INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL

B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – Nov./ Dec. 2020

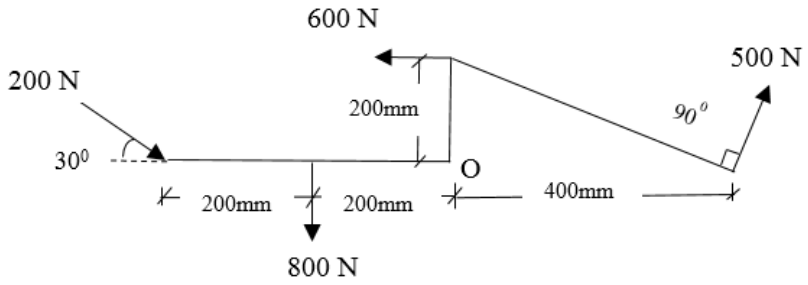
I SEMESTER - MECHANICS OF SOLID (ICE 111)

(Branch: Common to all)

Time: 3 Hours **Date: 24 November 2020** **Max. Marks: 100**

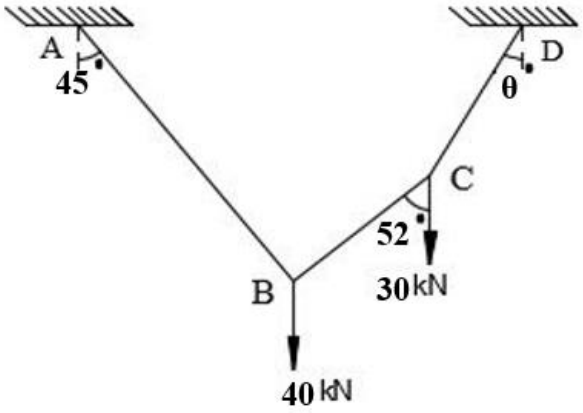
- ✓ **Answer any FIVE full questions.**
- ✓ **Missing data, if any, may be suitably assumed**
- ✓ **Draw neat sketches wherever necessary**

1A. Find the resultant of the force system shown in the figure and its location with respect to point 'O.



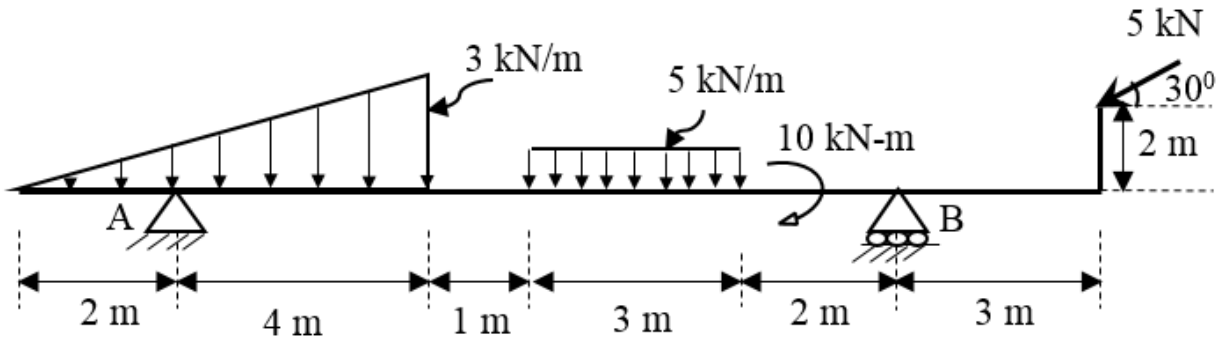
(10)

1B. Determine tension in the strings AB, BC, CD in a system and the inclination of segment CD to the vertical shown in the figure.



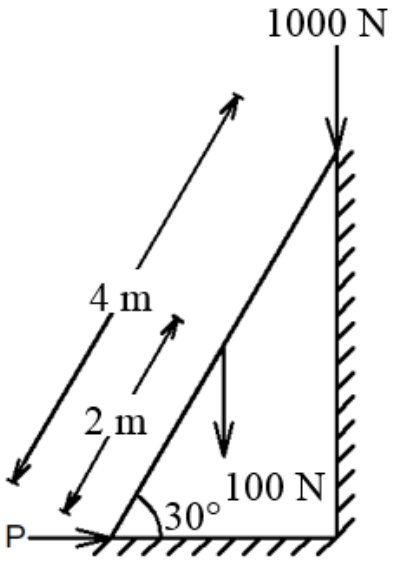
(10)

2A. Determine the reactions that develop at the supports A and B for the beam loaded as shown in the figure.



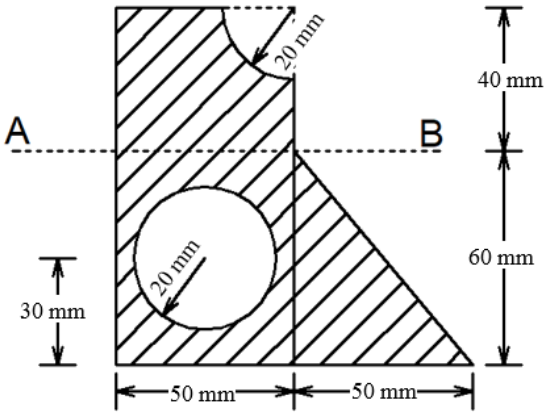
(10)

2B. Determine the magnitude of horizontal force 'P' to be applied on the ladder as shown in the figure to prevent it from slipping. Consider the coefficient of friction between wall and ladder as 0.3 and that between ground and ladder as 0.5.



