CBCS SCHEME

USN | | | | | | | | | | |

18AE33

Third Semester B.E. Degree Examination, June/July 2025
Mechanics of Materials

Time: 3 hrs. Max. Marks: 100

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

Module-1

1 a. Define the following :
i) Factor of safety ii) Poisson's ratio iii) True stress iv) Plane stress v) Hooke's law. **(10 Marks)**

b. An axial pull of 140 KN is acting on a bar consists of three length as shown in Fig Q1(b). If the Young's modulus = $2.1 \times 10^5 N/mm^2$, determine :
i) Stress in each section ii) Total extension of bar iii) Maximum stress in the material.

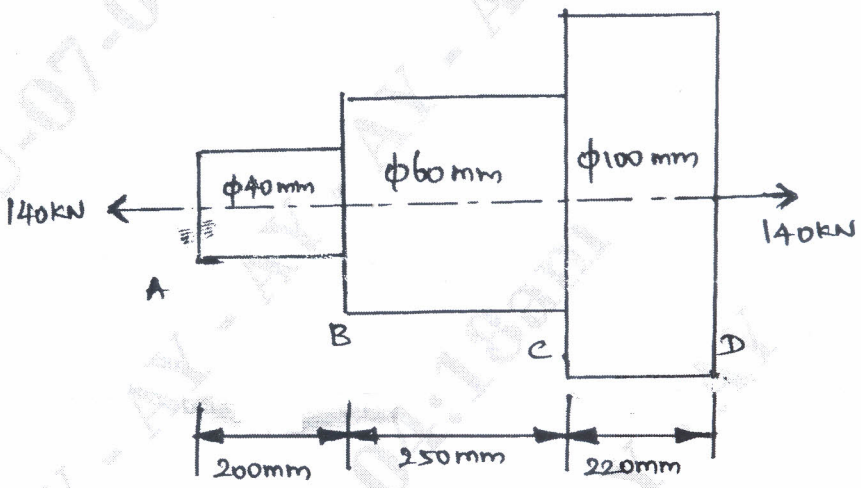

Fig Q1(b) **(10 Marks)**

OR

2 a. Derive the relation between modulus of Elasticity and Bulk modulus. **(10 Marks)**

b. A point is a plate girder is subjected to a horizontal tensile stress of 100 N/mm^2 and vertical shear stress of 60 N/mm^2. Find the magnitude of principle stresses and its location. **(10 Marks)**

Module-2

3 a. Derive the relation between loads, shear force and Bending moments. **(08 Marks)**

b. A cantilever beam carries UDL and point loads as shown in Fig Q3(b). Find the reactions at the fixed end and draw the SFD and BMD.

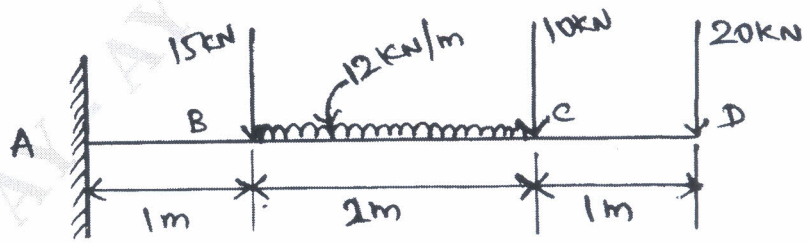

Fig Q3(b) **(12 Marks)**

OR

4 a. Explain the Implication of the Euler – Bernoulli assumption with relevant sketches. **(10 Marks)**

b. A beam of I section 200 mm × 300 mm has web thickness 10 mm and flange thickness 10 mm. It carries a shearing force of 10 kN at a section. Sketch the shear stress distribution across the section. **(10 Marks)**

Module-3

5 a. Derive the equation for deflection of a cantilever with a point load at the free end by double Integration method. **(10 Marks)**

b. A cantilever of length 2 m carries a uniformly distributed load 2kN/m over a length of 1 m from the free end, and a point load of 1 kN at the free end. Find the slope and deflection at the free end if $E = 2.1 \times 10^5$ N/mm^2 end $I = 6.667 \times 10^7$mm^4. **(10 Marks)**

OR

6 a. What are the assumptions in the theory of Torsion? Derive the equation for maximum torque transmitted by a solid circular shaft. **(10 Marks)**

b. A hollow circular shaft has to transmit 60 KW at 210 rpm such that the maximum shear stress does not exceed 60 MN/m^2. IF the ratio of internal to external diameter is equal to $\frac{3}{4}$ and the value of rigidity modulus is 84 GPa, find the diameter of the shaft and angle of twist in a length of 3 m. **(10 Marks)**

Module-4

7 a. Describe the principles of virtual work for a particle with relevant sketch. **(10 Marks)**

b. Explain the virtual work due to external force systems. **(10 Marks)**

OR

8 a. State and derive the Castigliano's energy theorem. **(10 Marks)**

b. State and prove the Maxwell's reciprocal theorem. **(10 Marks)**

Module-5

9 a. Define fracture. Explain the various modes of fracture with relevant sketches. **(10 Marks)**

b. Define Creep and explain the various stages of Creep. **(10 Marks)**

OR

10 a. Draw the S-N diagram and explain in detail. **(10 Marks)**

b. Define fatigue. Explain any one method of fatigue texting. **(10 Marks)**

* * * * *