronics converters. Fundamental of power quality and system harmonics effects and mitigation. Power quality standards.

Prerequisite: EE 360

EE 461 Smart Grids (3-0-3)

Smart Grids Fundamentals and Components, Smart grid Control and Automation Technologies, Power Electronics and Energy Storage, Information and Communication Technologies, Demand Side Management, Energy Efficiency, Overview of Typical Pilot Projects in the World.

Prerequisite: EE 360

EE 462 Electric Machines (3-0-3)

Dynamics of Electrical drives; Steady state and dynamics of DC motors; speed control of DC motor; breaking of DC motors; Steady state and dynamic analysis of Induction machine (IM); Starting, speed control and breaking of IM; Steady state and dynamics of synchronous machines; special machines control and applications.

Prerequisites: EE 360, EE 380

EE 463 Power System Analysis (3-0-3)

The basic concepts: representation, equivalent circuits. Per unit system. Power flow analysis. Short circuit analysis. Stability Analysis. Use of power system simulation packages.

Prerequisite: EE 360

EE 464 High Voltage Engineering (3-0-3)
Introduction to High Voltage Engineering, Generation of testing voltages. Impulse voltages and currents, High Voltage measurements. High Voltage insulation. Electric fields and electric breakdown. Pollution and flashover studies; High Voltage Insulators. Circuit breakers. Lightning protection systems; Switchgears. Industrial applications.
Prerequisite: EE 360

EE 465 Power Transmission and Distribution (3-0-3)
Transmission line parameters and modeling; Transmission line Steady State analysis; Transient Operations of transmission lines; Introduction to Direct Current transmission line; Fundamentals of distribution systems; Load characteristics; Design of distribution systems.
Prerequisite: EE 360

EE 466 Power System Protection (3-3-4)
Introduction to protective relaying. Relay operating principles. Current and potential transformers. Principles of numerical relays. Over current differential, distance, and pilot protection. Protection of generators, motors, transformers, bus bars, and transmission lines. Protection aspects of power system phenomena. Relay coordination.
Prerequisite: EE 360

EE 467 Power System Planning & Operation (3-0-3)
Short and long term demand forecasting. Expansion of generation and transmission systems. power generation cost, economic dispatch and unit commitment. Power system state estimation. Load frequency control.
Prerequisite: EE 360

EE 468 Renewable Energy (3-0-3)
Energy Conversion; Electric energy from renewable sources: Hydro-electric, Solar, Wind, Fuel cells, Geothermal, Biomass, Tidal power plants; Energy storage; Renewable energy sources integration; Design of standalone and integrated systems.
Note: For EE, ME and CHE Students Only
Prerequisite: EE202 or EE204 or EE234

EE 469 Introduction to Nuclear Engineering (3-0-3)
Introduction to reactor physics, radioactivity, radioactive materials, fission and fusion reactions, radiation detection, kinematics, nuclear fuel cycle, reactor design and dynamics, reactor technology with particular emphasis of power generation, nuclear power plants, industrial and medical applications of nuclear science, waste disposal, safety and socio-economic factors.
Prerequisite: EE 360

EE 470 Optoelectronic Devices (3-0-3)
Optical processes in semiconductors. Spontaneous and induced transitions. Absorption and amplification of radiation. Atomic susceptibility. Semiconductor lasers. Operating principles and practical device features. Rate equations. Gain saturation. Feedback. Coherent optical oscillation. Laser resonators. Properties of laser light. Materials and heterostructures. Fabry-Perot lasers. Mode locking. Q-switching. Modulation and bandwidth. Light emitting diodes. Optical detectors, pn, and pin, schottky and avalanche diodes, Solar Cells. Photoconductive detectors.
Prerequisites: PHYS 305, EE 203

EE 471 Telecommunication Networks Lab (0-3-1)

Internetworking Basics, Devices & Models. Configuration of TCP/IP Parameters & Troubleshooting Network Connectivity using DOS Networking Utilities & Lab Safety, IP Addressing & Subnetting: Establishing Elementary Networks using Hubs, Switches, and Routers, Data Traffic Capture & Protocols Analysis Design of Simple & Complex Networks, Establishing Wireless LAN (WLAN) using WAP & Point-to-Point WAN Link using Wireless Bridges, Access Methods, Configuration & Monitoring of Layer-2 Switches, Configuration of Routers and Establishing Routed Networks, Understanding Dynamic Routing Protocols. Connecting networks using two or more routers through RIP protocol, Real-World Networking Equipment & Servers. Introduction to Voice Switches & Inter-System Links.

Corequisite: EE 400

EE 472 Microwave Transmission Lab (0-3-1)

Introduction to EM Software Packages, Simulation Software for High Frequency Structures, Coaxial Slotted Line and Standing Wave Ratio (SWR) Measurements, Impedance and Admittance Measurements, Transmission Line Stub Matching using "CAEME" Software, Waveguide wavelength, SWR and Impedance Measurements, Characteristics of Microwave Directional Coupler and Magic-Tee, Characteristics of Microwave Phase-Shifters, Measurement of return loss, reflection coefficient and voltage standing ration of Microstrip lines and Characteristic of Microstrip Low pass Filter (using Network analyzer).

Corequisite: EE 405

EE 473 Microwave Engineering Lab (0-3-1)

Introduction to software packages (CAEME & HFSS), Transmission line analysis using 'CAEME/HFSS' software, Measurement of return loss, reflection coefficient and VSWR, Transmission line Stub matching using 'CAEME/HFSS' software, Impedance measurements and microstrip matching networks, Insertion loss characteristics of microstrip low pass filter, Properties of a microstrip directional coupler, Properties of a Wilkinson power divider and hybrid ring couple, DC biasing and microwave amplifiers, Microwave radio link and antennas and Project.

Corequisite: EE 407

EE 474 Optical Fiber Communications Lab (0-3-1)

Optical Power Measurements, The HeNe Laser Intensity Profile: Theory and Experimental Verification, Light Polarization and Focal Length of Thin Lenses, Determination of the Acceptance Angle and Numerical Aperture of Optical Fiber, Light Coupling to Multimode Graded Index Fibers, Fiber Misalignment Loss Measurement, Fiber Splicing and Introduction to the OTDR, OTDR Measurement of Fiber Length, Attenuation and Splice Loss, Characteristics of the Light Emitting Diode and Characteristics of the Photodiode.

Corequisite: EE 420

EE 475 Antenna Theory Lab (0-3-1)

Introduction to the Antenna Measurements Laboratory, Getting Started with the USRP system, HFSS Numerical Tool, Dipole Antenna, Yagi or Wave Channel Antenna, Helical Antenna, Horn Antenna, Parabolic Antenna and PID tuning using Zeigler-Nichols method.

Corequisite: EE 422

EE 476 Digital Control Systems Lab (0-3-1)

Analysis with MATLAB, Sample/Hold unit with zero-order hold, Simulink Primer, Matlab Simulation of Digital Control Systems, Sampled-data Servo Control System, Performance of a Digital PID Controller, Pole Placement Controller Implementation, Discretization of Continuous-time State Space Equations, Digital Servo Workshop, Digital Pendulum Control System and Magnetic Levitation System.

Prerequisite: EE 381

Corequisite: EE 432

EE 477 Applied Control Engineering Lab (0-3-1)

Simulation of a Stirred Tank Process Using SIMULINK, Simulation of Linearized and Nonlinear Stirred Tank Process Using SIMULINK, Empirical Modeling of First Order Pressure Process, Frequency Response Modeling of a Pressure Process, PI Control of a Level Process, PID Control of a Level Process, and PID Controller Tuning for a Pressure Process.

Corequisite: EE 433

EE 478 Industrial Instrumentation Lab (0-3-1)

Introduction to LabVIEW, Data Acquisition using Ni-DAQ, Temperature measurement using RTD, LabVIEW based temperature measurements and control using LM35, Optical sensors (LDR, Photo-diode and Opto-coupler), PWM using capacitive sensors with 555 timer, Magnetic sensors (Hall effect and reed switch) and Measurement System project.

Prerequisite: EE 304

Corequisite: EE 434

EE 479 Industrial Electronics Lab (0-3-1)

Lab Safety and Introduction to Lab Equipment, Instrumentation Amplifier, 555 Timer Industrial Applications, SCR and UJT Simulation, Light Dimmers and Motor Speed Control, UJT and SCR Relaxation and Sinusoidal Oscillators, Voltage Regulators, DC-DC Converters, Siemens Trainer System HW Configuration, Boolean Operation and Timers with Applications, PLC Programming Applications and LabVIEW and GPIB interface (Demo).

Prerequisite: EE 304

Corequisite: EE 445

EE 480 Digital Communication Electronics Lab (0-3-1)

Square Wave (clock) generator, Square Wave (clock) generator using logic gates, Simple N-to-1 channel analog multiplexer, 555 Timer Applications (Clock), 555 Timer Applications (timer), Pulse width modulation, Frequency to voltage and voltage to frequency converter, Binary ladder D/A converter, discrete phase locked loop and Phase locked loop applications in FSK systems.

Prerequisite: EE 304

Corequisite: EE 456

EE 481 Power Electronics Lab (0-3-1)

Introduction to MATLAB simulation applied to half-wave rectifiers, introduction to Cassy and hardware equipment applied to half-wave rectifiers, Three-phase bridge rectifier, Single-phase controlled bridge rectifier, Three-phase controlled bridge rectifier, Single-phase AC voltage controller, DC-DC converters, Buck/Boost Converters, Single-phase voltage source inverter, and Three-phase voltage source inverter (Matlab).

Prerequisite: EE 361

Corequisite: EE 460

EE 482 Electrical Machines Lab (0-3-1)

Parallel Operation of Three Phase Synchronous Generators & Lab Safety Measures and Guidelines, Slip Test for Determining Direct and Quadrature Axis Reactance of Synchronous Machines, V-Curve Characteristics of a Synchronous Motor, Effect of Rotor Resistance on Torque Speed Characteristics of Induction Motors, Parameter Identification of a Separately Excited DC Motor, PI Speed Controller Design for a Separately Excited DC Motor, PI Controller Implementation of a Separately Excited DC Motor, Performance of Universal Motors, Single Phase Induction Motor Characteristics and Tutorial on the Recent Variable Speed Industrial Drive Systems.

Prerequisite: EE 361

Corequisite: EE 462

EE 483 Power System Protection lab (0-3-1)

Fault studies in different circuit topologies, Measuring instruments: current transformer and voltage transformer, Transmission line protection, Generator protection, Motor protection, Transformer protection, and Coordination studies.

Prerequisite: EE 361

Corequisite: EE 466

EE 484 Renewable Energy lab (0-3-1)

Photovoltaic I-V and P-V Characteristics, Power Electronics Converters used with Renewable Energy (AC/DC, DC/AC, and DC/DC buck, boost, buck-boost, and bidirectional), Maximum power point tracking and Wind Generator Characteristics.

Prerequisite: EE 361

Corequisite: EE 468

EE 485 Applied Digital Signal Processing Lab (0-3-1)

Introduction to Machine Learning (ML), and Python programming language. Concepts of classical and contemporary ML approaches including deep learning. Fundamentals of using ML and deep learning frameworks in Python (Tensor Flow, Keras, etc.). Applications of DSP and different ML algorithms in speech, image processing, seismic processing, and medical signal processing. Implementation of the above-mentioned problems applied to the analysis of real signals.

Corequisite: EE 413

EE 490 Special Topics in Electrical Engineering I (3-0-3)

The contents of this course will be in the areas of interest in electrical engineering. The specific contents will be given in detail at least one semester in advance of that in which it is offered.

Prerequisite: Senior Standing or Consent of the Instructor

EE 491 Special Topics in Electrical Engineering II (3-0-3)

The contents of this course will be in the areas of interest in electrical engineering. The specific contents will be given in detail at least one semester in advance of that in which it is offered.

Prerequisite: Senior Standing or Consent of the Instructor

EE 492 Special Topics in Electrical Engineering III (3-0-3)

The contents of this course will be in the areas of interest in electrical engineering. The specific contents will be given in detail at least one semester in advance of that in which it is offered.

Prerequisite: Senior Standing or Consent of the Instructor

EE 497 Undergraduate Research (3-0-3)

This course provides a practical introduction to research methodologies and research communities. Students in the course learn about the nature of applied research and the iterative process of research writing. The course teaches students how to work in a mentor-mentee relationship with a KFUPM faculty advisor, post graduate fellows, and graduate students. The course helps students to identify a study topic, organize a literature review, and select appropriate research methodologies. By the end of the course, students will complete a technical paper that includes an introduction, problem statement (significance of study), literature review, methods section, results and analysis, and references findings, discussion, conclusions, and references. Students will be encouraged to participate in conferences and present their work.

Prerequisite: Consent of the Instructor

ENGLISH

ENGL 00-xx Preparatory English 0 (15-5-0)
Introduction to basic sentence formation, speaking, listening, and reading skills. The main emphasis is on elementary speaking skills. The course helps students to develop an understanding of basic language concepts. It is designed for students who are not presently prepared to study in a preparatory year program. The aim is to ensure students enter the main four components of the Prep Year program with basic skills necessary for success. Materials used are at the A-1 level according to the Common European Framework (CEF).

ENGL 01-xx Preparatory English I (15-5-4)
It is considered the academic starting-point of the Preparatory English Program. Elementary skills with an emphasis on structured reading and listening texts are employed with an emphasis on skill development. Students will study basic sentence structure and be introduce essay formation. Materials used are at a CEF A-1 /A-2 level.

ENGL 02-xx Preparatory English II (15-5-4)
Pre-Intermediate skill development in structured reading and listening texts will be emphasized. Students will also study basic essay formation. Materials used are at a CEF A-2 /B-1 level.
Prerequisite: ENGL 01-xx

ENGL 03-xx Preparatory English III (15-5-4)
Intermediate skills with an emphasis on near native reading and listening texts are employed. Students will study academic essay writing and Introductory TOEFL preparation is stressed. Materials used are at a CEF B-1 level.
Prerequisite: ENGL 02-xx

ENGL 04-xx Preparatory English IV (15-5-4)
This course completes the English component of the Preparatory English Program. Upper Intermediate skills with an emphasis on reading, listening, writing and TOEFL preparation are stressed. The aim is to ensure students are fully prepared to study at a university in the medium of English. Materials used are at a CEF B-2 level.
Prerequisite: ENGL 03-xx

ENGL 101 Introduction to Academic Discourse (3-0-3)
Introduction to academic writing and reading: Writing process, draft writing, peer editing, and error recognition and correction. Writing styles covered: definition, description, exemplification, comparison, causal analysis, and argumentation. Organizational and grammatical elements. Improvement of reading skills; comprehension, skimming, scanning, meaning from context, lexis and acquisition of academic vocabulary.

ENGL 102 Introduction to Report Writing (3-0-3)
Introduction to process of report writing: theme-based, and basic library research, finding, note taking, paraphrasing, summarizing text and illustrations, and referencing, MLA or APA. Critical thinking: independent research, group discussions and presentations. Mechanics of writing: functional grammar, lexis, punctuation, and organization.
Prerequisite: ENGL101

ENGL 214 Academic & Professional Communication (3-0-3)

Production of subject-specific report: discursive or positional, researched from a variety of academic or professional sources. Proposal relating to their research report. Referencing and documentation. Professional communication: work-related skills through a variety of role-play and business activities e.g. interviewing, processing CVs/resumes, group presentations.

Prerequisite: ENGL102

ENTREPRENEURSHIP

ENTR 322 Introduction to Entrepreneurship (3-0-3)

Introduction to the concepts of entrepreneurship, opportunity recognition and evaluation, characteristics, traits and behaviors of entrepreneurs, creativity and innovation, the role of the entrepreneur in the economy and society, and entrepreneurship in non-entrepreneurial settings. This course will help students to identify and diagnose their skills and abilities to be entrepreneurs. It will help students to understand how to develop their entrepreneurial abilities, knowledge and skills necessary to create an entrepreneurial structure. Entrepreneurial managerial functions of a new venture will be included in this course. A student will be introduced to some successful entrepreneurial business models to learn from.

Prerequisite: ENGL 214

ENTR 413 Entrepreneurial Marketing (3-0-3)

An examination of marketing theory, concepts, frameworks and processes used by entrepreneurial companies to create customer value while accomplishing their strategic mission and objectives. Key topics to be covered include Marketing the Entrepreneur, Finding and evaluating entrepreneurial opportunities, market development through customer value creation, building relationships, entrepreneurial pricing, entrepreneur distribution strategy and entrepreneurial communication strategy.

Prerequisite: MKT 250

ENTR 415 Social Entrepreneurship (3-0-3)

Social Entrepreneurship is an emerging and rapidly changing business field that examines the practice of identifying, starting and growing successful mission-driven for profit and nonprofit ventures, that is, organizations that strive to advance social change through innovative solutions. This course emphasizes an entrepreneurial approach to creating solutions for social problems and unmet needs of society, transforming them into authentic opportunities to create social value.

Prerequisite: MGT 301

ENTR 416 Entrepreneurship and New Venture Creation (3-0-3)

Starting, planning, organizing, and managing a small business. Coverage include the foundations of entrepreneurship, the entrepreneurial thinking and mind, identifying opportunities, developing a business plan, ownership issues, financing the venture, marketing strategies, human resources planning and management, facilities acquisition and operation, materials and supplies management, profit and cash flow planning and management, budgeting and controlling, use of computer and technology, and the future of family-ownership.

Prerequisites: BUS 200, Junior Standing

ENTR 423 Small and Medium Enterprise Management (3-0-3)

Designed to facilitate students in understanding the unique characteristics of SMEs, which make them different from that of large enterprises, and how does contemporary business knowledge, which students acquire during their undergraduate study at CIM, can be tailored to manage SMEs. The course aims to equip students with necessary skills and orientation to perform and excel in SME milieu, or look for career opportunities in national and international SME development companies. Basic SMEs functions such as finance, marketing, HRM, communication and MIS will be discussed in this course in order to equip students with knowledge and skills necessary to manage SMEs.

Prerequisite: MGT 301

FINANCE

FIN 200 Introduction to Finance (3-0-3)
Introduces the basics concepts and tools of financial accounting and corporate finance. Topics covered include income statement and statement of financial position, purposes and limitations; statement of cash flows; analysis of financial statements; introduction to corporate finance, introduction to financial markets and institutions, time value of money, interest rates, and risk and return. Covers ethics in accounting and financial management.

FIN 250 Financial Management (3-0-3)
Discusses the practice of financial management and the role of the Financial Manager. The basic concepts of finance, including the time value of money and conceptual framework of risk and return in financial markets. Overview of financial markets and institutions, financial statements, ratio analysis, cash flow analysis, capital budgeting techniques, security valuation, the cost of capital, techniques of financial planning and analysis and working capital management.
Prerequisites: ACCT 210, ECON 102

FIN 315 Corporate Finance (3-0-3)
Covers the theory and practice of financial decisions and their interaction to determine the firm's value. Capital investment decisions are examined with certainty and under risk. Financing decision is examined through capital structure theory, cost of capital. The dividends policy choices are explained with their implications. The management of working capital and short-term financing is explained. Valuation of securities integrates the impact different financial decisions. Other topics are also discussed such as real options analysis, leasing, mergers and acquisitions, agency theory and corporate governance.
Prerequisite: FIN 250

FIN 320 Investments (3-0-3)
Discusses the function of the financial markets, different asset classes, and how are they issued and traded and an introduction to security market indexes weighting schemes. Establish the relationship between risk and expected return within the framework of modern portfolio theory. Fundamentals of asset pricing theory, market efficiency, and behavioral finance are also covered in this course. Topics such as technical analysis, basic analysis of equity securities, fixed income securities, and basics of options are also covered in the course.
Prerequisites: FIN 250, STAT 212 or STAT 214

FIN 398 Internship (0-0-6)
The Finance Internship provides the student with the opportunity to gain valuable practical business experience and insights in an organizational environment for a continuous period of 16 weeks to explore career interests while applying knowledge, competency, and skills learned in the classroom. The internship performance and responsibilities are evaluated by a faculty Internship advisor and a work-site supervisor through student's submission of progress reports, employer's feedback, final report, and presentation.
Prerequisites: ENGL 214, FIN 315, FIN 320, CGPA and MGPA of 2.0 or above, at least 85 credit hours

FIN 410 International Financial Management (3-0-3)
Covers the analysis of the key financial decisions made by multinational corporations (MNCs). The course provides an international perspective on financial problems faced by multinationals. Topics include the international financial environment; international money

and capital markets; analysis of foreign exchange risk exposure and risk management; capital budgeting and working capital management for multinationals; foreign direct investment decisions; political risk assessment; international banking and taxation.
Prerequisite: FIN 250

FIN 415 Management of Financial Institutions (3-0-3)
Discusses the theoretical and practical aspects of decision making in financial institutions including commercial banks, insurance companies, pension funds and asset management firms. Major topics include interest rate risk management, asset/liability and capital management under current Basel regimes; credit evaluation, lending policies, and practices, liquidity management; performance evaluation; investment banking; investment portfolio management; international banking.
Prerequisite: FIN 250

FIN 416 Entrepreneurial Finance (3-0-3)
Introduces financial management tools and techniques that are encountered by entrepreneurs in the lifecycle of their venture. The course builds on the basic financial tools and financial decisions framework with an emphasis on the unique challenges of start-ups in the stages of planning, financing, operations, governance, and valuation. Also, the course explains the role of venture capital and private equity and how they would contribute to start-up development. In addition, deal structuring, choices of achieving liquidity are also discussed in the course.
Prerequisites: BUS 200, Junior Standing

FIN 421 Security Analysis and Portfolio Management (3-0-3)
Focuses on the application of investment theory in selection and analysis of securities and management of portfolios. Selection and management of security portfolios, applying tools and techniques developed within the modern portfolio theory framework. Management of fixed income security portfolios, duration analysis, asset pricing model; investment in options and futures and their role in hedging and speculation; portfolio performance evaluation and monitoring; examination of institutional investment policies.
Prerequisite: FIN 320

FIN 422 Financial Risk Management (3-0-3)
Discusses different types of risks that face business entities including financial institutions face in their day-to-day operations. It discusses various types of risks such as interest rate risk, credit risk, market risk, liquidity risk, operational risk, and reputational risk. This course will also introduce some important risk management tools and techniques such as hedging techniques to manage local and global markets risks.
Prerequisites: FIN 315, FIN 320

FIN 423 Fixed Income Analysis (3-0-3)
Covers the valuation and the analysis of risk of fixed income securities. The topics covered include risk measures, namely duration and convexity and their relation to the term structure of interest rate. Also, fundamentals of credit analysis and the credit analysis models. In addition, asset-backed securities and their structure and valuation are discussed.
Prerequisites: FIN 315, FIN 320

FIN 424 Investment Valuation (3-0-3)
Builds on basics of security analysis and valuation tools learned in corporate finance, investment, and other business courses. Variety of valuation techniques are covered such as

discounted cash flow models, multiples valuation, asset-based models, contingent claim models. Also, special topics of valuation will be introduced. For example, valuation of financial services firms, valuing start-ups, high-tech firms, and valuing businesses with negative earnings. In addition, accounting shenanigans and their impact on valuation will be discussed.
Prerequisites: FIN 315, FIN 320

FIN 425 Financial Modeling (3-0-3)
Focuses on practical financial modeling for purposes of financial planning and decision making. Spreadsheet-based financial models. Quantitative modeling applications in financial analysis and planning; valuation techniques including derivative security valuation; capital budgeting; leasing; statistical analysis; risk analysis; optimization techniques; investment analysis and portfolio management.
Prerequisites: FIN 315, FIN 320

FIN 430 Risk Management, Conventional and Islamic Insurance (3-0-3)
Introduces principles and practices of insurance and risk management including identification, measurement, and dealing with insurable risk in personal and business situations. Topics include theory of risk; insurance principles and terminology; implementation of risk management strategies through insurance coverage, risk retention, and risk reduction devices; financial aspects of insurance companies and markets; types of insurance coverage; basic features of selected insurance contracts.
Prerequisite: FIN 250

FIN 435 Real Estate Investment and Finance (3-0-3)
Overviews the real estate markets; analysis of residential and commercial real estate development, mortgage financing and investment decisions. Fundamentals of property valuation, economic factors influencing property values, property management, and appraising principles for residential and income property, leverage, and methods of financing.
Prerequisite: FIN 250

FIN 440 Islamic Finance (3-0-3)
Introduces Islamic Banking and Finance, Islamic finance in Saudi Arabia and international Markets, Islamic contract Law, Islamic Banking and financial instruments, Applications of Islamic financing and Islamic bonds (Sukuk), Islamic insurance (Takaful), Social financing institutions, Islamic assets and fund management, Risk management in Islamic finance and Basel Accord, Islamic international infrastructure bodies and banking regulations, Innovation, products development, and future of Islamic financial industry.
Pre/Co-requisite: FIN 320

FIN 441 Governance of Islamic Financial Institutions (3-0-3)
Covers corporate governance overview and Islamic perspective, Shariah requirements in products and operations (principles of Shariah Compliance), International shariah governance standards, Regulatory framework of Shariah governance system in Saudi and International markets, Governance structure and Shariah Supervisory Board, Shariah review and audit shariah review, Shariah committee reporting, Shariah Audit Scope, Shariah audit reporting, Shariah risk management, Special governance issues of Islamic financial Institutions, Shariah governance service industry (research, advisory, audit services).
Corequisite: FIN 440

FIN 442 Islamic Capital Markets (3-0-3)

Covers capital markets overview and founding thoughts, Islamic finance: underlying contracts, instrument design and requisites, Islamic interbank money market (IIMM), Sukuk and Sukuk markets and indices, Sukuk pricing, Islamic equity market and indices, Islamic mutual funds, Islamic Exchange traded funds (ETF), Islamic real estate investment trusts (REIT), Shariah-compliant derivative instruments, Structured Islamic products, Islamic portfolio management.

Prerequisite: FIN 440

FIN 443 Accounting of Islamic Financial Institutions (3-0-3)

Covers Islamic financial system, Islamic financial contracts, Islamic accounting and the regulatory framework, Conceptual framework, General presentation and disclosures requirements, Accounting for deposits and investments, Accounting for Mudarabah financing, Accounting for Musharakah financing, Accounting for Murabahah financing, Accounting for Ijarah financing, Accounting for Salam financing, Accounting for Istisna financing and parallel Istisna, Accounting for Takaful.

Prerequisite: FIN 440

FIN 450 Financial Policy (3-0-3)

Examines practical problems in all areas of finance in a case study format. The course emphasizes the application of financial theories and analytical techniques to solve business problems in both domestic and international settings. Topics covered in the course include financial analysis and planning; working capital management; capital budgeting and cash flow analysis; lease financing; long-term financing and capital structure decisions; corporate restructuring, mergers & acquisitions, investment analysis, international finance. The course will focus on business case analysis.

Prerequisites: FIN 315, FIN 320

FIN 460 Derivatives (3-0-3)

Introduces derivative securities and the markets in which they trade. Explores the regulatory framework for financial derivatives and the operations of derivatives exchanges. Investigates the characteristics of futures and option contracts and their associated trading strategies to achieve risk-return objectives. Discusses arbitrage principles and pricing of derivative securities.

Prerequisite: FIN 320

FIN 470 Financial Engineering (3-0-3)

Covers the pricing/valuation of derivative securities including futures, options and/or fixed-income and interest-rate derivatives. Presents the classic pricing theory based on stochastic process. Also, examines dynamic hedging and synthetic options based classic Greek Letters and numerical methods. In addition, it conducts empirical tests for financial asset return process as well as market anomaly. Besides that, it discusses the market microstructure, limits to arbitrage and trading algorithm that affect derivative pricing. Introduces special topics if there is a breakthrough in financial engineering research.

Prerequisite: FIN 320

FIN 495 Special Topics in Finance (3-0-3)

Focuses on advanced, contemporary, and specialized areas in Finance not covered extensively in other courses.

Prerequisite: FIN 315

GEOSCIENCES

GEO 401 Fundamentals of Climate Change (3-0-3)

Climate system, climate change and global warming; Historical climate change, politics, economy, and society; Global carbon cycle; Greenhouse gases, radiative forcing, and climate sensitivity; Sources of greenhouse gas emissions, Carbon footprint; Climate change models and scenarios; Impacts of climate change and associated vulnerability; Challenges associated with climate change; Adaptation and mitigation of climate change.

Prerequisite: Senior Standing

GEOLOGY

GEOL 102 Principles of Geology (2-0-2)

Origin and structure of the Earth and planets, the rock cycle, rock and mineral identification, plate tectonics, volcanism, erosion and sedimentation, metamorphism, geological time, relative and absolute dating, earthquakes, geological structures, desert landforms, natural resources.

Corequisite: GEOL 103 for Geology and Geophysics

GEOL 103 Principles of Geology - Lab (0-3-1)

This is the laboratory section that accompanies GEOL 102. Laboratory exercises concentrate on mineral and rock identification, map interpretation, and geological processes. At least one field trip is required.

Corequisite: GEOL 102 for Geology and Geophysics

GEOL 202 Applied Geosciences for Scientists and Engineers (2-3-3)

Introduction; geologic processes; rocks and minerals; natural resources: hydrocarbons, minerals and ground water; aspects of environmental and engineering geology; geophysics principles and practices; case histories.

Note: Cannot be taken by Geology Majors

GEOL 213 Earth History and Paleontology (2-3-3)

Introduction to the principles of geology and stratigraphy. Magneto- bio- lithostratigraphy, stratigraphic correlation, the geological time scale, origin of the Earth, evolution of Earth's biota and environments over the last 4 billion years. Critical events in Earth history. Laboratory exercises cover major fossil groups used in biostratigraphy. At least one field trip is required.

Prerequisites: GEOL 102

GEOL 217 Mineralogy and Optical Mineralogy (2-3-3)

Systematic mineralogy including detailed study of major rock-forming minerals with emphasis on their physical and optical properties, chemical composition, occurrences, and associations. Principles of crystallography, crystal systems, symmetry classes and forms. Crystal chemistry. Structure of minerals. Optical mineralogy. Laboratory exercises include studies of common rock-forming minerals using the polarizing microscope, determination of mineral specimens by their physical properties, and morphological crystallography using crystal models.

