15. a) An ISWB 200 mm × 140 mm rolled steel beam is freely supported over a span of 2 m. It is subjected to a BM of 10 kNm at the central section, the trace OY' of the plane loading being inclined at 20 degree to the principal axis OY. If $I_{xx} = 2624.5 \text{ cm}^4$ and $I_{yy} = 328.8 \text{ cm}^4$, locate the neutral axis and calculate the maximum bending stress in the section. Ref. fig. Q. 15 a. **(16)**

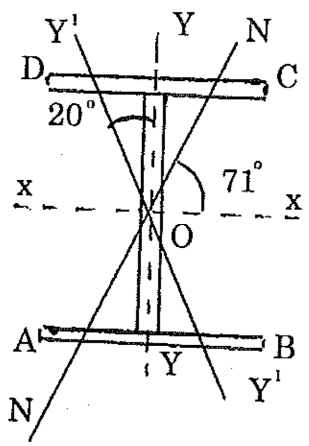

Fig. Q. 15 a

(OR)

b) Determine : i) Location of neutral axis and ii) maximum and minimum stresses, when a curved beam of trapezoidal section of bottom width 30 mm top width 20 mm and height is 40 mm is subjected to pure bending moment of 600 Nm. The bottom width is towards the centre of curvature. The radius of curvature is 50 mm and the beam is curved in a plane parallel to the depth. **(16)**

Reg. No. :

Question Paper Code : 42248

B.E./B.Tech. DEGREE EXAMINATION, APRIL/MAY 2018

Fourth Semester

Civil Engineering

CE 2252 – STRENGTH OF MATERIALS

(Common to PTCE 2252 – Strength of Materials for B.E. (Part-Time) Fourth Semester – Civil Engineering – Regulations 2009)

(Regulations 2008)

Time : Three Hours Maximum : 100 Marks

Answer ALL questions.

PART – A (10×2=20 Marks)

1. State Modulus of Toughness.
2. Describe the Williot's Mohr diagram.
3. Discuss the Clapeyron's Theorem.
4. Draw the BMD for the fixed beam having span L and subjected to a point load W kN at the centre.
5. What are assumptions used for the Euler Columns ?
6. What do you mean by middle third rule ?
7. Describe the volumetric strain.
8. Write short notes on residual stresses.
9. What do you mean by stress concentration. ?
10. Discuss the term fracture.

PART – B **(5×16=80 Marks)**

11. a) Calculate the strain energy stored in the member shown in fig. Q. 11a. If the stepped member is converted into uniform bar having same length and volume for the same load, find the strain energy stored. Also find the ratio of strain energy stored. **(16)**

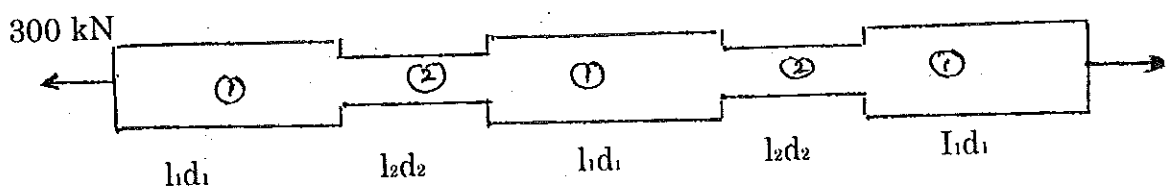

Fig. Q. 11 a

l_1 = 1000 mm l_2 = 700 mm d_1 = 25 mm d_2 = 16 mm

E = 2 × 10^5 N/mm^2.

(OR)

b) i) A circular bar has a cross sectional area of 800 mm^2 and length of 2.10 m the stress at the elastic limit is 230 N/mm^2. Calculate the proof resilience and the maximum value of the applied load which may be suddenly applied without exceeding the limit. Find the value of the gradually applied load which will produce the same extension as that produced by the suddenly applied load, let E = 200 GN/m^2. **(10)**

ii) The maximum instantaneous extension, produced by an unknown falling weight through a height of 4 cm in a vertical bar of length 3 m and of cross sectional area 5 cm^2, is 2.10 mm. Determine i) the instantaneous stress induced in the vertical bar and ii) the value of unknown weight. Take E = 2 × 10^5 Nmm^2. **(6)**

12. a) Find the fixed end moments and plot the SFD and BMD for the fixed beam Loaded as shown in fig Q. 12 a. **(16)**

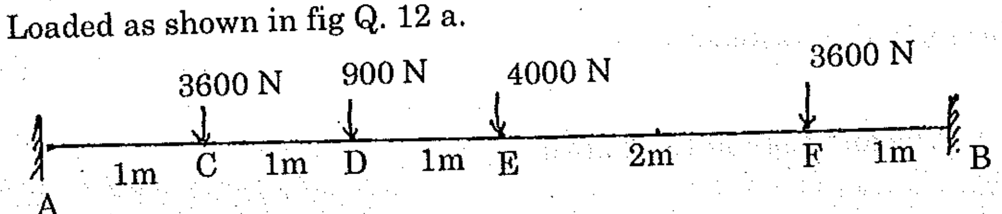

Fig. Q. 12 a

(OR)

b) A continuous beam ABC covers two consecutive span AB and BC of lengths 4 m and 6 m carrying uniformly distributed loads of 6 kN/m and 10 kN/m respectively. If the ends A and C are simply supported, find the support moment at B and draw SFD and BMD. **(16)**

13. a) i) Calculate the thickness of metal necessary for a cylindrical shell of internal diameter 160 mm to withstand an internal pressure of 25 MN/m^2, if maximum tensile stress is 125 MN/m^2. **(10)**

ii) A short column of external diameter 40 cm and internal diameter 20 cm carries an eccentric load of 80 kN. Find the greatest eccentricity which the load can have without producing tension on the cross section **(6)**

(OR)

b) i) A hollow MS tube 6 m long 40 mm internal diameter and 5 mm thick is used as a column with both ends hinged. Find the crippling load and safe load. Taking factor of safety as 3 and E = 2 × 10^5 N/mm^2. **(10)**

ii) A mild steel column 1500 mm long of angle section 60 mm × 60 mm × 5 mm is fixed at one end and hinged at other. Find by Rankine's formula the safe load for the column using a factor of safety 3. For the 60 mm × 60 mm × 5 mm angle area = 575 mm^2, minimum radius of gyration = 11.6 mm. Take f_c = 315 N/mm^2 $a = \frac{1}{7500}$. **(6)**

14. a) A shaft is subjected to a maximum torque of 10 kNm and a maximum bending moment of 7.5 kNm at a particular section. If the allowable equivalent stress in the simple tension is 160 MN/m^2. Find the diameter of the shaft according to the maximum shear stress theory. **(16)**

(OR)

b) A cylindrical shell made of mild steel plate and 1.2 m in diameter is to be subjected to an internal pressure of 1.5 MN/m^2. If the material yields at 200 MN/m^2. Calculate the thickness of the plate on the basis of the following three theories, assuming a factor of safety 3 in each case. **(16)**

i) Maximum principal stress theory

ii) Maximum shear stress theory and

iii) Maximum shear strain theory.