

B.Tech Sem - III (2007 Course) (Civil Engg.) : WINTER - 2018
SUBJECT: MECHANICS OF MATERIALS

Day: Wednesday
Date: 28/11/2018

W-2018-2702

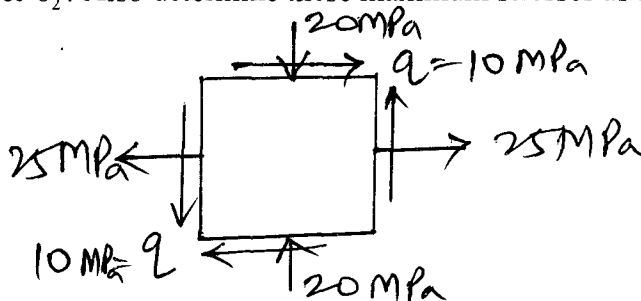
Time: 10.00 AM TO 01.00 PM
Max. Marks: 80

N.B.:

- 1) **Q. No. 1 and Q. No. 5 are COMPULSORY.** Out of remaining attempt **ANY TWO** questions from Section – I and Section – II.
- 2) Figures to the right indicate **FULL** marks.
- 3) Answers to both the sections should be in **SEPARATE** answer books.
- 4) Draw neat and labeled diagrams **WHEREVER** necessary.
- 5) Assume suitable data, if necessary.

SECTION - I

- Q.1** a) Obtain a relation for the elongation of a uniformly circular tapering section. (05)
- b) Explain the failure of long columns and short columns. (05)
- c) Define strain energy and explain how it is stored in body. (04)
- Q.2** a) A 1.2m long rod with 20mm diameter is subjected to an axial force of 10kN. The rod elongated by 0.2mm and its diameter got reduced by 0.001mm. Compute all four elastic constants of the material. (07)
- b) A reinforced concrete column 400mm & 400mm is provided with 4 bars of 20 mm. diameter with proper cover. Determine the safe load the column can carry without exceeding the stress in steel 130MPa and in concrete 4Mpa. Take $\frac{E_{st}}{E_{co}} = 20$. (06)
- Q.3** a) A column of hollow circular section has external diameter of 120mm and internal diameter 80mm. The column is 4m long and hinged at both ends. Find the slenderness ratio of the column. (07)
- b) A load of 5kN falls from a distance of 1m onto a timber pole ($E = 200\text{GPa}$) of 300mm diameter and 6m height. Determine instantaneous stresses induced in the pole neglecting the self weight. (06)
- Q.4** a) Locate the planes carrying maximum shear stresses and maximum normal stresses σ_1 & σ_2 . Also determine these maximum stresses as shown in figure :- (07)



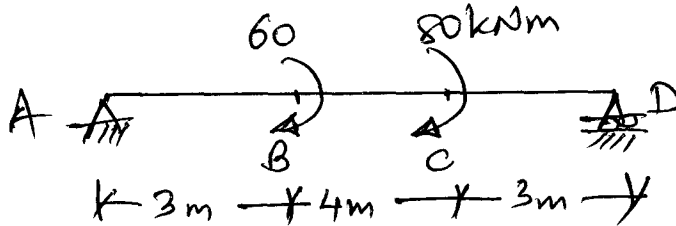
- b) A lift weighing 20kN is to function at a speed of 1m/s. Length of rope connecting lift is 40m. If yield stress is 300 MPa. Find diameter of rope take – F.S.= 2, $E = 200\text{ GPa}$. (06)

P.T. O.

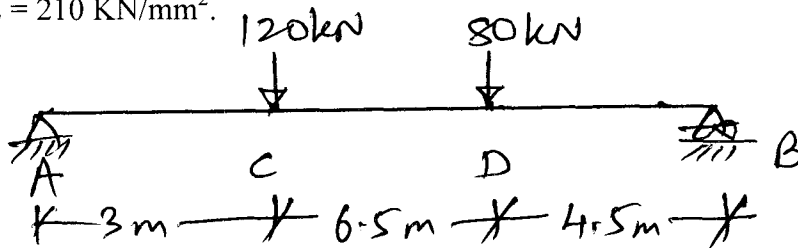
SECTION - II

- Q.5** a) Derive Lamé's equation of stresses. (05)
- b) Derive the expression for the shear stress. Distribution across the cross section for a rectangular beam. (05)
- c) State assumptions in theory of torsion of circular shaft. (04)

- Q.6** a) Draw S.F.D. & B.M.D. as shown in figure : - (07)



- b) A rectangular beam 300 deep is simply supported over a span of 4m. What udl the beam can carry if the bending stress is not to exceed 120MPa? Take $I = 8 \times 10^6 \text{mm}^4$. (06)
- Q.7** a) Draw shear stress distribution of a T-section with flange 150mm x 15mm and web 200mm x 20mm. S.F. is 110kN. (06)
- b) A hollow shaft having an inside diameter 60% of its outer is to replace a solid shaft transmitting the same power at same speed calculate the percentage saving in material to be used is also the same. (07)
- Q.8** a) Calculate the deflections of the girder points under the two loads. $I = 16 \times 10^8 \text{mm}^4$ $E = 210 \text{KN/mm}^2$. (07)



- b) A cylindrical air receiver for a compressor is 2m in internal diameter and made of plates 12mm thick. If the hoop stress is not to exceed 90N/mm^2 and axial stress is not to exceed 60N/mm^2 find the max air pressure. (06)

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