Prerequisites: GEOL 102, CHEM 101

GEOL 220 Petrology (2-3-3)

Nature and origin of igneous, sedimentary, and metamorphic rocks. Phase relations in silicate melts, modes of occurrence, textures, and petrography of igneous rocks. Texture, structure, composition, provenance, diagenesis, and classification of sedimentary rocks. Processes and types of metamorphism. Facies, textures, and mineralogy of metamorphic rocks. P-T paths. Laboratory studies of igneous, sedimentary, and metamorphic rocks in hand specimen and under the microscope. At least one field trip is required.

Prerequisites: GEOL 217

GEOL 270 Sedimentology and Stratigraphy (2-3-3)

Sediments and their properties, sedimentation processes, depositional environments, facies and facies analyses, provenance, principles and fundamentals of stratigraphic units, Walther's law, correlation and overview of seismic and sequence stratigraphy. Laboratory covers types, texture, and composition of common sedimentary rocks, core description, lithofacies mapping, facies analyses, and correlation. Computer software used for stratigraphic column construction and data interpretation. At least one field trip is required.

Prerequisites: GEOL 213

GEOL 303 Sustaining the Earth (3-0-3)

Introduction to environmental issues facing humanity. Sustainability, biodiversity, and evolution. Food-, soil-, and pest management, water resources and pollution, renewable energy, environmental hazards and human health, air pollution, climate change, and ozone depletion.

Prerequisites: Junior Standing

GEOL 305 Structural Geology (2-3-3)

Principles of structural geology. Both tectonic and non-tectonic structures. Fundamentals of rock mechanics, stress, strain and deformation, and their effects on rock structures. Brittle deformation, fractures, faults, and joints. Ductile deformation and associated structures. Cross section construction and interpretation. Cleavage, foliation and lineations; their types and interpretation. Lab sessions include display and analysis of structural data, structural map analysis, three-point problems, and use of structural geology software for analyses. At least one field trip is required.

Prerequisites: Junior Standing

GEOL 312 Remote Sensing and GIS Applications in Geology (2-3-3)

Introduction to Geographic Information Systems (GIS) and its application to geosciences, and introduction and principles of remote sensing. Aerial photography and other remote sensing techniques, principles of photogrammetry and image interpretation for geological information.

Prerequisites: GEOL 305

GEOL 315 Petroleum Geology (3-0-3)

Fundamentals of the geology of oil and natural gas. Definition and properties of petroleum fluids and reservoir properties. Origin, migration, and accumulation of hydrocarbons as related to source, reservoir, and seal rocks. Structural, stratigraphic, and combination traps. Survey of exploration methods. Concept of petroleum province and basin analysis. Computer software used for basin analysis and data interpretation. At least one field trip is required.

Prerequisites: GEOL 305

GEOL 318 Regional Geology (3-0-3)

Tectonic elements of the Arabian Peninsula. Rocks and the sedimentary cover of Arabia. Geological, structural, and geomorphological evolution of Arabia with emphasis on hydrocarbon potential, mineral wealth, and groundwater resources. At least one field trip is required.

Prerequisites: GEOL 305

GEOL 341 Engineering Geology (3-0-3)

Modern concepts of engineering geology. Impact of geology on siting and structures, design of engineering projects. Geological and mechanical fundamentals as related to engineering practices, emphasis on parameters of rock mass classification systems, and on techniques relevant to site investigation studies. Case histories.

Prerequisites: GEOL 102 or Consent of Instructor for Non-Geosciences Majors

GEOL 345 Integrated Petroleum Geology (3-3-4)

Sedimentary rock properties and classification, major depositional environments, lithostratigraphic units, sedimentary basins. Origin and migration of hydrocarbons. Petroleum system elements. Reservoir rocks and controls on reservoir quality. Tectonic framework of the Arabian plate. Petroleum systems of Saudi Arabia. Laboratory analysis on identification, classification, and description of clastic and carbonate sedimentary rocks in hand specimen. Porosity evaluation of reservoir rocks under the microscope. Well log interpretation.

Note: Cannot be taken by Geology Majors

Prerequisites: GEOL 102

GEOL 354 Computational Methods in Geology (2-3-3)

Introduction to modern concepts of quantifying geological variables. Integration, analysis, and interpretation of geological data. Application of statistical, spatial, and numerical techniques to characterize oil reservoirs, groundwater aquifers, mineral resources and contaminated sites. Computer software for modeling purposes is introduced.

Prerequisites: GEOL 220, GEOL 270

GEOL 356 Fundamentals of Geochemistry (2-3-3)

Investigation of the abundance and distribution of chemical elements in the solid Earth and its oceans and atmosphere. Solar system nucleosynthesis, basics of geochemical thermodynamics, aqueous geochemistry, phase and mineral equilibria, stable and radiogenic isotopes, geochronology, and petroleum geochemistry. Application of geochemistry to understanding global cycling of elements, finite resources, and environmental and climate issues.

Prerequisites: GEOL 220

GEOL 357 Stable Isotope Geochemistry (3-0-3)

Introduction to stable isotope systematics. Theoretical aspects of isotope exchange, isotope fractionation, and isotopic variations in geologic systems. Application of light stable isotope geochemistry to understanding the hydrologic cycle, biogeochemical cycling, diagenesis, and global change.

Prerequisites: GEOL 356

GEOL 364 Carbonate Geology (3-0-3)

Carbonate sediment and rock constituents, rock classification, carbonate porosity, and sedimentary processes. Environments of deposition, facies associations, and economic importance. Modern carbonate sedimentary environments as analogs for ancient accumulations. Carbonate petroleum reservoirs. Study of outcrops, hand specimens, and thin sections. At least one field trip is required.

Prerequisites: GEOL 270

GEOL 399 Summer Training (0-0-1)

Each student must work as a trainee geologist for a period of eight weeks in an organization/company that conducts geological activities, after which he must submit a written report and make an oral presentation, based on his training in the organization.

Prerequisites: ENGL 214, Junior Standing

GEOL 423 Hydrogeology (3-0-3)

Theory and geology of groundwater occurrence and flow. Introduction to the hydrology of surface and groundwater supplies, water-bearing properties of rocks, hydrodynamics of flow through porous media, flow nets, well hydraulics, and analysis and evaluation of pumping test data. Groundwater quality and groundwater occurrence in various rock types and sediments, field techniques used in groundwater exploration and survey. Computer software used for data interpretation, simulation, manipulation, and graphs survey.

Prerequisites: GEOL 102

GEOL 430 Field Geology (0-18-6)

Six weeks of systematic field work for training in geological field and laboratory techniques. Field safety and field mapping techniques. Preparation of field notebook, geological maps, stratigraphic sections, and cross sections. Laboratory analysis of rocks collected in the field, and preparation of oral and written final report. On-site fieldwork and on-campus laboratory study required.

Prerequisites: GEOL 318

GEOL 434 Marine Geology (3-0-3)

Introduction to geology of the world's ocean basins. Continental margin geological processes and features. Characterization of continental shelves, barrier islands, reefs, atolls, slope, rise, and abyssal plains, submarine canyons, and plate-tectonic activity. Global sea-level history, oxygen isotope stratigraphy, plate tectonic control of ocean circulation, ocean gateways, critical events in ocean history. Collaborative international ocean drilling programs. At least one field trip is required.

Prerequisites: GEOL 270

GEOL 436 Oceanography (3-0-3)

Fundamental principles of geological, chemical and physical oceanography. Historical overview of ocean exploration. Distribution of terrigenous and biogenic sediments. Seawater characteristics including temperature, salinity, and density. Tidal theory, geostrophic flow, surface and deep ocean circulation. Water column zonation. Concept of CCD, lysocline, thermocline, halocline and pycnocline, nutrients, the oxygen minimum zone, and oxygen utilization. The global carbon cycle. The glacial ocean. At least one field trip is required.

Prerequisites: GEOL 270

GEOL 444 Undergraduate Research (3-0-3)

Students in high standing undertake research. The student joins an ongoing research project with one of the faculty members of the college. The student, with help of the faculty, identifies an aspect of the project that can be accomplished within the span of one semester, prepares a brief proposal, writes a literature review, collects and interprets original data, and produces a written report and an oral presentation.

Prerequisites: GPA above 3.0 or Approval of Program Coordinator

GEOL 446 Environmental Geology (3-0-3)

Environmental problems, hazards, and their mitigation. Critical evaluation of geological processes: volcanic activity, earthquakes, slope failures and landslides, flooding, groundwater movement, solution cavities and sinkholes. Environmental problems associated with human interaction: groundwater pollution, groundwater withdrawal, acid rain, solid waste disposal, land development and urbanization, agricultural activity, soil erosion, and desertification. Current environmental issues. At least one field trip is required.

Prerequisites: Junior Standing

GEOL 447 Energy and the Environment (3-0-3)

Energy supply and demand. How various forms of energy impact the Earth's environment. Traditional and alternative energy: hydrocarbons (conventional and unconventional), nuclear, solar, geothermal, hydroelectric, biofuels, wind. Policy considerations. Subsurface engineering and problem-solving methods. Provides an understanding of the Earth relevant to the production of natural energy resources.

Prerequisites: Junior Standing

GEOL 450 Biostratigraphy of the Arabian Plate (2-3-3)

Introduction to micro- and macrofossils, including preservation, biodiversity, and basic aspects of zoological nomenclature. Principles of biostratigraphy and biochronology. Review of major fossil groups. Laboratory sessions cover practical examples from the Arabian Peninsula, including foraminifera, palynomorphs, calcareous nannofossils, conodonts, trilobites, graptolites, ammonites. Applications of fossils for biostratigraphic and paleoenvironmental determinations applied to hydrocarbon exploration.

Prerequisites: GEOL 213

GEOL 465 Subsurface Geology (3-0-3)

Characterization and analysis of sedimentary rocks in the subsurface specifically related to hydrocarbon exploration and production. Integration of well logs, seismic data, and core data. Creation and interpretation of subsurface structural, isopach, and depositional facies maps. Computer software used for subsurface analysis.

Prerequisites: GEOL 315 or GEOL 345

GEOL 470 Geology of Unconventional Reservoirs (3-0-3)

Geological principles of unconventional petroleum systems. Principal unconventional reservoirs and their characteristics in Saudi Arabia. Sedimentology, reservoir heterogeneity, geochemistry, geomechanics, and petrophysics of unconventional petroleum systems.

Prerequisites: Senior Standing

GEOL 482 Current Topics in Geosciences (3-0-3)

A seminar-style course, taught by various members of the Department. Faculty members discuss their own research in the broader context of cutting-edge geoscience.

Prerequisites: Senior Standing in Geology

GEOL 490 Special Topics (3-0-3)

Special topics in the broad topical area of the geosciences.

Prerequisites: Senior Standing, Approval of Department

GEOL 499 Geology Seminar (1-0-1)

Preparation and presentation of various geological topics, selected in consultation with course faculty. Collection of geological information (e.g., journals, books, maps, government

publications), primary geological literature, proper citation, data synthesis, elements of organization and style for presentations and geological reports. Each student submits a written report on a chosen topic and delivers an oral presentation.
Prerequisites: Senior Standing in Geology

GEOPHYSICS

GEOP 102 Essentials of Geophysics (2-0-2)

Introduction to the ways that geophysics contributes to our understanding of the Earth, and the key concepts and principles of widely used geophysical methods. Emphasis is on physical basis, data acquisition, processing, interpretation of each method, and their application to hydrocarbon exploration, ground water exploration as well as engineering and archaeological applications.

GEOP 204 Introduction to Seismology (3-0-3)

Basic seismological theory, relationship of earthquakes to plate tectonics, causes and effects of earthquakes, source parameters, earthquake location, determination of earthquake magnitude. Interpretation of seismograms, earthquake statistics, seismic hazard and risk assessment, earthquake prediction, seismometers and seismological networks. At least one field trip to a seismic station is required.

Prerequisite: GEOP 102

GEOP 205 Computational Geophysics (3-0-3)

Elements of geophysical data inversion, linear systems theory, basic digital signal processing, statistics, error propagation, numerical differentiation, matrix calculus, linear parameter estimation, data fitting, spectral analysis, convolution, deconvolution, and filter design, analysis and implementation.

Prerequisites: MATH 201, ICS 104, GEOP 102

GEOP 215 Introduction to Seismic Exploration (3-0-3)

Seismic waves (elasticity, wave equation, anisotropy, body and surface waves, propagation and interface effects, reflection coefficients), time-distance curves (NMO, DMO), seismic velocity (sedimentary rock model, velocity types, velocity determination), seismic signal and noise (primary reflections, direct, air, surface, and head waves, diffractions, multiples, random noise), seismic equipment (positioning, sources, receivers, recording), field procedures (spreads, arrays, CMP method, survey parameter selection), 3-D seismic exploration (terminology, swath shooting, marine 3-D).

Prerequisite: GEOP 102

GEOP 304 Gravity and Magnetic Exploration (3-0-3)

Physics of gravity, description of the Earth's gravity field, its temporal variations, and the small-scale perturbations that are the signal of gravity exploration methods, field procedures, data acquisition, correction and processing, basic interpretation techniques, estimation of source parameters for simple anomalies by manual methods and by data inversion and case histories. Physics of magnetism and description of the Earth's magnetic field and its variations in space and time, rock magnetism, instrumentation, survey procedure, interpretation and case histories. Matlab is used for computation and modeling.

Prerequisites: GEOP 205, PHYS 305

GEOP 320 Seismic Data Processing (2-3-3)

Objectives of seismic data processing, basic data processing sequence, Fourier transform, delta and sinc functions, convolution, correlation, wavelet phase, frequency filtering and aliasing, amplitude gain, deconvolution (spiking, optimum, predictive), velocity analysis (velocity spectrum, constant velocity stacks), static corrections (elevation, residual), NMO correction and stacking, migration (2D, 3D, poststack, prestack, time, depth, algorithms

including Kirchhoff, finite difference, and FK. Students will apply basic data processing sequence on a real seismic data set using a seismic data processing package.
Prerequisites: GEOP 205, GEOP 215

GEOP 340 Borehole Geophysics (3-0-3)
Introduction to downhole geophysical well logging and borehole seismics (VSP; cross-hole methods), key concepts and techniques utilized to identify geological formations and to characterize rock units of interest using data gathered from wells, physical and mathematical foundations to conceptual and practical understanding of varieties of borehole data and properly using them in reservoir characterization and Earth modeling. Basic logging and VSP principles, theory of tool operation, analysis of open-hole logs to estimate rock and fluid properties via integration of different log data and calibration with other data types such as core samples and seismic data, techniques of tying log depths to seismic times and rock property extraction from wells and seismic data.
Prerequisite: GEOP 102

GEOP 353 Electrical and Electromagnetic Exploration (3-0-3)
The basic theory of electrical and electromagnetic exploration, electrical properties of minerals and rocks. Natural-source methods (self-potential and magnetotelluric,) and artificial-source methods (direct current resistivity, induced polarization, ground penetrating radar, electromagnetic induction) are studied in terms of field acquisition procedures, data processing, and data interpretation. One data inversion and modeling software will be utilized during the course to get hands on experience in forward and inverse modeling techniques used in interpretation of electrical and electromagnetic data.
Prerequisites: GEOP 205, PHYS 305

GEOP 399 Summer Training (0-0-1)
A continuous period of eight weeks of summer working in the exploration industry to gain practical experience in the field of geophysics. The student is required to submit a written report and give an oral presentation in a seminar at the department about his experience and the knowledge he gained during his summer work.
Prerequisites: ENGL 214, CPG 199, Junior Standing

GEOP 416 Seismic Data Interpretation (3-0-3)
Seismic resolution, types of events on seismic sections, characteristics of events, vertical seismic profiling, geologic aspects of velocity, and seismic response of various stratigraphic and structural features. Direct hydrocarbon indicators, 2-D and 3-D seismic exploration techniques will also be covered along with an introduction to seismic stratigraphy.
Prerequisite: Senior Standing

GEOP 420 Current Topics in Geosciences (3-0-3)
A seminar-style course, taught by various members of the department. Faculty members discuss about their own research in the broader context of cutting-edge geophysical research.
Prerequisite: Senior Standing

GEOP 422 Remote Sensing (3-0-3)
Introduction to microwave & optical remote sensing and Geographic Information Systems (GIS) and their application to geosciences. Aerial photography and other remote sensing techniques, principles of photogrammetry and image interpretation for geological information. Electromagnetic (EM) Properties of natural earth materials. Fundamentals of

ground-penetrating radar (GPR) systems. Design, processing, interpretation, and applications of EM and GPR methods.
Prerequisite: PHYS 305

GEOP 430 Geophysical Well Logging (2-3-3)
Introduction to general aspects of well logging, drilling mud, compositional properties of rocks, porosity, permeability, and fluids content. Logging techniques – resistivity, self-potential, gamma ray, neutron, density, sonic, calipers, and dipmeters will be studied to determine formation factor, water saturation, oil and gas zones, shaliness, and permeability. The course will also cover well log patterns of known rock units, the geological interpretation of well logs, correlation between wells, and tying wells to seismic sections.
Note: Not to be taken for credit with PETE 313
Prerequisite: GEOP 102

GEOP 455 Geodynamics (3-0-3)
Basic physical principles applied to the study of the Earth's material properties and the Earth dynamical processes. A variety of geological phenomena such as heat and fluid flow, rock rheology and deformation, lithospheric flexure and isostatic equilibrium, and mechanics of plate tectonics will be discussed too.
Prerequisites: GEOP 102, PHYS 210

GEOP 465 Paleomagnetism (3-0-3)
Methods and techniques of paleomagnetism and their application to a variety of geological problems in regional and global tectonics, geochronology, paleogeography, rock fabric analysis, etc. Students conduct a small-scale study as a term project.
Prerequisite: GEOP 102

GEOP 470 Geophysical Engineering (3-0-3)
The practical and theoretical aspects of seismic refraction and electrical resistivity methods as applied for the siting and control of engineering projects such as dams, tunnels, highway cuts and water supply. Correlation between parameters of field data and rock mechanics, such as joint frequency, rock quality designation, strength and solution cavities will be covered. Interpretation techniques and fieldwork constitute the main part of the course.
Prerequisite: GEOP 102

GEOP 475 Environmental Geophysics (3-0-3)
Application of geophysical methods to environmental problems such as impact-assessment, clean-up, city planning, and siting of civic, industrial, and military critical facilities. Techniques include seismic, electrical and electromagnetic sounding, ground-penetrating radar, magnetics, gravity, and borehole geophysics are used in such environmental problems.
Prerequisite: GEOP 102

GEOP 478 Data Inversion in Geophysics (3-0-3)
Basic concepts and techniques of inverse theory and its application to geophysical problems. Focus is on linear inverse problems in gravity, magnetic, seismic, and electrical data modeling and interpretation.
Prerequisites: GEOP 102, MATH 202

GEOP 480 Special Topics (3-0-3)

The topic of this course is determined based on mutual agreement and interest of the instructor and the students.

Prerequisite: Senior Standing

GEOP 488 Petrophysics (3-0-3)

Introduction to basic petrophysical properties of permeability, porosity, and acoustical impedance. Laboratory measurement of porosity, permeability, capillary pressure, wettability, fluid saturation and relative permeability, principles of acoustic, electric, electromagnetic, and nuclear measurements and their applications to exploration and production of hydrocarbons. Lab topics also include measurement instruments and techniques, analysis and uncertainty of measured data.

Prerequisite: Junior Standing

GEOP 490 Geophysics Field Camp (0-9-4)

Four weeks of geological and geophysical field training and geophysical data acquisition followed by four weeks of data processing, interpretation and scientific communication. Students spend four weeks in the field learning basic geological and geophysical field techniques, participating in designing geophysical surveys, acquiring field data using different geophysical techniques such as gravity, seismic and geoelectrics. Then, they process, analyze and interpret the acquired data. Completion of weekly reports and final report and oral presentations are requried.

Prequisite: GEOP 320

GEOP 495 Advanced Reservoir Characterization (3-0-3)

Reservoir modeling using software tools for statistical analysis of reservoir data, cluster analysis, semivariogram analysis and modeling, spatial interpolation (Kriging), tools for data integration in Kriging, stochastic simulation of rock-types (lithology), pay thickness, porosity, and permeability, use of geological models in flow simulation, and uncertainty assessment.

Prerequisite: Senior Standing

GEOP 497 Undergraduate Research (3-0-3)

This course introduces the undergraduate students to research projects during the junior and/or senior years. It will provide, at an early stage, an appreciation of research and real-world problem solving. Students may take either a well-defined role in an ongoing research project or initiate a project of their own in consultation with a faculty advisor.

Prerequisites: ENGL 214, Junior Standing, Approval of the Department

GEOP 499 Seminar (1-0-1)

This course requires weekly discussion and presentation of research topics of geophysical interest. The theme of the seminar varies from year to year depending on the interest of the coordinator of the seminar. Participants are expected to make presentations and lead discussions on the subject of interest.

Prerequisite: Senior Standing

GLOBAL STUDIES

GS 220 Information Searching Skills (2-0-2)

Acquaintance to printed and electronic information resources, methods of searching for information, searching in the indexes and the abridgments, seeking by subject and word, using electronic information bases and the Internet, practical exercises through searching for information.

Prerequisite: ENGL 102

GS 318 World Civilizations (3-0-3)

The development of world civilizations from 1500 AD until the present, examining the peoples, forces and concepts that have shaped the rise of major world civilizations. This includes: the history of nation-states and related inter-nation and inter regional rivalries, colonialism and geographical context, the discovery and exploration of the new world, the role of societal development and intellectual thought, analysis of diverse socio-cultural perspectives and religions in determining the interaction of world cultures and their influence on the development of world civilization.

Prerequisite: ENGL 102

GS 321 Principles of Human Behavior (3–0–3)

Understand and explain human behavior: psychological concepts, theories, and scientific methods. Human activities: processing information and world perception, learning, remembering. Behavioral energizers: motivation, emotions and changing (development). Mental processes: critical thinking, and creatively. Individual differences: intelligence and personality. Social interactions and influences. Mental health: stress, adaptation and coping, and psychological disorders.

Prerequisite: ENGL 102

GS 332 Principles of Sociology (3-0-3)

Concepts, relevance, development, and research methods of sociology. Major sociological paradigms and theories. Socialization and social interaction. Social groups and institutions: analyses of function and impact. Analyses of everyday social life through sociological concepts, such as social stratification, social control (conformity, deviance and authority), social and cultural changes, and social development.

Prerequisite: ENGL 102

GS 336 Work & Society (3-0-3)

Development of Industrial Society. Management and work forces relations. Theories of human relations and interactions. Various economic activities. Theories of motivation, bureaucracy, leadership, emphasizing basic needs and human relations.

Prerequisite: ENGL 102

GS 342 International Relations (3–0–3)

The nature of the International community and how states interact. Theories of international relations and the factors that affect the international community. Aspects related to international relations such as globalization, United Nations and other Organizations. Some regional and international current issues.

Prerequisite: ENGL 102

GS 355 Cultural Anthropology (3–0–3)

The discipline of cultural anthropology including key theoretical and methodological approaches to the study of culture. The nature of ethnographic analysis: how cultural anthropologists understand, describe, explain, and highlight the particularities, similarities, and differences of the human experience. Examine the comparative study of contemporary human societies, cultures, and diversity, including local and regional cultures. How people adapt to, make sense of, and transform their worlds. Examine and understand the cultural dimensions of human life expressed through value of systems, language, and social practices and their meanings.

GS 420 Personality Psychology (3–0–3)

Personality definitions, assumptions, different characteristics (traits, dispositions, and styles), and effects on behavior. Measurement of personality. Theories of personality. Personality and related issues; namely: its relation to some psychological concepts and constructs. Culture and gender. Individual well-being.

Prerequisite: ENGL 102

GS 424 Business Psychology (3–0–3)

Introduction to business psychology. Research and application of business psychology. Individual differences and the foundation and procedures of assessment. Psychological aspects of organizational processes related to employee selection and recruitment, job analysis, and performance measurement. Psychological health, wellbeing, and attitude toward work. Teams, leadership and other organizational dynamics.

Prerequisite: ENGL 102

GS 426 Social Psychology (3-0-3)

The study of the social nature of humans: social psychology notions and development. Exploring and implementing the scientific methods of social psychology. The influence of heredity and culture on the individual. The development of the components of the self. An introduction to social cognition, including person perception, stereotyping, and prejudice. The foundations of social influence, including compliance, persuasion and obedience. Understanding the processes that drive prosocial and antisocial behavior. A comparative approach to the nature of belonging and social relationships. The effects of groups on the individual and vice-versa: group and the self, power, status, and leadership.

Prerequisite: ENGL 102

GS 434 Mass Media & Society (3–0–3)

An overview and analysis of sociological perspectives regarding the role of mass media in society. Critical analysis of issues in mass media. Mapping mass media structure. The basic functions of communication through analyses of information, opinion, entertainment, advertising and marketing. Ways of directing public opinion. An overview of the impact of mass media in promoting economic products and industries. Effects on society and cultural change. Legal and ethical issues in mass media. History and development of mass media in the Middle East.

Prerequisite: ENGL 102

GS 445 Energy Management and Policies (3–0–3)

Overview of electricity generation, transmission, distribution, power plant economics, regulations, and policies used in new technologies (IoT, Data analysis, Smart metering), big data management in energy projects, role of a digital industry 4.0 in a renewable energy

system, review of existing energy policies, world electricity market and energy security, electricity price regulations, future market trends, and derivatives, environmental impacts, policy planning.
Prerequisite: Senior Standing

GS 447 Globalization (3–0–3)
The nature of globalization including: definitions, concepts, dimensions, and prospects. The historical context of globalization. The global security. International political economy in a global age. International law, international system, and international organizations in a globalized world. Transitional actors in global politics. Globalization and contemporary global issues. The overall impact of globalization and its future prospective locally and internationally.
Prerequisite: ENGL 102

GS 454 Anthropology of Travel (3–0–3)
Introduction of the social implications of travel; exploration of the origins, history, and contemporary development of human travel and its impacts for socio-cultural change of society; examination of multiple theories of travel and global mobility; travel accounts of great travelers and explorers as well as explaining various forms of human travel; investigating globalization and transnationalism and their links to society’s capital and economic flow; implications of human travel for changing social boundary and identity; Arab diaspora across the world; Saudi Arabia as a global migrant destination.
Prerequisite: ENGL 102

GS 456 Science, Technology & Society (3–0–3)
Introduction to science, technology, and society. Theories of knowledge, science, and technology. Social and cultural aspects of science and technology. The social construction of scientific and technological realities. Controversies, rhetoric, and discourse in science and technology. Public participation in scientific and technological activities. The political economies of knowledge.
Prerequisite: ENGL 102

GS 457 Social Networks (3–0–3)
Introduction of the subject of social human connectivity through social organization and network analysis; foundations of social networks theory, the constructs of social networks, and transformative properties of networks; exploration of the science of social networks analysis, choice, and its limitations; the role of social capital and social capital's relationship to social networks; consideration of large and egocentric networks and the mapping and visualization of such networks.
Prerequisite: ENGL 102

GS 494 Special Topics I (3–0–3)
The course presents special topics within the disciplines of the Department. Topics are selected from either Cultural Anthropology, History, International Relations, Psychology, or Sociology. A detailed description and syllabus of the course is announced one semester in advance.
Prerequisite: ENGL 102

GS 495 Special Topics II (3–0–3)

The course presents special topics within the disciplines of the Department. Topics are selected from either Cultural Anthropology, History, International Relations, Psychology, or Sociology. A detailed description and syllabus of the course is announced one semester in advance.

Prerequisite: ENGL 102

GS 496 Special Topics III (3–0–3)

The course presents special topics within the disciplines of the Department. Topics are selected from either Cultural Anthropology, History, International Relations, Psychology, or Sociology. A detailed description and syllabus of the course is announced one semester in advance.

Prerequisite: ENGL 102

HUMAN RESOURCES MANAGEMENT

HRM 301 Human Resources Management (3-0-3)

Covers all activities and processes of the human resources function that include recruitment, selection, placement, training, career development, performance appraisal and motivation, compensation, and separation. Emphases are put on the role of HRM in organizational strategies and the human resources as a source of competitive advantage. Also included, coverage of the environmental, contextual and global aspects and dimensions of the human resource management function and activities and the case of the Saudi Business environment.

Prerequisite: MGT 301

HRM 390 Performance Appraisal & Management (3-0-3)

Covers how employee performance is organized, appraised, and managed to achieve organizational and individual performance goals. Topics include introduction to performance management, performance management process, performance management and strategic planning, appraisal systems and techniques, measurement approaches, performance analytics, team performance management, performance measurements and their validity, and performance appraisal and management.

Prerequisite: HRM 301

HRM 401 Staffing & Selection (3-0-3)

Provides an in-depth analysis of the methods used in staffing and selection processes. Topics include strategic staffing, strategic job analysis, and competency modelling, recruitment and selection, legal context, choosing and hiring candidates, and managing workforce flow.

Prerequisite: HRM 301

HRM 402 Training & Development (3-0-3)

Provides students with information and insights into the training and development functions in organizations. Topics include aligning training with strategy, types of learning styles, designing training needs analysis questionnaire, training methodology, implementation and evaluation of training, and employee and management development.

Prerequisite: HRM 301

HRM 403 Compensation and Benefits Management (3-0-3)

Focuses on the techniques, processes and decisions of the design and management of employee compensation. Topics include job analysis, job descriptions and specifications, job evaluation techniques, pay levels determination, labor markets, pay surveys, performance appraisal, incentives, benefits, compensation laws, compensation of special groups, non-traditional forms of compensation such as knowledge and skill-based pay systems, the role of government and society, as well as the global implications of compensation and benefit systems to the Saudi business environment.

Prerequisite: HRM 301

ISLAMIC AND ARABIC STUDIES

IAS 101 Practical Grammar (2–0–2)

Selection of aspects of Arabic grammar essential for written and spoken communication in everyday life with emphasis on correct grammar usage.

IAS 111 Belief and its Consequences (2–0–2)

Study the true faith of the good ancestors' approach (salaf) and its evidence. The Six Pillars of Faith and its effects. The right perception of faith and life in a moderate approach. Answer the suspicions related to faith and protect the student from any extremism.