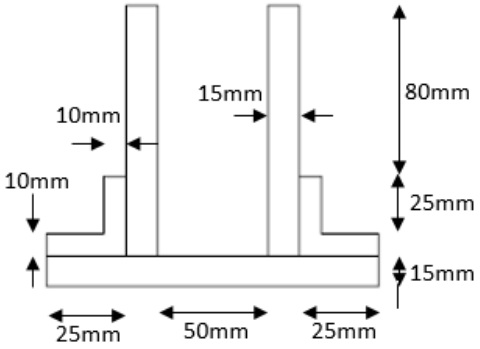
(10)

3A. Determine the position of centroid of the hatched portion with respect to axis AB.



(10)

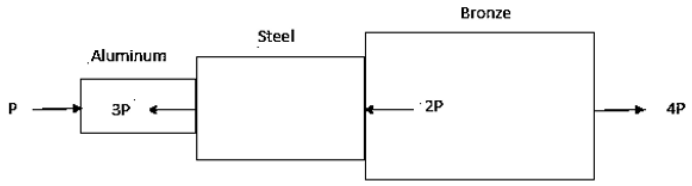
3B. Determine moment of inertia for the figure shown in the figure w.r.t base.



(10)

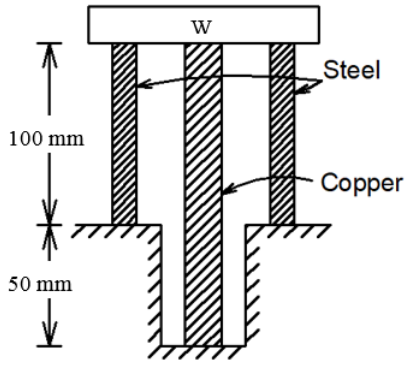
4A. A steel tube is rigidly fastened between aluminum and bronze rods and the axial loads are applied at the position shown. Find P that will not exceed stress of 80 MPa in aluminium, 100 MPa in bronze and 150 MPa in steel, given the following details

Aluminium: A = 200 mm^2, L = 1m; Steel: A = 400mm^2, L = 2m Bronze: A = 500mm^2, L = 3m



(10)

4B. A copper rod and two steel rods together support a load of W=410 kN as shown in figure. The cross sectional area of copper rod is 2000 mm^2 and of each steel rod is 1000 mm^2. Find the stresses in the rods and total deformation of the compound bar. Take $E_S = 2 \times 105$ N/mm^2 and $E_{Cu} = 1 \times 10^5$ N/mm^2.



(10)

5A. A steel bar is of 20mm X 40mm section and 400mm long. It is subjected to an axial pull of 200kN. E = $2X10^5$ MPa and Poisson's ratio = 0.3. Determine the changes in the dimensions of the bar and in the volume. **(10)**

5B. The modulus of rigidity of a material is 0.8 X 10^5 N/mm^2. When a 6mm X 6mm rod of this material was subjected to an axial pull of 3600N it was found that lateral dimensions of the rod changed to 5.9991mm X 5.9991mm. Find the poisson's ration and the modulus of elasticity.

(10)

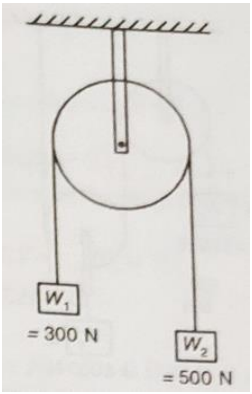
6A. A thin cylindrical shell is 2m long and 900 mm in internal diameter is subjected to an internal fluid pressure of 1 MPa. If wall thickness of the shell is 10 mm, find the hoop stress, longitudinal stress and maximum shear stress. Also, determine change in the diameter, length and volume. Take young's modulus of the shell as 200 GPa and Poissons's ratio as 0.3

(10)

6B. A weight of 200kN is supported by three short pillars, each 500mm^2 in section. The central pillar is of steel and the outer ones are of copper. The pillars are so adjusted that at temperature of 15^{o}C each carries equal load. The temperature is then raised to 115^{o}C. Estimate the stress in each pillar at 15^{o}C and 115^{o}C. Take, For steel Es = 2 X 10^5 N/mm^2 and α_s = 1.2 x 10^{-5} /^{0}C; For Copper, E_C = 0.8 X 10^5 N/mm^2 and α_c = 1.85 x 10^{-5} /^{0}C.

(10)

7A. Two bodies weighing 500N and 300N are connected to the two ends of light inextensible string. The string is passing over a smooth pully. Find (a) acceleration of the system, (b) tension in the string.



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7B. Derive Work energy relation for translation **(10)**

8A. With the help of neat diagram explain,

i)Principal of Transmissibility ii) What is couple? What are the properties of couple

(10)

8B. State and Prove the Parallel axis theorem for obtaining Moment of Inertia. **(10)**

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