

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

King Fahd University of Petroleum & Minerals
DEPARTMENT OF CIVIL ENGINEERING
First Semester 1433-34 / 2012-13 (121)
CE 203 STRUCTURAL MECHANICS I

Major Exam I

Tuesday, October 16, 2012 7:15-9:15 P.M.

Student Name	Family					First				
ID No. (9 Digits)										

CIRCLE YOUR COURSE--SECTION NO.							
Section #	1&2	3	4	5	6	7	8
Instructor	Hamdan	Suwaiyan	Shamshad	Salah	Mesfer	Khathlan	Saeid

Summary of Scores

Problem	Full Mark	Score
1	20	
2	20	
3	20	
4	20	
5	20	
Total	100	
Remarks		

Notes:

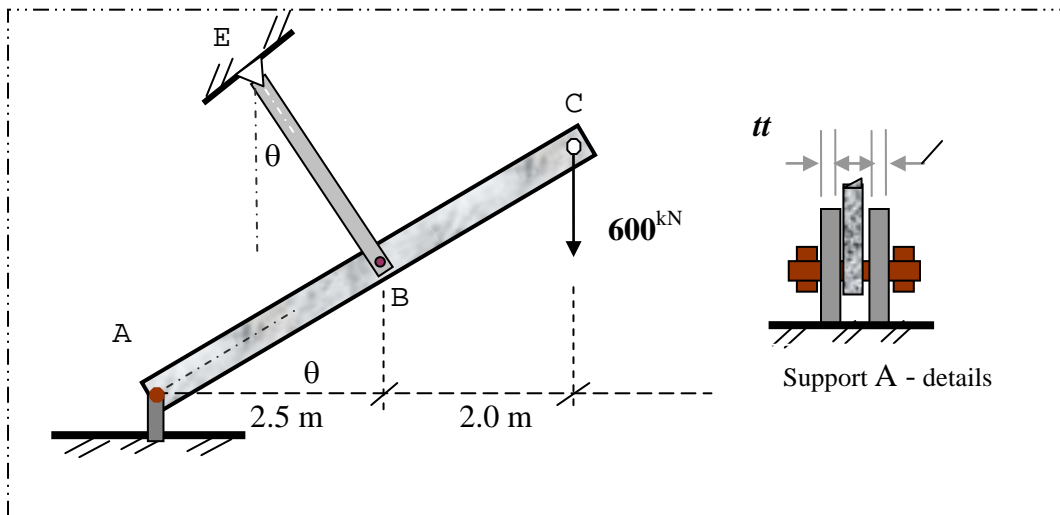
1. A sheet that includes selected Basic Formulae and definitions is provided with this examination.
2. Write clearly and show all calculations, FBDs, and units.

Problem 1: (20 points)

The bar ABC is supported by a pin-support at A and a short link BE which has a circular cross-section having a diameter D . For the load shown and with the information listed in the Table:

- Determine the required diameter D of the cross-section of link BE.
- Determine the shear stress in the bolt at pin-support A which has a diameter of 40 mm.
- Determine the required plate thickness t at support A.

Given	θ	Safety factor	Material Ultimate Strength (MPa)	
			Normal σ	Bearing σ
Value	30°	1.5	450.	200.

