Roll No .....

AU/IP/IEM/ME/AE/PR - 303

B.E. III Semester Examination, December 2014

Strength of Mechanics of Materials

Time : Three Hours

Maximum Marks : 70

Note: i) Answer five questions. In each question part A, B, C is compulsory and D part has internal choice.

ii) All parts of each question are to be attempted at one place.

iii) All questions carry equal marks, out of which part A and B (Max.50 words) carry 2 marks, part C (Max.100 words) carry 3 marks, part D (Max.400 words) carry 7 marks.

iv) Except numericals, Derivation, Design and Drawing etc.

1. a) Explain the phenomenon of fatigue and crap.
   b) Explain the terms lateral strain and Poisson's ratio.
   c) Define impact load. Give its significance.
   d) Obtain the relation for deformation of a body when it is subjected to
      i) A tensile force
      ii) Its own weight

      OR

      A rectangular block of material is subjected to a direct compressive stress 'σ_x', in the longitudinal direction. Compressive stresses of magnitude 'σ_y' and 'σ_z' act in the lateral directions perpendicular to the longitudinal direction. So that the net transverse strain along the 'σ_y' and 'σ_z' direction will ½ and ¼ of the lateral strain that would have occurred if 'σ_x' alone was acting. Determine 'σ_y' and 'σ_z' in terms of σ_x and the net strain in longitudinal direction take $\frac{1}{m}=\frac{1}{4}$.

2. a) Explain the terms principal planes and principal stresses.
   b) State the applications of Mohr's circle for stresses.
   c) Distinguish between thin and thick pressure vessels.
   d) In a piece of material a tensile stress 'P_1' and shearing stress of acts on a given plane shot that the principal stresses are of opposite nature.

      If in addition to 'P_1' a tensile stress 'P_2' acts on a plane perpendicular to the plane of P_1 and all stresses are coupler find the condition that both the principal stresses are of since nature.

      OR

      A shaft of 100 mm diameter is subjected to a bending moment of 4000 N-m and torque of 6000 N-m. Find

      i) The maximum direct stress induced on the section and specify the position of plane on which it acts.

ii) What stress acting alone can produce the since maximum strain. Assume Poisson's ratio as 0.30.

3. a) Explain point of contra flexure.
   b) What do you mean by shear stresses in beam.
   c) Explain moment area method used to determine the deflection of beams.
   d) A beam consists of a Wooden joist 12 cm wide and 20 cm deep strengthened by a steel plate 1 cm thick and 18cm deep one on the either side of the joist. If the stresses in wood and steel are not to exceed 8 mN/m^2 and 128 mN/m^2. Find the moment of resistance of the beam. Take modulus of elasticity of steel equal to twenty times that of wood.

OR

A beam of length 6m is simply supported at its ends and carries two point loads of 48 KN and 40 KN at a distance of 1m and 3m. respectively from the left support find

i) Deflection under each load.

ii) Maximum deflection

Take $E = 2 \times 10^5$ N/mm^2 and $I = 85 \times 10^6$ mm^4

4. a) What do you mean by torsional rigidity of a shaft?
   b) What is leaf spring? Explain in short.
   c) Write short note on shaft of varying section.
   d) Obtain an expression for finding deflection of an open coiled spring subjected to an axial load and an axial twisting moment.

OR

A hollow shaft of an internal diameter half of its external diameter transmits 600 kw at 150 rpm. Find the external diameter of the shaft. If the shear stress is not to exceed 65 N/mm^2 and a twist in a length of 3m should not exceed 1.4 degree. Assume maximum torque 20% more than the mean torque and modulus of rigidity is 1×10^5 N/mm^2.

5. a) Explain Saint Venant's theory.
   b) What is strut? How does it differ from column.
   c) Give limitations of Euler's formula.
   d) A shaft is subjected to a maximum torque of 10 kN-m and a maximum bending moment of 7.5 kN-m if the allowable equivalent stress in simple tension in 160 mN/m^2 find the diameter of the shaft using maximum shear stress theory.

OR

Calculate the maximum value of the slenderness ratio for which the Eulers formula is valid for steel take maximum permissible stress and modulus of elasticity is 330 mN/m^2 and 210 mN/m^2 respectively.

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