IAS 121 Language Foundation (2–0–2)

The course teaches the basic skills of Arabic grammar, discusses the contemporary issues of the Arabic language, and develops the skills that enable the student to speak or write correctly. It aims to strengthen the mental abilities that enable students to think correctly, gain different writing abilities, multiple expression skills, and techniques of speaking and dialogue.

IAS 131 Reading and Writing (1–3–2)

Alphabetization, correct pronunciation and handwriting. Step by step explanation of the principles of the Arabic language using everyday illustrations (excluding grammar and morphology).
(Open for non-Arabic speakers only)

IAS 201 Writing for Professional Needs (2–0–2)

Characteristics and types of formal writing: reports; scientific research; summaries; forms; resumes; evaluations and minutes of meetings.
Prerequisite: IAS 101

IAS 212 Ethics and Governance (2–0–2)

Understand and explain Ethics and Governance: the institutional and personal values in Islam, The relationship between morality and faith. Professional ethics: ethical responsibilities for individuals, rules of professional conduct, the most ethical violation in the level of individuals and institutions, and the application of business ethics. Governance: Definition of governance, function and impact, principles and standards of governance, its role in strengthening the ethical system in job environments.
Prerequisite: IAS 111

IAS 231 Grammar and Composition (1–3–2)

A simplified systematic study of selected important topics of Arabic grammar.
(Open for non-Arabic speakers only)
Prerequisite: IAS 131

IAS 301 Oral Communication Skills (2–0–2)

Promoting interactive skills and techniques for social, academic and professional life: dialogue; presentations; persuasion and developing a positive approach.
Prerequisite: IAS 201

IAS 321 Effective Language Communication (2–0–2)

Pillars of communication. Types of communication. Positive listening. Dialogue. Display

and presentation, Personal interview, Writing contracts and agreements. Writing minutes of meetings. Writing administrative letters.
Prerequisite: IAS 121

IAS 322 Human Rights in Islam (2–0–2)
The dignity of mankind and basic human rights. The Islamic viewpoint of human rights, its distinguishing characteristics, and debates related to this issue.
Prerequisite: IAS 212

IAS 331 Literature and Text (1–3–2)
Reading, understanding and discussion of the meaning of some Quranic *Ayas* and *hadiths*. Selected Islamic stories and Arabic verses.
(Open for non-Arabic speakers only)
Prerequisite: IAS 231

IAS 411 Contemporary Islamic World (2–0–2)
An introduction to the Islamic world. Internal challenges relating to the lagging behind in educational and scientific pursuits, differences in opinions, and differing contemporary schools of thought. External forces opposed to Islam. Current Islamic issues and means for solving them. The role played by Islamic organizations.
Prerequisite: Junior Standing

IAS 416 Al-Sirah Al-Nabawiyyah (2–0–2)
The biography and lifestyle of the Holy Prophet Mohammad (Peace Be Upon Him) portraying and exemplary model for students in their practical life.
Prerequisite: Junior Standing

IAS 418 Contemporary Financial Transactions in Islam (2–0–2)
Contemporary business transactions; corporative structure; Islamic banking; contracts; borrowing and lending; investments (Stocks, Shares, and Bonds).
Prerequisite: Junior Standing

IAS 419 Inimitability of Al-Quran (2–0–2)
Different aspects of inimitability of Al-Quran; rhetorical, metaphysical, legislative; and scientific inimitabilities.
Prerequisite: Junior Standing

INFORMATION AND COMPUTER SCIENCE

ICS 104 Introduction to Programming in Python and C (2-3-3)

Overview of computer hardware and software. Programming in Python with emphasis on basic program constructs: variables, assignments, expressions, decision structures, looping, functions, lists, files and exceptions; Introduction to objects and classes. Programming in C with emphasis on pointers and functions with output parameters. Simple multidisciplinary problem solving in science, engineering and business.

ICS 108 Object-Oriented Programming (3-3-4)

Advanced object-oriented programming; Inheritance; Polymorphism; Abstract classes and interfaces; Generic and collection classes; File input and output; Exception handling; GUI and event-driven programming; Recursion; Searching and sorting.

Prerequisite: ICS 104

ICS 202 Data Structures and Algorithms (3-3-4)

Review of object-oriented concepts; Introduction to design patterns; Basic algorithms analysis; Fundamental data structures - implementation strategies for stacks, queues and linked lists; Recursion; Implementation strategies for tree and graph algorithms; Hash tables; Applications of data structures (e.g. data compression and string matching).

Prerequisite: ICS 108

ICS 253 Discrete Structures (3-0-3)

Propositional Logic, Propositional Equivalence, Predicates and Quantifiers, Nested Quantifiers, Rules of Inference, Introduction to Proofs; Sets, Set Operations, Functions, Sequences and Summations; Mathematical Induction, Strong Induction, Recursive Definitions and Structural Induction; Basics of Counting, Pigeonhole Principle, Permutations and Combinations, Binomial Coefficients, Discrete Probability, Probability Theory; Recurrence Relations, Solving Linear Recurrence Relations, Generating Functions, Inclusion-Exclusion.

Prerequisite: ICS 104

ICS 321 Database Systems (3-0-3)

Basic database concepts; Conceptual data modeling; Relational data model; Relational theory and languages; Database design; SQL; Introduction to query processing and optimization; Introduction to concurrency and recovery.

Prerequisite: ICS 202

ICS 343 Fundamentals of Computer Networks (3-3-4)

Introduction to computer networks and layered architectures: Connectivity, topology, circuit and packet switching, TCP/IP and ISO models; Application layer: C/S model, DNS, SMTP, FTP, WWW; Transport layer: TCP and UDP, ARQ, congestion and flow control; Network layer: Internetworking, addressing and routing algorithms and protocols; Data link layer: Framing, error detection and correction, medium access control and LANs; Physical layer: Principles of data communications, circuit switching, encoding, multiplexing and transmission media; Introduction to network security.

Note: Not to be taken for credits with COE 344

Prerequisite: ICS 108

ICS 344 Information Security (3-0-3)

Security properties; Confidentiality, integrity, authentication, non-repudiation; Attack vectors, malicious software and countermeasures; Risk management and analysis; Security mechanisms; Secure software development; Defensive programming; Input sanitization; Symmetric and public-key cryptography; User authentication and access control; Internet security: Email and web security, network security protocols and standards such as IPSec and SSL/TLS; Security technologies and systems: Firewalls, VPNs and IDSs/IPSs; Information security process, ethical and legal issues.

Prerequisite: ICS 343 or COE 344

ICS 353 Design and Analysis of Algorithms (3-0-3)

Basic algorithmic analysis; Analysis of iterative and recursive algorithms; Advanced algorithmic design techniques (induction, divide and conquer, dynamic programming, backtracking); The complexity classes P and NP; Basic computability; Parallel algorithms.

Prerequisites: ICS 202, ICS 253

ICS 355 Theory of Computing (3-0-3)

Regular grammars: Equivalence of DFA, NDFA and regular expressions, pumping lemma, emptiness and membership; Context-Free Grammars: parsing and ambiguity, normal forms, applications, equivalence of PDA's and CFG's, pumping lemma, emptiness and membership; Turing machines: Programming techniques for Turing machines, universal Turing-machine; Undecidability: Recursively enumerable and recursive languages, undecidability, problem reduction, undecidable problems of CFG's, RE's and TM's.

Prerequisite: ICS 253

ICS 381 Principles of Artificial Intelligence (3-0-3)

AI history and applications; Intelligent agents and expert systems; Introduction to AI programming; Problem solving agents by uninformed, heuristic and local search; Constraint satisfaction and programming, games and adversarial search; Knowledge-based agents: Propositional and first-order logic, Forward and backward chaining and inference; Planning and reasoning in uncertain situations; Basics of machine learning; Natural language processing; Exposure to other applications of AI (e.g. Vision and Robotics).

Prerequisite: ICS 253

Corequisite: STAT 319

ICS 398 Internship (0-0-6)

A continuous period of 16 weeks spent as a normal “new” employee in industry, business, or government agencies with the purpose of familiarizing students with the real world of work and enabling them to integrate their learning to a real work environment. During this period, a student is exposed to a real-life work in the field and work as a normal employee. Each student is required to participate with at least one project. Students are required to submit progress reports during the work period. Students are also required to give a presentation and submit a final report on their experience and the knowledge they gained during their work.

Prerequisites: ENGL 214, ICS 321, SWE 206, SWE 363, Completion of at least 85 hours, Major and Cumulative GPA of at least 2.0

ICS 399 Summer Training (0-0-0)

A continuous period of 8 weeks spent as a normal employee in industry, business, or government agencies with the purpose of familiarizing students with the real world of work and enabling them to integrate their classroom learning to a real work environment. During

this period, a student is exposed to a real-life work in the field. Students are required to submit progress reports during the work period. Students are also required to give a presentation and submit a final report on their experience and the knowledge they gained during their Training.
Prerequisites: ENGL 214, ICS 321, SWE 206, SWE 363, Completion of at least 85 hours, Major and Cumulative GPA of at least 2.0

ICS 410 Programming Languages (3-0-3)
Programming Paradigms: Object-oriented, imperative, functional, and logic. Application development in these paradigms. Fundamentals of Language Design: Syntax and Semantics. Language implementation: virtual machines; compilation, interpretation, and hybrid.
Prerequisite: ICS 202

ICS 411 Senior Project (1-6-3)
Project-oriented course in which students work in teams on an applied real-world problem of their interest, go through its software development lifecycle in order to develop a prototype software solution for the problem at hand. The senior project offers the opportunity to integrate the knowledge acquired in preceding courses, as well as promote and instill communication skills, writing skills, and lifelong self-learning.
Prerequisite: ICS 398 or ICS 399

ICS 412 Compiler Construction Techniques (3-0-3)
Compiler techniques and methodology; Organization of compilers. Lexical and syntax analysis; Parsing techniques; Object code generation and optimization, detection and recovery from errors; Contrast between compilers and interpreters.
Prerequisites: ICS 202, ICS 253

ICS 415 Computer Graphics (3-0-3)
Applications of Computer Graphics; Graphics systems and devices; Output Primitives and their Attributes; Geometric Transformations; Window to Viewport Mapping and Clipping; Curves and Surfaces; Three-Dimensional viewing; Hidden surface removal; illumination and color models, Animation.
Prerequisite: ICS 202

ICS 424 Advanced Database Systems (3-0-3)
Data preprocessing, data warehousing and OLAP; Security, transaction processing, concurrency control techniques, and backup and recovery of relational databases; Introduction to non-relational database systems such as NoSQL and NewSQL databases.
Prerequisite: ICS 321

ICS 433 Operating Systems (3-1-3)
History and evolution of operating systems; Types of operating systems; Operating system structures; Process management: processes, threads, CPU scheduling, process synchronization; Memory management and virtual memory; File systems; I/O systems; Security and protection; Distributed systems; Case studies.
Prerequisite: COE 233 or COE 301

ICS 437 Distributed Systems (3-0-3)
Introduction to distributed systems; Distributed systems architecture; Computer networks for distributed systems; Distributed objects and remote invocation; Distributed naming;

Distributed file systems; Security and synchronization in distributed systems; Distributed coordination and agreement; Distributed transactions; Distributed replication; Distributed multimedia systems, distributed shared memory; Case studies.
Note: Not to be taken for credits with COE 423
Prerequisite: ICS 343 or COE 344

ICS 439 Cryptography in Quantum Era (3-0-3)
The difference between quantum cryptography and existing conventional cryptography, Integer Algorithms, Modular Arithmetic , Symmetric-key Cryptography, Perfect Secrecy, Stream and Block cipher, Group Theory, Public Key Cryptography, Quantum cryptography and cryptanalysis, Key distribution protocols, Quantum money, quantum one-time pad.
Note: Not to be taken for credits with COE 440
Prerequisite: COE 466

ICS 440 Cryptography and Blockchain Applications (3-0-3)
Secret key encryption; Block and stream ciphers, Encryption standards; Number theory: Divisibility, Modular arithmetic, Group theory and Finite fields; Public key encryption: RSA, ElGamal and Rabin cryptosystems; Diffie-Hellman key exchange; Cryptographically secure hashing; Authentication and digital signatures; Digital signature standard (DSS), Randomized encryption; Cryptocurrency, Blockchain models and applications. Security issues and their solutions in Blockchain models and applications. Blockchain payment networks.
Prerequisites: MATH 208, STAT 319

ICS 441 Digital Forensics Techniques (3-0-3)
Major phases of digital investigation; Data acquisition of physical storage devices; Study of file systems with a main focus on Microsoft Windows and Linux systems; File system analysis and file recovery; File carving and document analysis; Information hiding and steganography; Time, registry and password recovery; Email and database forensics; Memory acquisition.
Prerequisite: ICS 253 or Consent of the Instructor

ICS 442 Penetration Testing and Ethical Hacking (3-0-3)
Introduction to penetration testing and ethical hacking, requirements and legal issues, setting up virtual lab; Exploring Kali Linux and Metasploit framework, hacking and penetration testing phases; Information gathering through passive and active reconnaissance, footprinting, social engineering, port scanning; Advanced fuzzing techniques; Exploitation, password attacks and gaining access to remote services; Web penetration testing and web-based exploitation; Maintaining access with backdoors and rootkits; Bypassing defense applications; Wireless and mobile device hacking techniques; Writing penetration testing report; Tools and programming available for penetration testers in both Windows and Linux platforms such as Kali Linux, OpenVAS, Burp, NMAP, Netcat, Python, etc.
Prerequisite: ICS 343 or COE 344 or COE 353

ICS 443 Network Design and Management (3-0-3)
Overview of network design and management; Design methodologies; Network management strategies; Network configuration management; Network management protocols: SNMP, and RMON; Network management tools and systems; Network management applications; Desktop and web-based network management; Network troubleshooting.
Note: Not to be taken for credits with COE 444

Prerequisite: ICS 343 or COE 344

ICS 445 Network Management and Security (3-0-3)

Network Management Standards, Models, and protocols. Network Management Applications, Tools, and Systems. Remote Monitoring and Management (RMM). Large scale network management techniques and systems. Security of LANs, wireless LANs, and cellular networks. Authentication, authorization, accountability, and access controls of computer networks. Network protection tools: Firewalls, Intrusion Detection and Prevention Systems, Sandboxing, proxies. Study of diverse attack types: DDoS, spoofing, flooding, hijacking, poisoning, DNS, replay attacks and their countermeasures. Hands-on experiences in network security using Kali Linux. Hands-on experiences in implementing secure, manageable networks.

Note: Cross-listed with COE 555

Prerequisite: ICS 343 or COE 344 or EE 400

ICS 446 Cluster Computing (3-0-3)

Introduction to high performance computing: Types of parallel computers, system architectures and performance measures; Message passing programming; Complexity analysis of parallel algorithms; Embarrassingly parallel computations; Partitioning and divide-and-conquer strategies; Pipelined computations; Synchronous computations; Load balancing and termination detection; Programming with shared memory; Parallel sorting algorithms; Numerical algorithms; Parallel image processing; Searching and optimization.

Note: Not to be taken for credits with COE 420

Prerequisites: ICS 202, Junior Standing

ICS 447 Computer Network Technologies (3-0-3)

Performance measures and evaluation techniques; Advanced network architectures and differentiated services in IP networks; Switched, fast and gigabit Ethernet; VLANs; Wireless LANs; ISDN and ATM; Frame relay; Mobile computing and mobile IP; VPN and enterprise networks; Emerging network trends and technologies.

Note: Not to be taken for credits with COE 446

Prerequisite: ICS 343 or COE 344

ICS 448 Network and Security Administration (2-3-3)

Installing, configuring, securing, and administering network services. Assessing tools for improving data/service protection; Securing remote and local network infrastructures; DNS servers, web servers, network file sharing, and other common network communication components; Practical experience through hands-on lab exercises.

Prerequisite: ICS 344 or Consent of the Instructor

ICS 471 Artificial Neural Networks and Deep Learning (3-0-3)

The course will review linear models and stochastic optimization. It will develop an in-depth understanding of Feedforward networks, Loss functions, Back-propagation training, Regularization, Convolutional neural networks, Recurrent and recursive networks, Vanishing gradient problem, Long-short term memory (LSTM) model, Gated recurrent units (GRUs), Processing sequences, images, and hierarchical structures, Auto-encoders, Transfer learning, and Generative adversarial networks. The course will develop models for several domain problems such as automatic speech recognition, image recognition, drug discovery, and recommendation systems, etc.

Prerequisites: COE 292, MATH 208, STAT 319

ICS 472 Natural Language Processing (3-0-3)

Foundations of natural language processing (NLP); Different algorithms and techniques for NLP: Word-level, syntactic, and semantic; Quantitative NLP using large corpora, statistical models for acquisition, disambiguation, parsing and the construction of representative systems.

Prerequisite: ICS 381 or Consent of the Instructor

ICS 473 Bioinformatics Mining and Algorithms (3-0-3)

Foundations of bioinformatics; Sequence alignment; Sequence motifs/patterns; Protein structures prediction; Microarray data analysis; Biological networks modeling and mining.

Prerequisites: (ICS 202, ICS 381) or Consent of the Instructor

ICS 474 Big Data Analytics (3-0-3)

Introduction and foundation of big data and big-data analytics. Sources of big data. Smart clouds. Hadoop file system and Apache Spark. Storage management for big data. Machine learning and visualization with big data. Applications of big data. Big data security, privacy, and its societal impacts.

Prerequisites: (MATH 101 or MATH 106), (ISE 205 or STAT 201 or STAT 212 or STAT 319 or EE 315)

ICS 483 Computer Vision (3-0-3)

Image acquisition, Digital image and its properties, Image preprocessing, Segmentation (Thresholding, edge- and region-based segmentation), Morphological image processing. Image feature extraction. Bag of words. Image segmentation. Object detection and classification. Shape analysis. Feature tracking. Motion analysis. Case studies (object recognition / object tracking).

Note: Not to be taken for credits with COE 487 or EE 410

Prerequisite: Senior Standing

ICS 484 Arabic Computing (3-0-3)

Arabic language characteristics; Arabic character sets; Standardization; Unicode; Arabization systems; Arabic software tools; Arabic programming languages and introduction to Arabic computations.

Prerequisite: ICS 108 or Consent of the Instructor

ICS 485 Machine Learning (3-0-3)

This course provides a thorough grounding in a wide range of machine learning methods, for classification, regression, conditional probability estimation, clustering, and dimensionality reduction. It provides the students with the essential foundations of machine learning and their applications to real world problems.

Prerequisites: COE 292, MATH 208, STAT 319

ICS 486 Agent-Based Systems and Swarm Intelligence (3-0-3)

Fundamental concepts and models of multi-agent systems (MAS) and their characteristics; Models of agency; Architectures and languages; Logics for MAS; Deductive and practical reasoning agents; Reactive and hybrid agents; Coordination, negotiation and coalition mechanisms; Learning in MAS; Agent and swarm-based models to solve an optimization problem using PSO, Ants, and GA; Implementing agent and swarm-based applications (e.g. in electronic commerce, semantic Web agents, and information retrieval).

Prerequisite: ICS 381

ICS 487 Intelligent Decision Support Systems (3-0-3)

Introduction and need for Decision Support Systems (DSS). Nature of Decision problems and the elements of the decision process with examples. Essential elements of decision-making. Evolution of DSS: management information systems, decision support systems (DSS), intelligent decision support systems (IDSS). IDSS architecture, data collection, data analysis & exploration, design and implementation. IDSS techniques: case-based reasoning, decision trees, knowledge representation. Case studies and projects: e-commerce, knowledge management, recommender systems and actions.

Prerequisite: ISE 205 or STAT 319 or EE 315

ICS 488 Knowledge Based System and Soft Computing (3-0-3)

Introduction to knowledge and soft computing based systems; Handling imprecision and uncertainty; Probabilistic reasoning and rough sets; Structured approach to fuzzy reasoning; Machine learning and neuro computing; Evolutionary computation and genetic algorithms; Immunological computing; Hybrid computational intelligence methods; Neuro-fuzzy inference systems; Combination of genetic algorithms with neural networks; Combination of genetic algorithms with fuzzy based systems; Applications to real life applications for building expert systems and pattern recognition.

Prerequisite: ICS 381

ICS 489 Applications of Machine Learning (3-0-3)

This is a multidisciplinary course that covers applications of artificial intelligence (AI) and machine learning (ML) in different domains. Students will use the knowledge earned from AI & ML concentration courses to develop industry-relevant solutions on electrical engineering, computer linguistics, embedded systems, and health domains. Students will work on several programming assignments and mini projects in signal processing, natural language processing and medical imaging. In addition, students will learn how to implement energy-efficient, real-time ML-based solutions.

Prerequisite: ICS 485

ICS 490 Special Topics I (3-0-3)

State-of-the-art topics in Computer Science and Information Systems.

Prerequisite: Senior Standing

ICS 491 Special Topics II (3-0-3)

State-of-the-art topics in Computer Science and Information Systems.

Prerequisite: Senior Standing

ICS 497 Directed Undergraduate Research (3-0-3)

The course introduces students to research. Explains the differences between different publications channels like conferences, journals, books, and book chapters. Introduces students to metrics like impact factor and H-index. Teaches how to search and locate relevant literature on a given research topic. Introduces students to research methodology, experimentation design, and ways to conduct experiments and report the results. It also teaches students on how to prepare a research article.

Prerequisite: Consent of the Instructor

INDUSTRIAL AND SYSTEMS ENGINEERING

ISE 205 Engineering Probability and Statistics (3-0-3)

Data description and presentation. Basic concepts in probability. Random variables and probability distributions. Joint Probability Distributions. Covariance and correlation. Sampling distributions. Point estimation of parameters.

Prerequisite: MATH 102

ISE 291 Introduction to Data Science (3-0-3)

A hands-on introductory level course on data science techniques and applications. Preliminary statistics, programming, and SQL. Basic data acquisition, cleaning, manipulation and pre-processing. Emphasis on: Data understanding and preparation; Exploratory data analysis and visualization. Implementing and validating linear and penalized regression, basic classification and basic clustering methods. Introduction to big data analysis.

Prerequisite: MATH 102 or MATH 106, ICS 104

ISE 303 Operations Research I (3-0-3)

Modeling in Operations Research. Linear Programming: Simplex Method, Duality, Sensitivity Analysis. Network Models: Shortest-Route Problem, PERT/CPM, Maximum Flow Problem, Minimal Spanning Tree Problem, Transportation and Assignment Problems. Goal Programming.

Prerequisite: MATH 208

ISE 307 Engineering Economic Analysis (3-0-3)

Introduction to concepts of economic decision-making from a cash flow viewpoint. It includes present worth analysis, cash flow equivalence, rates of return, replacement analysis, benefit-cost analysis, depreciation and taxes, and projects break-even point, selection, and sensitivity analysis.

Prerequisite: Junior Standing

ISE 315 Engineering Statistics (3-0-3)

Review for estimation. Statistical intervals using single and two samples. Test of hypothesis for single and two samples. Applications of test of hypothesis in engineering. Simple and multiple linear regression and their applications. Design and analysis of single-factor experiments: analysis of variance. Design of experiments with several factors. Case studies in engineering statistics.

Prerequisite: ISE 205 or STAT 319

ISE 320 Quality Control and Industrial Statistics (3-0-3)

Introduction to quality control and process improvement. Cost of quality and the effects of quality on productivity. Concepts of variation. Statistical process control (SPC tools). Control charts for variables and attributes and their applications in process control. Process capability studies. Acceptance sampling. Case studies in applied quality control.

Corequisite: ISE 315

ISE 321 Optimization Methods (3-0-3)

Formulation of engineering and planning problems as integer or nonlinear programs. Cutting planes and the branch and bound approach for IPs. Optimality conditions. Solution algorithms for unconstrained and constrained NLPs.

Prerequisite: ISE 303

ISE 324 Work and Process Improvements (2-0-2)

This course explains methods design and work measurement, process analysis, operation analysis, introduction to human engineering, standardization, work measurement, predetermined motion-time systems, standard data, and work sampling.

Prerequisite: ISE 205 or STAT 319

ISE 391 Industrial Engineering Design (1-3-2)

Introduction to engineering design, formulation of design problems, the design process, design phases, IE and the design process, Quality function deployment for specifying design requirements, design strategies, generating alternatives, probabilistic consideration in design, communication issues, design evaluation, selection and implementation. Discussion of case studies including operations systems, manufacturing, quality, ergonomics, layout and scheduling. Includes team project with an application in manufacturing or service industry.

Prerequisites: ISE 205 or STAT 319, ENGL 214, Junior Standing

ISE 398 Internship (0-0-6)

A 15-week program of industrial training approved by the department. The student must submit a comprehensive report on his work during that period.

Prerequisites: ENG 214, Junior Standing

ISE 399 Summer Training (0-0-0)

An 8-week program of industrial training approved by the department. The student must submit a report on his work during that period.

Prerequisites: ENG 214, Junior Standing or Approval of Department

ISE 402 Production Systems and Inventory Control (3-0-3)

Elements of functional organization, Forecasting in production systems, Product and process design considerations, Deterministic and stochastic inventory systems, Capacity planning and material requirement planning (MRP), Computer applications in production control and case studies and applications.

Prerequisites: ISE 205 or STAT 319, ISE 303 or (MATH 106, OM 210, OM 311 for KBS)

ISE 405 Stochastic Systems Simulation (2-3-3)

Basic discrete-event simulation modeling, queuing models, simulation languages, review of basic probability and statistics, random-number generators, generating random variables, output data analysis, validation of simulation models. A simulation language is used in the lab to illustrate simulation models on real case studies.

Prerequisite: ISE 315

ISE 413 Productivity Engineering and Management (3-0-3)

Introduction to productivity, productivity factors, measurement of productivity, planning for productivity, total productivity model, product base productivity improvement, and employee based productivity improvement, productivity improvement programs, case studies and class project.

Prerequisite: ISE 324

ISE 420 Quality Improvement Methods (3-0-3)

Introduction to principles and philosophies of total quality management, advance methods for process control, six sigma approach to quality, Quality function deployment (QFD) and Taguchi approach to quality and parameter optimization.

Prerequisite: ISE 320

ISE 422 Facility Layout and Location (3-0-3)

Introduction to facility planning issues. Material handling. Facility location and layout and computer-aided techniques and packages. Storage and warehousing functions, emphasizing quantitative and simulation techniques.

Prerequisite: ISE 303

ISE 426 Operations Research II (3-0-3)

Deterministic and probabilistic dynamic programming. Stochastic programming. Poisson process. Theory of queues. Markov Chains.

Prerequisite: ISE 303

ISE 429 Maintenance Planning and Control (3-0-3)

Maintenance Organization, Maintenance strategy, Forecasting maintenance work, Maintenance capacity planning, Component replacement decision models, Maintenance Measurement and Standards, Scheduling of maintenance, Maintenance material control, Quality of maintenance jobs, Maintenance productivity, Maintenance audit, Maintenance management information systems, Case Studies.

Prerequisite: Senior Standing

ISE 430 Industrial Engineering in Healthcare Systems (3-0-3)

The course covers topics in healthcare management and operations improvement. The course will cover topics from healthcare prospective and application such as scheduling, simulation, data analysis, productivity, resource allocation, decision-making, etc. Students will become familiar with current methods and resources for implementing change in a health care setting, such as a hospital.

Prerequisites: Senior Standing, Approval of Instructor

ISE 440 Engineering Project Management (3-0-3)

This course deals with projects in engineering organizations including product development. Topics include project initiation; effective project management; project risk management project life cycle; planning and scheduling including PERT/CPM; resourcing; cost estimating; and project monitoring and control. Case studies and project management software.

Prerequisite: ISE 307

ISE 443 Human Factors Engineering (2-3-3)

Study of human response into man-machine systems. Study of visual displays as a medium of input. Auditory and tactual displays. Human control of systems. Control tools and related devices. Applied anthropometry and workplace design. Physical space arrangement, Environment, Illumination, Atmospheric conditions and noise.

Prerequisite: ISE 205

ISE 447 Decision Making (3-0-3)

Basic decision-making model under certainty with multiple criteria as well as under pure Uncertainty, Risk, Risk with information and conflict with single criteria. Structuring decision problems as well as applications in systems engineering are emphasized through problem sets, case studies and term project.

Prerequisites: ISE 205, Junior Standing

ISE 448 Sequencing and Scheduling (3-0-3)

Scheduling problems, optimality of schedules, processing, basic single machine results, precedence constraints and efficiency, constructive algorithms for flow-shops and job-shops, dynamic programming approaches, branch and bound methods, integer programming formulations, hard problems and NP-completeness. Heuristic methods: general approaches and worst-case bounds, simulated annealing approach.

Prerequisite: ISE 303

ISE 455 Cases in Decision Analytics (3-0-3)

Review of decision making under uncertainty and risk. Linear and linear programming for deterministic decision making. Chance constrained and two stage stochastic programming. Risk analysis, robust and queuing theory. New concepts will be presented through cases studies using inductive teaching. Students must work on a project that demonstrates their understanding of decision making under uncertainty applied to a real case.

Prerequisite: ISE 447

ISE 460 Industrial Process Re-Engineering (3-0-3)

Introduction to function and Process Organization, strategy plan and business context, stockholder analysis, value and non-value added activities, process identification, process architect & align, understanding of existing process, mapping and process evaluation, measures and target setting, process visioning, process renew and re-engineering, element for essential and sustainability, continues improvements.

Prerequisite: ISE 324

ISE 463 Theory of Stochastic Processes (3-0-3)

Basic review of probability, statistical independence, conditional expectation and characteristic function. Introduction to stochastic processes, stationarity and ergodicity. Markov chains and Poisson processes. Linear models of continuous- and discrete- time stochastic processes. Engineering applications.

Prerequisite: ISE 315

ISE 464 Industrial Information Systems (2-3-3)

Design of industrial information systems. Focus on the planning, control of the flow of engineering and industrial information. Information systems requirements, analysis, and design. Students are required to work on a project of applied nature.

Prerequisite: ISE 365

ISE 465 Industrial Safety (3-0-3)

The scope of occupational safety: Human safety, Environmental safety, Setting safety standard: Safety administration, Legal aspect of industrial safety.

