Code: 13A01308

R13

B.Tech II Year I Semester (R13) Supplementary Examinations June 2017

MECHANICS OF SOLIDS

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) When is a material said to show elasticity. How is the behavior different from plasticity?

(b) Define resilience and explain the principal strain.

(c) Explain briefly how a beam differs from a column.

(d) What is point of contra flexure? Explain with diagram.

(e) How are bending stresses different from shear stresses?

(f) Explain whether the first derivative of deflection is important or the second derivative with respect to beam bending.

(g) What is polar sectional modulus?

(h) Draw the shear force diagram of a cantilever beam with point load "P" at its end.

(i) What is Hoop stress?

(j) Write down Lame's equation describing all the terms.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 (a) Derive the constitutive relations between the stress and strain.

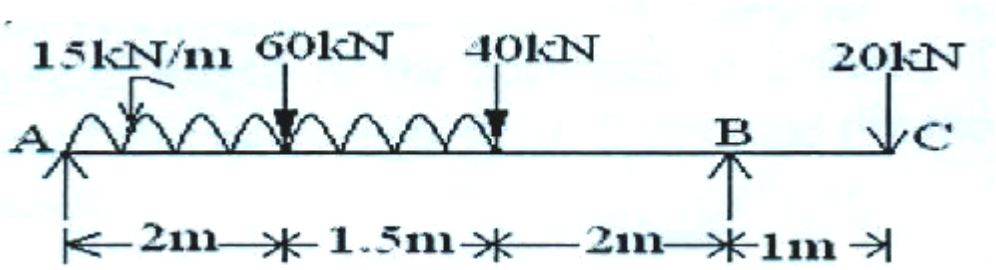
(b) A metallic bar 300 x 100 x 40 mm is subjected to a force of 5 kN, 6 kN and 7 kN along X, Y and Z directions respectively. Determine the change in volume of the block take E = 2 x 10^5 N/mm^2 and poisons ratio 0.25.

OR

3 Derive the expression for analysis of uniformly tapering circular rod subjected to an axial load P.

UNIT – II

4 (a) Draw the shear force and bending moment diagram for the problem below.



(b) A cantilever 2 m long is loaded with a uniformly distributed load of 2 kN/m run over a length of 1 m from the free end. It also carries a point load of 4 kN at a distance of 0.5 m from the free end. Draw the S.F and B.M. diagrams.

OR

5 (a) Obtain the relation between transverse force, shear force and bending moment at a section of a beam.

(b) A rectangular beam 200 mm deep and 300 mm wide is simply supported over a span of 8 m. What uniformly distributed load per meter the beam may carry if the bending stress is not exceeding 120 N/mm^2 .

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UNIT – III

6 (a) Derive flexural formula.

(b) A beam 500 mm deep of a symmetrical section has $I = 1 \times 10^8$ mm^4 and is simply supported over a span of 10 m. Calculate: (i) The uniformly distributed load it may carry if the maximum bending stress is not to exceed 150 N/mm^2. (ii) The bending stress if the beam carries a central point load of 25 kN.

OR

7 Draw the shear stress distribution across:

(a) Rectangular section.

(b) Triangular section.

(c) Circular section.

(d) I & T Sections.

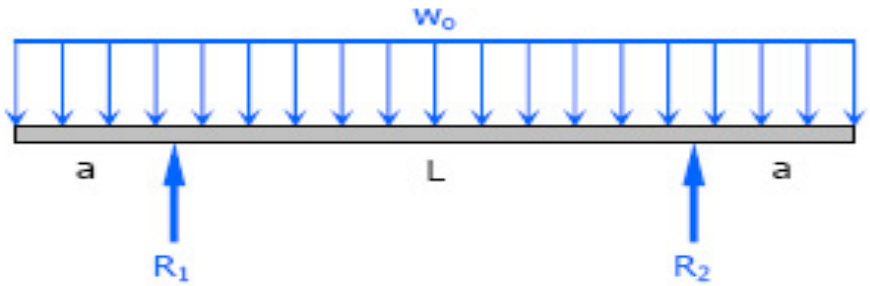
UNIT – IV

8 (a) Write torsion equation and its assumptions.

(b) A circular shaft of 25 mm diameter is tested under torsion. The gauge length of the specimen is 250 mm. The torque of 2.12 kN/m produces an angular twist. Determine the modulus of rigidity of the shaft.

OR

9 Determine the value of EIδ midway between the supports for the beam shown:



UNIT – V

10 A pipe carrying steam at 3.5 MPa has an outside diameter of 450 mm and a wall thickness of 10 mm. A gasket is inserted between the flange at one end of the pipe and a flat plate used to cap the end. How many 40 mm diameter bolts must be used to hold the cap on if the allowable stress in the bolts is 80 MPa, of which 55 MPa is the initial stress? What circumferential stress is developed in the pipe? Why is it necessary to tighten the bolt initially and what will happen if the steam pressure should cause the stress in the bolts to be twice the value of the initial stress?

OR

11 (a) Derive Lame's equation.

(b) Show the distribution of radial and circumferential stresses for boundary conditions of 50 MPa at Outer radius of 10 mm and 30 MPa at inner radius of 5 mm of cylinder 5 mm thick.

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