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INTERNATIONAL CENTRE FOR APPLIED SCIENCES
(MAHE, MANIPAL)

I SEMESTER B.Sc. (Applied Sciences) in Engg.

End – Semester Theory Examinations – Jan./ Feb. 2022

SUBJECT: MECHANICS OF SOLID (ICE 111)

(Branch: Common to all)

Time: 3 Hours **Date: 04 February 2022** **Max. Marks: 50**

- ✓ **Answer All questions.**
- ✓ **All questions carry equal marks.**
- ✓ **Missing data, if any, may be suitably assumed.**
- ✓ **Draw neat sketches wherever necessary.**

1A. A steel tube is rigidly fastened between aluminum and bronze rods and the axial loads are applied at the position shown. Find the maximum value of 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.

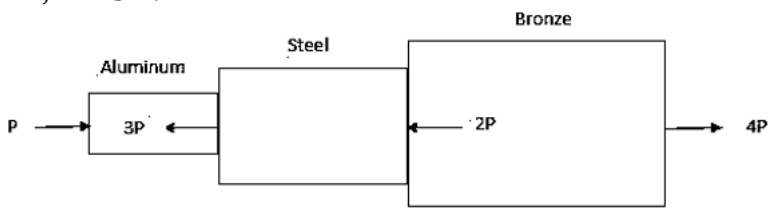

FIG. Q.No. 1A

1B. Derive from first principles the moment of inertia for a right-angled triangle about its base and then demonstrate the application of parallel axes theorem to determine MI about its horizontal centroidal axis.

2A. 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 $E_S = 2 \times 10^5$ N/mm^2 and $E_{Cu} = 1 \times 10^5$ N/mm^2.

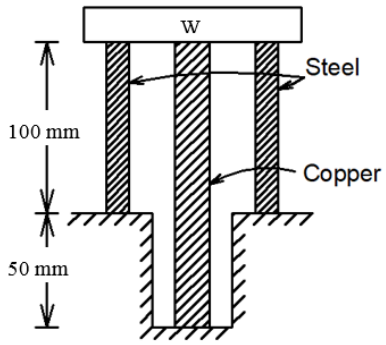

FIG. Q.No. 2A

2B. 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.

3A. Find the radius of gyration from the horizontal centroidal axis for the channel section having 10 mm thickness shown.

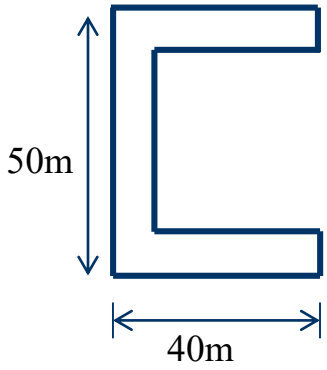

FIG. Q.No. 3A

3B. Locate the resultant of the non-concurrent force system shown in the figure with respect to 'A'.

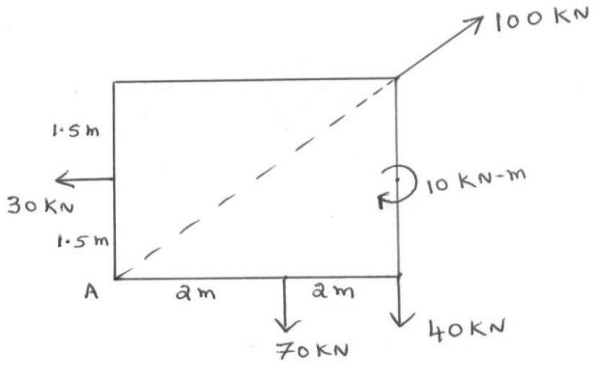

FIG. Q.No. 3B

4A. Find the acceleration and tension in the string of the system shown in figure. Coefficient of the friction =0.3 for all planes of the contact. Pulley is smooth. Also determine the velocity of the system in 5 sec after starting from rest.

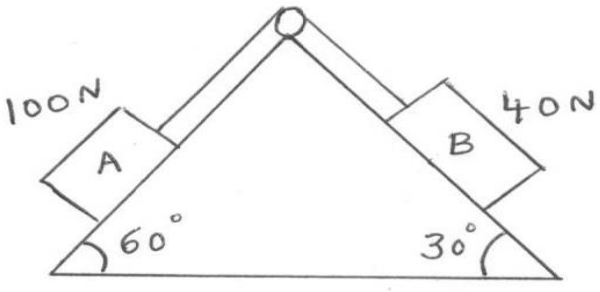

FIG. Q.No. 4A

4B. Find the support reactions at A and B for the beam loaded as shown in the figure.

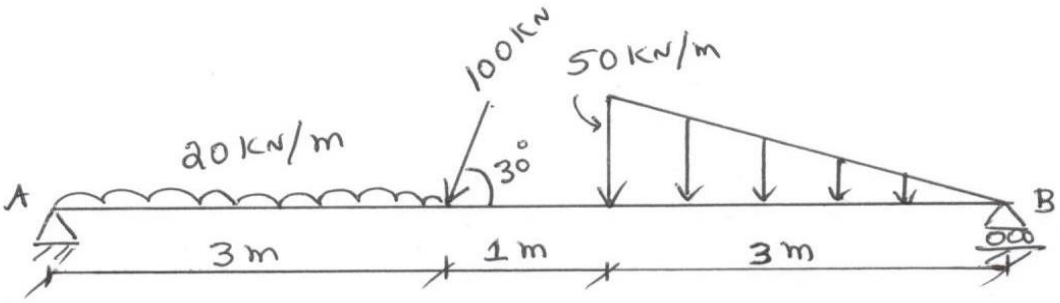

FIG. Q.No. 4B

5A. Find the relationship between (i) Volumetric strain and Linear strain (ii) Modulus of elasticity and Bulk modulus.

5B. A cylindrical boiler is 1.0 m in diameter and 1.2 m length. It is required to withstand a pressure of 1.177 N/mm^2. If the permissible tensile stress is 25 N/mm^2, permissible shear stress is 10 N/mm^2 and permissible change in diameter is 0.25 mm, find the minimum thickness of the metal required for the wall of cylinder. Take E = 90 GPa, and $\mu = 0.3$.