Prerequisite: Junior Standing

ISE 468 Introduction to Machine Learning and Data Analytics (3-0-3)

An introduction to data analysis, clustering algorithms, classification algorithms, and R programming language.

Prerequisite: ISE 205 or STAT 319

ISE 470 Supply Chain Systems Modeling (3-0-3)

This course adopts a modeling approach to supply chains that is designed to study trade-offs between system costs and customer service. Topics covered include supply chain design, multi-

location inventory-distribution models, bullwhip effect, delayed differentiation, and e-commerce and supply chain. The key insights provided by such system-wide models will be illustrated through the use of software packages, real cases discussion and presentations and term projects. In addition, the course will highlight the role of information technology in supporting supply chain operations.
Prerequisite: ISE 402

ISE 472 Logistics and Transportation Systems (3-0-3)
This course deals with logistics and transportation issues in the supply chain. Topics covered include logistics management, design of distribution and logistics networks, Transportation systems, routing and scheduling in transportation and transportation and logistics information systems.
Prerequisite: ISE 402
Corequisite: ISE 426

ISE 480 Reliability and Maintainability (3-0-3)
Introduction to Reliability Engineering, hazard and reliability functions, analyzing reliability data, reliability prediction and modeling, fault tress construction and decision tables, maintainability, maintenance and availability, reliability improvement.
Prerequisite: ISE 315

ISE 482 Senior Design Project (1-6-3)
A design course that draws upon various components of the undergraduate curriculum. The project typically contains problem definition, analysis, evaluation and selection of alternatives. Real life applications are emphasized where appropriate constraints are considered. Oral presentation and a report are essential for course completion. The work should be supervised by faculty member(s). Team projects are acceptable wherever appropriate.
Prerequisite: ISE 499

ISE 487 Predictive Analytics Techniques (3-0-3)
Characteristics of time series, trends, seasonality, noise, stationarity; Statistical background and model evaluation methods; Time series regression, variable selection and general linear regression; Exponential Smoothing and seasonal data; ARIMA based models including MA, AR, ARMA, ARIMA and SARIMA, Model validation and parameter estimation; Advance predictive analytics: Multivariate prediction, state space models, neural networks, spectral analysis and Bayesian methods.
Prerequisites: (MATH 405 or ISE 315), (ICS 103 or ICS 104)

ISE 491 Special Topics in Operations Research (3-0-3)
A course in an area of operation research reflecting current theory and practice.
Prerequisite: Approval of Department

ISE 492 Special Topics in Production and Quality Control (3-0-3)
A course in an area of production and quality control reflecting current theory and practice.
Prerequisite: Approval of Department

ISE 493 Special Topics in IE/OR (3-0-3)
A course in an area of reliability and maintenance reflecting current theory and practice.
Prerequisite: Approval of Department

ISE 496 Industrial Strategic Planning & Balanced Scorecard (3-0-3)

Introduction to Strategic Planning and BSC, development of strategy plans, Creating the Strategy Focused Organization, Building Strategy Map, Building Strategy Map for Private sectors, Building Strategy Map for non -profit organizations, Develop Balanced Scorecard Cooperate, Creating Business Unit Synergy (Department BSC), Individual BSC (Defining Personal and Team Objectives).

Prerequisite: Senior Standing

ISE 499 Seminars (1-0-0)

The purpose of this course is to raise students' awareness of contemporary issues in their discipline and otherwise. The student has to attend a required number of seminars, workshops, professional societal meetings or governmental agency conferences; at least half of these should address issues in his discipline. The student has to attend a required number of industrial visits.

Prerequisite: Junior Standing

MATHEMATICS

MATH 001 Preparatory Mathematics I (3-1-4)
Concepts and manipulations in algebra. Introduction to concepts of calculus. Preparation for rigorous study of mathematics.

MATH 002 Preparatory Mathematics II (3-1-4)
Concepts and manipulations in algebra. Trigonometry. Elementary analytic geometry. Introduction to concepts of calculus. Preparation for rigorous study of mathematics.
Prerequisite: MATH 001 or its equivalent

MATH 101 Calculus I (4-0-4)
Limits and continuity of functions of a single variable. Differentiability. Techniques of differentiation. Implicit differentiation. Local extrema, first and second derivative tests for local extrema. Concavity and inflection points. Curve sketching. Applied extrema problems. The Mean Value Theorem and applications.
Prerequisite: One year preparatory mathematics or its equivalent

MATH 102 Calculus II (4-0-4)
Definite and indefinite integrals of functions of a single variable. Fundamental Theorem of Calculus. Techniques of integration. Hyperbolic functions. Applications of the definite integral to area, volume, arc length and surface of revolution. Improper integrals. Sequences and series: convergence tests, integral, comparison, ratio and root tests. Alternating series. Absolute and conditional convergence. Power series. Taylor and Maclaurin series.
Prerequisite: MATH 101

MATH 105 Finite Mathematics (3-0-3)
Linear equations and inequalities. Systems of linear equations. Basic material on matrices. Elementary introduction to linear programming. Counting techniques. Permutations and combinations. Probability for finite sample space. Basic concepts in statistics. Topics in the mathematics of finance.
Prerequisite: One year preparatory mathematics or its equivalent

MATH 106 Applied Calculus (3-0-3)
The derivative. Rules for differentiation. Derivative of logarithmic, exponential, and trigonometric functions. Differentials. Growth and decay models. Definite and indefinite integrals. Techniques of integration. Integrals involving logarithmic, exponential and trigonometric functions. Integration by tables. Area under a curve and between curves. Functions of several variables. Partial derivatives and their applications to optimization.
Prerequisite: One year preparatory mathematics or its equivalent

MATH 201 Calculus III (3-0-3)
Definite and indefinite integrals of functions of a single variable. Fundamental Theorem of Calculus. Techniques of integration. Hyperbolic functions. Applications of the definite integral to area, volume, arc length and surface of revolution. Improper integrals. Sequences and series: convergence tests, integral, comparison, ratio and root tests. Alternating series. Absolute and conditional convergence. Power series. Taylor and Maclaurin series.
Prerequisite: MATH 102

MATH 202 Elements of Differential Equations (3-0-3)

First order and first degree equations. The homogeneous differential equations with constant coefficients. The methods of undetermined coefficients, reduction of order, and variation of parameters. The Cauchy-Euler equation. Series solutions. Systems of linear differential equations. Applications to linear models of first and second order.

Prerequisite: MATH 102

MATH 208 Introduction to Differential Equations & Linear Algebra (3-0-3)

Systems of linear equations. Rank of matrices. Eigenvalues and eigenvectors. Vector spaces, subspaces, bases, dimensions. Invertible matrices. Similar matrices. Diagonalizable matrices. Block diagonal and Jordan forms. First order differential equations: separable and exact. The homogeneous differential equations with constant coefficients. Wronskian. Nonhomogeneous differential equations. Methods of undetermined coefficients and variation of parameters. Systems of differential equations. Non-homogeneous systems. Applications to linear models of first and second order.

Note: Not to be taken for credit with MATH 202 or MATH 225

Prerequisite: MATH 102

MATH 210 Introduction to Sets and Structures (3-0-3)

Elementary logic. Methods of proof. Set theory. Relations and functions. Finite and infinite sets. Equivalence relations and congruence. Divisibility and the fundamental theorem of arithmetic. Well-ordering and axiom of choice. Groups, subgroups, symmetric groups, cyclic groups and order of an element, isomorphisms, cosets and Lagrange's Theorem.

Note: Not to be taken for credit with ICS 253

Prerequisite: MATH 102

MATH 225 Introduction to Linear Algebra (3-0-3)

Matrices and systems of linear equations. Vector spaces and subspaces. Linear independence. Basis and dimension. Inner product spaces. The Gram-Schmidt process. Linear transformations. Determinants. Diagonalization. Real quadratic forms. Applications as mini Projects.

Prerequisite: MATH 102

MATH 302 Engineering Mathematics (3-0-3)

Vector analysis including vector fields, gradient, divergence, curl, line and surface integrals, Gauss' and Stokes' theorems. Introduction to complex variables. Vector spaces and subspaces. Linear independence, basis and dimension. Solution of linear equations. Orthogonality. Eigenvalues and eigenvectors. Applications to systems of differential equations.

Note: Not to be taken for credit with MATH 225 or MATH 333

Prerequisite: MATH 201

MATH 310 Logic and Set Theory (3-0-3)

The Propositional Logic, First-order predicate calculus. Truth and Models. Soundness and Completeness for Propositional Logic. Deduction. Models of Theories. Interpretations. Soundness and Completeness Theorems for first-order logic. The Compactness Theorem. Nonstandard models. Naive Set Theory. Zermelo-Fraenkel Axioms. Wellorders and Ordinal Numbers. ON as a proper class. Arithmetic of Ordinals. Transfinite Induction and Recursion. Cardinality. Goodstein Sequences.

Prerequisite: MATH 210

MATH 315 Development of Mathematics (3-0-3)

History of numeration: Egyptian, Babylonian, Hindu and Arabic contributions. Algebra: including the contributions of Al-Khwarizmi and Ibn Kura. Geometry: areas, approximation of π, the work of Al-Toussi on Euclid's axioms. Analysis. The calculus: Newton, Leibniz, Gauss. The concept of limit: Cauchy, Laplace. An introduction to some famous old open problems.

Prerequisite: MATH 102 or MATH 106

MATH 323 Modern Algebra I (3-0-3)

Review of basic group theory including Lagrange's Theorem. Normal subgroups, factor groups, homomorphisms, fundamental theorem of finite Abelian groups. Examples and basic properties, integral domains and fields, ideal and factor rings, homomorphisms. Polynomials, factorization of polynomials over a field, factor rings of polynomials over a field. Irreducibles and unique factorization, principal ideal domains.

Prerequisite: MATH 210 or (ICS 253, ICS 254)

MATH 325 Linear Algebra (3-0-3)

Theory of vector spaces and linear transformations. Direct sums. Inner product spaces. The dual space. Bilinear forms. Polynomials and matrices. Triangulation of matrices and linear transformations. Hamilton-Cayley theorem.

Prerequisite: MATH 225

MATH 333 Methods of Applied Mathematics I (3-0-3)

Special functions. Bessel's functions and Legendre polynomials. Vector analysis including vector fields, divergence, curl, line and surface integrals, Green's, Gauss' and Stokes' theorems. Sturm-Liouville theory. Laplace transforms. Fourier series and transforms. Introduction to partial differential equations and boundary value problems in rectangular, cylindrical and spherical coordinates.

Prerequisites: MATH 201, MATH 202 or MATH 208

MATH 336 Mathematical Models in Biology (3-0-3)

Growth models, Single species and interacting population dynamics. Dynamics of infectious diseases. Modeling enzyme dynamics. Some fatal diseases models. Programing software for numerical simulations.

Prerequisite: MATH 202 or MATH 208

MATH 341 Advanced Calculus I (3-0-3)

The real number system. Continuity and limits. Uniform continuity. Differentiability of functions of one variable. Definition, existence and properties of the Riemann integral. The fundamental theorem of calculus. Sequences and series of real numbers.

Prerequisite: MATH 210 or ICS 253

MATH 353 Euclidean and Non-Euclidean Geometry (3-0-3)

Classical Euclidean and non-Euclidean geometries. Matrix representations of transformations in R3. Isometries. Transformation and symmetric groups. Similarity and affine transformations.

Prerequisite: MATH 210

MATH 371 Introduction to Numerical Computing (2-2-3)

Floating-point arithmetic and error analysis. Solution of non-linear equations. Polynomial interpolation. Numerical integration and differentiation. Data fitting. Solution of linear algebraic systems. Initial and boundary value problems of ordinary differential equations; Using computer software as a computational platform.

Note: Not to be taken for credit with CISE 301

Prerequisite: MATH 201

MATH 399 Summer Training (0-0-2)

Students are required to spend one summer working in industry prior to the term in which they expect to graduate. Students are required to submit a report and make a presentation on their summer training experience and the knowledge gained. The student may do his summer training by doing research and other academic activities.

Prerequisites: ENGL 214, Junior Standing, Approval of the Department

MATH 405 Learning from Data (3-0-3)

Basic vector and matrix operations, Factorizations, Basic Probability Theory, Inference, LeastSquare Estimation, Maximum Likelihood Estimation, Gradient Descent, Linear Regression and Neural Networks.

Prerequisites: (MATH 102 or MATH 106), (STAT 201 or STAT 212 or STAT 319 or ISE 205), ICS 103

MATH 407 Applied Game Theory (3-0-3)

Formulation of strategic and cooperative games in energy industry, such as oil & gas and electric power companies, and portfolio analysis. Dominant, optimal strategies and Nash equilibrium. Coalition formation in cooperative games is used to represent OPEC to investigate their formation. Games in characteristic function format. Concepts of solutions for games. Pareto optimal solutions, core, and Shapely value. Other cases for allocation of resources, design, supply chain will be modelled in the context of game theory.

Prerequisite: ISE 303 or STAT 361

MATH 423 Modern Algebra II (3-0-3)

Finite and finitely generated Abelian groups. Solvable groups. Nilpotent groups. Sylow theorems. Factorization in integral domains. Principal ideal domains. Fields. Field extensions. Finite fields. An introduction to Galois theory.

Prerequisite: MATH 323

MATH 424 Applied Algebra (3-0-3)

Boolean algebras. Symmetry groups in three dimensions. Polya-Burnside method of enumeration. Monoids and machines. Introduction to automata theory. Error correcting codes.

Prerequisite: MATH 323

MATH 427 Number Theory (3-0-3)

Divisibility and primes. Congruences. Positive roots. Quadratic reciprocity. Arithmetic functions. Diophantine equations. Applications (e.g. cryptography or rational approximations).

Prerequisite: MATH 210 or Senior Standing

MATH 432 Applied Matrix Theory (3-0-3)

Review of the theory of linear systems. Eigenvalues and eigenvectors. The Jordan canonical form. Bilinear and quadratic forms. Matrix analysis of differential equations. Variational principles and perturbation theory: the Courant minimax theorem, Weyl's inequalities, Gershgorin's theorem, perturbations of the spectrum, vector norms and related matrix norms, the condition number of a matrix.

Prerequisite: MATH 208 or MATH 225 or MATH 302

MATH 433 Methods of Applied Mathematics II (3-0-3)

Introduction to linear spaces and Hilbert spaces. Strong and weak convergence. Orthogonal and orthonormal systems. Integral Equations: Fredholm and Volterra equations. Green's Function: Idea of distributions, properties of Green's function and construction. Any one of the following topics: Asymptotic Methods: Laplace method, Steepest descent method, Perturbation Theory: regular and singular perturbations, Integral Transforms: Fourier, Laplace, Mellin and Hankel transforms.

Prerequisite: MATH 333

MATH 434 Calculus of Variations and Optimal Control (3-0-3)

Introduction to the calculus of variations. Euler-Lagrange, Weierstrass, Legendre and Jacobi necessary conditions. Formulation of optimal control problems. Bolza, Mayer and Lagrange formulations. Variational approach to optimal control. Pontryagin maximum principle.

Prerequisite: MATH 202 or MATH 208

MATH 435 Ordinary Differential Equations (3-0-3)

First order scalar differential equations. Initial value problems. Existence, uniqueness, continuous dependence on initial data. Linear systems with constant coefficients. The exponential matrix. Asymptotic behavior of linear and almost linear systems. Two dimensional autonomous systems. Critical points and their classifications. Phase plane analysis. Introduction to the theory of Lyapunov stability.

Prerequisites: (MATH 202, MATH 225) or MATH 208

MATH 436 Discrete Models (3-0-3)

Difference equations and discrete dynamical systems, linear and nonlinear models, linear and nonlinear systems, stability and well-posedness, models and numerical experiments (from different fields of science and engineering).

Prerequisite: Math 202 or Math 208

MATH 437 Partial Differential Equations (3-0-3)

Systems of linear equations. Rank of matrices. Eigenvalues and eigenvectors. Vector spaces, subspaces, bases, dimensions. Invertible matrices. Similar matrices. Diagonalizable matrices. Block diagonal and Jordan forms. First order differential equations: separable and exact. The homogeneous differential equations with constant coefficients. Wronskian. Nonhomogeneous differential equations. Methods of undetermined coefficients and variation of parameters. Systems of differential equations. Non-homogeneous systems.

Prerequisite: MATH 333

MATH 441 Advanced Calculus II (3-0-3)

Theory of sequences and series of functions. Real functions of several real variables: limit, continuity, differentiability. Taylor's theorem. Maxima and minima, Lagrange multipliers rule. Elementary notion of integration on RN. Change of variables in multiple integrals,

Fubini’s theorem. Implicit and inverse function theorems. Convergence and divergence of improper integrals- Differentiation under the integral sign.
Prerequisite: MATH 341

MATH 443 Advanced Calculus III (3-0-3)
Functions of bounded variation. The Riemann-Stieltjes integral. Implicit and inverse function theorems. Lagrange multipliers. Change of variables in multiple integrals. Vector functions and fields on R^n. Line and surface integrals. Green's theorem. Divergence theorem. Stokes’ theorem.
Prerequisite: MATH 441

MATH 445 Introduction to Complex Variables (3-0-3)
The theory of complex analytic functions, Cauchy's integral theorem, contour integrals, Laurent expansions, the residue theorem with applications, evaluation of improper real integrals and series, conformal mappings.
Prerequisite: MATH 201

MATH 451 Differential Geometry (3-0-3)
Curves in 3-dimensional Euclidean space: the Frenet frame and formulae, curvature and torsion, natural equations. Surfaces in 3-dimensional Euclidean space: tangent plane, first fundamental form and isometries, second fundamental forms, normal and principal curvatures, Gaussian and mean curvatures, geodesics. Geometry of the sphere and the disc (with Poincare metric).
Prerequisite: MATH 208 or MATH 225 or MATH 302

MATH 453 Introduction to Topology (3-0-3)
Topological Spaces: Basis for a topology, The order topology. The subspace topology. Closed sets and limit points. Continuous functions. The product topology, The metric topology. Connected spaces. Compact spaces. Limit point compactness. The countability axioms. The separation axioms. Complete metric spaces.
Prerequisite: MATH 341

MATH 463 Combinatorics (3-0-3)
Enumerative techniques, Recurrence relations, Generating functions, Principle of inclusion-exclusion, Introduction to graph theory, selected topics (e.g. Ramsey Theory, Optimization in graphs and networks, Combinatorial designs, Probabilistic methods.)
Prerequisite: MATH 201

MATH 467 Graph Theory (3-0-3)
Graphs and digraphs. Degree sequences, paths, cycles, cut-vertices, and blocks. Eulerian graphs and digraphs. Trees, incidence matrix, cut-matrix, circuit matrix and adjacency matrix. Orthogonality relation. Decomposition, Euler formula, planar and nonplanar graphs. Menger’s theorem. Hamiltonian graphs.
Prerequisite: MATH 208 or MATH 225 or MATH 302

MATH 471 Numerical Analysis I (3-0-3)
Floating-point, round-off analysis. Solution of linear algebraic systems: Gaussian elimination and LU decomposition, condition of a linear system, error analysis of Gaussian elimination, iterative improvement. Least squares and singular value decomposition. Matrix eigenvalue problems.

Prerequisite: MATH 371 or CISE 301

MATH 472 Numerical Analysis II (3-0-3)

Approximation of functions: Polynomial interpolation, spline interpolation, least squares theory, adaptive approximation. Differentiation. Integration: basic and composite rules, Gaussian quadrature, Romberg integration, adaptive quadrature. Solution of ODEs: Euler, Taylor series and Runge-Kutta methods for IVPs, multistep methods for IVPs, systems of higher-order ODEs. Shooting, finite difference and collocation methods for BVPs. Stiff equations.

Prerequisite: MATH 371 or CISE 301

MATH 474 Linear & Nonlinear Programming (3-0-3)

Formulation of linear programs. Basic properties of linear programs. The simplex method. Duality. Necessary and sufficient conditions for unconstrained problems. Minimization of convex functions. A method of solving unconstrained problems. Equality and inequality constrained optimization. The Lagrange multipliers theorem. The Kuhn-Tucker conditions. A method of solving constrained problems.

Prerequisite: MATH 201

MATH 475 Wavelets and Applications (3-0-3)

Wavelets. Wavelet transforms. Multiresolution analysis. Discrete wavelet transform. Fast wavelet transform. Wavelet decomposition and reconstruction. Applications such as boundary value problems, data compression, etc.

Prerequisite: MATH 225 or MATH 302

MATH 477 Foundation of Scientific Computing (3-0-3)

Concepts of numerical mathematics, approximation tools, system of equations, least squares, numerical differentiation and integration, quadrature on different geometries, Runge-Kutta and multistep methods for initial value problems, finite difference methods for initial and boundary value problems. Applications to steady-state and time-dependent problems.

Prerequisite: MATH 102

MATH 481 Computational Inverse Problem (3-0-3)

Regression, Least squares, Maximum likelihood estimation, Rank deficiency, Ill-conditioning, Generalized and Truncated SVD solutions, regularizations (Tikohonov, spectral filtering), proximal and primal-dual iterative schemes, Nonlinear inverse (gradient-based and global optimization methods), OCCAM method.

Prerequisite: MATH 405 or Consent of the Instructor

MATH 490 Seminar in Mathematics (1-0-1)

This course provides a forum for the exchange of mathematical ideas between faculty and students under the guidance of the course instructor. Students are expected to do research on a mathematical problem of their choice or the instructor’s. The instructor arranges weekly presentations by himself, other faculty members and/or students, of lectures or discussions on topics or problems of general interest. The course culminates in the presentation by each student of at least one written report on a selected topic or problem, reflecting some independent work and evidence of familiarity with the mathematical literature. With the permission of the instructor, students may work with other faculty members in the preparation of written reports.

Prerequisites: Any two of {MATH 323, MATH 333, MATH 341, MATH 371}

MATH 498 Topics in Mathematics I (1-3, 0, 1-3)

Variable contents. Open for Senior students interested in studying an advanced topic in mathematics.

Note: May be repeated for a maximum of three credit hours total.

Prerequisites: Senior Standing, Permission of the Department Chairman upon recommendation of the instructor.

MATH 499 Topics in Mathematics II (1-3, 0, 1-3)

Variable contents. Open for Senior students interested in studying an advanced topic in mathematics.

Note: May be repeated for a maximum of three credit hours total.

Prerequisites: Senior Standing, Permission of the Department Chairman upon recommendation of the instructor.

MECHANICAL ENGINEERING

ME 201 Dynamics (3-0-3)

Kinematics of rectilinear and curvilinear motion of particles. Dynamics of particles and systems of particles. Kinematics of rotation and plane motion of rigid bodies. Work and energy relations. Impulse and momentum principles. Dynamics of rigid bodies in plane motion.

Prerequisites: CE 201, CE 202

ME 203 Thermodynamics I (3-0-3)

Control mass and control volume, properties of a pure substance and ideal gas, work and heat. First law of thermodynamics applied to closed and open systems, internal energy, enthalpy. Second law of thermodynamics, reversible and irreversible processes, Carnot cycle, entropy and entropy generation. Applications of steady state steady-flow, uniform-state uniform-flow, and other processes.

Prerequisites: MATH 102, PHYS 102

ME 204 Thermodynamics II (3-0-3)

Irreversibility and availability. Power and Refrigeration cycles: steam power cycles, air-standard power cycles, and refrigeration cycles. Gas-gas and gas water vapor mixtures. Psychrometrics. Thermodynamic relations: the Clapeyron equation, the Maxwell relations, and enthalpy and entropy departures. Chemical reactions: fuels and combustion processes.

Prerequisite: ME 203

ME 205 Materials Science (2-3-3)

Atomic bonding in solids, bonding forces and energies, primary and secondary bonds. The structure of crystalline solids, lattice, unit cell, and crystal systems, density computation, crystal directions and planes, linear and planar atomic densities. Impurities and imperfections in solids: point, linear and interfacial defects. Atomic movement and diffusion. Mechanical properties of metallic materials, elastic and plastic deformation. Strengthening mechanisms, recrystallization and grain growth. Phase diagrams of single phase and multiphase materials with emphasis on iron-iron carbide system. The basics of materials characterization and mechanical testing will be covered in the lab.

Prerequisites: CHEM 101, MATH 102

ME 207 Materials Science for CHE (2-0-2)

Atomic bonding in solids, bonding forces and energies, primary and secondary bonds. The structure of crystalline solids, lattice, unit cell, and crystal systems, density computation, crystal directions and planes, linear and planar atomic densities. Impurities and imperfections in solids: point, linear and interfacial defects. Atomic movement and diffusion. Mechanical properties of metallic materials, elastic and plastic deformation. Strengthening mechanisms, recrystallization and grain growth. Phase diagrams of single phase and multiphase materials with emphasis on iron-iron carbide system.

Prerequisites: CHEM 101, MATH 102

ME 210 Mechanical Engineering Drawing & Graphics (2-3-3)

Graphical interpretation of orthographic projection to include auxiliary views, section views, dimensioning, translation of design instructions into detail and assembly drawings, drawing conventions including weldments, piping, surface finish notation and selection of tolerances based on design requirements.

ME 216 Materials Science and Engineering (3-0-3)

Review of atomic bonding in solids. Metallic crystal structures (crystallographic points/directions, planes and density computation). Imperfections in solids. Mechanisms of diffusion (steady and non-steady state diffusion). Elastic and plastic deformation of metals. Design problems based on mechanical properties. Strengthening mechanism in metals. Design based on cold and hot working of metals. Binary phase diagrams and the Fe-C system. Basics of phase transformations with emphasis on phase transformations in Fe-C system. Applications of steels and cast irons. Composite Materials.

Prerequisites: CHEM 101, MATH 102

Corequisite : ME 217

ME 217 Materials Lab (0-3-1)

Materials characterization: metallography, microstructure analysis using optical microscopy and x-ray diffraction, scanning electron microscopy. Mechanical testing to measure materials properties: hardness, tensile, flexural, impact, torsion, fatigue, and creep. Phase diagrams, cold working, heat treatment of carbon steels.

Corequisite : ME 216

ME 218 Introduction to Mechanical Engineering Design (1-3-2)

Mechanical engineering design process. Open-ended problem solving. Teamwork. Team-based design projects. Estimation, modeling and basic science principles related to project. Manufacturing, assembly and testing. Communication skills in design, Ethical issues in design.

Prerequisites: PHYS 102, ME 210

ME 301 Machine Design I (3-0-3)

Design process, review of stress, strain and deformation analysis as applied to mechanical design; properties of materials; static failure theories; designing against fatigue failures; element design; shafts, keys, couplings, power screws; bolted, riveted and welded joints.

Prerequisites: CE 202, ME 218

ME 302 Machine Design II (3-0-3)

Machine element definition, the purpose of use, types, followed by kinematics (displacement, speed, and acceleration with trajectory if needed) and force analysis. Design of power and motion transmission elements spur, helical, bevel and worm gears; cams and followers; flexible drives (belts and chains); Design of power and motion control clutches and brakes, couplings, flywheels and mechanical springs; Elements for shaft support: bearings (journal and anti-friction). Elements for assembly and casing design: non-permanent and permanent joints i.e. rivets, screws, and welded joints.

Prerequisite: ME 301

Corequisite : ME 303

ME 303 Mechanical System Design Lab (0-3-1)

Design project based learning to include: Machine elements with kinematics (displacement, speed, and acceleration with trajectory if needed) and force analysis; Design of power and motion transmission elements spur, helical, bevel and worm gears; cams and followers; flexible drives (belts and chains); Design of power and motion control clutches and brakes, couplings, flywheels and mechanical springs; Elements for shaft support: bearings (journal and anti-friction); Elements for assembly and casing design: non-permanent and permanent

joints i.e. rivets, screws, and welded joints. The design project considers stress analysis using FEM, cost analysis and the use of standards.
Corequisite : ME 302

ME 311 Fluid Mechanics (3-0-3)
Definition and properties of fluids. Fluid statics with applications. Basic fluid dynamic equations of continuity, energy and momentum with applications to different flow situations and flow measurement. Viscous effects, boundary-layer concepts, laminar and turbulent flow in pipes, open channel flow, fluid dynamics forces on immersed bodies. Modeling and dimensional similarity. Introduction to turbomachinery.
Prerequisites: MATH 201, ME 201, ME 203

ME 315 Heat Transfer (3-0-3)
Introduction to heat transfer by conduction, radiation and convection. Electric network analogy. Steady state solution for heat conduction in plane and radial walls, composite walls, walls with energy generating sections, and extended surfaces (fins). Introduction to multi-dimensional conduction. Unsteady heat transfer to plates, cylinders and spheres. Black- and gray-body radiation systems. Practical hydraulic and thermal analysis of convection with applications to heat exchangers.
Prerequisites: ME 204, ME 311

ME 316 Thermo-Fluids Lab (0-3-1)
Experimentation of the fundamental elements of theory and practice in fluid mechanics and heat transfer. Uncertainty analysis; flow measurements; pipelines and energy losses; hydraulic systems; temperature measurements; heat transfer by conduction, convection and radiation; heat exchanger design and performance evaluation.
Prerequisite: ME 311
Corequisite: ME 315

ME 322 Manufacturing Processes (3-0-3)
Manufacturing methods of metals and alloys including metal casting, welding, bulk forming, sheet metal forming, and machining processes. Both quantitative and qualitative study of manufacturing processes with emphasis on process selection for optimum design. Guidelines and best practices for ease of manufacturing. Design of simple casting molds, sheet metal blanking/punching dies and machining processes. 3D printing technologies and impact on rapid prototyping and manufacturing.
Prerequisites: CE 101 or ME 210, ME 216, ME 217

ME 323 Manufacturing Laboratory (0-3-1)
The laboratory experiments and demonstrations are focused on lab learning of various manufacturing processes related to metrology, material testing, machining including CNC and conventional machine tools, welding processes, die casting facilities, plastic processing, and sheet metal processing to demonstrate and give students a hands on experience of different manufacturing processes.
Corequisite: ME 322

ME 398 Internship (0-0-6)
A period of 16 weeks of industrial employment where Applied Mechanical Engineering students work in appropriate industries or firms. Students are evaluated on their performance

on the job and are required to submit an extensive formal report on their experience in addition to making a presentation before an examining committee.

