B.E. III - Semester Examination

BE-III/11 (A)

247049

MECHANICAL ENGINEERING

Course No. : PME - 304

(Mechanics of Solids)

Time Allowed- 3 Hours *Maximum Marks-100*

Note: The students shall attempt five questions, selecting at least 2 from each Section. Use of scientific calculator is allowed in the Examination Hall.

SECTION - A

1. Explain the following:
   a) Hooks law
   b) Poissons ratio
   c) Bulk Modulus
   d) Principal stresses

2. A bronze bar is fastened between a steel bar and an aluminum bar as shown in Fig.1. Axial loads are applied at the positions indicated. Find the largest value of P that will not exceed an overall deformation of 3.0 mm, or the following stresses: 140 MPa in the steel, 120 MPa in the bronze, and 80 MPa in the aluminum. Assume that the assembly is suitably braced to prevent buckling. Use E_{st} = 200 GPa, E_{al} = 70 GPa, and E_{br} = 83 GPa.

8. A column with length 10 m that is fixed in both ends. The column is made of an I-beam with flange dimensions 8m×2m and web of 2m thickness and 7 m length. The Modulus of Elasticity for aluminum is 60 GPa.

a) Find the Euler Load for this Column.

b) If the FS is 3, what is the maximum allowable load for this column?

A steel shaft of either solid bar or circular tube is subjected to 1200 N-m torque, 40MPa allowable shear stress. The allowable angle of twist is 0.75°/m and G=78GPa

a) Determine diameter of the solid bar and

b) For the hollow shaft, $t=d_0/10$, determine outer diameter

c) Determine ratio of weight of tube to that of solid shaft. (d_0 = outer diameter)

SECTION - B

What is the difference between a beam and a column? Discuss the formulas for buckling load in all the end conditions of columns. What is the significance of these end conditions?

What do you understand by theories of failures? Discuss any three theories of failures with their usefulness in Machine design?

A curved bar of rectangular section of 20 mm width, 30 mm depth and mean radius of curvature of 50 mm is initially unstressed. If a bending moment of 350Nm is applied to the bar which tends to straighten it, determine the stresses at the inner and outer surfaces and sketch a diagram to show the variation of stress across the section. Also find the position of the neutral axis.

8. For the given continuous beam ABC as shown in Fig.2, determine the reactions?

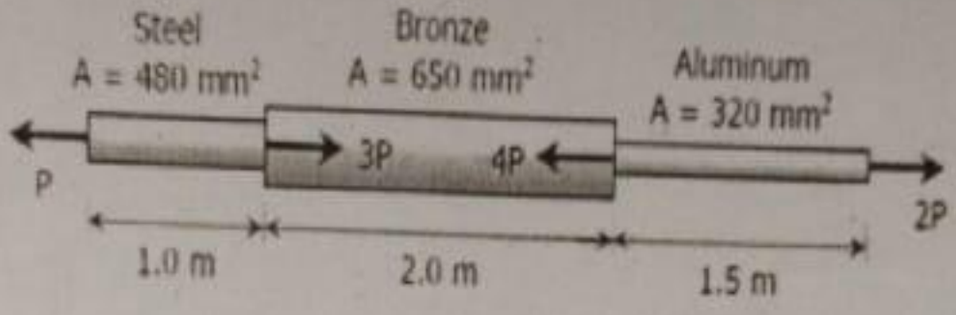

Fig.1

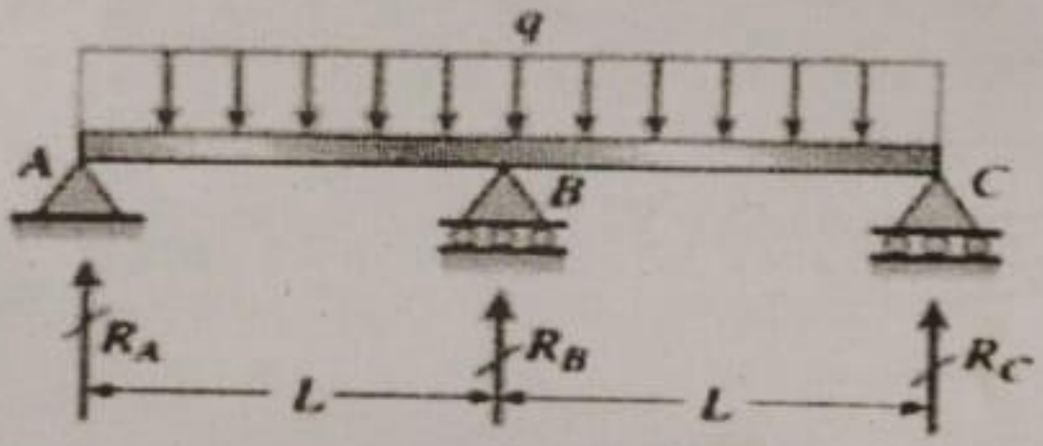

Fig.2

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