[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2063)

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B.Tech 2nd Semester Examination

Engineering Mechanics (N.S.)

BE-105

Time : 3 Hours **Max. Marks : 100**

The candidates shall limit their answers precisely within the answer-book (40 pages) issued to them and no supplementary/ continuation sheet will be issued.

Note : This question paper carries five sections. Attempt any five questions selecting atleast one question each from section A, B, C & D. Section E is compulsory.

SECTION - A

1. (a) Two steel cylinders are supported in a right angle wedge support as shown in Fig. 1. The side OL makes an angle of 30° with the horizontal. The diameters of the cylinders are 250 mm and 500mm; their weights being 100 and 400N respectively. Determine the reaction R between the smaller cylinder and the side OL.

   (b) Determine the centroid of the built up section in Fig. 2 and find the moment of inertia and radius of gyration about the horizontal centroidal axis. **(8,12)**

2. (a) Determine the forces in all the members of the truss shown in Fig. 3. Tabulate the results and Indicate the magnitude and nature of forces on the diagram of the truss. (Use Method of Joints to solve this problem)

   (b) Differentiate between Perfect, Deficient and Redundant frames. **(15, 5)**

SECTION - B

3. (a) A CI Flat, 300mm x 50mm uniform section as shown in Fig. 4, is acted upon by the following forces uniformly distributed over the respective cross-section, 25kN in the direction of length (tensile); 350kN in the direction of width and 200kN in the direction of thickness. Determine the change in the volume of the flat.

(b) The composite steel and brass rod shown in Fig. 5 is attached to unyielding supports with no initial stress at 25°C. Determine the stress in each segment when the temperature is reduced to –5°C. For steel, E=210GPa and $\alpha=12\times10^{-6}$/°C, and for brass, E=100GPa and $\alpha=12\times10^{-6}$/°C **(10, 10)**

4. (a) Sketch the Shear Force and Bending moment diagrams of a loaded beam as shown in Fig. 6. Also calculate the maximum bending moment and the point at which it occurs.

(b) Establish the relationship among load, shear and bending Moment with suitable example. **(15, 5)**

SECTION - C

5. A beam simply supported at ends and having cross-section as shown in Fig. 7 is loaded with a UDL, over whole of its span. If the beam is 8m long, find the UDL, if the maximum permissible bending stress in tension is limited to 30MN/m^2 and in compression to 4530MN/m^2. What are the actual maximum bending stresses set up in the section? **(20)**

6. A steel section as shown in Fig. 8 is subjected to a shear stress force 200 kN. Determine the shear stresses at the important points and sketch the shear distribution diagram. **(20)**

SECTION - D

7. (a) Assuming the same material, same length and same outside diameter, prove that a hollow shaft will transmit more power as compared to a solid shaft, when subjected to same torque.

(b) Determine the maximum shear stress in the shaft subjected to the external torques as shown in Fig. 8. **(8,12)**

8. A uniform ladder rests with one end against a smooth vertical wall and the other on the ground, the coefficient of friction being 0.75. If the inclination of the ladder to the ground be 045°. Show that a man whose weight is equal to that of ladder, can just ascend to the top of the ladder without its slipping. **(20)**

SECTION - E

9 (a) State theorems of parallel and perpendicular axis to find Moment of Inertia.

[P.T.O.]

(b) State and Explain varignon's theorem.

(c) Explain the various types of supports in mechanics.

(d) Draw and explain the stress-strain diagram for a brittle material.

(e) Establish a relationship among Young's, shear and Bulk modulus in Engineering.

(f) State the different means of supporting a beam and differentiate between an overhanging, a cantilever and a continuous beam.

(g) Explain the terms: (i) Rolling Friction (ii) Cone of Friction.

(h) What are composite beams? Explain their significance in engineering applications.

(i) The shafts are designed on the basis of strength and rigidity. Justify.

(j) Give a physical significance of shear force and bending moment at a cross-section in a beam. **(10×2=20)**

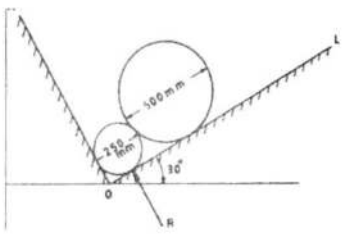

Fig.1

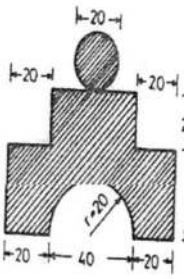

Fig.2

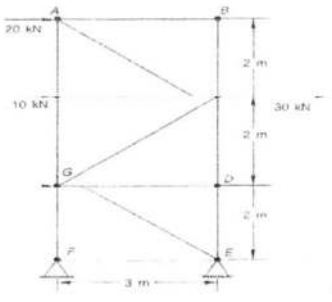

Fig.3

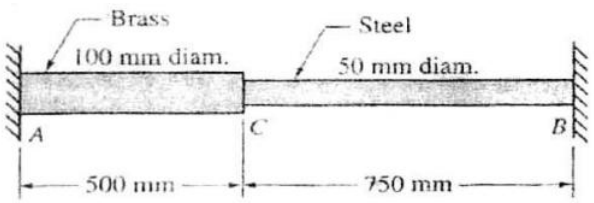

Fig. 4

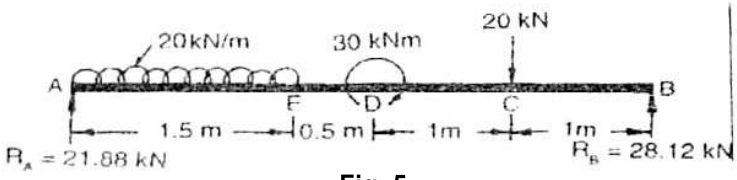

Fig. 5

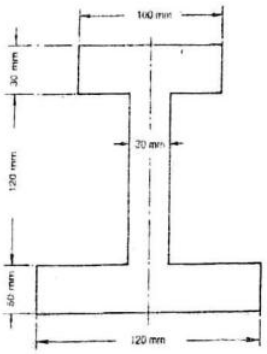

Fig. 6

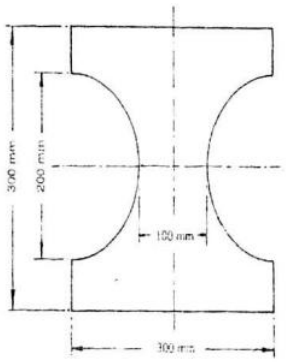

Fig. 7

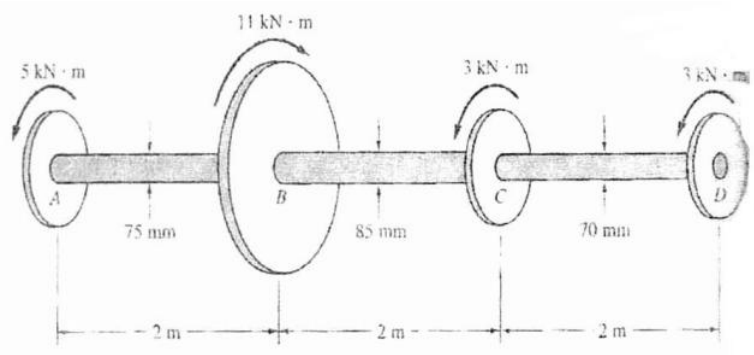

Fig. 8