Model Question Paper - (CBCS) with effect from 2015-16

USN | | | | | | | | | | | **15ME34**

Third Semester B.E. Degree (CBCS) Examination

Mechanics of Materials

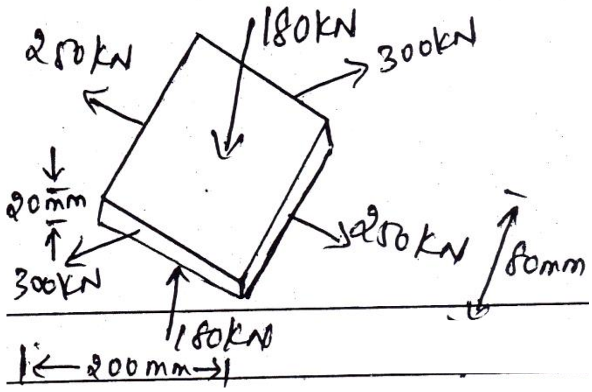
Time: 3 hrs. Max. Marks: 80

Note: Answer any FIVE full questions, choosing one full question from each module.

MODULE – I

1 **a** State Hooke's law. (02 Marks)

b A block size of 200mmx80mmx20mm is subjected to forces as shown in fig. determine (i) Change in dimensions (ii) Change in volume. (10 Marks)



c Determine an expression for shortening /extension of bar (04 Marks)

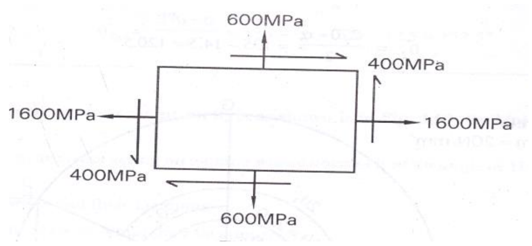
OR

2 **a** Derive an expression for deformation of tapering bar (circular c/s) (08 Marks)

b When the temperature of the compound bar is increased by 50^0c. determine the stresses induced in each bar considering the following cases (i) Rigid supports (ii) Supports yield by 0.5mm. Take $\alpha_s = 12x10^{-6}/^0c$; $\alpha_c = 19x10^{-6}/^0c$; $\alpha_{Al} = 22x10^{-6}/^0c$, E_s= 200GPa; E_c= 83GPa; E_{Al}= 70GPa. (08 Marks)

MODULE – II

3 **a** Using Mohr's circle determine the principal stress and the planes. Show the same on element separately. (12 Marks)



b Define Principal stresses and planes. (04 Marks)

OR

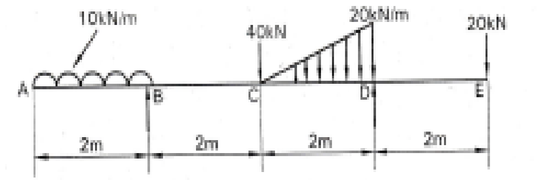
4 **a** An element is subjected to principal tensile stresses across 2 perpendicular planes as shown in fig. Determine normal stress, shear stress and resultant stress on the plane EC. Determine the obliquity. What will be the intensity of stress which is acting alone will produce the same maximum strain if poisson's ratio is0.33. (08 Marks)

b Prove that half the difference between principal stresses is equal to maximum shear stress (10 Marks)

Important Note: 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written e.g, 38+2 = 40, will be treated as malpractice.

MODULE – III

5 **a** Draw the SFD and BMD for the structure shown in fig. and find Point of contra flexure and find maximum bending moment (16 Marks)



OR

6 **a** Derive an expression for maximum slope and deflection for a cantilever beam subjected to UDL (08 Marks)

b Derive Bernoulli- Euler Bending equation or General Bending equation and state assumptions (08 Marks)

MODULE – IV

7 **a** State Determine the diameter of the solid shaft which will transmit 440KW at 280 rpm. The angle of twist is 1^0/metre length and shear stress should not exceed 40Mpa.Assume G=80GPa (08 Marks)

b Prove that Torsional strength of hollow shaft is greater than that of solid shaft (08 Marks)

OR

8 **a** Derive an expression for Euler's crippling load for a column when one of its ends are hinged or pinned (08 Marks)

b A hollow C.I circular section column is 2.8m long is fixed at one end and hinged at the other end. External diameter is 150mm and thickness of wall is 15mm. Take σ_c = 550N/mm^2, α= 1/1600 & E = 8x10^4. Compare bucling load using Euler's and Rankine's formula (08 Marks)

MODULE - V

9 **a** Explain Maximum Shear stress theory and state the need of theories of failure. (08 Marks)

b A plate of C45 steel (σ_y = 353Mpa) is subjected to the following stresses. (08 Marks)
σ_x= 150N/mm^2; τ_{xy} = 50N/mm^2. Find FOS by
(i) Maximum Principal stress theory.
(ii) Maximum shear stress theory

OR

10 **a** Define strain energy, Resilience, Proof resilience and Modulus of resilience (08 Marks)

b A cantilever beam of length 'L' carries UDL 'W' per unit length over its entire length. Determine (i) strain energy stored in beam (ii) If W=10kN/m; L=2m & EI=2x10^{5}kN-m^2 determine strain energy (08 Marks)