INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL

B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – MAY 2021- Repeaters 2018 Batch

I SEMESTER - MECHANICS OF SOLIDS (ICE 111)

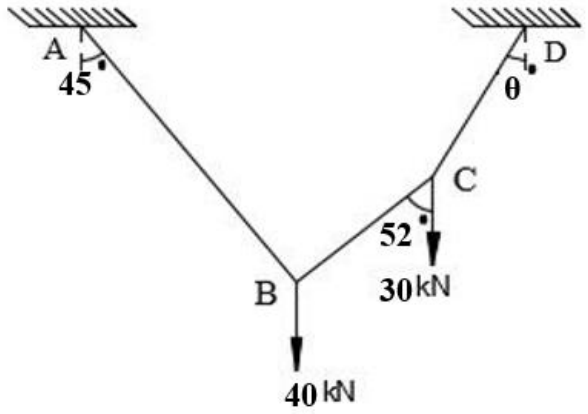
(Branch: Common to all)

Time: 3 Hours **Date: 28 May 2021** **Max. Marks: 100**

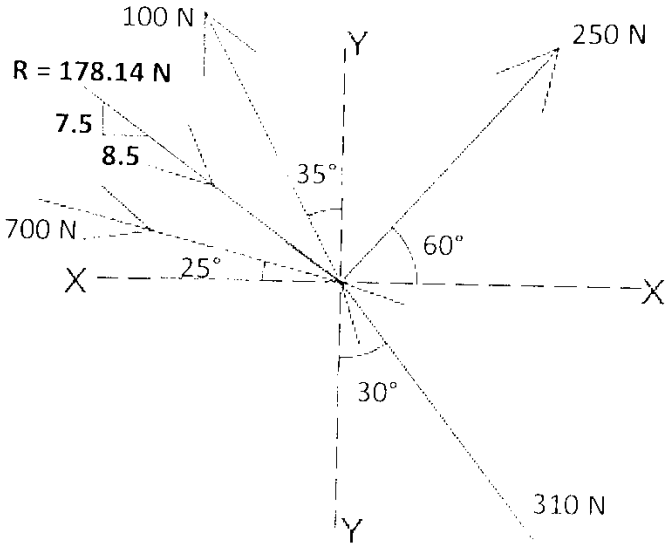
- ✓ **Answer any FIVE full questions.**
- ✓ **Missing data, if any, may be suitably assumed.**
- ✓ **Draw neat sketches wherever necessary.**

1A. what is a Force? Give its characteristics. Explain concurrent and non-concurrent force system with examples. **(10)**

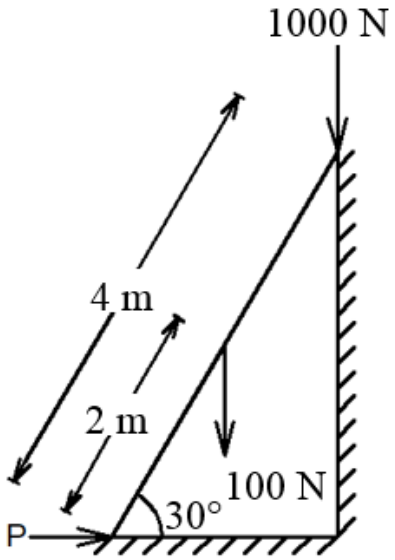
1B. Determine tension in the strings AB, BC, CD in a system and the inclination of segment CD to the vertical shown in the figure. **(10)**



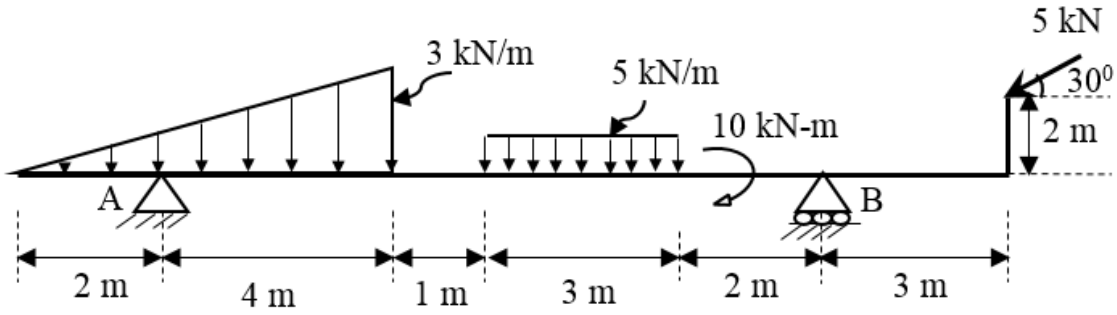
2A. Determine the magnitude and direction of the unknown fifth force for the coplanar concurrent force system shown in Fig. **(10)**