Prerequisites: BUS 200, ENGL 214, ME 301, ME 315

ME 399 Summer Training (0-0-0)

A continuous period of 8 weeks of summer training spent in the industry working in any of the fields of mechanical engineering. The training should be carried out in an organization with an interest in one or more of these fields. On completion of the program, the student is required to submit a formal written report of his work.

Prerequisites: BUS 200, ENGL 214, ME 204

ME 401 System Dynamics & Control (3-0-3)

Dynamics of mechanical, electrical, fluid and thermal systems. Transfer function and block diagram representations. Analysis and simulation of dynamic systems in the time and frequency domains. Design of basic controllers in the time and frequency domains. Stability of open- and closed-loop dynamic systems.

Prerequisites: EE 234, EE 235, MATH 202, ME 315

Corequisite: ME 402

ME 402 Measurements and Control Laboratory (0-3-1)

Design of experiments, sensors selection, wiring and calibration, uncertainty analysis, data acquisition, Introduction to LabVIEW software. Measurements of pressure, temperature and flow. Design and implementation of different control actions to electromechanical, fluid and thermal systems. Lab projects include measurements and control of mechanical or thermal systems.

Corequisite: ME 401

ME 408 Rapid Prototyping and Digital Manufacturing (2-3-3)

3D Printing technologies including SLA, SLS, SLM, LOM, and FDM, concept modeling, rapid prototyping and digital manufacturing technologies. Preparation, consideration factors, and analysis of rapid prototyping. Advantages and limitations of the various rapid prototyping technologies. Rapid tooling. Making informed rapid prototyping choices. Group projects to gain hands on experience in Rapid Prototyping and parts realization.

Prerequisites: ME 322, ME 323

ME 409 Design and Manufacturing of Composite Structures (3-0-3)

Basics in the design and manufacture of fiber-reinforced polymer composite structures, key aspects of composites design, various methods of composites manufacture, micromechanics, mechanical performance, durability, repair, recycling and applications of composites.

Prerequisites: ME 322, ME 323

ME 410 Introduction to Ceramics (3-0-3)

Atomic bonding, crystal structure, defects, physical properties, phase diagrams, and ceramic microstructure; Classification of ceramic materials including oxides, silicates, carbides, nitrides, glasses, cements, clays, refractories, and glass-ceramics; Ceramic synthesis and processing; Ceramic properties including mechanical, thermal, dielectric, magnetic, and optical.

Prerequisite: ME 205 or ME 207 or ME 216

ME 411 Senior Design Project I (1-0-1)

This is the first part of the capstone design course for ME program. Students form teams to design, and produce a prototype of a product or system of their own design. The design process includes formulation of the problem statement, establishment of objectives, technical literature, concept generation and consideration of alternative solutions, feasibility study, engineering design procedure and analyses, prototype fabrication and testing. The design should take into consideration appropriate standards and constraints such as cost, safety, reliability, ethics and environmental and social impact. Submission of a preliminary technical report is required.

Prerequisites: BUS 200, ME 315

Corequisites: ME 302, ME 303

ME 412 Senior Design Project II (0-6-2)

This is the second part of the capstone design course for ME program. Continuation and completion of the project started in ME 411. An oral presentation and the submission of a final technical report of the design project are required.

Prerequisite: ME 411

ME 415 Senior Design Project (0-9-3)

This one-semester capstone design course is restricted for AME program. Students form teams to research, design, and produce a prototype of a product or system of their own design. The design process includes formulation of the problem statement, establishment of objectives, concept generation and consideration of alternative solutions, feasibility study, engineering design analyses, and prototype fabrication and testing. The design should take into consideration appropriate standard and constraints such as cost, safety, reliability, ethics and environmental and social impact.

Prerequisite: ME 398

Corequisites: ME 302, ME 303

ME 417 Mechanics of Machines (3-0-3)

Synthesis and graphical method of analysis of plane mechanisms: kinematics and kinetics of 2D mechanisms. Design of cam-follower mechanism. Static and dynamic balancing. Introduction to kinematics of basic industrial robots.

Prerequisite: ME 201

ME 418 Advanced Manufacturing and Design (2-3-3)

CNC machining, abrasive and non-traditional metal removal processes, powder metallurgy, and ceramics processing. Manufacturing with polymers. Design considerations in manufacturing. Rapid Prototyping and 3D Printing current applications and future trends. Design for manufacturability and economics of manufacturing, cycle times and cost analysis.

Prerequisites: ME 322, ME 323

ME 420 Materials Selection and Design (3-0-3)

Mechanical design process, materials properties and indices, product shape, multiple constraints, conflicting objectives, hybrid materials, impact of materials selection on the environment, extensive case studies.

Prerequisite: ME 205 or ME 207 or ME 216

ME 421 Automotive Design and Engineering (3-0-3)

Major systems and subsystems of a vehicle will be discussed. Engineering metrics and design requirements will be presented for major sub systems of a vehicle. Vehicle dynamics, aerodynamics, safety, fuel economy, and performance will be explained using real world examples and relevant engineering analysis. Automotive materials, manufacturing, and future trends in mobility will also be discussed.

Prerequisites: EE 234, ME 301, ME 322

ME 422 Propulsion Systems (3-0-3)

Aerothermodynamics of aerospace vehicle engines, combustion, thrust and efficiency. Gas turbine engines: turbojet, turbofan, turboprop; ramjet and scramjet, typical engine performance. Aerothermodynamics of inlets, combustors and nozzles. Introduction to propellers, turbo compressors and turbines. Introduction to rockets and performances of rocket vehicle engines. Chemical and electrical driven rocket engines.

Note: Not to be taken for credits with AE 422

Prerequisites: ME 204, ME 311

ME 423 Energy Conversion (3-0-3)

Energy sources and their classification. Conventional energy conversion; power plant and vapor cycles. Renewable energy; solar energy with emphasis on solar cells, wind energy, OTEC systems, geothermal energy. Nuclear fission and types of fission reactors.

Prerequisite: ME 315

ME 424 Maintenance Engineering (3-0-3)

Introduction to maintenance engineering; Condition monitoring of machines, plants & structures, various methods of condition monitoring: vibration acoustic emission, temperature, etc. and their practical applications. Interpreting the results of condition monitoring. Economics of Maintenance, Optimal maintenance strategies: Inspection intervals planning for maintenance crew, forecasting the spare parts and determining optimal stocking policy.

Corequisite: Junior Standing in ME or AME

ME 425 Compressible Fluid Flow (3-0-3)

Fundamentals of compressible fluid flow. Flow through frictional pipes, flow through ducts with heat transfer, normal shock waves, two-dimensional shock waves, and linearized flow.

Note: Not to be taken for credits with AE 325

Prerequisite: ME 311

ME 427 Turbomachinery (3-0-3)

Thermo-fluid dynamics aspects of fluid flow, kinematic relations and efficiencies of turbomachines. Two dimensional cascades; Turbine and Compressor cascade correlations and performance. Axial Turbines (two dimensional analysis), Axial Flow Compressors and Fans (two dimensional analysis), Centrifugal Compressors and Fans, Radial Flow Turbines, and preliminary design fundamentals of turbomachines and three dimensional considerations.

Prerequisites: ME 204, ME 311

ME 428 Structure of Flight Vehicles (3-0-3)

Statically determinate and indeterminate structures; aerodynamic and inertia loads, load factors; elasticity of structures, stress-strain relationships; mechanical properties of vehicle materials; fatigue; strength-weight comparisons of materials; sandwich constructions; stresses

in beams, shear flow in thin webs, closed-section box beams; deflection analysis of structural systems; Castigliano's theorems, Rayleigh-Ritz method, finite difference method; redundancy in structures.
Note: Not to be taken for credits with AE 328
Prerequisites: CE 202, MATH 201

ME 429 Energy Efficiency and Auditing (3-0-3)
Overview on energies and energy auditing standard processes, understanding and analysis of energy bills, economic and life cycle costing analysis, fundamentals of electric systems, lighting, electric motors and drives, Building Envelop (revisions of modes of heat transfer, Insulation and building codes), HVAC, boilers and steam distribution systems, compressed air systems, renewable energy systems and waste water management, human behavior and facility energy management.
Prerequisite: Senior Standing in ARE or in EE or in ME

ME 430 Air Conditioning (3-0-3)
Thermodynamics of moist air; construction of the psychrometric chart; psychrometric processes; psychrometric systems; industrial processes, air conditioning systems; Air Conditioning for comfort and health- Indoor air quality, cooling and heating load calculations, duct design and air distribution methods; cooling towers.
Prerequisite: ME 315 or CHE 300

ME 431 Refrigeration (3-0-3)
Mechanical vapor compression refrigeration cycles (single-stage and multi-stage); refrigerant compressors; refrigerants; absorption refrigeration systems; thermoelectric cooling; flash cooling; gas cycle refrigeration; ultra-low-temperature refrigeration (cryogenics); food refrigeration; transport refrigeration; Design and performance evaluation problems in refrigeration systems and applications.
Prerequisite: ME 315

ME 432 Internal Combustion Engines (3-0-3)
Engine anatomy, designs, classifications, and configurations. Combustion chemistry and energy analysis. Idealized cycles of internal combustion engines. Spark-ignition (SI) and compression-ignition (CI) engines. Low-temperature-combustion (LTC) and gasoline-compression-ignition (GCI) engines. Engine performance parameters. Engine knock. Fuel octane and cetane numbers. Super and turbocharging. Engine emissions and control.
Prerequisite: ME 204 or CHE 303

ME 433 Fundamentals of Combustion (3-0-3)
Combustion modes. Chemical thermodynamics and chemical kinetics. Conservation equations of reacting flows. Multi-species transport. Ignition, flammability, and extinction. Premixed and Non-premixed flames. Combustion instabilities. Turbulent combustion. Liquid and solid burning. Pollutant Emissions.
Prerequisite: ME 204

ME 434 Wind Engineering (3-0-3)
Basic Meteorological Aspects; Meteorological Measurements; Fundamentals of Wind Speed; Wind Power Resource Assessment; Introduction to Wind Speed Analysis, Power Generation; Wind Power Economics, and Mitigation of Green House Gases Tools; Wind Turbine

Technology and Selection; Introduction to Wind-Diesel Hybrid Power System Design and Optimization.
Prerequisite: ME 311 or Equivalent

ME 435 Thermal Power Plants (2-3-3)
Forms of energy, oil, gas and coal. Combustion processes, energy cycles. Steam generators and their component design, turbines, load curves. Field trips to power plants and other energy installations during laboratory hours.
Prerequisite: ME 315

ME 436 Fluid Power Systems (3-0-3)
Study of fluid power systems as used in industrial applications to transmit power by the flow of hydraulic fluids. Fluid power circuit diagrams including components such as valves, pumps, motors, filters, reservoirs and accumulators. Analysis of fluid leakage, hydrostatic transmissions, hydraulic stiffness, and performance of positive displacement pumps and motors.
Prerequisite: ME 311

ME 437 Design and Rating of Heat Exchangers (3-0-3)
Heat transfer mechanism leading to basic heat exchanger equations; classification and analyses of heat exchangers including geometry; heat transfer and flow friction characteristics; compact and shell and tube heat exchanger application and design procedures; fouling and its effect on life cycle analysis; maintenance methodology; flow induced vibration and noise in heat exchangers.
Prerequisite: ME 315

ME 438 Pumping Machinery (3-0-3)
Terminology and description of typical pump machinery. Momentum and energy transfer between fluid and rotor; Performance characteristics of centrifugal and axial flow fans, compressors and pumps; Various types of losses; Axial and radial thrust in dynamic pumps and thrust balancing device; Common problems in centrifugal pump operation; Positive displacement pumps; Water hammer problems in pump systems; Special problems in pump design and applications.
Prerequisite: ME 311

ME 439 Solar Energy Conversion (3-0-3)
Thermal aspects of solar energy conversion. Solar radiation measurement and prediction. Selected topics in heat transfer. Flat plate and focusing collector analysis. Solar energy storage. Solar systems including hot water, space heating and cooling, distillation and thermal power conversion.
Prerequisite: ME 315 or CHE 300

ME 440 Convective Heat and Mass Transfer (3-0-3)
Boundary layers; laminar boundary layer heat transfer; turbulent boundary layer heat transfer; free convection boundary layers; enclosures; convection mass transfer; boiling and condensation; pool boiling; two-phase flow; laminar and turbulent film condensation.
Prerequisite: ME 315

ME 441 Energy and the Environment (3-0-3)

General introduction. Engineering and environment. Overview of environmental issues. Case studies in design for the environment. Automobiles and the environment. Batteries and the environment. Power plants and the environment. Refrigeration and the environment. Environmental life cycle assessments. Pollution control technologies and instrumentation. Thermodynamic assessment of environmental impacts. Case studies in mechanical engineering for environmental modeling. Smog control. CFCs and ozone layer. Acid rain. Global warming and climate change. Toxic metals. Environmental policy. Economic analysis. Environmental risk and decision.

Prerequisite: ME 203 or Equivalent

ME 442 Design of PV-Solar Systems (3-0-3)

Photovoltaic (PV) systems, solar radiation, site surveys and preplanning for photovoltaic systems, photovoltaic system components and configurations, cells, modules, and arrays for photovoltaic systems, batteries, charge controllers, and inverters, photovoltaic system sizing, photovoltaic systems mechanical integration, photovoltaic systems electrical integration, installation, commissioning, maintenance, and troubleshooting, photovoltaic systems economic analysis. PV Systems Design Software will be used throughout the course.

Prerequisites: EE 234, EE 235

ME 443 Mechanics of Robotic Manipulators (3-0-3)

Basic configurations of robots and their industrial applications, Kinematics of robotic manipulators; coordinate transformations and workspace calculations, Robotic forces, moments, torques and compliant motions, Introduction to robot motion dynamics and control.

Prerequisite: ME 301

ME 444 Introduction to Mechatronics (2-3-3)

A multidisciplinary course that introduces the design and realization of mechatronics; Electro-mechanical systems controlled by microcontroller technology; Instrumentation and measurement system analysis and design; sensors and actuators; computer data acquisition and control; The integration of mechanisms, materials, sensors, interfaces, actuators, microcontrollers, and information technology.

Prerequisites: EE 234, EE 235

ME 445 Principles of Nanostructure Materials & Sensor Technology (3-0-3)

Technological needs, justification and scope; Nanostructure materials and their properties; Top down and bottom up manufacturing techniques as typified by electrochemical and laser machining, chemical vapor deposition (CVD), Physical vapor deposition (PVD), Sputtering, Sol-gel synthesis and Ball milling; Industrial applications and future potential; Introduction to sensor basics; Primary sensor mechanisms, electrical measurement techniques, Characterization of sensors, Sensor fabrication principles; Enabling technologies; Applications in Saudi oil, gas, petrochemical industry and utilities.

Prerequisite: ME 205 or ME 207 or ME 216

ME 446 Computational Fluid Dynamics and Heat Transfer (3-0-3)

Introduction to computational fluid dynamics as an engineering tool for the analysis and design of thermal-fluid systems; Fundamental equations of fluid mechanics in differential and integral form and common approximations; Discretization and solution methods for incompressible flow; Application of numerical techniques to the solution of some practical

fluid flow and heat transfer problem; Turbulence models and their implementation in CFD; Application of commercial CFD codes to illustrative fluid flow and heat transfer problems.
Prerequisite: ME 315

ME 447 Intelligent Energy Systems (3-0-3)
Overview of systems engineering concepts; fundamentals of energy systems; energy and the environment; instrumentation and control of energy systems; energy systems control fundamentals; energy systems control design. Development of intelligent control for energy systems, automation network protocols, distributed control systems, and smart grids. Application of multi-agent methods for energy monitoring and management, Internet of Things (IoT) to energy systems, big data analytics for energy systems, power over Ethernet (PoE) for energy systems.
Prerequisite: Senior Standing

ME 449 Introduction to Atomistic Simulation (3-0-3)
Classical and quantum mechanics techniques for atomistic simulations, Essentials of statistical thermodynamics and quantum mechanics concepts, Classical molecular dynamics, Density functional theory. Materials properties: Band structure, elastic constant, thermal conductivity, Phonons and vibrational spectroscopies, free-energy calculations, diffusion coefficients, viscosity, surface chemistry, Transition State Theory.
Prerequisite: Senior Standing

ME 453 Polymer Sustainability (3-0-3)
Concepts of polymer sustainability. Biodegradation of polymers and approaches toward synthesizing biodegradable polymers. Health impact of polymers and various additives used in plastics industry. Managing plastic waste, recycling of polymers, life-cycle assessment, and circular economy of polymers.
Prerequisite: Senior Standing

ME 455 Mechatronic Design (2-3-3)
Advanced mechatronic theories and computational methodologies in modeling and control of mechatronics systems. Artificial Intelligence and Machine Learning applications in Robotics. System stability, controllability, observability, minimal realizations and optimal/sub-optimal solution options. Mechatronic design for mass production/manufacturing.
Prerequisites: EE 234, EE 235

ME 456 Fundamentals of Nondestructive Evaluation (3-0-3)
Principles of ultrasonic and elastic wave propagation; Ultrasonic transducers, and instrumentation; Ultrasonic inspection techniques; Defects and material ultrasonic characterization; Introduction to acoustic emission AE techniques; AE data collection and analysis; Industrial applications of AE; Basic principles of magnetic particle inspection MPI; MPI techniques and equipment; Application of MPI; Fundamental Eddy current concepts; Eddy current instrumentation, and inspection principles; Techniques for liquid penetrant inspection, and applications; Fundamental theory of radiation; Equipment, and inspection techniques for radiation testing; Selected radiographic application; Radiation safety.
Prerequisite: Junior Standing

ME 457 Failure of Materials and Prevention (3-0-3)
Stiffness and strength limited designs; major modes of failure of engineering materials: fracture, fatigue, creep rupture, oxidation of high temperature alloys, corrosion, friction and wear; basics of non-destructive testing and inspection.
Prerequisite: ME 205 or ME 207 or ME 216

ME 458 Design of Thermo-Fluid Systems (3-0-3)
Application of thermodynamics, mechanical engineering design, fluid mechanics, and heat transfer in the design of thermo fluid systems. Introduction to system-oriented design methods. Thermo fluid system component analysis, selection and design. Component and system modeling, simulation, economics and optimization.
Prerequisite: ME 315 or CHE 300

ME 459 Design of Renewable Energy Systems (3-0-3)
Fundamentals of solar radiation, available solar radiation and clearness index, concentrating solar collectors, optical characteristics and performance analysis of concentrating solar collectors. Basics of solar photovoltaic energy generation, configuration and components of solar photovoltaic systems. Basics of wind energy conversion, horizontal and vertical axis wind turbines and their components, power characteristics and efficiency of wind turbines.
Note: Not to be taken for credits with ME 434 or ME 439 or ME 442
Prerequisites: EE 234, EE 235, ME 315

ME 460 Thermal Desalination Systems (3-0-3)
Seawater composition. The need for water desalination. Classification of desalination processes. Single effect evaporation. Thermal vapor compression systems. Multiple effect evaporation. Multistage flash distillation, once through MSF, Brine mixing and recirculation MSF. Reverse osmosis. Desalination using renewable energy sources. Economic analysis of desalination processes
Prerequisite: ME 315 or CHE 300

ME 461 Risk Management Tools in Systems Design and Operation (3-0-3)
The assessment and management of risk, uncertainty, and reliability are critical to the success of any engineering venture today, this course deals with understanding, theory and methodology and tools in assessment and management of risk, uncertainty, and reliability in engineering systems and enterprises. Quantification of Risk and its Impact. Applications will be explored through case studies in some of the following area; environmental, water resources and technology management, clean energy, safety-critical systems, and reliability modeling of multiple failure modes in complex systems. Risk Assessment and management in systems operation.
Prerequisite: Senior Standing

ME 462 Products and Systems Reliability (3-0-3)
Fundamentals of probability theory. Reliability in Design- Probabilistic models of load (stress) and resistance (strength) variables. Stress-strength interference models in probabilistic design. Monte Carlo simulation. Hazard functions and reliability models for random and wear-out failures. Hazard plotting and reliability estimation. System reliability – series, parallel, and n-out of k and series parallel systems, Failure rate endurance testing and failure data analysis. Accelerated life testing. Reliability in systems operation: availability, spare parts computation and maintenance strategies. Use of Excel and other reliability software in reliability analysis and predictions.

Prerequisite: ME 301

ME 463 Tool Design (3-0-3)

Limits, fits, tolerance charts. Part analysis, process selection and operations sequence planning. Integrating and combining operations. Workpiece control, cutting tools, dies, and work holding devices. Tooling Design in manufacturing - specifically for machining, and sheet metal forming Metal cutting economics and process selection.

Prerequisites: ME 322, ME 323

ME 467 Tribology in Design (3-0-3)

Fundamentals of tribology: Contact mechanics, surface energy, elastic and elastoplastic deformation, surface interactions at the macro- and micro-scale, friction theories and wear mechanisms. Temperatures in sliding contacts, hydrodynamics and boundary lubrication. Friction and wear control through lubrication, materials selection, and coatings; case studies of tribology applied in components design.

Prerequisites: ME 301, ME 322

ME 468 Casting and Welding Engineering (3-0-3)

Metallurgical and engineering principles applied to melting, casting and solidification. Testing and evaluation of castings; Foundry processes; Introduction to the metallurgy of welding; Material and process selection, codes and specifications, weldment design and testing; Welding defects; Analysis of industrial welding processes; Laboratory experience in foundry, production and evaluation of weldments; Casting and welding demonstrations, experimentation and project(s) work will be conducted in Casting and Welding areas of ME Workshop. Two industrial visits will be made.

Prerequisites: ME 322, ME 323

ME 469 Computer-Aided Manufacturing (3-0-3)

High volume discrete parts production systems; CAD/CAM fundamentals; Numerical Control (NC) manufacturing systems. Part Programming; NC justification, advances in NC (CNC, DNC, adaptive control); Tooling for NC and CNC; Overview of group technology, flexible manufacturing systems (FMS), and robotics in manufacturing. Related laboratory experiments, CNC Programming, and projects will be done on CNC machines and associates CAD/CAM software available in ME Workshop.

Prerequisites: ME 322, ME 323

ME 470 Product Design and Development (3-0-3)

Opportunity identification; Creativity and Innovation; Concept Development Processes; Product concepts; Concept evaluation; Building and testing of models and prototypes; Product economics and Product management; Teamwork. Multidisciplinary project planning and execution.

Prerequisite: Junior Standing

ME 471 Mechanical Metallurgy (3-0-3)

Review of mechanical properties of metals and alloys. Introduction to theory of elasticity. Elements of theory of plasticity; flow curve, yield criteria, plastic stress-strain relationship, introduction to slip-line fields. Metallurgical aspects of plastic deformation. Metalworking processes: Forging, rolling, extrusion, and drawing.

Prerequisites: ME 216, ME 217

ME 472 Corrosion Engineering (3-0-3)

Technical and economical aspects of corrosion problems. Types of corrosion; pitting, crevice, intergranular, galvanic and stress corrosion cracking. Mechanisms and prevention of corrosion failures. Cathodic protection of pipelines and submerged structures. Principles of inhibition of corrosion in process industries. Behavior of iron, copper, aluminum and their alloys in corrosive environments. Metallurgical aspects of corrosion. Design considerations in prevention of corrosion failures.

Prerequisites: ME 216, ME 217

ME 474 Physical Metallurgy (3-0-3)

Review of crystal structures, dislocation and slip phenomena, plastic deformation. Metals and alloy systems. Diffusion in solids Strengthening mechanisms. Heat treatment of metals, phase transformations. Metallurgical aspects of failure.

Prerequisites: ME 216, ME 217

ME 475 Mechanical Behavior of Materials (3-0-3)

Elements of theories of elasticity and plasticity. Dislocations and plastic deformation. Behavior of materials under static loading. Fracture and fracture mechanics. Fatigue, creep, impact, and wear failures. Environmentally induced cracking. Basic metallurgical failure analysis. Laboratory demonstrations and experimental projects.

Prerequisites: ME 216, ME 217, ME 301

ME 476 Non-Metallic Materials (3-0-3)

Structures, mechanical properties, and processing of ceramics, polymers, and composites. Electrical and thermal properties. Case studies on the use of non-metallic materials in applications related to energy, desalination, aerospace, and civil infrastructure.

Prerequisite: ME 205 or ME 207 or ME 216 or Consent of the Instructor

ME 477 Non-Ferrous Extractive Metallurgy (3-0-3)

Physical and chemical principles involved in the extraction of non-ferrous metals. Principles of hydrometallurgical and pyrometallurgical processes. Extraction of aluminum, copper, nickel, silver and gold. Refining processes for non-ferrous metals.

Prerequisites: ME 204, ME 216, ME 217

ME 478 Iron and Steel Making (3-0-3)

Introduction to extractive metallurgy and iron ore dressing including the following topics: iron ores, mining, and ore dressing. Production of pig iron. The blast furnace. Production of steel. Bessemer process, basic oxygen process, open-hearth process, direct reduction process, and electric-furnace process. Continuous casting.

Prerequisites: ME 216, ME 217

ME 479 Modern Materials (3-0-3)

Electrical, magnetic, optical and thermal properties of materials. Modern materials and applications: thermoelectric materials, high temperature materials and coatings, carbon fiber composites, cellular materials.

Prerequisites: ME 216, ME 217

ME 480 Plastics Materials and Processing (3-0-3)

Thermoplastic and thermosetting polymers, their properties and engineering applications. Plastic manufacturing processes, equipment and mold design. Plastic materials and process selection.

Note: Not to be taken for credits with CHE 463
Prerequisite: ME 205 or ME 207 or ME 216 or CHEM 451

ME 482 Mechanical Vibrations (3-0-3)
Free and forced vibrations; Applications to systems with one-, two-, and multi-degree of freedom; Viscous, hysteretic, and Coulomb damping; Response to general periodic excitations; Transient vibration and the phase method; Principal and coupled coordinates; Dynamic vibration absorbers; Energy methods and Rayleigh's principle; Laboratory sessions on vibration measuring instruments, vibration measurement techniques, and experiments to illustrate various vibration phenomena studied.
Prerequisite: ME 201

ME 483 Mechanisms (2-3-3)
Kinematic pairs, kinematic chain, mobility of planar and space mechanisms, inversion. Vector and complex algebra methods of analysis of plane mechanisms. Centros and mechanical advantage. Hartmann's construction and Euler-Salvary equation. Kinematics of gears and simple, compound, reverted and epicyclic gear trains. Synthesis and analysis of cam mechanisms. Universal joints. Synthesis of function, path and motion generating mechanisms. Laboratory sessions to include graphical and computer methods of analysis and synthesis of mechanisms.
Prerequisite: ME 417

ME 484 Acoustics (3-0-3)
Fundamentals of vibrations. Plane and spherical acoustic waves. Radiation, transmission and filters. Loudspeakers and microphones. Speech, hearing, noise and intelligibility. Architectural acoustics. Acoustic measurements and demonstration of measurement apparatus. Case studies.
Prerequisite: ME 201

ME 485 Mechanical System Design (3-0-3)
Mechanical systems: definition and classification; the engineering design process; Need, identification and problem definition; Concept generation and evaluation; Embodiment design. Modeling and simulation; Materials selection and materials in design; Materials processing and design; Design for X. Risk, reliability and safety; Robust and quality design; Economic decision making; Cost evaluation; Legal and ethical issues in design; Detail design; Case studies; Projects.
Prerequisites: ME 302, ME 303

ME 486 Optimization of Mechanical Systems (3-0-3)
Formulation and simulation of mechanical engineering systems involving dynamics, kinematics, and machine design and thermo-fluid systems; The concept of optimization; Analytical and numerical methods such as unconstrained and constrained optimization, Lagrange multipliers, linear programming for optimum design of mechanical systems. Lab demonstration sessions involve formulation and solution of optimization problems using computers and existing software packages during the design process.
Prerequisites: ME 301, ME 315

ME 487 Mechanics of Materials (3-0-3)
Analysis of stress and strain in two and three dimensions. Equilibrium, compatibility and stress-strain relations. Analysis of torsion; non-circular sections. Saint-Venant's theory,

membrane analogy, hollow sections. Thick walled cylinders. Membrane stresses in thin shells. Bending of flat plates. Energy theorems.
Prerequisite: ME 301

ME 488 Systems Control (3-0-3)
Classical control techniques: basic control actions; Design of system by means of root-locus method and Bodes plots; Control system synthesis. Modern control techniques: state variable representation. State variable feedback; Linear quadratic controller; Laboratory demonstration sessions involve utilization of control of software for analysis and design of control system.
Corequisite: ME 401

ME 489 Finite Element Analysis in Mechanical Design (3-0-3)
Introduction to Finite Element Method and its application in different mechanical problems including: static loading of beam and beam structure, free vibration of beam and beam structures, 2-D plane stress and plane strain, elasticity, and 2-D steady state heat conduction. Using a commercial FE software, in solving various 2-D and 3-D design problems.
Prerequisite: ME 301

ME 490 Special Topics in Mechanical Engineering (3-0-3)
In-depth study of topics chosen from areas of emerging and current interests to mechanical engineering faculty, students, and the local industry. The specific topic and course description will be made available to students one semester in advance.
Prerequisite: To be set by the ME Department

ME 491 Special Topics in Energy (3-0-3)
In-depth study of topics related to Energy that attract the interests of mechanical engineering faculty, students, and the local industry. The specific topic and course description will be made available to students one semester in advance.
Prerequisite: To be set by the ME Department

ME 492 Special Topics in Dynamics & Control (3-0-3)
In-depth study of topics related to Dynamics and Control that attract the interests of mechanical engineering faculty, students, and the local industry. The specific topic and course description will be made available to students one semester in advance.
Prerequisite: To be set by the ME Department

ME 493 Special Topics in Materials & Manufacturing (3-0-3)
In-depth study of topics related to Materials and Manufacturing that attract the interests of mechanical engineering faculty, students, and the local industry. The specific topic and course description will be made available to students one semester in advance.
Prerequisite: To be set by the ME Department

ME 495 Undergraduate Research (3-0-3)
A course for ME senior students to be involved in one of the ongoing research projects under the supervision of ME faculty. The course is intended to expose the student to the process of scientific research. The student is expected to acquire research skills and methodologies including formulation of a research plan, design and execution, laboratory techniques, data

collection, assessment, analysis, and presentation. Work may be of experimental, theoretical, or design nature related to Mechanical Engineering.
Prerequisite: Senior Standing or Consent of the Instructor

MANAGEMENT

MGT 210 Business Communication (3-0-3)

Communication process, communication styles, and communication forms in organizations. Emphases are on developing skills essential for effective communication. Coverage includes fundamentals of business writing, patterns of business messages, report writing, public speaking and oral reporting, verbal and nonverbal communication, use of visual and presentation aides, and cultural and international dimensions of communication.

