[Total No. of Questions - 9] [Total No. of Printed Pages - 4]
(2064)

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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) Three cylinders weighing 200N each and of 160mm diameter are placed in a channel of 360 mm width as shown in Fig. 1. Determine the pressure exerted by :

(i) The cylinder L on M at the point of contact

(ii) The cylinder M on the base

(iii) The cylinder M on the wall

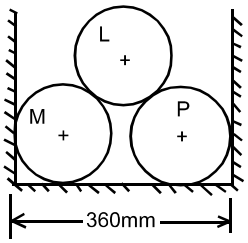

Fig. 1

(b) A column is made up of two rolled steel joints of I-section 16cm x 8cm x 1 cm with plate 20 cm x 1 cm riveted with flanges one each on the top and at the bottom. The edges of the plates flush with outside edges of joint flanges. Find for the compound section:

(i) I_{xx}

(ii) I_{yy}

(iii) Least radius of Gyration (8+12=20)

2. (a) Determine the forces in all the members of the truss shown in Fig. 2. 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)

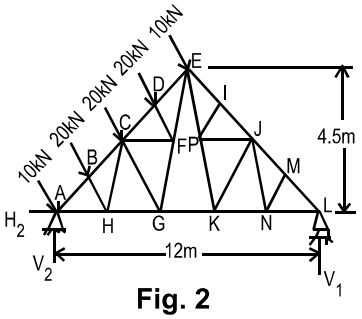

Fig. 2

(b) Define parallel and perpendicular axis theorems. (15+5=20)

SECTION - B

3. (a) A straight uniform bar AD is clamped at both ends and loaded as shown in Fig. 3. Initially the Bar is stress free. Determine the stresses in all the three parts (AB, BC, CD) of the bar if the cross-sectional area of the bar is 1000mm^2.

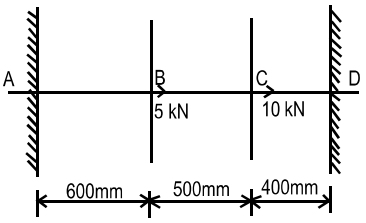

Fig. 3

(b) Two vertical rods as shown in Fig. 4, one of steel and the other of bronze, are rigidly fastened at upper ends at a horizontal distance of 760mm apart. Each rod is 3m long and 25mm in diameter. A horizontal cross-piece connects the lower ends of the bars. Where should a load of 4.5 kN be placed on the cross piece so that it remains horizontal after being loaded?

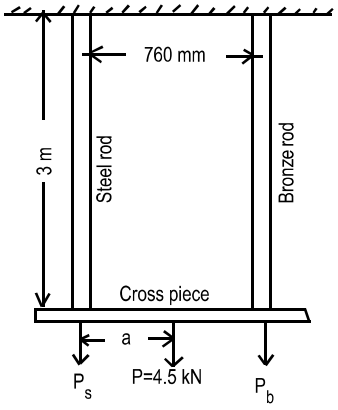

Fig. 4

(10+10=20)

4. (a) A beam AB is 10m long, carries a uniformly distributed load of 20kN/m over its entire length together with concentrated load of 50 kN at the left end A and 80 kN at the end B. The beam is to be supported at two props (C & D) at the same level, 6m apart so that the reaction is same at each. Determine the positions of the supports and draw Shear force and Bending Moment diagrams. Find the value of maximum B.M.

   (b) Establish the relationship among load, shear and bending moment with suitable example. (15+5=20)

SECTION - C

5. A timber beam 16 cm wide and 20 cm deep is to be reinforced by bolting on two steel flitches each 16 cm x 1 cm in section. Find bending moment when:

   (i) The flitches are attached symmetrically at the top and bottom and

   (ii) The flitches are attached symmetrically at the sides.

   Alowable stress in timber is 6 MN/m^2. Also determine the maximum stress in steel in each case. (20)

6. An I-section having flanges 200mm x 20 mm and web 400mm x 15mm is used as a beam. If At a section, it is subjected to a shear force of 150kN, find the greatest intensity of shear stress in the beam and show also the variation of shear stress across the section. (20)

SECTION - D

7. (a) A solid cylindrical shaft is to transmit 300kW at 100rpm. Find the diameter of the shaft, if the shear stress is not to exceed 80 MN/m^2. What percentage saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals 0.6 of the external diameter, the length, the material and maximum shear stress being the same.

   (b) For a closed coiled helical spring subjected to an axial load of 300N having 12 coils of wire diameter 16mm and made with coil diameter of 250mm find:

[P.T.O.]

(i) Axial Deflection, (ii) Strain energy stored; (iii) Maximum torsional shear stress in the wire; (iv) Maximum shear stress using Wahl's correction factor. (8+12=20)

8. (a) Enumerate the various laws of friction.

(b) In Fig 5. The coefficient of friction is 0.20 between the rope and the fixed drum, and between other surface of contact, μ=0.3. Determine weight W to prevent downward motion of the 1000N body.

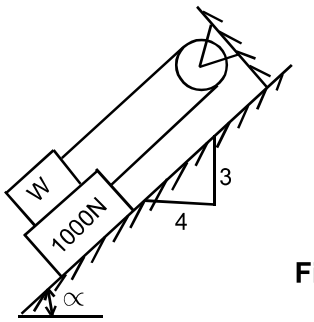

Fig. 5

(6+14=20)

SECTION - E

9. (a) Explain the significance of free body diagram in mechanics. Illustrate your answer with suitable examples.

(b) State and Explain Lami's theorem.

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

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

(e) Discuss the significance Thermal stresses in Engineering.

(f) Draw the shear force diagrams of concentrated and uniformly distributed loads.

(g) What do you understand by the term composite beams? Enumerate advantages of such beams.

(h) Enumerate the various remedial measures of reducing friction.

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

(j) Enumerate the various applications of close coiled helical springs. (2×10=20)