INTERNATIONAL CENTRE FOR APPLIED SCIENCES
MAHE, MANIPAL

B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – January 2021

I SEMESTER - MECHANICS OF SOLIDS (ICE 111)

(Branch: Common to all)

Time: 3 Hours **Date: 25 Nov. 2021** **Max. Marks: 50**

- ✓ **Answer ALL the questions.**
- ✓ **Missing data, if any, may be suitably assumed.**
- ✓ **All questions carry equal marks.**

1A. Four forces act on a 700mm x 375mm plate as shown in Fig. Q. No. 1A. Find the resultant of these forces and locate the point where the line of action of the resultant intersects the face AB of the plate.

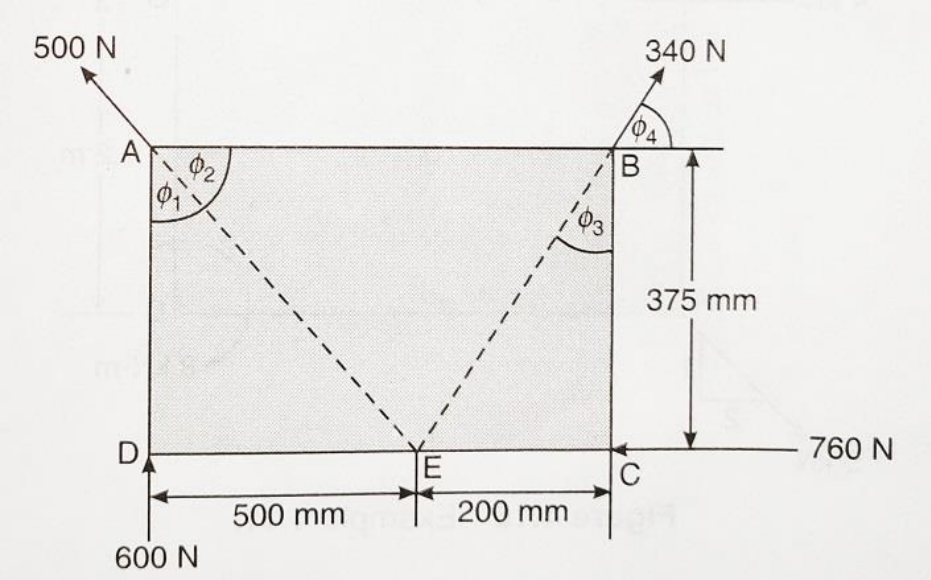

Fig. Q. No. 1A

1B. A uniform ladder of weight 250 N and length 5 m is placed against a vertical wall with which it makes an inclination of 30°. A man weighing 800 N climbs the ladder. At what position will he induced slipping? Take coefficient of friction between all the contact surfaces as 0.2.

2A. A steel rail is 12.6 m long and is laid at a temperature of 25°C. The maximum temperature expected is 45°C.

i) Estimate the minimum gap between two rails to be left so that temperature stress do not develop.

ii) Calculate the thermal stresses developed in the rails if,
   a. No expansion joint is provided.
   b. If a 1.5 mm gap is provided for expansion.

Take E= $2x10^5$ MN/m^2 and $\alpha=12x10^{-6}/^oC$

2B. What is a Force? Give its characteristics with an example. Also give the conditions for equilibrium for non-concurrent force system.

3A. State and prove Parallel axis theorem of Moment of Inertia.

3B. Determine the tension in the string and accelerations of blocks A and B weighing 1800N and 600N connected by an inextensible string as shown in figure. Assume pulleys as frictionless and weightless. Refer Fig. Q. No. 3B

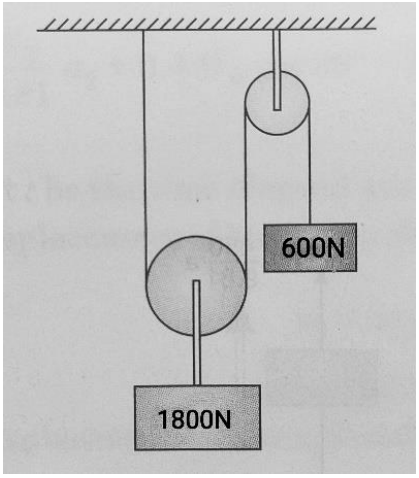

Fig. Q. No. 3B

4A. Determine second moment of area about the centroidal horizontal axis for the area shown in Fig. Q.No. 4A.

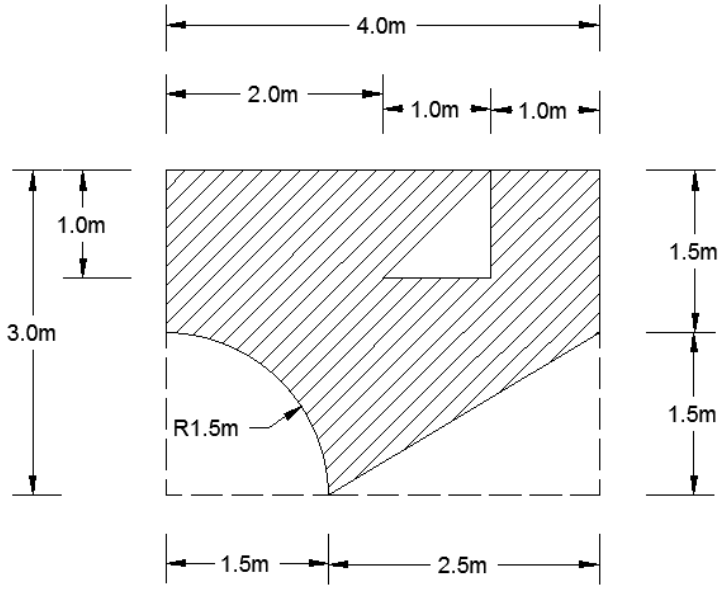

Fig. Q. No. 4A

4B. Explain (i) D'Alembert's Principle (ii) Work Energy Principle (iii) Impulse-momentum Principle.

5A. A copper rod and two steel rods together support a load of W = 410 kN as shown in figure below. 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 $E_S = 2 \times 10^5$ N/mm^2 and $E_{Cu} = 1 \times 10^5$ N/mm^2. Refer Fig. Q. No. 5A.

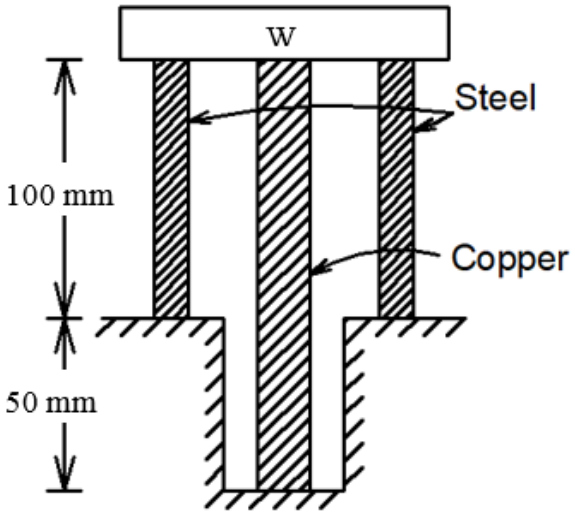

Fig. Q. No. 5A

5B. Define (i) Couple (ii) Poisson's Ratio (iii) Modulus of Rigidity (iv) Free Body Diagram (v) Principle of Transmissibility.

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