Prerequisite: ENGL 214

MGT 301 Principles of Management (3-0-3)

Overview of the evolution of management thought; the business environment and context; the basic functions of planning, organizing, staffing, leading and controlling; the basic processes of leadership, decision making, communication, and motivation; groups, teams, conflict, power, and politics; and overview of the fields of human resources management, operations management, management information systems, international management, and organizational change and development.

MGT 310 Organization Behavior (3-0-3)

Deals with behavior of individuals and groups in organizations and the related organizational processes, influences, and consequences. Emphasis is on individual, group, and organizational performance. Topics include an overview of the field of organizational behavior, organizational structure and design, organizational culture, learning, personality, attitudes and perceptions, motivation theories and their application, stress and stress management, teams and group dynamics, communication, decision-making, conflict and conflict management, leadership, influence, power, organizational politics, organizational change and development, and organizational behavior in the global context. Instructional techniques will include teamwork and oral and written presentations.

Prerequisite: MGT 301

MGT 311 Legal Environment (in Arabic) (3-0-3)

Business legal system in Saudi Arabia, legal concepts dealing with business activities and traders, Saudi Arabian laws that govern the establishment and operations of corporations and other business enterprises, negotiable instruments, external legal frameworks and their relationships to the Saudi Arabian business legal environment.

MGT 312 Ethics and Social Responsibility (3-0-3)

Explores ethical questions that confront a manager when facing social, political, and legal issues in the conduct of day-to-day business and long-term planning. Examine the role of business in formulating social conscience, and learn how to recognize and address ethical issues and critically think about ethics and social responsibility in the business context

Prerequisite: MGT 301

MGT 313 International Legal Environment (3-0-3)

International business law through an examination of general rules, cases and contemporary legal problems. Topics include sale contracts, international arbitration, regulation of international trade; protection and licensing of intellectual property; and the legal ramifications of regional and economically integrated trade organizations, including the World Trade Organization, and other multinational trade bodies. Discussion of various international bodies and agreements that affect international trade, including international labor laws, environmental, and climate change agreements.

MGT 355 Business Research Methods (3-0-3)

Consists of modules, which cover the fundamentals of research plan, literature review, and qualitative and quantitative methods. The course first emphasizes the research process and the importance of the literature review. It then focuses upon the appropriateness of specific research methods. Students are encouraged to critically evaluate different strategies and methods by identifying both the strengths and weaknesses of qualitative and quantitative methods. Overall, this course equips students with the skills and expertise to develop and implement a research study

Prerequisites: STAT 212, ENGL 214

MGT 398 Internship (0-0-6)

The MGT Internship provides the student with the opportunity to gain valuable practical business experience and insights in an organizational environment for a continuous period of 16 weeks to explore career interests while applying knowledge, competency, and skills learned in the classroom. The internship performance and responsibilities are evaluated by a faculty Internship advisor and a work-site supervisor through student's submission of progress reports, employer's feedback, final report, and presentation.

Prerequisites: MGT 355, CGPA and MGPA of 2.0 or above, at least 85 credit hours

MGT 413 International Management (3-0-3)

Examines cross-cultural and international management issues, and analyzes the problems of managing in an international marketplace. It focuses on cultural and regional diversity and differences, political and economic influences, global market factors, and other contingencies with which managers of multinational enterprises must contend. The course covers an array of management practices – from human resource staffing, to leading and motivating a multi-cultural workforce, to creating strategic alliances for both large and small international firms.

Prerequisite: MGT 301

MGT 430 Organizational Leadership (3-0-3)

Leadership concepts, theories and applications of managerial leadership. The topic of leadership effectiveness is of special interest in this course. The course covers many issues related to leadership such as the nature of managerial work, perspective on effective leadership behavior, participative leadership, delegation and empowerment, power and influence, theories of leadership, strategic leadership, developing leadership skills, ethical leadership and diversity.

Prerequisite: MGT 301

MGT 440 International Business (3-0-3)

A survey of international business operations, including organization structure, finance, marketing, cultural differences, global trade, capital markets and economic growth, impact of international organizations and regional trading blocs, corporate global competitiveness, and global strategies.

Prerequisite: MGT 301

MGT 449 Strategic Management (3-0-3)

Capstone course in the College. It integrates the knowledge gained in other courses to develop the strategic perspective of the organization internal operation and its competitive

position in its environment. Students will be put into the position of strategic managers or teams and will be required to make decisions and strategic choices about the long-term direction of organizations and to justify those decisions and choices through oral and written communication. Case studies and analysis will be used extensively. Specific topics include mission and vision, internal and external assessments, strategies and strategic choices, and strategies in the international environment, and strategy implementation. Instructional techniques include cases, teamwork, and oral and written presentations
Prerequisites: MGT 301, MKT 250, FIN 250, Senior Standing

MGT 450 Management of Innovation and Change (3-0-3)
Covers two interrelated dimensions: Innovation and Change. The focus is on the need to keeping introducing innovations and organizational changes with the view to upgrade individual and organizational performance whatever the industry or sector the public and private firm is in. The course will allow students to learn how to manage new ideas, products, and processes and implement new methods of organization. It enhances teamwork, knowledge sharing and innovativeness.
Prerequisite: MGT 301

MGT 495 Special Topics in Management (3-0-3)
Focuses on specific areas of management that reflect contemporary topics not covered by the listed courses.
Prerequisite: MGT 301 or HRM 301

MANAGEMENT INFORMATION SYSTEMS

MIS 101 Business Computing (0-3-1)

Introduction to business computing concepts. Topics include business applications and problem solving using high-level programming languages; development of web-based and mobile applications; use of business software with emphasis on database queries and reports; spreadsheet and financial and statistical functions. Concepts are reinforced through practical exercises from real world domains.

MIS 215 Principles of Management Information Systems (3-0-3)

Information systems concepts and principles with managerial emphasis. Information systems for operational, tactical and top management. Strategic impact of technologies on organizations.

Prerequisite: MIS 101

MIS 300 Fundamentals of Electronic Commerce (2-2-3)

E-Commerce fundamentals; E-Commerce business models; infrastructure; electronic payment systems and E-commerce security; Development, implementation, marketing and managing E-Commerce applications. Benefits and limitations, legal, ethical and global issues.

Prerequisite: MIS 215

MIS 301 Systems Analysis & Design (2-2-3)

Examining the design of information systems from a problem-solving perspective. Providing a methodological approach to developing computer systems including feasibility studies, systems planning, analysis, design, testing, implementation, and maintenance. Emphasis is on the strategies and techniques of systems analysis and design for producing logical methodologies for dealing with complexity in the development of information systems.

Prerequisite: MIS 215

MIS 302 Business Applications Development (3-0-3)

Programming process with emphasis on program design and quality assurance and control. End user systems versus traditional systems development issues. Advanced HCI concepts and principles. Common business topics: data validation, report taxonomy, files and database processing. RAD methodologies, techniques, and tools. RAD success and risk factors. User documentation development techniques and tools. Application deployment issues. Emphasis on the development of end-user-focused, high quality business applications with user-centered design and using RAD methodologies, techniques, and tools.

Prerequisite: ICS 104

MIS 311 Business Data Management (2-2-3)

Data resource management concepts. Database support for various levels of management. Relational database model. Database life cycle. Conceptual data modeling. Database logical and physical design. Database integrity. Database languages and technologies. Data and database administration.

Prerequisite: ICS 104

MIS 315 MIS Innovation and New Technologies (3-0-3)

Introduction to MIS Innovation and New Technologies, Nurturing an Entrepreneurial Innovative Environment, Understand the Business Value of Innovation, Innovation with

Online Communities Social Web Networks, Re-engineer business processes with Innovations and New Technologies.
Prerequisite: MIS 215

MIS 320 Knowledge Management (3-0-3)
Introduction to Knowledge Management (KM) – Knowledge Management (KM) to gain competitive advantage. KM for innovation, KM's emerging systems (Enterprise 2.0, Semantic Web), E-Knowledge Management, KM Development Methods.
Prerequisite: MIS 215

MIS 325 Human Resources Information System (3-0-3)
Introduction to Human Resource Information Systems (HRIS): Strategic role of Human Resource Information Systems (HRIS) in the effective management of organizations, HRIS capabilities and limitations, Organizational needs for HRIS, Evaluation and selection factors of an appropriate HRIS, HRIS software application packages for management decision-making. Role of HRIS in current Information Technology topics (Internet, Privacy, Security).
Prerequisite: MIS 215

MIS 341 Introduction to Data Analytics (2-2-3)
Introduction and scope to business data analytics. Topics include data pre-processing, use of analytical methods, multidimensionality of data, knowledge discovery, data visualization, application of business analytics tools, descriptive analytics, and application of decision support and intelligent systems.
Prerequisites: MIS 215, STAT 212

MIS 345 Information Technology in Society (3-0-3)
Impact of IT on individuals, organizations, society, and quality of life. Social and ethical considerations. Computer and Internet crimes. Intellectual property rights. Risks of IT. Human computer interaction. Data protection. National and international legal environment of IT. E-Government issues. Health and work hazards related to IT.
Prerequisite: MIS 215

MIS 355 Enterprise Systems (3-0-3)
Architecture, setup, configuration, operations and management of system that is of "enterprise class". Fundamentals of business process and business process re-engineering concepts. Selection, process mapping, GAP analysis, and implementation of enterprise systems. Enterprise modules and decision analysis tools. Use of project management techniques to emphasize team dynamics and management skills.
Prerequisite: MIS 215

MIS 365 Blockchain Fundamentals in Business (3-0-3)
Introduction to Blockchain fundamentals and history, applications of Blockchain transactions in business operations, impact of Blockchain in adding value and increased efficiency to commercial operations and models, risks and governance of Blockchain, and future trends of Blockchain in business.
Prerequisite: MIS 215

MIS 380 IS Security (3-0-3)
Introduce important aspects of IS security, with the focus on common threats to IS and ways to prevent security breaches or information loss. Topics cover techniques, methods, and

strategies used by information security professionals to manage security breaches and threats. Overview of information security and managerial methods of analyzing security threats, authentication, cryptography, and web, database and network security methods.
Prerequisite: Junior Standing

MIS 398 Internship (0-0-6)
The MIS Internship provides the student with the opportunity to gain valuable practical business experience and insights in an organizational environment for a continuous period of 16 weeks to explore career interests while applying knowledge competency, and skills learnt in the classroom. The internship performance and responsibilities are evaluated by a faculty Internship advisor and a work-site supervisor through student's submission of progress reports, employer's feedback, final report, and presentation.
Prerequisites: ENGL 214, MIS 311, CGPA and MGPA of 2.0 or above, at least 85 credit hours

MIS 400 Digital Business Project (2-2-3)
Apply conceptual knowledge and technical skills of Digital Business / E-Commerce to a digital business initiative. Team based project course with lecture and labs sessions covering the topics on digital entrepreneurship, digital business applications, current trends in mobile and digital commerce. Design and operate a digital business Enhance the skills set of the students and prepare them for the knowledge economy.
Prerequisite: MIS 300 or Consent of Instructor

MIS 405 IS Project Management (3-0-3)
Information Systems Project management fundamentals and strategies. Examine the application and integration of the project management body of knowledge (PMBOK). Focus on project management processes, methods, techniques, tools and implementation issues for defining and managing the project's goal, scope, schedule, and budget.
Prerequisites: MIS 301, MIS 311

MIS 410 Management Support Systems (2-2-3)
Introduction to Management Support Systems (MSS): Decision Support Systems, Collaborative Work Systems, Executive Support Systems, Expert Systems, and Neural Networks. Impact of MSS on decision making. Exposure to MSS tools and development methods. Integration of MSS. Team projects to develop MSS
Prerequisite: MIS 311

MIS 442 Data Analytics Applications (3-0-3)
Fundamentals of data science and analytics. The use of data, statistical and quantitative analysis to inform business decisions and actions. Topics include classification analysis, multi-criteria decision making, logistic regression, naïve Bayes, nearest neighbors, association rules, neural network and recommender systems. Application of data analytics to different business problems.
Prerequisite: MIS 341

MIS 490 Information Resources Management (3-0-3)
Theories and practices in the management of organizational information systems resources. Frameworks for introduction, evolution and assimilation of information systems into an organization. Align IT strategy with business strategy. Roles of IT and people using, developing. Managing systems. Global concepts of IT. Societal and ethical issues.

Prerequisite: Senior Standing

MIS 495 Special Topics in MIS (3-0-3)

Coverage of the contemporary and advanced MIS topics such as data management, information processing, decision making, social implications of IT, and emerging technologies.

Prerequisite: Senior Standing

MARKETING

MKT 250 Principles of Marketing (3-0-3)
Introduction to the basic concepts and principles of marketing. Focuses on providing students with a conceptual framework for understanding the role of marketing in society and the firm. Topics include the marketing concept, market segmentation, target marketing, demand estimation, product management, channels of distribution, promotion, and pricing.
Prerequisites: (ENGL 214, BUS 200 for KBS) or (ENGL 214 to non-KBS)

MKT 313 Marketing for Entrepreneurs (3-0-3)
Introduction to marketing in an entrepreneurial context. Provides appropriate theories, models and other tools to build key marketing skills and to facilitate improved decision-making in relation to launching and managing an entrepreneurial venture. The course activities include idea generation, new product/service development, business modelling, and marketing plan. This course is open to all majors in the University.
Note: Not open for credits to Business Students
Prerequisite: Junior standing

MKT 345 Marketing Research (3-0-3)
A senior level course which emphasizes the applications of marketing research tools to address marketing management problems. Key topics covered include research design, sampling methods, questionnaire design, field work/use of digital media for data collection, basic data analysis, advanced marketing analytics (linear and multivariate), and effective communication of research results via written reports and oral presentation. A key feature of the course involves students undertaking empirical marketing research projects, which seek to provide relevant recommendations to address managerial problems.
Prerequisites: MKT 250, MGT 355

MKT 360 Product & Brand Management (3-0-3)
Examination of concepts, tools, and frameworks used in management of the product component of marketing strategy. Topics include formulation of product strategy and policy, brand management, packaging and labeling, product portfolio and life cycle management, and new product development.
Prerequisite: MKT 250

MKT 370 Integrated Marketing Communications (3-0-3)
Focuses on the promotion aspect of the marketing mix. Discusses the elements of the promotional mix (advertising, personal selling, sales promotion, direct marketing, and public relations) and their use in creating synchronized, multi-channel, customer-based communications. Topics include communication theory, setting communication objectives, message planning and evaluation, and choice of communications media.
Prerequisite: MKT 250

MKT 380 Marketing Channels (3-0-3)
Examines issues and strategies relating to the distribution of products/services to final consumers or end-users. Both distribution channel management and physical distribution issues are examined. Emphasis is on the role such strategies play in the overall marketing plan. Topics include physical distribution strategies, warehousing and inventory management, distribution channel design, selection, and management, channel conflict, cooperation, and channel control.

Prerequisite: MKT 250

MKT 390 New Product Development (3-0-3)

Developing new products is at the core of any business organization. New products determine the survival and continued success of any organization. Focuses on identifying market opportunities by understanding customer needs and developing new products that would provide high value to customers. The course addresses the new product development process, including, idea generation, customer needs, new product diffusion, concept generation, concept evaluation and testing, and product launch strategies. The course takes a project based learning approach in creating a new product.

Prerequisite: MKT 250

MKT 398 Internship (0-0-6)

The MKT Internship provides the student with the opportunity to gain valuable practical business experience and insights in an organizational environment for a continuous period of 16 weeks to explore career interests while applying knowledge, competency, and skills learned in the classroom. The internship performance and responsibilities are evaluated by a faculty Internship advisor and a work-site supervisor through student's submission of progress reports, employer's feedback, final report, and presentation.

Prerequisites: MKT 250, MGT 355, CGPA and MGPA of 2.0 or above, at least 85 credit hours

MKT 410 Consumer Behavior (3-0-3)

Introduction to the concepts and frameworks for understanding the behavior of consumers relating to evaluation, choice, purchase, consumption, and disposal of products. Topics include examination of consumer motivations in product choice, consumer perceptions, learning, attitudes, information processing, and decision-making. Also included are the influence of culture, social class, family, and reference groups on the behavior of consumers.

Prerequisite: MKT 250

MKT 420 International Marketing (3-0-3)

Focuses on the application of marketing principles and strategies to international markets. Emphasizes the need for modification and/or adaptation of marketing thinking and practice in foreign markets to accommodate national/regional environmental differences. Topics include analysis of the international market environment, assessing global market opportunities, foreign market entry modes, and developing product, pricing, promotion, and distribution strategies for international markets.

Prerequisite: MKT 250

MKT 430 Services Marketing (3-0-3)

Focuses on the processes of planning, organizing, and implementing marketing efforts in service organizations. Topics include examination of differences between services and physical goods, frameworks for understanding and positioning service organizations in the marketplace, creating and delivering services, costing and pricing issues for services, and management of demand and customer mix of service organizations.

Prerequisite: MKT 250

MKT 440 Retail Management (3-0-3)

Introduction to principles and methods applied in the management of retail operations. Topics include analysis of retail structure, strategic planning for retail operations, financing retail

operations, organizing and staffing a retail enterprise, location and site decisions, merchandise planning, store design and layout, buying and inventory management, pricing, developing customer support services, and franchising.
Prerequisite: MKT 250

MKT 450 Strategic Marketing (3-0-3)
Adopts a problem solving orientation and an integrated view of marketing strategy implementation. Emphasis will be placed on topics relating to corporate and business strategy, segmentation, targeting and positioning, ethical and social issues in customer management, value chain strategy and the effective application of marketing mix elements (product/brand, pricing, distribution, promotion/sales strategies) to meet the needs of various customer segments. The effective implementation of marketing strategy will also be given a strong emphasis.
Prerequisite: MKT 250

MKT 460 Advertising (3-0-3)
Examines the role of advertising in the marketing program. Adopts a communication-theory perspective to management of advertising activities. Advertising-related topics include organization of advertising activities, setting advertising objectives, planning and developing advertising campaigns, message and media strategies, budgeting advertising expenses, and evaluation and control of the advertising efforts.
Prerequisite: MKT 250

MKT 470 Personal Selling and Sales Management (3-0-3)
Provides an appreciation and understanding of the role of the salesperson, focusing on what is required to make an effective sales presentation. Topics include the approach, qualifying prospects, questioning to determine needs, presentation and demonstration of product benefits, handling objections, and closing the sale. Others are the roles and responsibilities of the Sales Manager related to planning, implementing, and controlling the firm's personal selling function, analysis and design of sales territories, recruitment, selection, training, motivation/compensation of sales personnel, evaluation of sales performance, and ethical issues in sales and sales force management.
Prerequisite: MKT 250

MKT 485 Digital Marketing (3-0-3)
The internet and digital media play a very significant role in today’s business world. Focuses on the role of marketing in a digital world. Digital marketing has become an integral part of marketing strategies for creating value, acquiring, and retaining customers. The course addresses marketing research and consumer behavior online, segmentation, targeting and positioning, the digital marketing mix, owned media, earned media, and paid media. Effective use of different digital vehicles like websites, email, blogs, mobile, and different social media platforms (e.g. Twitter, Facebook, Instagram, YouTube, LinkedIn etc.) will be addressed.
Prerequisite: MKT 250

MKT 490 Business-to-Business Marketing (3-0-3)
Examination and analysis of the unique aspects of marketing goods and services to organizational buyers rather than final consumers. Topics include in-depth examination of business- to-business markets, complex nature of business-to-business buying behavior, developing business-to-business marketing strategy, roles of product strategy, managing

innovations and new industrial products, managing services for business markets, supply chain. Other topics are personal selling, promotion, distribution, pricing strategies and the measurement of marketing performance.
Prerequisite: MKT 250

MKT 495 Special Topics in Marketing (3-0-3)
Focuses on specific areas of marketing that reflect contemporary topics not covered by the listed courses.
Prerequisite: MKT 250

MATERIALS SCIENCE AND ENGINEERING

MSE 201 Introduction to Materials (3-0-3)

Review of atomic bonding in solids. Crystal structures (crystallographic points/directions, planes and density computation). Imperfections in solids. Mechanisms of diffusion (steady and non-steady state diffusion). Elastic and plastic deformation of metals. Design problems based on mechanical properties. Strengthening mechanism in metals. Design based on cold and hot working of metals. Binary phase diagrams and the Fe-C system. Basics of phase transformations with emphasis on phase transformations in Fe-C system. Applications of materials.

Note: Not to be taken for credits with ME 216

Prerequisites: CHEM 101, MATH 102

Corequisite: MSE 202

MSE 202 Materials Lab (0-3-1)

Materials characterization: metallography, microstructure analysis using optical microscopy and x-ray diffraction. Mechanical testing to measure materials properties: hardness, tensile, flexural, impact, torsion, fatigue, and creep. Phase diagrams, cold working, heat treatment of carbon steels.

Note: Not to be taken for credits with ME 217

Corequisite: MSE 201

MSE 203 Thermodynamics of Materials (3-0-3)

Classical and irreversible thermodynamics, phase equilibria, theory of solutions, surface phenomena, thermodynamics and kinetics of chemical reactions, electrochemistry, gas-solid reactions. Calculation of Phase Diagrams using CALPHAD software.

Prerequisites: CHEM 101, PHYS 102

MSE 204 Materials Structure and Defects (3-0-3)

The fundamentals of crystalline and non-crystalline states. The periodide trends, primary and secondary bonding types. The principles of structure common to all materials. Symmetry theory, structures of ceramic, metallic, and polymeric materials. Different types of defects. Modeling and visualization of three-dimensional structures using Crystal Maker software.

Prerequisite: MSE 201

MSE 205 Diffusion & Kinetics (3-0-3)

The kinetics aspect in materials science. Phenomenological and atomistic theories of diffusion in metals, alloys, ionic compounds, semiconductors and polymers. Introduction to the general theory of transport and non-equilibrium thermodynamics. Kinetic effects in solidifications and solid-state transformations that determine the structure and properties of materials including: interfaces and microstructure; nucleation, growth, and coarsening; alloy solidification; and diffusional and diffusionless transformations in solids.

Prerequisites: MSE 201, MSE 203

MSE 206 Materials Characterization (2-3-3)

Fundamentals, instrumentation and applications of characterization techniques commonly used to investigate material structure, surface topography, chemistry, and phase constitution: light microscopy, scanning electron microscopy, energy and wavelength dispersive x-ray spectroscopy, x-ray fluorescence, and x-ray diffraction. Lab experiments on materials

structure and composition analysis using light microscopy, SEM, XRD, EDS, WDS and XRF.
Prerequisite: MSE 201

MSE 301 Engineering Metallic Materials (3-0-3)
Review of metallic bonding and crystal structures, dislocations and plastic deformation, strengthening mechanisms. Solidification of metals. Heat treatment, properties and applications of ferrous alloys: steels, cast irons, stainless steels, and non-ferrous alloys: Cu, Al, Ti, and Ni.
Prerequisite: MSE 204

MSE 302 Polymeric Materials (3-0-3)
Basic concepts of polymer chemistry, types of polymerization processes (condensation, addition, anionic, cationic, radical, etc.,), copolymerization, thermoplastics, and thermosets. Chemical, mechanical, thermal, and engineering properties of Polymers. Polymer processing and basic concepts of polymer technology.
Note: Not to be taken for credits with ME 480 or CHE 463
Prerequisite: MSE 204

MSE 303 Materials Synthesis Lab (0-3-1)
This laboratory is intended as an intensive experience in synthetic approach to materials used for polymers, glasses, ceramics, metals, composite. Topic includes: polymerization, self-assembly, sol-gel reactions, synthesis of nanomaterials, vapor phase synthesis, porous materials synthesis.
Prerequisite: MSE 206
Corequisite: MSE 202

MSE 304 Engineering Ceramics (3-0-3)
Fundamentals, structure, processing, and properties of ceramics and glasses; Structure-property relations in ceramic and glassy materials; Application of ceramics and glasses.
Prerequisite: MSE 204

MSE 305 Composite Materials (3-0-3)
Key aspects of composite materials: matrix materials, reinforcement materials, and interfacial properties. Micro/Macromechanics, strength, fracture, fatigue and creep. Advanced composite topics: nanocomposites, carbon fiber / carbon matrix, laminates, and sandiwiches. Design, processing, and manufacturing techniques. Durability, repair, and recycling.
Prerequisite: MSE 302

MSE 306 Failure of Materials & Prevention (3-0-3)
Modes of failure of engineering materials with emphasis on preventive measures during design, material selection, operation, and monitoring using non-destructive methods. Review of stiffness and strength limited designs, fracture, fracture toughness, fatigue, creep, creep rupture, oxidation of high temperature alloys, corrosion, common corrosion forms, friction and wear, lubrication. Brief introduction to major non-destructive methods: liquid penetrant, magnetic flux leakage, radiography, and ultrasonic.
Note: Not to be taken for credits with ME 457
Prerequisite: MSE 301

MSE 307 Materials Processing & Properties Lab (0-3-1)

Processing techniques used for metals, ceramics and polymers with emphasis on processing-structure-properties relationships and microstructural design. Laboratory experiments: Casting and post-processing (work hardening, heat treatment) of metals and alloys. Powder processing of ceramics. Extrusion and injection molding of polymers. Microstructure characterization and measurement of mechanical and physical properties.

Prerequisites: MSE 301, MSE 302

MSE 399 Summer Training (0-0-0)

This course is limited to MSE program. A continuous period of 8 weeks of summer training spent in the industry working in any of the fields of materials science and engineering. The training should be carried out in an organization with an interest in one or more of these fields. On completion of the program, the student is required to submit a formal written report of his work.

Prerequisites: ENGL 214, MSE 306, Junior Standing

MSE 401 Electronic, Optical & Mag. Prop (3-0-3)

Free Electron Theory Free Electron Theory, Review of quantum mechanics, Fermi-Dirac statistics, Fermi energy, Fermi surface, Fermi distribution, density of states, effective mass. Electrons in periodic solids, Bloch wave functions, Electronic band structure-materials classification, Electrical conduction in polymers, ceramics, and amorphous materials, Optical properties of materials, Quantum mechanical treatment of the optical properties, Magnetic phenomena and their classical interpretation, Quantum mechanical considerations of the properties of materials, Superconductivity.

Prerequisite: PHYS 102

MSE 402 Materials Selection & Design (3-0-3)

Mechanical design process, materials properties and indices, product shape, multiple constraints, conflicting objectives, hybrid materials, impact of materials selection on the environment, extensive case studies.

Note: Not to be taken for credits with ME 420

Prerequisite: Senior Standing

MSE 411 Senior Design Project I (1-0-1)

This is the first part of the capstone design course for MSE program. Students form teams to design a material, component, or process. The design process includes formulation of the problem statement, establishment of objectives, technical literature, concept generation and consideration of alternative solutions, feasibility study, engineering design procedure and analyses, prototype fabrication and testing. The design should take into consideration appropriate standards and constraints such as cost, safety, reliability, ethics and environmental and social impact. Submission of a preliminary technical report is required.

Prerequisite: BUS 200, MSE 307

MSE 412 Senior Design Project II (0-6-2)

This is the second part of the capstone design course for MSE program. Continuation and completion of the project started in MSE 411. An oral presentation and the submission of a final technical report of the design project are required.

Prerequisite: MSE 411

MSE 413 Materials Physics (3-0-3)

Use of tensors to describe equilibrium and transport macroscopic physical properties; connection between symmetry and properties; ferroelectrics, ferromagnets, and multiferroics; dispersion relations of phonons and electrons in solids; and effects of defects, application of quantum mechanics to determine allowed energies in crystalline and non-crystalline materials, origins of bands gaps, effect of defects, k-space description of energy bands, applications in microelectronics.

Prerequisite: MSE 304

MSE 414 Materials Chemistry (3-0-3)

Transitions in materials, including intermolecular forces, self-assembly, physical organic chemistry, surface chemistry and electrostatics, hierarchical structure, and reactivity. The synthesis of polymer, glass, ceramics, nanomaterials, composite, porous material.

Prerequisites: CHEM 102, Junior Standing

MSE 415 Modeling in Materials Processing (3-0-3)

Techniques for model development and simplification – estimation and scaling. Analytical solutions to simple problems as building-blocks for more complicated computational models. Physical phenomenon important to materials processing: Newtonian flow, solidification, and microstructure development. Examples and case studies from a variety of materials processes: polymer extrusion and molding; various metal casting processes; crystal growth.

Prerequisites: MATH 201, MSE 301, MSE 302

MSE 416 Introduction to Atomistic Simulations (3-0-3)

Introduction to atomistic simulations covers both classical and quantum mechanics techniques. The course is primarily hand-on with a very brief introduction to essential statistical thermodynamics and quantum mechanics concepts. The main focus of the class is on classical molecular dynamics and density functional theory. Basic shell scripting will be introduced as efficient computer simulations relays on some scripting abilities.

Prerequisite: Senior Standing

MSE 417 Introduction to Nanomaterials (3-0-3)

Introduction about nanomaterials. Classification of nanomaterials. Size effects. Bottom-up and top-down approaches for synthesis and processing of nanomaterials. Mechanical and physical properties of nanomaterials. Methods for characterizing the structure and properties of nanomaterials. Emerging applications for nanomaterials. Impact of nanomaterials on the environment and human health.

