Total No. of Questions—8] [Total No. of Printed Pages—4

Seat No.	

[5352]-502

S.E. (Civil) (First Semester) EXAMINATION, 2018
STRENGTH OF MATERIAL
(2015 PATTERN)

Time : Two Hours **Maximum Marks : 50**

N.B. :— (*i*) Q. Nos. 1 *or* 2, Q. Nos. 3 *or* 4, Q. Nos. 5 *or* 6 and Q. Nos. 7 *or* 8.
(*ii*) Neat sketches must be drawn wherever necessary.
(*iii*) Figures to the right indicate full marks.
(*iv*) Assume suitable data, if necessary.
(*v*) Use of electronic pocket calculator is allowed.
(*vi*) Use of cell phone is prohibited in the examination hall.

1. a) A stepped bar is subjected to axial forces as shown in fig.1. Determine the total deformation of the bar. Take $E_1 = E_2 = E_3$ 200GPa. [6]

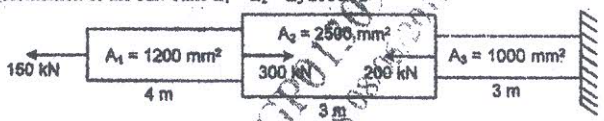

Fig.1

b) A groove 40 mm × 40 mm is cut symmetrically at the bottom of a rectangular beam section as shown in fig.2. If the tensile stresses shall not exceed 25 N/mm², Find the safe uniformly distributed load which the beam can carry on a simply supported beam of a span 4 m. (All dimensions are in mm) [6]

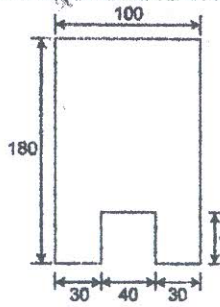

Fig.2

P.T.O.

OR

2. a) A steel rod 20 mm diameter and 6 m long is connected to two grips one at each end a temperature of 120°C. Find the pull exerted when the temperature falls to 40°C.
i) If the ends do not yield
ii) If the ends yield by 1.10 mm Take $E = 2 \times 10^5$ N/mm² and $\alpha = 1.2 \times 10^{-6}$/°C. [6]

b) An I section has the following dimensions. Web: 300 mm × 10 mm, Flange: 150 mm × 20 mm. The beam is subjected to a shear force of 44 kN. Draw the shear stress distribution diagram over the depth of the section. [6]

3. a) If a solid steel shaft that will not twist through more than 3° in a 6 m length when subjected to a torque of 10kN.m, Find the minimum diameter of the shaft and maximum shear stress developed. G = 83 GPa [6]

b) A shaft of 95 mm diameter transmits 300 kW power at 150 rpm. If at a section, bending moment is 20 kN.m Find the principal stress and maximum shear stress [6]

OR

4. a) Using the equation of strain energy, derive the stress intensity due to the following types of axial loading. [6]
i) Gradually applied load
ii) Suddenly Applied load.

b) A hollow steel shaft 4 m long transmits a torque of 25 kN.m. The total angle of twist in this length is limited to 2.5° and the allowable shearing stress is 90 MPa. Find out the outside and inside diameter of the shaft if G=85 GPa. [6]

5. a) A simply supported beam of span 5 m, intensity of loading increases uniformly from 8 kN/m at one end to 16 kN/m at the other end as shown in fig.3. Find the position and magnitude of the maximum bending moment. Also Draw Shear Force & Bending Moment Diagram [6]

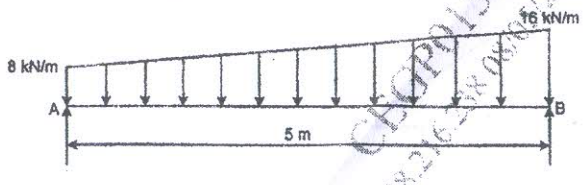

Fig.3

b) Draw the loading diagram & bending moment diagram from the given shear force diagram of a beam as shown in fig.4 [7]

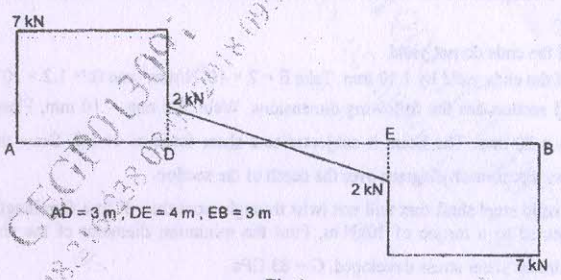

Fig 4

OR

6. a) Draw Shear Force Diagram & Bending Moment Diagram for the overhanging beam carrying loads as shown in fig.5. also locate point of contra flexure. [6]

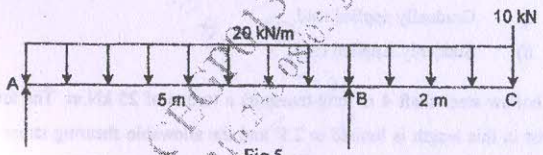

Fig.5

b) Construct loading diagram for the following shear force diagram for a beam as shown in fig.6. [7]

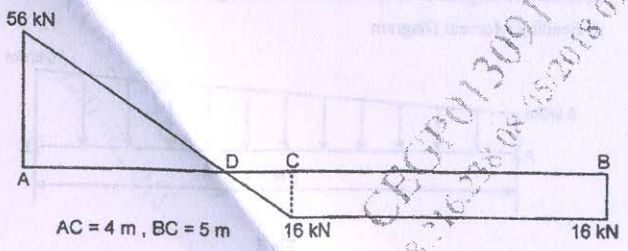

Fig.6

7. a) A hollow alloy tube 5 m long with external and internal diameters equal to 40 mm and 25 mm respectively was found to be 6.4 mm under a tensile load of 60 kN. Find the buckling load for the tube, when used as a column with both ends pinned. Also find the safe compressive load for the tube, with a factor of safety 4. [6]

b) State the assumptions made in Euler's theory and its limitations. [7]

OR

8. a) Define core of section and hence obtain core of section for a rectangular column of breadth 480 mm × depth 120 mm. [6]

b) A short masonry pillar 600 mm × 600 mm in section. The pillar carries an eccentric load of 1000 kN acting at an eccentricity of 80 mm from the longitudinal axis as shown in fig.7 . Find the maximum and minimum stresses on the section. [7]

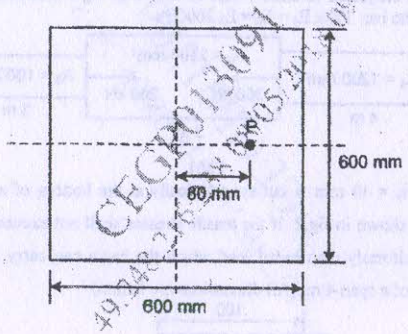

Fig.7