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)**



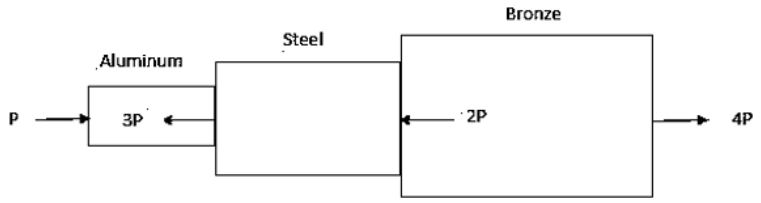
3A. Determine the reactions that develop at the supports A and B for the beam loaded as shown in the figure below. **(10)**



3B. A steel tube of 35mm outer diameter and 30mm inner diameter encloses a gun metal rod of 25mm diameter and is rigidly joined at each end. If at a temperature of 40°C there is no longitudinal stress, determine the stresses developed in the rod and tube when the temperature of the assembly is raised to 240°C.

Take $\alpha_s = 11 \times 10^{-6}/^oC$, $\alpha_g = 18 \times 10^{-6}/^oC$, $E_s = 205$ GPa and $E_g = 91.5$ GPa. **(10)**

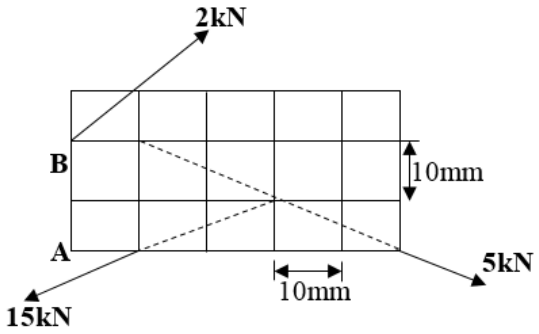
4A. A steel tube is rigidly fastened between aluminum and bronze rods and the axial loads are applied at the position shown. Find P that will not exceed stress of 60 MPa in aluminium, 80 MPa in bronze and 120 MPa in steel, given the following details, **(10)**
Aluminium: A = 200 mm^2, L = 1m; Steel: A = 400mm^2, L = 2m Bronze: A = 500mm^2, L = 3m



4B. State and Prove the Parallel axis theorem for Moment of Inertia. **(10)**

5A. A steel bar is of 20mm x 40mm in 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)**

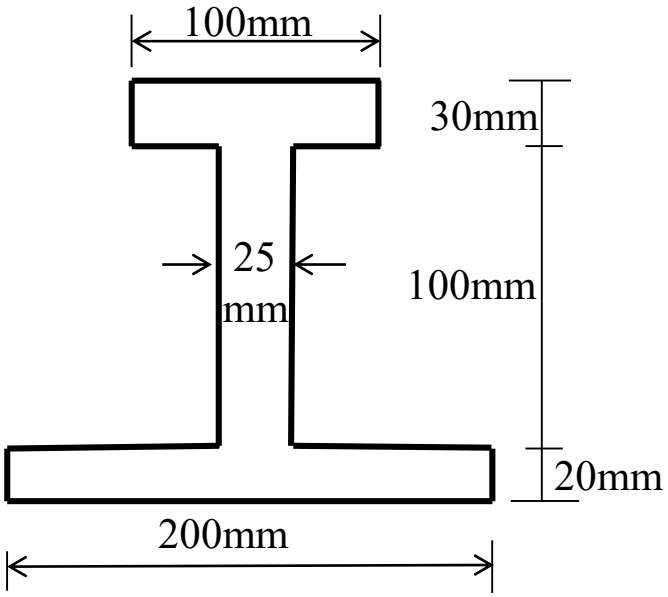
5B. Find the resultant of the system of three coplanar forces acting at point B, C and D on a lamina as shown in Fig. with respect to point A. Each square has a side of 10mm. **(10)**



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. Explain (i) D'Alembert's principle (ii) Work energy principle (iii) Impulse-momentum principle. **(10)**

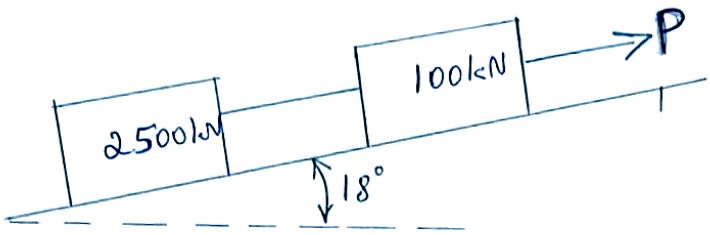
7A. Determine the MI of the unsymmetrical I – section shown in figure about both the centroidal axes. **(15)**



7B. Explain with example the Free Body Diagram. **(05)**

8A. With the help of neat diagram explain, (i) Principle of Transmissibility (ii) Force-couple system. (iii) Saint Venant's principle. **(10)**

8B. An engine weighing 100 kN drags carriages weighing 2500kN up an incline of 18^0 against a resistance of 5N/kN starting from rest. It attains a velocity of 6 m/s in 1 km distance with a constant draw bar pull supplied by the engine. What is the power required for the same ? What is the tension developed in the link connecting the engine and carriages? **(10)**



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