Prerequisite: MSE 304

MSE 418 Corrosion Engineering (3-0-3)

Technical and economic aspects of corrosion problems. Types of corrosion; pitting, crevice, intergranular, galvanic and stress corrosion cracking. Mechanisms and prevention of corrosion failures. Cathodic protection of pipelines and submerged structures. Principles of inhibition of corrosion in process industries. Behavior of iron, copper, aluminum and their alloys in corrosive environments. Metallurgical aspects of corrosion. Design considerations in prevention of corrosion failures.

Prerequisite: MSE 201 or MSE 207 or CHEM 311

MSE 419 Corrosion in Oil and Petrochemical Industries (3-0-3)
Principles of corrosion; forms of corrosion in oil and gas industries; corrosion in petroleum production and operations; corrosion in petrochemical industry. Corrosion detection and monitoring techniques. Corrosion inhibition fundamentals, quality control, selection and application of oil field water chemistry. Emulsion theory and selection. Control by coating offshore and onshore installations. Economics of corrosion control in oil and gas industry.
Prerequisite: Senior Standing

MSE 420 Degradation of Polymers (3-0-3)
Concepts of polymer sustainability. Biodegradation of polymers and approaches toward synthesizing biodegradable polymers. Health impact of polymers and various additives used in plastics industry. Managing plastic waste, recycling of polymers and circular economy of polymers.
Prerequisite: MSE 302

MSE 421 Electrochemistry (3-0-3)
Basic concepts and laws in electrochemistry, electrolytes, electrodes, and development of the potential differences in combining electrolytes with electrodes. Applications of electrochemistry in materials science and technology: electrodeposition of metals and alloys, electrochemistry of oxides and semiconductors, corrosion and corrosion protection, intrinsically conducting polymers, electrodialysis and salt splitting, and nanoelectrochemistry. Electrochemistry for energy storage (materials for batteries, fuel cells, hydrogen generation).
Prerequisite: CHEM 102 or MSE 203

MSE 422 Nondestructive Evaluation (3-0-3)
Principles of ultrasonic and elastic wave propagation; Ultrasonic transducers, and instrumentation; Ultrasonic inspection techniques; Defects and material ultrasonic characterization; Introduction to acoustic emission AE techniques; AE data collection and analysis; Industrial applications of AE; Basic principles of magnetic particle inspection MPI; MPI techniques and equipment; Application of MPI; Fundamental Eddy current concepts; Eddy current instrumentation, and inspection principles; Techniques for liquid penetrant inspection, and applications; Fundamental theory of radiation; Equipment, and inspection techniques for radiation testing; Selected radiographic application; Radiation safety.
Prerequisite: Senior Standing

MSE 423 Introduction to Semiconductor and Micro/Nano Fabrication (3-0-3)
Materials science of semiconductors, micro/nanoelectronics technologies, device/circuit fabrication, parasitics and packaging. Unit processes will be the main focus of this course. Examples of these processes are: photo-lithography, deposition/growth of thin films, dry and wet chemical etching, ion implantation, and packaging techniques. Using these unit processes we will discuss their integration and examine existing process flows .
Prerequisite: MSE 304

MSE 424 Introduction to Computational Materials Science (3-0-3)
Materials design, random-walk model, DFT, MD, interatomic potentials, MC, KMC, mesoscopic methods, integrated computational materials engineering.
Prerequisite: Junior Standing

MSE 425 Polymer Characterization and Analysis (3-0-3)

Polymer characterization and analysis using various qualitative and quantitative analytical instruments. Principles, applications, and limitations of the classical analytical techniques required for analysis and characterizing of different kinds of polymers. Analysis of molecular weight, mechanical properties, thermal properties, in addition to spectral analysis. Interpretation of data collected using different techniques of polymer analysis.

Prerequisite: MSE 302

MSE 426 Principles of Metal Heat Treatment (3-0-3)

Principles of phase transformations, heat treatment, and mechanical properties as applied to ferrous and non-ferrous metals and alloys. Heat treatment processes including: normalizing, hardening, tempering, annealing, surface hardening. Applications of heat treatment and surface hardening techniques.

Prerequisites: MSE 201, MSE 203, MSE 205

MSE 427 Welding Processes and Metallurgy (3-0-3)

Metallurgical and engineering principles applied to melting, casting and solidification. Testing and evaluation of castings; Foundry processes; Introduction to the metallurgy of welding; Material and process selection, codes and specifications, weldment design and testing; Welding defects; Analysis of industrial welding processes; Laboratory experience in foundry, production and evaluation of weldments; Casting and welding demonstrations, experimentation and project(s) work will be conducted in Casting and Welding areas of ME Workshop. Two industrial visits will be made.

Prerequisite: MSE 301

MSE 428 Physical Metallurgy (3-0-3)

Review of crystal structures, dislocation and slip phenomena, plastic deformation. Metals and alloy systems. Diffusion in solids Strengthening mechanisms. Heat treatment of metals, phase transformations. Metallurgical aspects of failure.

Prerequisite: MSE 201 or ME 216

MSE 429 Non-Ferrous Extractive Metallurgy (3-0-3)

Thermodynamic, kinetics and chemical principles involved in the extraction of non-ferrous metals. Principles of pyro-metallurgical, hydrometallurgical and electrometallurgical processes. Extraction of non-ferrous elements from oxide, halide and sulphide ores. Refining processes for non-ferrous metals.

Prerequisites: MSE 201, MSE 203, MSE 205

MSE 430 Iron and Steel Making (3-0-3)

Introduction to extractive metallurgy of iron ore, Production of pig iron. Modern trends in blast furnace practice. Alternative routes of iron production. Kinetics of iron oxide reduction. Production of plain carbon and alloy steels by various steel making processes. Physical chemistry of steel making. Degassing and secondary steel making. Solidification of steel ingots and continuous casting of steel products. Production of ferroalloys.

Prerequisites: MSE 201, MSE 203, MSE 205

MSE 431 Materials for Clean Water (3-0-3)

Water quality and standards. Physical and chemical processes for water treatment. Natural and synthetic materials for water cleaning technologies: desalination and treatment. Advanced adsorbent materials and membranes.

Prerequisites: MSE 205 or Senior Standing

MSE 432 Materials and Sustainable Development (3-0-3)

A structure and framework for analyzing sustainable development and the role of materials in it. The links between materials, energy, and sustainability, approach to assessing a proposed articulation of sustainable technological development, The role of critical materials in important technological applications (electric cars as the future of clean personal transport, solar PV for low-carbon power..etc) Supply chain security of materials and the risk of disruption of material markets. A circular materials economy. Sustainability database.

Prerequisite: Senior Standing

MSE 433 Electrochemical Engineering Fundamentals (3-0-3)

Introduction about energy storage (i.e., batteries), energy conversion (i.e., fuel cells) and protection from corrosion (i.e., electrodeposition). Basics of electrochemical cells, fundamentals of electrochemical thermodynamics, kinetics and species, mass and heat transport. Examples of electroanalytical techniques and electrochemical technologies. Electrochemical systems.

Prerequisites: MSE 201 or Equivalent, Senior Standing

MSE 490 Special Topics in Materials Science and Engineering (3-0-3)

State-of-art topics in materials science and engineering.

Prerequisite: To be set by the MSE Department

MSE 491 Special Topics in Materials Synthesis (3-0-3)

State-of-art topics in materials synthesis.

Prerequisite: To be set by the MSE Department

MSE 492 Special Topics in Materials Processing (3-0-3)

Advanced topics in Materials Processing.

Prerequisite: To be set by the MSE Department

MSE 493 Special Topics in Advanced Materials (3-0-3)

State-of-art topics in advanced materials.

Prerequisite: To be set by the MSE Department

MSE 495 Undergraduate Research (3-0-3)

A course for MSE senior students to be involved in one of the ongoing research projects under the supervision of MSE faculty. The course is intended to expose the student to the process of scientific research. The student is expected to acquire research skills and methodologies including formulation of a research plan, design and execution, laboratory techniques, data collection, assessment, analysis, and presentation. Work may be of experimental, theoretical, or design nature related to Materials Science and Engineering.

Prerequisite: Senior Standing or Consent of the Instructor

OPERATIONS MANAGEMENT

OM 210 Operations Management (3-0-3)

Production systems; capacity and facility location problems; layout planning; forecasting; production scheduling and control; inventory and quality control.

Prerequisite: STAT 211

OM 310 Quantitative Methods for Management (3-0-3)

Decisions theory, linear programming, simplex method and duality. Inventory control under certain and uncertain demand. Network models including traveling salesman problem, maximal flow problem, and PERT/CPM networks.

Prerequisite: OM 210

OM 311 Business Analytics (3-0-3)

Introduction to business analytics. Decisions theory, linear programming, simplex method and duality, integer programming, goal programming, network models, maximal flow problem, simulation and sensitivity analyses. Emphasis on using spreadsheet modeling in solving problems. Introduction of data mining and its application for decision-making.

Prerequisite: STAT 212

OM 320 Introduction to Supply Chain Management (3-0-3)

Foundations of Supply Chain Management (SCM) and its role in the operations of the organization. SCM strategies, order fulfillment, demand forecasting, inventory management, logistics, facility location, network design, sourcing, supplier relationship management, and global supply chain management. In addition, the course addresses developments in Supply Chain Management, such as optimization, Lean, and integration.

Note: Not to be taken for credits with OM 430

Prerequisites: MGT 301, OM 210

OM 321 Procurement and Supplier Relationship Management (3-0-3)

Purchasing and Supply Management, Supply organization and strategy, Make or Buy decisions, Insourcing and Outsourcing, Needs Identification, Specification and Standardization, Quality, Inventory and Delivery Issues, Price and Cost Analysis, Cost Management, Sourcing , Supplier Selection and Evaluation, Contracting, Negotiations, Types of Compensation, Supplier Relationships, Global Supply Management, Legal and Ethical Considerations, Evaluation of the Supply Function and Trends, Supply Management Integration.

Note: Not to be taken for credits with OM 421

Prerequisite: Junior Standing

OM 322 Inventory and Warehouse Management (3-0-3)

Purpose of Inventory, Inventory Costs, Types of Stock, Electronic Data Interchange, Automatic Identification Systems, Inventory Performance Ratios and Analysis, Forecasting, Planning and Replenishment, Inventory Control Models, Economic Order Quantity, Material Requirements Planning, Enterprise Resource Planning, Cycle Counting, A-B-C Analysis, Just In Time System, The Bullwhip Effect. Types of Warehouses, Quantitative Methods for Warehouse Location and Layout Design, Material Flow Planning, Cross-Docking and other New Warehouse Functions.

Prerequisite: OM 210

OM 323 Logistics and Transportation Management (3-0-3)

Function of Logistics and Transportation in Supply Chains, Global Supply Chains, Responsive Supply Chains, Lead-Time Management, Just-in Time Systems, Network Design, Transportation models, Classification of Freight, Shipping Documentation, Packaging and Handling Issues, Measuring Logistics Costs and Performance, Service Logistics, Managing Risk in the Supply Chain, Revise Logistics, Closed-Loop Supply Chains, Green Logistics, Sustainable Supply Chains, Logistics Information Systems and Technologies.

Note: Not to be taken for credits with OM 423

Prerequisite: OM 210

OM 405 Production Planning and Control (3-0-3)

Facilities location and design. Job design, line balancing, aggregate planning, project planning, project management, operations, scheduling, and inventory management.

Prerequisites: OM 210, OM 311

OM 407 Quality Control and Reliability (3-0-3)

Analysis and design of quality control systems and procedures. Topics to include inspection policies, sampling, reliability engineering, and product testing.

Prerequisite: STAT 211

OM 420 Operations Research (3-0-3)

Integer programming, dynamic programming, simulation, queuing theory, Markov process.

Prerequisite: OM 311

OM 421 Procurement and Suppliers Management (3-0-3)

The course will develop an overarching understanding about sourcing or procurement function. The course will cover several topics such as purchasing process, policies and procedures, supply management and the competitive advantage, suppliers' management and evaluation, global sourcing, cost management, negotiation conflict management, and purchasing services. Some case studies and articles will be discussed too.

Note: Not to be taken for credits with OM 321

Prerequisite: OM 210

OM 423 Logistics and Transportation Management (3-0-3)

This course is about managing materials and information flows throughout the supply chain. Several topics will be covered in this course such as lean logistics, customers accommodation, market distribution strategy, manufacturing strategy, ERP and execution systems, inventory management and strategy, transportation management, warehousing, packaging and materials handling, network integration, performance and financial assessment, operational integration.

Note: Not to be taken for credits with OM 323

Prerequisite: OM 210

OM 430 Supply Chain Management (3-0-3)

This course is about Supply Chain Management (SCM) and its role in any organization. Topics covered: SCM strategies, supply chain drivers, transportation, sourcing, distribution networks, global supply chain management, sustainability and coordination in the supply chain. Different case studies will be discussed in this course.

Note: Not to be taken for credits with OM 320

Prerequisite: OM 210

PHYSICAL EDUCATION

PE 001 Preparatory Health and Physical Education I (0-2-1)

Basics of personal health. Diseases, causes and prevention. Nutrition: balanced diet. Health related fitness: body composition, cardiovascular endurance and flexibility test. Physical Education: fundamental and practice of specified sports. Topics related to health education represent 20% of the course.

PE 002 Preparatory Health and Physical Education II (0-2-1)

Addictive habits, risk and prevention. Muscular strength, definition and assessment. Obesity, definition, risk and prevention. Physical Education: fundamental and practice of specified sports. Topics related to health education represent 20% of the course.

Prerequisite: PE 001

PE 101 Health and Physical Education I (0-2-1)

Health: blood pressure, heart rate, cholesterol. Safety: CPR (Cardio Pulmonary Resuscitation) and techniques. Physical Education: rules, tactics and practice of specified sports. Topics related to health education represent 20% of the course.

Prerequisite: Freshman Standing

PE 102 Health and Physical Education II (0-2-1)

Body Structure: skeletal system, muscular system. Sports injuries. Physical Education: rules, tactics and practice of specified sports. Topics related to health education represent 20% of the course.

Prerequisite: PE 101

PETTROLEUM ENGINEERING

PETE 101 Introduction to the Petroleum Industry (2-0-2)
Overview of petroleum technology and its importance to society. History of the petroleum industry. Overview of petroleum exploration, drilling and production. Future energy demand and supply. Alternative energy. Oil economics. Engineering ethics and professionalism. Health, safety, environment and social responsibility.

PETE 202 Phase Behavior (3-0-3)
Introduction to the first and second laws of thermodynamics with applications. Phase behavior of pure hydrocarbons. Phase behavior of binary and multi-component hydrocarbon systems: P-V, P-T and P-composition diagrams. Phase equilibrium.
Prerequisite: PHYS 102

PETE 206 Rock and Fluid Properties (3-3-4)
Basic petrophysical properties of reservoir rock-fluid systems such as porosity, permeability, fluid saturation, electrical conductivity, capillary pressure, and relative permeability. Applications of Darcy's law to flow in porous media. Estimation of properties of reservoir fluids under various conditions of pressure and temperature. Vapor-liquid equlibria and crude oil separation calculations. Laboratory measurement of various reservoir rock and fluid properties.
Prerequisite: PETE 202

PETE 301 Reservoir Engineering (3-0-3)
The general material balance equation and its application. Initial oil and gas in place. Steady and unsteady-state water influx models. Fractional flow and the theory of immiscible displacement. Areal and vertical sweep efficiencies and waterflood performance prediction.
Prerequisite: PETE 206

PETE 302 Well Completion (3-0-3)
Subsurface operations needed to prepare the well for production after being drilled and cased. Well completion designs based upon reservoir, mechanical and economic considerations. The production system. Subsurface production control. Completion and work-over fluids. Perforation, remedial cementing, sand control, and well stimulation operations.

PETE 306 Well Testing (3-0-3)
Basic theory and modern practices and applications of well testing. Derivation of diffusivity equation and its solutions for slightly compressible fluids within infinite- and finite-acting systems. Introduction to the principles and techniques of well testing and evaluation using conventional and modern well test analysis. Well test design and instrumentation.
Prerequisite: PETE 301

PETE 311 Drilling Engineering (3-3-4)
Description of rotary drilling systems and operations. Drilling fluid formulation and conditioning. Drill String Design and drilling bits. Casing design, landing and cementing practices. Optimization of drilling parameters, well control and drilling hydraulics. Directional drilling, horizontal drilling, deviation control, offshore drilling and equipment, drilling problems and economics. Laboratory sessions cover drilling fluids and cement formulation and testing. Simulation of drilling operations and control.
Prerequisite: CE 202

PETE 313 Well Logging (3-0-3)

Introduction to modern well logging techniques. Open-hole and cased-hole log interpretation methods. Production logging. Concepts of logging program design.

Prerequisite: PHYS 102

PETE 315 Reservoir Description (3-3-4)

Principles and techniques of petroleum reservoir description. Subsurface data from geological and engineering sources. Random variables and probability distributions. Linear and non-linear regression. Univariate and bivariate descriptions. Measures of heterogeneity. Estimation techniques. Kriging and sequential Gaussian simulation. Contour and image maps and cross-sections. Averaging and scale up of reservoir properties. Correlation of saturation functions. Deterministic and probabilistic reserve estimation methods. The lab sessions will be devoted to problem solving using statistical, geostatistical and reserve estimation softwares.

Prerequisite: PETE 313

PETE 399 Summer Training (0-0-0)

A student of junior standing spends a period of eight summer weeks working in the industry to gain exposure to and appreciation of the petroleum engineering profession. On-the-job training can be acquired in any field of petroleum engineering. On completion of the training, the student is required to write a brief report on his work.

Prerequisites: ENGL 214, PETE 302

PETE 402 Reservoir Simulation (2-3-3)

Introduction to the basic theory and practices in reservoir simulation. Formulation of equations governing single phase and multi-phase flow in porous media. Use of finite difference methods to solve ordinary and partial differential equations. Solution techniques of linear equations. Applications using a black oil simulator

Prerequisites: PETE 301, PETE 315

PETE 403 Petroleum Production Engineering (3-0-3)

Introduction inflow and outflow performance. Multi-phase flow in pipes. Nodal analysis and production optimization. Artificial lift with emphasis on electric submersible pumps and gas lift systems. Oil and water treatment and separation processes. Design and economic applications.

Prerequisite: CHE 204

PETE 406 Improved Oil Recovery (3-0-3)

Introduction to current techniques of improved oil recovery. Principles of thermal recovery chemical flooding, and miscible gas displacement methods and performance prediction. Advantages and drawbacks of each displacement methods. Selection criteria for target reservoirs.

Prerequisite: PETE 301

PETE 407 Petroleum Economics (3-0-3)

Introduction to the standards and practices of economic analysis in the petroleum industry. Review of principles of economic evaluation. Typical decision making situations including risk analysis. Alternative reservoir depletion schemes utilizing decline curve analysis, secondary stage development options, and various improved oil recovery methods. Analysis

involves reserve estimation and forecasting of capital investment, operating cost, and manpower requirement.
Prerequisite: Senior Standing

PETE 409 Artificial Lift (3-0-3)
Artificial lift methods in oil wells. Basic theoretical and design aspects. Gas lift, electric submersible pumping, and sucker-rod pumping systems. Principles of multi-phase flow integrated with system performance and coupled with in inflow performance. Well performance prediction.
Prerequisite: PETE 302

PETE 410 Natural Gas Engineering (3-0-3)
Methods to estimate gas reserves for volumetric and water-drive gas reservoirs. Performance analysis of gas-condensate reservoirs. Derivation of the basic flow equations for real gas and their solutions and applications. Analysis of gas well testing, including hydraulically-fractured gas wells. Deliverability testing of gas wells. Decline-curve analysis. Estimating static and flowing bottomhole pressures. Fundamentals of gas treatment processes and equipment. Gas flow rate measurement. Gas compression and transmission. Field development plans.
Prerequisite: PETE 306

PETE 412 Formation Damage (3-0-3)
Methods of diagnosis, prevention and treatment of formation damage in petroleum reservoirs. Mechanism of damage from various sources such as scale and asphaltene precipitation, mud solids, cement filtrates and completion fluids. Techniques used to diagnose damage and remediate its effects.
Prerequisite: Senior Standing

PETE 417 Surface Facilities (3-0-3)
Processes for the gathering system, fluid treatment, transportation, measurements and storage of produced fluid. Operation and design of oil, gas and water surface handling and processing facilities. Gas/oil separation, oil sweetening and de-emulsification, produced water treatment, gas treatment, and pipe system.
Prerequisites: CHE 204, PETE 206

PETE 424 Rock Mechanics for Petroleum Engineers (3-0-3)
The student is introduced to rock mechanics as an essential tool in petroleum engineering. Topics include mechanical properties of rocks and their laboratory determination; acoustics in rock mechanics; in-situ stress conditions and their determination; failure of rocks; stresses in boreholes and borehole failure mechanisms; and sand production. A brief introduction to hydraulic fracturing, reservoir compaction and surface subsidence is also provided.
Prerequisite: Senior Standing

PETE 431 Reservoir Management (3-0-3)
Introduction to techniques that utilize geological, geophysical and petroleum engineering data to predict and manage the behavior of hydrocarbon reservoirs. Field operating plans to optimize profitability: principles of planning, implementing, monitoring, and evaluating reservoir performance. Real case studies.
Prerequisite: PETE 301

PETE 432 Water Flooding (3-0-3)

Introduction to basic theoretical and design aspects of water flooding processes. Review of capillary phenomena and relative permeability characteristics of reservoir rocks. Theory of immiscible displacement including piston-like and frontal advance mechanisms. Injectivity analysis and performance prediction of linear and pattern floods including heterogeneous reservoirs. Problems encountered in water flooding projects such as scaling.

Prerequisite: PETE 301

PETE 453 Production Logging (3-0-3)

Identification of undesired changes in well performance to propose suitable solutions. Various open-hole and cased-hole production logging techniques and tools: Flowmeter, Gradiomanometer, cement evaluation, noise and temperature, thermal decay time, reservoir saturation, formation resistivity. Field examples in vertical and horizontal wells.

Prerequisite: PETE 313

PETE 461 Chemical Enhanced Oil Recovery (3-0-3)

Processes that involve injecting aqueous solutions of chemicals into an oil reservoir to reduce water/oil interfacial tension, alter the wettability of reservoir rock, or improve the sweep efficiency of flood water. Types of surfactants, co-surfactants, polymers, and alkalis used. Phase behaviour of water-oil-surfactant mixtures. Design and recovery forecasting of chemical floods. Chemical retention problems.

Prerequisite: PETE 301 or PETE 330

PETE 462 Thermal Enhanced Oil Recovery (3-0-3)

Processes that involve heating an oil reservoir to reduce oil viscosity. Thermal properties of reservoir rocks and fluids. Modes of steam flooding: Cyclic and continuous. Oxidation and pyrolysis kinetics of crude oil. Air injection. In-situ combustion modes: Dry forward, wet, and reverse combustion. Design and recovery forecasting of thermal floods.

Prerequisite: PETE 432

PETE 463 Miscible Enhanced Oil Recovery (3-0-3)

Processes that involve injecting gases or liquids into an oil reservoir to achieve miscibility with the oil and improve its displacement efficiency. Phase behaviour of various gases/gas mixtures with crude oil. First-contact and multiple-contact miscibility conditions. Carbon dioxide flood. Nitrogen/flue gas flood. LPG flood. Estimation of minimum miscibility pressure. Design, selection/screening criteria and recovery forecasting of miscible floods.

Prerequisite: PETE 432

PETE 471 Introduction to Unconventional Resources (3-0-3)

A multidisciplinary knowledge about the various aspects of unconventional resources. Description of unconventional resources rock and fluid properties. Fluid flow in nanopores and kerogen impact on adsorption/desorption. Completion types and drilling strategies. Rigless operations and frac fleet components. Artificial lift methods.

Prerequisite: PETE 301 or PETE 330

PETE 472 Unconventional Resources Stimulation (3-0-3)

Productivity optimization of fracture size based on reservoir engineering understanding. Rock mechanics, fracture mechanics, and fluids mechanics. Simple 2D and P3D hydraulic fracture design including fracture length, width, and height determination and proppant scheduling.

Chemistry of fracture fluids and proppant materials. Field diagnostic test such as DIFT. Introduction to acid fracturing.
Prerequisite: PETE 471

PETE 473 Unconventional Resources Evaluation (3-0-3)
Petrophysics of unconventional reservoirs and building geostatistical models. Reserve estimation methods, including simulation (CMG) and decline curve analysis. RTA and PTA application to unconventional resources. Introduction to AI basics and application of AI to unconventional resources through an intensive term project.
Prerequisite: PETE 471, GEOL 470

PETE 490 Special Topics in Petroleum Engineering I (3-0-3)
The course presents a special topic in one area of the petroleum engineering discipline. Topics are selected according to faculty expertise and availability and students' interest and enrollment. A detailed description and syllabus of the course is announced one semester in advance.
Prerequisite: Senior Standing

PETE 491 Special Topics in Petroleum Engineering II (3-0-3)
The course presents a special topic in one area of the petroleum engineering discipline. Topics are selected according to faculty expertise and availability and students' interest and enrollment. A detailed description and syllabus of the course is announced one semester in advance.
Prerequisite: Senior Standing

PETE 495 Directed Undergraduate Research (3-0-3)
A supervised research project on a theoretical, experimental or simulation problem. It provides the undergraduate student the opportunity for faculty mentorship, active learning, and a chance to create new knowledge. The instructor conducting the course submits a detailed program of the research work with deliverables and grading policy in the preceding semester for Department approval.
Prerequisite: Consent of the instructor

PHYSICS

PHYS 101 **General Physics I** **(3-3-4)**
Particle kinematics and dynamics; conservation of energy and linear momentum; rotational kinematics; rigid body dynamics; conservation of angular momentum; simple harmonic motion; gravitation; the statics and dynamics of fluids.
Corequisite: MATH 101

PHYS 102 **General Physics II** **(3-3-4)**
Wave motion and sound; temperature, first and second law of thermodynamics; kinetic theory of gases; Coulomb's law; the electric field; Gauss's law; electric potential; capacitors and dielectrics; D.C. circuits; the magnetic field; Ampere's and Faraday's laws.
Prerequisite: PHYS 101
Corequisite: MATH 102

PHYS 133 **Principles of Physics** **(3-3-4)**
Particle kinematics and dynamics, work, energy, and power. Kinetic theory of gases. Temperature, first and second laws of thermodynamics. Heat transfer. Wave motion and sound. Electricity and magnetism. Light and optics.

PHYS 204 **General Physics III** **(3-0-3)**
Inductance; magnetic properties of matter, electromagnetic oscillations and waves; geometrical and physical optics. Relativity, introduction to quantum physics, atomic physics, solids, nuclear physics, particle physics and cosmology.
Prerequisites: PHYS 102, MATH 102

PHYS 205 **General Physics III LAB** **(0-3-1)**
This is the Lab component of General Physics III. It consists of selected experiments in electrical circuits, geometrical and physical optics as well as modern physics.
Corequisite: PHYS 204

PHYS 210 **Methods of Theoretical Physics** **(3-0-3)**
Vector Calculus, Matrix algebra, Fourier Series and Transforms, Functions of a complex variable; Contour integration and Residue theorem; Orthogonal Polynomials; Partial differential equations; Introduction to tensors.
Note: Not to be taken for credit with MATH 333 or Math 302
Corequisite: MATH 202

PHYS 213 **Modern Physics** **(3-0-3)**
Quantum mechanics: the particle and wave aspects of matter; quantum mechanics in one and three dimensions, quantum theory of the hydrogen atom; atomic physics; statistical physics; selected topics from molecular Physics, solid state physics, nuclear physics, elementary particle physics, and cosmology.
Prerequisite: PHYS 102

PHYS 215 **Introduction to Astronomy** **(3-0-3)**
Celestial mechanics; the solar system; stellar measurement; stellar magnitudes and spectra; galaxies; cosmology, Light and Telescopes, Parallaxes, Early and Modern History of Astronomy including contributions of Arab and Muslim Scientists.

Prerequisite: PHYS 102

PHYS 234 The Physics of How Things Work (3-0-3)
Selected topics from materials engineering, nuclear physics, aerodynamics, energy, electronics, communications, biological systems, terrestrial and celestial natural systems.
Prerequisite: PHYS 102

PHYS 261 Energy (3-0-3)
A survey of energy sources and resources; a quantitative evaluation of energy technologies; the production, transportation, and consumption of energy. Topics covered include Nuclear energy; fossil fuels; solar energy; wind energy; hydropower; geothermal energy; energy storage and distribution; automotive transportation.
Prerequisite: PHYS 102

PHYS 271 Introduction to Special Relativity (3-0-3)
Properties of space-time; the Lorentz transformation; paradoxes; four vector formulations of mechanics and electromagnetism.
Prerequisite: PHYS 102

PHYS 300 Classical Mechanics I (4-0-4)
Newton's laws of motion and conservation theorems, Forced damped Oscillations; Coupled Oscillations; Lagrangian Dynamics, Hamilton's equations of motion; Central-force motion; Dynamics of systems of particles, Motion in a non-inertial reference frame, Dynamics of Rigid bodies including properties of Inertia tensor.
Prerequisites: PHYS 101, PHYS 210 or MATH 333 or MATH 302

PHYS 302 Classical Mechanics II (3-0-3)
Lagrangian formalism in the study of Euler equations for rigid body motion and coupled oscillations; continuous systems and waves; special theory of relativity and relativistic kinematics; Hamiltonian dynamics, Poisson Brackets and conserved quantities, introduction to chaos.
Prerequisite: PHYS 300

PHYS 305 Electricity and Magnetism I (3-0-3)
Electrostatics; Laplace and Poisson's equations; Dielectric media, Magnetostatics and magnetic fields in matter; Electrodynamics.
Prerequisites: PHYS 102, MATH 201, PHYS 210 or MATH 208 or MATH 333

PHYS 306 Electricity and Magnetism II (3-0-3)
Conservation Laws; Electromagnetic waves; Diffraction and scattering; Potentials and fields, Electromagnetic radiation, Relativity and relativistic electrodynamics.
Prerequisite: PHYS 305

PHYS 307 Laser Molecular Spectroscopy (3-0-3)
Introduction to lasers; laser in time-resolved and in frequency-resolved spectroscopy; basic elements of spectroscopy; rotational, vibrational, and electronic spectroscopy.
Prerequisite: PHYS 204 or PHYS 213

PHYS 308 Electronics (3-3-4)

Physics of semi-conductors; junction transistors; amplifiers; feedback circuits; oscillators; nonlinear devices; digital electronics; digital logic; counters and registers; analog-to-digital converters.

