

B.TECH SEM - III (2007 COURSE) (CHEMICAL ENGG.) :
SUMMER - 2018
SUBJECT : SOLID MECHANICS

Day : **Wednesday**
Date : **23/05/2018**

S-2018-2559

Time : **02.30 PM TO 05.30 PM**
Max. Marks : 80

N.B.:

- 1) **Q.No.1 and Q.No.5 are COMPULSORY.** Out of the remaining attempt **ANY TWO** questions from each section.
- 2) Answer to the both the sections should be written in **SEPARATE** answer books.
- 3) Use of non programmable **CALCULATOR** is allowed.
- 4) Figures to the right indicate **FULL** marks.
- 5) Assume suitable data if necessary.

SECTION - I

- Q.1 a)** A hollow steel cylinder of inside diameter 125mm and length 300mm is filled with concrete and is compressed by a load of 300kN. Calculate the compressive stress in steel and concrete. Also find the shortening of the composite section. Take $m = \text{modular ratio} = 10$, $E_{st} = 200\text{Gpa}$. **[07]**
- b)** A bar 1.8 cm diameter gets stretched by 0.35cm under a steady load of 8kN. What stress would be produced in the same bar by a weight of 0.9kN which falls freely vertically through a distance of 7cm to a rigid collar attached at its end? **[07]**
- Q.2 a)** A steel bar of diameter 30 mm and length 300mm is subjected to a pull of 54kN. The extension and change in diameter of the bar is found to be 0.112mm and 0.00366mm respectively. Calculate:
i) Poisson's ratio ii) Bulk Modulus. **[07]**
- b)** A steel rod 20mm in diameter with screwed ends passes through a copper tube of 23 mm internal diameter and 30mm external diameter. The temperature of whole assembly is raised to 250^of and nuts are tightened. Find the stresses in steel and copper if the temperature of assembly falls to 80^oF. Take $\alpha_c = 10 \times 10^{-6}/^{\circ}\text{C}$, $\alpha_s = 6 \times 10^{-6}/^{\circ}\text{C}$, $E_s = 2 \times 10^5\text{N/mm}^2$, $E_c = 1.1 \times 10^5\text{N/mm}^2$. **[06]**
- Q.3 a)** A load of 100kN is carried by a column made of cast iron. The external and internal diameters are 300mm and 280mm respectively. If the eccentricity of load is 35mm. Find the maximum and minimum stress intensities. **[07]**
- b)** Calculate the safe compressive load on a hollow cast iron column of 200mm external diameter and 130mm internal diameter. The column 8m long and whose one end fixed and other hinged. Factor of safety is 4 and $E = 105\text{ GPa}$. Use Euler's equation. **[06]**
- Q.4 a)** An element in a strained body is subjected to a tensile stress of 150 MPa and a shear stress of 50 MPa tending to rotate the element in an anticlockwise direction. Find:
i) The magnitude of the normal and shear stresses on a section inclined at 40^o with the tensile stress.
ii) The magnitude and direction of maximum shear stress that can exist on the element. **[06]**
- b)** Explain the terms:
i) Proof Resilience ii) Resilience iii) Modulus of Toughness. **[07]**

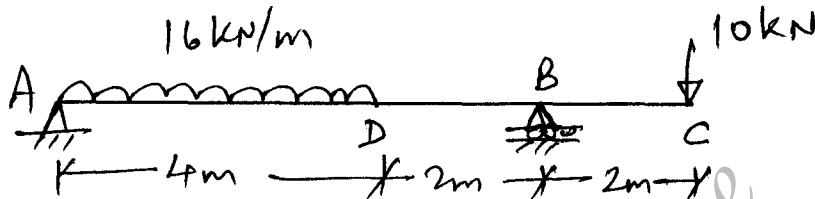
P.T.O.

SECTION – II

Q.5 a) Calculate the maximum stress in round steel bar 12mm in diameter and 20m long due to its own weight, when it is simply supported at its ends. Density of steel – $78,500 \text{ N/m}^3$. [07]

b) The cross-section of beam is rectangle $60\text{mm} \times 80 \text{ mm}$ deep. The maximum shear stress in the section is 45MPa . Calculate shear stress at a section.
 i) 40mm above NA ii) 20 mm above NA. [07]

Q.6 a) Draw SFD and BMD for the beam shown below: [07]

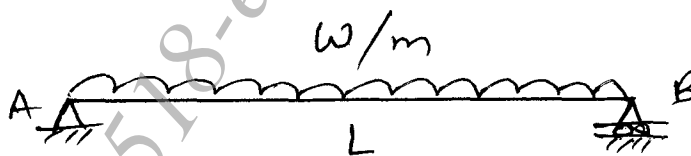


b) Derive the relation between rate of loading, shear force and bending moment. [06]

Q.7 a) A solid shaft of 200mm diameter has the same cross-sectional area as that of a hollow shaft of the same material with inside diameter of 150mm. Find the ratio of the power transmitted by the two shafts of the same speed. [07]

b) A cylindrical vessel 2m long and 500 in diameters with 10mm thick plates are subjected to an internal pressure of 3MPa . Calculate the change in volume of the vessels. Take $E = 200\text{GPa}$ and Poisson's ratio = 0.3 for vessel material. [06]

Q.8 A simply supported beam subjected to a uniformly distributed load 'w' over its entire span. Determine slope and deflection in the beam. [13]



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