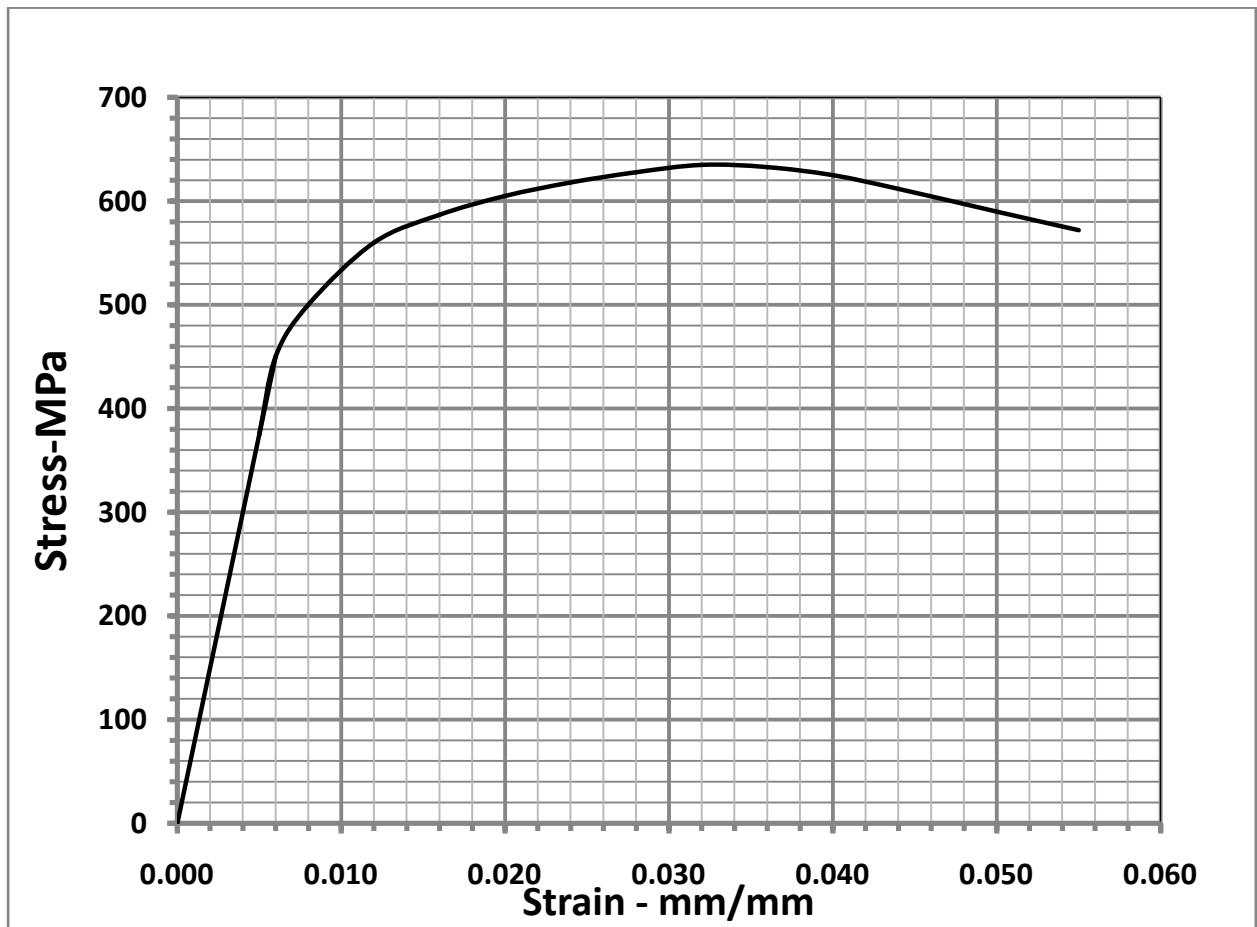


Problem 2: (20 points)

The stress-strain diagram for a specimen having a length of 300 mm and a diameter of 25 mm is shown below.

- Determine the modulus of elasticity, the ultimate stress and the fracture stress.
- Determine the yield strength using the 0.2% offset method.
- Determine the new length and diameter when the specimen is stressed to 400 MPa.
- Determine the final length when the specimen is stressed to 600 MPa and then unloaded.

$\nu = 0.35$



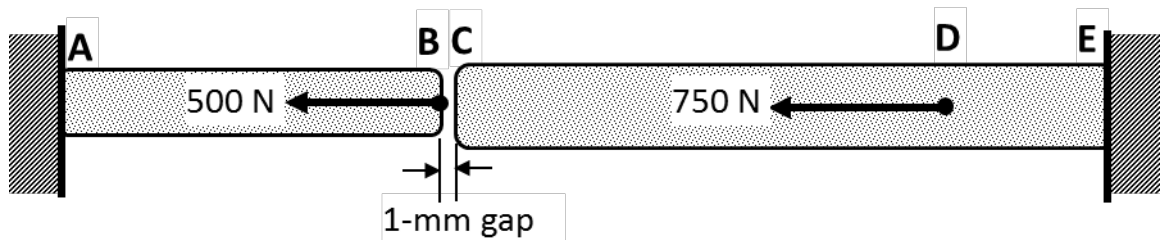
Problem 3: (20 points)

In the figure shown,

- prove that the problem is *statically determinate*;
- based on the conclusion of part (a), determine the **stresses in AB, CD, and DE**; indicate *Tension or Compression*.

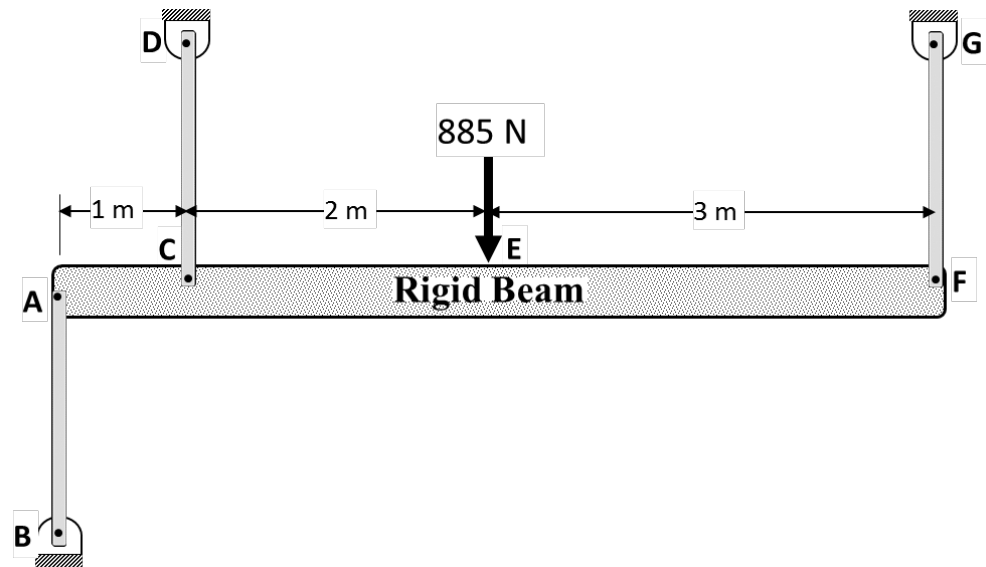
Note that all dimensions given, including the gap, are before applying the load and temperature.

Properties Member	L (m)	A (m ²)	E (N/m ²)	ΔT (°C)	α (/°C)
AB	0.2	$20 (10)^{-6}$	$50 (10)^9$	+20	$10 (10)^{-6}$
CD	0.25	$25 (10)^{-6}$	$100 (10)^9$	-10	$20 (10)^{-6}$
DE	0.1	$25 (10)^{-6}$	$100 (10)^9$	-10	$20 (10)^{-6}$



Problem 4: (20 points)

In the figure shown, determine the forces in members AB, CD, and FG; indicate *Tension* or *Compression*. All members have the same length, area, and material (L, A, E).



Problem 5: (20 points)

The plate shown in the figure has a uniform thickness t and is subjected to a tensile force $P = 10$ kN. Determine the required thickness of the plate if the allowable normal stress is 150 MPa.

