Graphic Era
HILL UNIVERSITY
Established by an Act of the State Legislature of Uttarakhand (Adhiniyam Sankhya 12 of 2011)
University under section 2(f) of UGC Act, 1956

Term Evaluation (Even) Semester Examination March 2025

Roll no...............................

Name of the Course: **B.Tech (ME)**
Semester: **IV**
Name of the Paper: **Mechanics of Materials**
Paper Code: **TME 406**
Time: 1.5 hour   **Maximum Marks: 50**

Note:
- (i) Answer all the questions by choosing any one of the sub-questions
- (ii) Each question carries 10 marks.

Q1.   (10 Marks)
   a. Deduce expression to determine the elongation of a bar of tapering circular section.   (CO1)
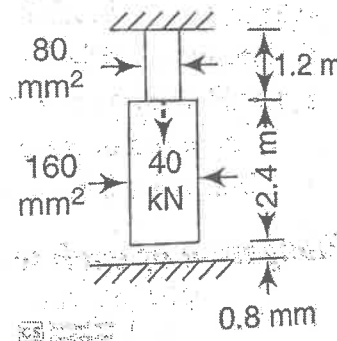
<div align="center">OR</div>

   b. A suspended bar system consists of two cross-sections as shown in figure. Initially its lower surface   is 0.8 mm above the ground surface. Determine the reaction of the lower support and the stresses in each section when a load of 40 kN is applied as shown in the figure.
   Take E = 205GPa   (CO1)

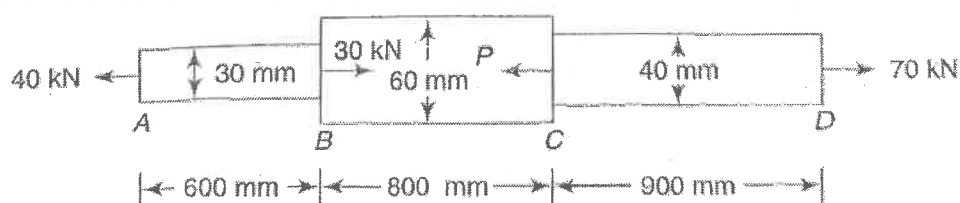Q2.   (10 Marks)
   a. An axial load of 56 kN is applied to a bar of 36 mm diameter and 1 m length. The extension of the bar is measured to be 0.265 mm whereas the reduction in diameter is 0.003 mm. Calculate the Poisson's ratio and the values of the three moduli.   (CO1)

<div align="center">OR</div>

   b. A circular steel bar having three segments is subjected to various forces at different cross-sections as shown in figure. Determine the necessary force to be applied at Section C for the equilibrium of the bar. Also, find the total elongation of the bar. Take E = 202 GPa.   (CO1)

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Q3. (10 Marks)
a. Explain the following properties: (CO1)
   i. Elasticity
   ii. Plasticity
   iii. Ductility
   iv. Brittleness
   v. Toughness

OR

b. Rails are laid such that there is no stress in them at 24° C. If the rails are 32 m long. Determine:
   i. Stress in the rail at 80° C, when there is no allowance for expansion
   ii. Stress in the rail at 80° C, when there is expansion allowance of 8mm per rail.
   iii. The expansion allowance for no stress in the rail at 80°C.

   Take:
   Coefficient of linear expansion = 11 x 10^(-6) /°C, E= 205 GPa (CO2)

Q4. (10 Marks)
a. What do you mean by thermal stresses? Explain (CO2)

OR

b. A steel wire of 8-mm diameter is used to lift a weight of 1.5 kN at its lowest end. The density of the wire material is 8000 kg/m³. Determine the elongation of the wire if the length of the wire is 100m. E=205 GPa (CO1)

Q5. (10 Marks)
a. What do you mean by principal planes and principal stresses? Derive the expression for principal stresses for a body subjected to direct and shear stresses. (CO2)

OR

b. Draw Mohr's stress circle indicating the radius and centre point coordinate for given stress conditions. (CO2)
   i. Pure shear (60 MPa)
   ii. Hydrostatic stresses (120 MPa)
   iii. Normal stress in X- direction 120 MPa(tensile) and Normal stress in Y- direction 60 MPa(tensile)
   iv. Normal stress in X- direction 120 MPa(tensile) and Normal stress in Y- direction 60 MPa(compressive)
   v. Normal stress in X- direction 120 MPa(tensile) and Normal stress in Y- direction 60 MPa(tensile) with 60 MPa shear stress