Prerequisite: PHYS 205

PHYS 309 Experimental Physics (1-3-2)

Curve fitting processes; fundamentals of the theory of statistics; evaluation of experimental data; estimation of errors; computer interfacing and data acquisition. Selected experiments in physics will be performed in conjunction with lecture material.

Prerequisite: PHYS 308

PHYS 310 Quantum Mechanics and Applications I (3-0-3)

Fundamentals of non-relativistic quantum mechanics. Mathematical tools and basic postulates of Quantum Mechanics. The Schrödinger equation and its applications to various one-and three dimensional systems. Spin and identical particle effects. Addition of angular momenta.

Prerequisites: PHYS 213, PHYS 300

PHYS 311 Optics (3-0-3)

Nature and propagation of light; image formation-paraxial approximation; optical instruments; superposition of waves; standing waves; beats; Fourier analysis of harmonic periodic waves and wave packets; two-beam and multiple-beam interference; polarization; Fraunhoffer and Fresnel diffraction; holography; lasers.

Prerequisite: PHYS 204

PHYS 315 Astrophysics (3-0-3)

Stellar positions, size, luminosity, spectra. Newtonian gravitation, spectral analysis, Doppler shift, interaction of matter and radiation. Modeling the structure of stars. Pulsating stars, novae and supernovae. Collapsed stars (white dwarfs, neutron stars, and black holes). Stellar systems and clusters, Galaxies, systems of galaxies, filament and voids.

Prerequisite: PHYS 204 or PHYS 213

PHYS 323 Physics of Nuclear Reactors (3-0-3)

Nuclear reactions and fission; the multiplication factor and nuclear reactor criticality; homogeneous and heterogeneous reactors; the one-speed diffusion theory; reactor kinetics; multi group diffusion theory; Computers will be used in simple criticality calculations and reactor kinetics.

Prerequisites: PHYS 102, MATH 202

PHYS 336 Physics of Semiconductor Devices (3-0-3)

Electronic structure of isolated atoms; atoms bonding, crystal structure, energy bands in solids; electrons and holes in semiconductors, drift and diffusion, mobility, recombination and lifetime, conductivity; PN junctions, I(V)characteristic, applications; photo detectors, Light emitting diodes, Solar-cell, Bipolar transistor, MOSFET and JFET, Semiconducting Lasers.

Prerequisite: PHYS 102

PHYS 353 Radiation and Health Physics (3-3-4)

Introduction to atomic and nuclear structure, Radioactivity, Properties of ionizing radiation, interaction of radiation with matter, detection methods, dosimetry, biological effects of radiation, external and internal radiation protection.

Prerequisite: PHYS 102

PHYS 365 Introduction to Medical Physics (3-0-3)

Biomechanics, sound and hearing, pressure and motion of fluids, heat and temperature, electricity and magnetism in the body, optics and the eye, biological effects of light, use of ionizing radiation in diagnosis and therapy, radiation safety, medical instrumentation.

Prerequisites: PHYS102, MATH 202

PHYS 373 Introduction to Computational Physics (2-3-3)

Computer simulation of physical systems; simulation techniques; programming methods; comparison of ideal and realistic systems; limitations of physical theory, behavior of physical systems.

Note: Not to be taken for credit with MATH 371 or CISE 301

Prerequisites: PHYS 204 or PHYS 213, ICS 103

PHYS 399 Summer Training (0-0-2)

Students are required to spend one summer working in industry prior to the term in which they expect to graduate. Students are required to submit a report and make a presentation on their summer training experience and the knowledge gained. The student may also do his summer training by doing research and other academic activities.

Prerequisites: ENGL 214, Junior Standing, Approval of Department

PHYS 403 Senior Physics Lab (0-6-2)

Students are introduced to some experiments that are selected both for their importance in the historical development of physics and their educational value in presenting the techniques used in experimental physics, correlation of the experimental work with theory is stressed.

Prerequisite: PHYS 309

PHYS 405 Physics Project Laboratory (1-6-3)

A laboratory course which offers an opportunity for students to carry out experimental projects, based on their special interests and ideas to study physical phenomena. Faculty help students determine the feasibility of proposed projects.

Prerequisite: Senior Standing

PHYS 410 Quantum Mechanics and Applications II (3-0-3)

Time-independent perturbation theory. The variational method and its applications; WKB Approximation, The adiabatic approximation, Time-dependent perturbation theory. Scattering Theory. Approximate solutions of several Schrödinger equations obtained via computer packages.

Prerequisite: PHYS 310

PHYS 413 Advanced Optics (3-0-3)

Fourier transforms and applications, theory of coherence, interference spectroscopy, auto-correlation function, fluctuations, optical transfer functions, diffraction and Gaussian beams, Kirchhoff diffraction theory, theory of image formation, spatial filtering, aberrations in optical images, interaction of light with matter, crystal optics, nonlinear optics, lasers.

Prerequisites: PHYS 306, PHYS 311

PHYS 414 Physics of Lasers (3-0-3)

Stimulated emission and coherence; population inversion; Gaussian beam propagation; optical resonators and cavity modes; stability criteria; phase conjugate resonators; oscillation threshold and gain; line broadening; gain saturation; density matrix formulation and semi-classical theory of laser; lasers without inversion; mode-locking and pulse compression.

Prerequisites: PHYS 213, PHYS 311

PHYS 415 Laser and Applications (3-0-3)

Basic physics of laser, theoretical formulations and experimental foundations; stimulated emission, population inversion, optical pumping; Solid, liquid and gas lasing media and metastable states; Laser resonators and geometries; transverse and longitudinal modes of the laser; CW and pulsed laser; temporal characteristics of the laser; tuneable laser/ optical parametric oscillation, harmonic generation; Q-switching, mode locking, cavity dumping; key laser parameters; temporal and spatial coherence of laser; different kinds of lasers; Laser based remote sensor (LIDAR); DIAL, fluorescence, Raman, Doppler, wind, air born, and space born LIDAR systems.

Prerequisites: Senior Standing

PHYS 416 Cosmology and the Early universe (3-0-3)

Relativity, Gravitational phenomena, Cosmological models, Thermal history of the universe, Cosmic Inflation, Cosmic Microwave Background, Cosmic Structures and Dark Matter.

Prerequisites: PHYS 204 or PHYS 213, MATH 202

PHYS 417 Introduction to General Relativity (3-0-3)

Review of Special Relativity, Tensor Calculus and Spacetime curvature, Equivalence Principle, Einstein Field Equations and their spherical solution, Black Holes; Experimental Tests of General Relativity

Prerequisite: PHYS 306 or Consent of Instructor

PHYS 422 Nuclear and Particle Physics (3-0-3)

Nuclear properties, forces between nucleons, nuclear models, radioactive decays and detectors, nuclear reactions, accelerators. Selected Applications.

Prerequisite: PHYS 310

PHYS 430 Thermal and Statistical Physics (4-0-4)

Concepts of temperature, laws of thermodynamics, entropy, thermodynamic relations, free energy. Applications to phase equilibrium, multicomponent systems, chemical reactions, and thermodynamic cycles. Introduction to Kinetic theory and transport phenomena. Introduction to Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics.

Prerequisite: PHYS 213

PHYS 431 Monte Carlo Simulations in Statistical Mechanics (3-0-3)

Review of pertinent topics in classical and quantum physics. Gibb's statistical ensembles, MB, BE, and FD statistics with simple applications to solids. Theoretical foundations of Monte Carlo simulation, Markov chains, random walks. Study of phase transitions in the 2D and 3D Ising models as well as in the Landau Ginsburg Model using Monte Carlo simulations. Selected Topics in Kinetic Monte Carlo Simulations.

Prerequisite: Senior Standing

PHYS 432 Introduction to Solid State Physics (3-0-3)

Crystal bonding; lattice vibrations; thermal properties of insulators; free electron theory of metals; band theory; semiconductors, introduction to superconductivity. Simple band structure calculations using computer software packages.

Prerequisite: PHYS 310

PHYS 434 Introduction to the Physics of Surface (3-0-3)

A course may be offered in conjunction with current research at the Surface Science Laboratory. Preparation of clean surfaces; experimental methods such as XPS, UPS, Auger, and LEED; thin films; surface states; temperature effects.

Prerequisite: PHYS 432

PHYS 435 Superconductivity (3-0-3)

The two-fluid model, electrodynamics of superconductors. Thermodynamics of phase transition in type I and type II superconductors. Landau-Ginzburg phenomenological theory of type II superconductors: coherence length, vortices, Abrikosov vortex lattice, critical fields and vortex flow dynamics. The microscopic theory of BCS, electron pairing.

Prerequisite: PHYS 432

PHYS 441 Particle Physics (3-0-3)

Symmetries and conservation laws; the quark model, Bound States, Feynman diagrams; Selected topics in Quantum Electrodynamics, Weak Interactions, Quantum Chromodynamics, and Gauge theories. Survey of particle accelerators and particle detectors.

Prerequisite: PHYS 310

PHYS 442 Relativistic Quantum Mechanics (3-0-3)

Relativistic spin zero particles and the Klein-Gordon equation; relativistic spin one-half particles and the Dirac equation; propagator theory; Selected Applications.

Prerequisite: PHYS 410

PHYS 451 Nanophysics and Nanotechnology (3-0-3)

Physical concepts, techniques and applications of nanoscale systems. Quantum Mechanics in the nano-regime. Special properties of Nano-materials: nano-slabs, nano-wires and quantum dots. Magnetism at the nano-level and characterization techniques

Prerequisite: PHYS 213

PHYS 461 Introduction to Plasma Physics (3-0-3)

Single-particle motions; plasmas as fluids; waves in plasmas; diffusion and resistivity; equilibrium and stability; a simple introduction to kinetic theory; nonlinear effects; controlled fusion.

Prerequisite: PHYS 306

PHYS 471 Introduction to Quantum Information and Computing (3-0-3)

Review of relevant Quantum Mechanics concepts including linear vector spaces, Entanglement, the EPR paradox, and Bell’s inequality. Quantum Computation including the qubit, quantum gates and search algorithms. Quantum Communication including cryptography and teleportation. Overview of some experimental implementations.

Prerequisite: PHYS 210 or MATH 208 or MATH 225

PHYS 472 Qubits and Circuit Quantum Electrodynamics (3-0-3)

Introduction to ion trap, spin, NV-center, and circuit qubit, Quantum electrical circuits, superconductivity, Josephson Junction (JJ)-based non-linear harmonic oscillators, JJ-based superconducting circuit-qubits, noise and decoherence, cavity and circuit quantum electrodynamics (QED), microwave-based measurements in circuit QED.

Prerequisite: PHYS 471

PHYS 473 Materials Informatics (3-0-3)

The course provides an introduction to materials informatics, which is an intersection between materials science, computational methods, and big-data sciences. The emphasis will be toward foundational backgrounds including machine and statistical learning, ML-based materials science modeling, and implementations. As the field is expanding, a short overview of the contemporary trends in the field will be provided.

Prerequisite: Senior Standing

PHYS 493 Selected Topics in Physics (3-0-3)

Selected topics of special interest to students. This course may be repeated for credit as an in-depth investigation of a single topic or as a survey of several topics.

Prerequisite: Consent of Instructor

PHYS 497 Undergraduate Research I (0-0-3)

The Student is trained in the process of carrying out scientific research under the supervision of a faculty member. This includes carrying out literature search, writing research proposal, and conducting experimental or theoretical research. The student is expected to present his work at the end of the semester.

Prerequisite: Senior Standing

PHYS 498 Undergraduate Research II (0-0-3)

This is a continuation of PHYS 497. The student carries out research, writes a thesis, and defends it at the end of the semester.

Prerequisite: PHYS 497

PHYS 499 Seminar (1-0-1)

Students have the opportunity to present and attend seminars on topics of current research interest.

Prerequisite: Senior Standing

PREPARATORY YEAR PROGRAM

PYP 001 Preparatory Physical Science (2-0-2)

Introduction to Physical Science, measurements, motion, Newton's Laws, momentum and energy, wave motion, the atom, elements and compounds, states of matter, the Periodic Table.

PYP 002 Preparatory Computer Science (0-2-1)

Introduction to computing systems; Using online learning management systems; Word processing; Numerical data analysis using spreadsheets; Preparing presentations; Introduction to computer networks; Computing ethics; Computational thinking skill by developing algorithms and visual programs.

PYP 003 Life Skills (0-2-1)

This course covers skills needed in student’s life such as thinking skills, goal setting, time management, team building and leadership, presentation skills, problem solving and decision-making skills. The complex problem-solving method is used as a model to expose students to the above mentioned life skills.

PYP 004 Preparatory Engineering Technology (0-2-1)

An introduction to various engineering disciplines. Topics include: Graphical Design, Pneumatics, Automotive Engineering, Measurement Tools and Sensors. Students work in groups to turn a simple design created through “*SolidWorks*” into a real model using CNC machines. Introduction to Robotics.

STATISTICS

STAT 201 Introduction to Statistics (2-2-3)

Descriptive statistics: measures of location, dispersion, and skewness. Probability. Random variables. Normal and binomial probability distributions. Sampling distribution of the mean. Estimation. Testing hypotheses. Regression and correlation. Applications using statistical packages.

Note: Not to be taken for credit with STAT 319 or ISE 205

Prerequisite: MATH 102

STAT 211 Statistics for Business I (3-0-3)

Data description: Frequency table, histogram, measures of central tendency, scatter diagram and correlation. Probability theory; sampling; probability distributions; point and confidence interval estimation; application for managerial decision. A statistical package will be used.

Note: Not open for credit to Statistics or Mathematics Majors. Not to be taken for credit with ISE 205, STAT 201 and STAT 319

STAT 212 Statistics for Business II (3-0-3)

Hypothesis testing for means and variances; index numbers and time series; simple linear progression and correlation analysis; multiple regression analysis; the chi-squared and F distributions and their applications. A statistical package will be used.

Note: Not open for credit to Statistics or Mathematics Majors. Not to be taken for credit with ISE 205, STAT 201 and STAT 319

Prerequisite: STAT 211

STAT 214 Statistical Methods for Actuaries (3-2-4)

Descriptive Statistics: Graphical and numerical measures. Elementary Probability theory; sampling techniques; probability distributions; estimation; hypothesis testing for means and variances; index number and introductory time series analyses; simple linear regression and correlation analysis; multiple regression analysis; the chi-squared and *F* distributions and their applications; application for financial decisions; application using statistical packages.

Note: Not to be taken for credit with STAT 201, STAT 211, STAT 212, or STAT 319

Prerequisite: MATH 102

STAT 220 Statistical Computing Software (2-2-3)

Statistical computation with major statistics packages used in academics and industry: data structure, entry, and manipulation; numerical and graphical summaries; basic statistical methods; exploratory data analysis, simulation-based methods, selected advanced methods.

Prerequisite: STAT 201 or STAT 212 or STAT 214 or STAT 319

STAT 301 Introduction to Probability Theory (3-0-3)

Basic classical models of probability. Set functions. Axiomatic definition of probability. Conditional probability and Bayes' theorem. Random variables and their types. Distributions, moments, and moment generating functions. Special discrete and continuous distributions. Random vectors and their distributions. Marginal and conditional distributions. Independent random variables. Functions of random variables. Sums of independent random variables. Weak law of large numbers and the central limit theorem.

Prerequisites: MATH 201, STAT 201 or STAT 212 or STAT 214 or STAT 319

STAT 302 Statistical Inference (3-0-3)
Random sampling and the sampling distributions: t, chi-square, and F. Order Statistics. Methods of estimation: maximum likelihood and moments. Properties of a good estimator: unbiasedness, consistency, efficiency, sufficiency, and approximate normality. Testing of simple hypotheses, the Neyman-Pearson lemma. Testing composite hypotheses, uniformly most powerful and likelihood ratio tests. Bayesian Statistics.
Prerequisite: STAT 301

STAT 310 Linear Regression (3-0-3)
Simple linear regression: The least squares method, parameter estimation, confidence intervals, tests of hypotheses and model adequacy checking. Multiple linear regression, including estimation of parameters, confidence intervals, tests of hypotheses and prediction. Model adequacy checking and multicollinearity. Polynomial regression. Variable selection and model building.
Prerequisite: STAT 201 or STAT 212 or STAT 213 or STAT 319

STAT 319 Probability and Statistics for Engineers and Scientist (2-3-3)
Presentation and interpretation of data, elementary probability concepts, random variables and probability distributions, binomial, Poisson, exponential, Weibull, normal and lognormal random variables. Estimation, tests of hypotheses for the one sample problem. Simple and multiple linear regression, application to engineering problems. The lab session will be devoted to problem solving using statistics software.
Note: Not open for credit to Statistics or Mathematics Majors. Not to be taken for credit with ISE 205 or STAT 201
Prerequisite: MATH 102

STAT 320 Statistical Quality Control (3-0-3)
How control charts work. Control chart methods for attributes and variables. Process-control chart techniques. Process-capability analysis. Acceptance-sampling by attributes and variables.
Note: Not to be taken for credit with ISE 320
Prerequisite: STAT 201 or STAT 212 or STAT 213 or STAT 319

STAT 325 Non Parametric Statistical Methods (3-0-3)
One sample problem, the sign, and Wilcoxon signed rank tests. Two-Sample problem, Wilcoxon rank sum and Mann-Whitney tests. Kruskal-Wallis test for one-way layout. Friedman test for randomized block design. Run test for randomness. Goodness of fit tests.
Prerequisite: STAT 201 or Consent of the Instructor

STAT 342 Applied Statistics (3-0-3)
Review for descriptive statistics, estimation, and testing hypotheses. Simple linear regression. One-way analysis of variance. Multiple regression. Randomized block designs. Factorial experiments. Random and mixed effect models.
Note: Not to be taken for credit with STAT 310 and/or STAT 430
Prerequisite: STAT 201 or STAT 212 or STAT 213 or STAT 319

STAT 355 Demographic Methods (3-0-3)
Scope of demography. Vital events. Demographic survey. History of world population and distribution. Demographic transition. Fertility and its measures. Mortality and its measures. Direct and indirect standardization. The life table. Construction of a life table. Stationary

population. Stable population. Migration. Theories of migration. Consequences of migration. Population estimates and projections.
Prerequisite: STAT 201 or STAT 212 or STAT 213 or STAT 319

STAT 361 Operational Research I (3-0-3)
Problem solving and decision making. Linear programming: formulation, the graphical method, the simplex method, sensitivity analysis, and duality. Transportation and assignment problem. Integer programming. Project scheduling PERT/CPM.
Note: Not to be taken for credit with ISE 303
Prerequisite: STAT 201 or STAT 212 or STAT 213 or STAT 319

STAT 365 Data Collection and Sampling Methods (3-0-3)
Concept of data collection. Sample surveys, finite and infinite populations, execution and analysis of samples. Basic sampling designs: simple, stratified, systematic, cluster, two-stage cluster. Methods of estimation of population means, proportions, totals, sizes, variances, standard errors, ratio, and regression.
Prerequisite: STAT 201 or consent of the instructor

STAT 375 Categorial Data Analysis (3-0-3)
2x2 contingency tables, two-way contingency tables, three-way and higher dimensional contingency tables. Loglinear models for contingency tables. Logistic regression. Building and applying loglinear models.
Prerequisite: STAT 201 or STAT 212 or STAT 213 or STAT 319

STAT 399 Summer Training (0-0-2)
Students are required to spend one summer working in industry prior to the term in which they expect to graduate. Students are required to submit a report and make a presentation on their summer training experience and the knowledge gained.
Prerequisites: ENGL 214, Junior Standing, Approval of the Department

STAT 413 Statistical Modeling (3-0-3)
Simple and Multiple Linear Regression, Polynomial Regression, Splines; Generalized Additive Models; Hierarchical and Mixed Effects Models; Bayesian Modeling; Logistic Regression, Generalized Linear Models, Discriminant Analysis; Model Selection.
Prerequisite: MATH 405

STAT 415 Stochastic Processes (3-0-3)
Basic classes of stochastic processes. Poisson and renewal processes with applications in simple queuing systems. Discrete and continuous time Markov chains. Birth-death and Yule processes. Branching models of population growth and physical processes.
Prerequisite: STAT 301

STAT 416 Stochastic Processes for Actuaries (3-0-3)
Basic classes of stochastic processes. Poisson (regular, compound, compound surplus, and non-homogenous) and renewal processes with applications in simple queuing systems and actuarial science. Discrete and continuous time Markov chains. Birth-death and Yule processes. Branching models of population growth processes. Actuarial risk models; simulation. Arithmetic and geometric Brownian motions, and applications of these processes such as in computation of resident fees for continuing care retirement communities, and pricing of financial instruments.

Note: Not to be taken for credit with STAT 415
Prerequisite: STAT 301

STAT 430 Experimental Design (3-0-3)
Importance of statistical design of experiments. Single-factor and multifactor analysis of variance. Factorial designs. Randomized blocks. Nested designs. Latin squares. Confounding and 2-level fractional factorials. Analysis of covariance.
Prerequisite: STAT 302

STAT 435 Linear Models (3-0-3)
Review of multiple regression. The general linear model. Quadratic forms. Gauss- Markov theorem. Multivariate normal distribution. Computational aspects. Full rank models. Models not of full rank. Computer applications.
Prerequisite: STAT 310

STAT 436 Generalized Linear Models (2-2-3)
Nonlinear, Poisson and Logistic regression. Linear models. Multivariate Normal and the distribution of Quadratic forms. Link function. The generalized linear model. Estimation (Estimation of Full and reduced rank models. OLS, GLS, ML and Quasi-likelihood. Fisher Scoring). Evaluation of Models (Including Deviance Residuals). Inference (Gauss-Markov theorem. Wald test). Computational aspects and Computer applications for categorical and continuous data.
Prerequisite: STAT 310

STAT 440 Multivariate Analysis (3-0-3)
Introduction to multivariate analysis. Multivariate normal distribution theory. Distribution of the sum of product matrix. Inference about the parameters of the multivariate normal distribution. Comparison of means. Linear models. Principal components. Factor analysis. Classification and discrimination techniques.
Prerequisite: STAT 310

STAT 460 Time Series (3-0-3)
Examples of simple time series. Stationary time series and autocorrelation. Autoregressive moving average processes. Modeling and forecasting with ARMA processes. Maximum likelihood and least squares estimator. Non-stationary time series.
Prerequisite: STAT 310

STAT 461 Operational Research II (3-0-3)
Inventory models. Waiting line models. Decision Analysis. Multicriteria decision problems. Markov process. Dynamic programming. Calculus-based Procedures.
Note: Not to be taken for credit with ISE 421
Prerequisites: STAT 301, STAT 361

STAT 470 Senior Project in Statistics (1-3-2)
This course is designed to draw upon various components of the undergraduate curriculum. The project could be in the area of data analysis, sampling survey, experimental design, regression analysis, multivariate data analysis, time series and etc. A report is essential for course completion.
Prerequisite: Senior Standing

STAT 475 Statistical Models for Life time Data (3-0-3)

Life tables, graph and related procedures. Single samples: complete or Type II censored data and Type I censored data for exponential, Weibull, gamma and other distributions. Parametric regression for exponential, Weibull and gamma distributions. Distributions- free methods for proportional hazard and related regression models.

Prerequisites: STAT 302, STAT 310

STAT 499 Topics in Statistics (3-0-3)

Variable contents. Open for senior students interested in studying an advanced topic in statistics with a departmental faculty member.

Prerequisites: Senior standing, permission of the Department Chairman upon recommendation of the instructor

SOFTWARE ENGINEERING

SWE 206 Introduction to Software Engineering (2-3-3)
Introduction to software engineering discipline, software process, requirements analysis and design models. Understanding of ethical and professional issues of software engineering discipline.
Prerequisite: ICS 108

SWE 216 Software Requirements Engineering (3-0-3)
Requirements engineering process. Methods, tools and techniques for eliciting, organizing and documenting software requirements. Analysis and validation techniques, including need, goal, and use case analysis. Requirements documentation standards. Traceability. Requirements management. Handling requirements changes. Capturing usability requirements and developing UI prototypes based on requirements. Students participate in a group project on software requirements.
Prerequisite: SWE 206

SWE 302 Game Programming (3-0-3)
Introduction to games; Game programming principles; Game development engines: PyGame and Unity3D; Game data structures; Game intelligence; Simulation; Graphics and animation; Collision detection; Strategy games; Action games; Games research; Application of games to other domains.
Prerequisite: SWE 206

SWE 316 Software Design and Construction (3-0-3)
Study of design concepts and notations. Architecture, construction and design patterns. Designing for different qualities criteria. Design evolution processes and activities.
Prerequisite: SWE 206

SWE 321 Formal Methods and Models in Software Engineering (3-0-3)
Mathematical foundations for formal methods. Formal languages and techniques for specification and design, including specifying syntax using grammars and finite state machines. Analysis and verification of specifications and designs. Use of assertions and proofs. Automated program and design transformation.
Prerequisites: ICS 202, ICS 253

SWE 326 Software Testing (3-0-3)
Practical ways to design high quality tests during all phases of software development. Test Planning. Test design. Test coverage criteria. Test automation. Concept of static analysis. Reviews. Walkthroughs. Inspections. Students participate in a group project on software.
Prerequisite: SWE 216

SWE 363 Web Engineering and Development (3-0-3)
Fundamentals of web and mobile applications and how they impact people's lives; Building responsive front-end web and mobile apps; Back-end programming of dynamic and data-driven websites; Development frameworks for web and mobile apps; Security issues of web applications; Practical applications to real-world problems.
Prerequisite: Junior Standing

SWE 387 Software Project Management (3-0-3)

Introduction to project management concepts, managing time, cost, change, risk, quality, communication and people; development and management standards and managing software development projects.

Prerequisite: Junior Standing

SWE 399 Summer Training (0-0-0)

A summer period of 8 weeks spent as a trainee in industry, business, or government agencies for the purpose of familiarizing the student with the real job world and enabling him to apply and relate his academic knowledge to a real work environment. The student is required to participate in software engineering related activities and use his time to get acquainted with the software engineering related functions and resources used by his employing organization. Besides progress reports, the student is required to submit a final report and do a presentation on his experience and the knowledge he gained during his summer training program.

Prerequisites: SWE 363, ENGL 214, Department Approval

SWE 411 Software Engineering Project I (1-6-3)

This is the first part of a two-semester senior-year capstone project. Student teams employ knowledge gained from courses throughout the program such as development of requirements, design, implementation, and quality assurance to develop a software solution to a real-world problem from conception to completion. In this part, students develop project plan and software requirements specification. Next, students' teams can either develop complete design document or follow agile like methodology to develop design document and implementation for 30% of system features.

Prerequisites: SWE 316, SWE 387

SWE 412 Software Engineering Project II (0-6-2)

This is the second part of a two-semester senior-year capstone project. Student teams employ knowledge gained from courses throughout the program to develop a software solution to a real-world problem from conception to completion. In this part, students review and refine documents prepared in SWE 411; finalize design, complete implementation of the application, test their code, and evaluate their final product.

Prerequisites: SWE 326, SWE 411

SWE 416 Software Architecture (3-0-3)

Study the concepts, principles, methods, and best practices in software architecture. Different architectural styles, patterns and product lines are presented and compared. Methods to analyze, evaluate and document software architectures are also discussed. Students participate in a group project on software architecture design.

Prerequisite: SWE 316

SWE 422 Usability Engineering (3-0-3)

Design, implement and evaluate software system interfaces with focus on usability, interaction paradigms and human computer activities. The lifecycle of an interactive human computer interface is studied from both engineering and end-user perspectives.

Prerequisite: SWE 206

SWE 436 Object-Oriented Design Patterns (3-0-3)

A depth study of object-oriented design patterns. How design patterns solve design problems? How to select a design pattern? How to use a design pattern? Detailed study of creational patterns, structural patterns, and behavioral patterns. Case studies.

Prerequisite: SWE 316

SWE 439 Software Quality Engineering (3-0-3)

Overview of engineering foundations of software, basics of measurement theory, empirical experimentation in software engineering, software metrics and measuring software quality.

Prerequisites: SWE 316, STAT 319

SWE 440 Information Security Management (3-0-3)

Introduction to information security management principles, management of threats to and vulnerabilities of information security, risk management, and to apply the knowledge of people and technical security controls.

Prerequisite: Senior Standing

SWE 445 Secure Software Development (3-0-3)

Security in requirements engineering; Secure designs; Risk analysis; The SQUARE Process Model; Threat modeling; Defensive coding; Software protection; Fuzzing; Static analysis and security assessment; Memory leaks, buffer and heap overflow attacks, injection attacks.

Prerequisite: Senior Standing

SWE 463 Mobile Application Development (3-0-3)

Comprehensive introduction to building mobile applications for devices based on Android and iOS operating systems, including use of standard integrated development environment: Android Studio and Xcode, as well as testing and debugging on devices and emulators/simulators. Topics cover programming language for iOS programming, and mobile platform APIs for user interface, graphics, networking, data, and web services.

Prerequisite: ICS 108

SWE 487 Software Processes and Process Improvements (3-0-3)

Software process models. Software process analysis. Life cycle process models and standards. Process implementation at various levels like organization, project, team, or individual. Measurement and analysis of software process. Process improvements.

Prerequisite: SWE 387

SWE 490 Special Topics I (3-0-3)

In-depth study of a selected special topic relevant to software engineering.

Prerequisite: Consent of the Instructor

SWE 491 Special Topics II (3-0-3)

In-depth study of a selected special topic relevant to software engineering.

Prerequisite: Consent of the Instructor

SWE 497 Undergraduate Research (3-0-3)

The course introduces students to research. Explains the differences between different publications channels like conferences, journals, books, and book chapters. Introduces students to metrics like impact factor and H-index. Teaches how to search and locate relevant literature on a given research topic. Introduces students to research methodology,

experimentation design, and ways to conduct experiments and report the results. It also teaches students on how to prepare a research article.
Prerequisite: Consent of the Instructor