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B. E. (Fourth Semester) Examination, April-May 2020

(New Scheme)

(Mech. Branch)

MECHANICS of SOLIDS - II

Time Allowed : Three hours

Maximum Marks : 80

Minimum Pass Marks : 28

Note *: Attempt all question. Part (a) of all questions is compulsory. Attempt worth 16 marks of each question. The figures in the right hand margin indicate marks.*

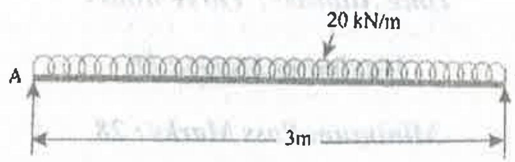
Unit - I

1. (a) Define term 'Modulus of Resilience'. 2

(b) State and prove Castigliano's theorem. 7

(c) A steel specimen 1.5 cm^2 in cross-section stretches 0.05 mm over 5 cm gauge length under an axial load of 30 kN. Calculate the strain energy stored in the specimen at this point. If the load at the elastic limit for specimen is 50 kN, calculate the elongation at the elastic limit and the resilience. 7

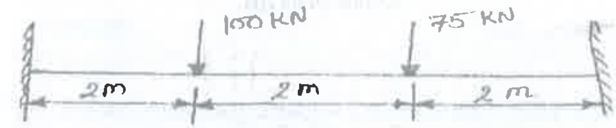
(d) Using castigliano's theorem determines the deflection at the centre of the simply supported beam 3 m span carries a uniformly distributed load of 20 kN/m. Take EI = 2·25 MNm^2. 7



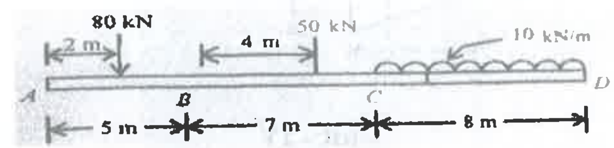
Unit - II

2. (a) Write the advantages of fixed beam. 2

(b) A fixed beam of 6 m span carries point loads of 100 kN and 75 kN as shown in figure. Find (i) Fixing moments at the ends, (ii) Reactions at the supports. Draw the B.M. and S.F. diagram. 14



(c) For the continuous loaded beam shown in figure. Find (i) Moment at the supports, (ii) Reactions at the supports. Draw the B.M. and S.F. diagram. 14

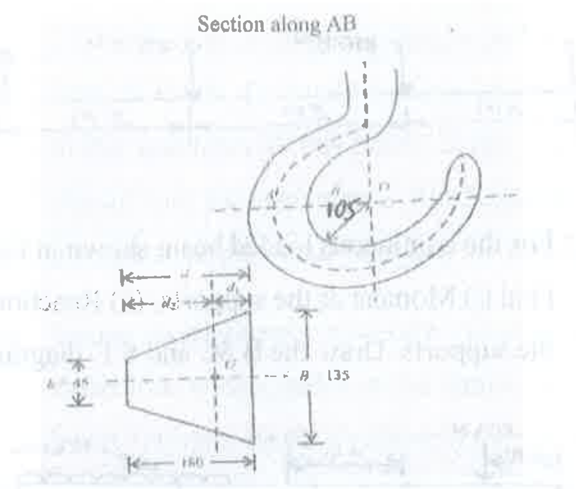


Unit - III

3. (a) State the assumption made in Winkler-Bach theory of stresses in curved bars. 2

(b) Prove that, for a curved member subjected to bending and neutral axis of a transverse section does not pass through the centroid of the section. 14

(c) Determine the maximum compressive and tensile stresses in the critical section of the crane hook, lifting a load of 150 kN. 14



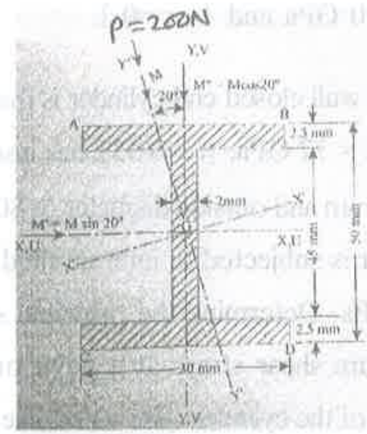
Unit - IV

4. (a) Define shear centre. 2

(b) Find the Eulers crushing load for a hollow cylindrical cast iron, 15 cm external dimeter and 2 cm thick, if it is 6 m long and hinged at both ends, E = 80 GPa. Compare this load with the crushing load given by Rankine's formula; using yield stress 550 MPa and Rankine constant 1/1600. For what length of strut of this cross section done Euler formula ceases to apply. 7

(c) Derive an expression for Euler's crippling load for long column with one end fixed and other end hinged. 7

(d) A cantilever of I-section 2·4 m long is subjected to a load of 200 N at the free end and is at 20° with the vertical. Determine the bending stresses at corner A, and B on the fixed section of the cantilever. 7



Unit - V

5. (a) Explain difference between thin and thick pressure vessel. 2

(b) Write the assumption made in lame's theory for thick cylinder. Also derive lame's equation for circumferential and radial stresses in thick cylinder. 7

(c) A cylindrical shell 90 m long, 20 cm internal diameter thickness of metal is 8 mm is filled with a fluid at atmospheric pressure. When an additional 20 cc of the fluid is pumped into the cylinder find the pressure exerted by the fluid on the wall of the cylinder. Find also the hoop stress induced. Take E = 200 GPa and 1/m =0·3. 7

(d) A thick wall closed end cylinder is made of an Al-alloy (E = 72 GPa, μ = 0·33), has inside diameter of 200 mm and outside diameter of 800 mm . The cylinder is subjected to internal fluid pressure of 150 MPa. Determine the principal stresses and maximum shear stress at a point on the inside surface of the cylinder. Also determine the increase in inside diameter due to fluid pressure. 7