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INTERNATIONAL CENTRE FOR APPLIED SCIENCES
(Manipal University)

III SEMESTER B.S. DEGREE EXAMINATION – NOV. / DEC. 2016
SUBJECT: STRENGTH OF MATERIALS (CE 241)
(BRANCH: ARCH / BM / CHEM / CIVIL / MECH)
Monday, 28 Nov. 2016

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

- ✓ **Answer ANY FIVE full Questions.**
- ✓ **Missing data, if any, may be suitably assumed**

1A. Derive an expression for deformation of a bar whose diameter decreases gradually from ‘D’ to‘d’ over a length of ‘L’, when it is subjected to an axial load of ‘P’.

1B. A rectangular bar 300mm long is 50mm wide and 20mm thick. It is loaded with an axial compressive load of 180 kN together with a normal compressive force of 1800 kN on face 50mm x 300mm. Calculate the change in length, breadth, thickness and volume. Also find the modulus of rigidity and bulk modulus of the material. Take E = 180GPa and $\mu = 0.3$. [6 + 14]

2A. Define (i) Bulk Modulus (ii) Young’s Modulus (iii) Modulus of Rigidity (iv) Modular Ratio (v) Section Modulus

2B. A circular tapered rod of length 1500mm is loaded as shown in FIG.Q2B. The diameter of the tapered rod is designed such that the maximum tensile stress in the rod is 200MPa and maximum compressive stress is 150MPa. Also find the net change in length. Take E = 200GPa. [10 + 10]

3A. Draw the SFD and BMD for the beam subjected to the loading as shown in the FIG.Q3A. Locate the points of contra flexure, if any. Also find the magnitude and location of maximum bending moment.

3B. What is pure bending? Explain with an example. Write the bending equation with usual notations and meaning of terms used. [12 + 8]

4A. A T-beam girder is simply supported over a span of 5m with overall depth of 400mm and flange width 200mm. Thickness of both flange and web is 20mm. If the extreme fibre stresses are restricted to 90MPa and 45MPa in tension and compression respectively, calculate the safe UDL the beam can carry inclusive of self-weight. Show the actual extreme fibre stresses with a sketch.

4B. With the usual notations, find the maximum deflection for a simply supported beam carrying a concentrated load at the mid span. [12+8]

5A. A hollow tube 4m long with external diameter 40mm and 25mm internal diameter was found to extend by 4.8mm under a tensile load of 60kN. Find the buckling load for the tube with both ends pinned. Also find the safe load with a factor of safety of 5.

5B. A solid Circular shaft has to transmit 150kW power at 200rpm. If the allowable shear stress is 75MPa and permissible twist one degree in a length of 3m, find the required diameter of the shaft. Take G = 82GPa. [10 +10]

6A. The principal stresses at a point in a strained material are 40MPa (T) and 18MPA (C) as shown in FIG.Q6A. Find the normal stress, shear stress and resultant stress acting on a plane inclined 35^o to the major principal plane.

6B. Explain (i) Slenderness Ratio (ii) Effective length of a column (iii) Principal plane (iv) Short Column (v) Point of Contraflexure (vi) Temperature stress. [8 + 12]

7A. The cross section of a beam is an Unsymmetrical I – section having overall depth 200mm, width of top and bottom flanges 100mm and 140mm respectively. Thickness of both flanges and web 10mm each. Draw the shear stress distribution diagram across its depth when it carries a shear force of 250kN.

7B. A simply supported beam is loaded as shown in FIG.Q7B. Determine the deflections under the loads. Take E = 210GPa and I = 16×10^8 mm^4. [12 + 8]

8A. Draw the SFD and BMD for a cantilever beam of span L, carrying a UVL with zero intensity at the free end and w/m intensity at the fixed end.

8B. A steel bar is placed between two copper bars each having same area and length as steel bar at 15^oC. At this stage they are rigidly connected together at both the ends. When the temperature is raised to 315^oC, the length of the bars increases by 1.5mm. Determine the original length and final stresses in the bars. Take E_{st} = 210GPa, E_{cu} = 100GPa, α_{st} = 0.000012 per ^oC and α_{cu} = 0.0000175 per ^oC [8 + 12]

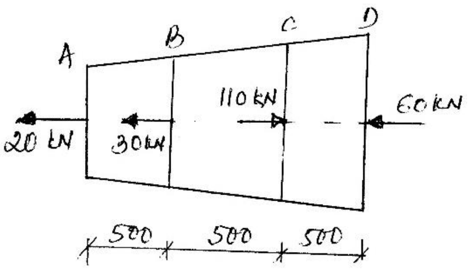

FIG.Q2B

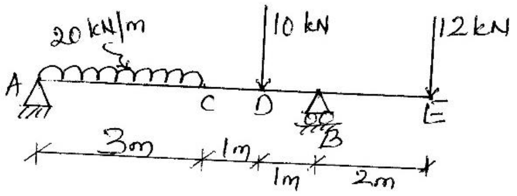

FIG Q3A

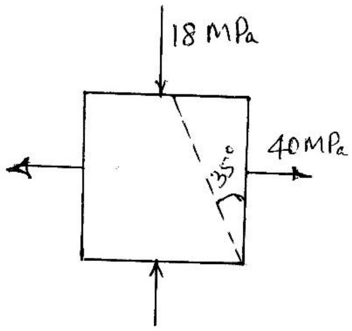

FIG Q6A

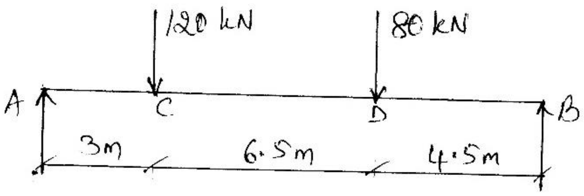

FIG Q7B