# GIET UNIVERSITY, GUNUPUR – 765022

B. Tech (Third Semester Regular) Examinations, December – 2023

## 22BMEPC23002 – Mechanics of Solids

(Mechanical)

Time: 3 hrs Maximum: 70 Marks

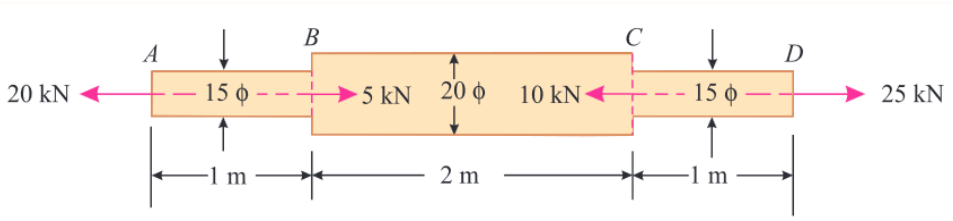
**(The figures in the right hand margin indicate marks)**

**PART – A** **(2 x 5 = 10 Marks)**

| | | CO # | Blooms Level |
|---|---|---|---|
| Q.1. | Answer ***ALL*** questions | | |
| a. | What is a composite section? Explain the procedure for finding the stresses developed when a composite section is subjected to an axial load. | CO1 | K1 |
| b. | Define the term Poisson's ratio. Write the expressions for strains in the three principal directions. | CO1 | K1 |
| c. | What do you mean by pressure vessel or shell? What types of stress acts upon them? | CO2 | K1 |
| d. | A steel wire of 5 mm diameter is bent into a circular shape of 5 mm radius. Determine the maximum stress induced in the wire. Take E = 200 GPa. | CO3 | K1 |
| e. | Why hollow circular shafts are preferred when compared to solid circular shafts? | CO4 | K1 |

**PART – B** **(15 x 4 = 60 Marks)**

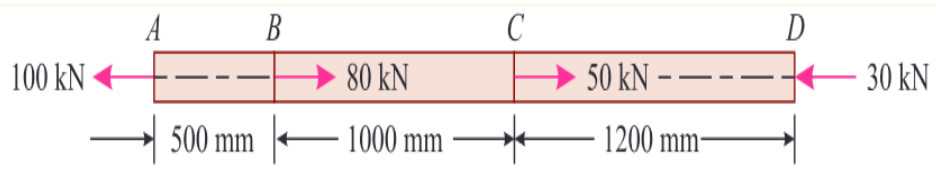
| | | Marks | CO # | Blooms Level |
|---|---|---|---|---|
| Answer ***ALL*** questions | | | | |
| 2. a. | A steel bar ABCD 4 m long is subjected to forces as shown in Fig. Find the elongation of the bar. Take E for the steel as 200 GPa. | 8 | CO1 | K2 |

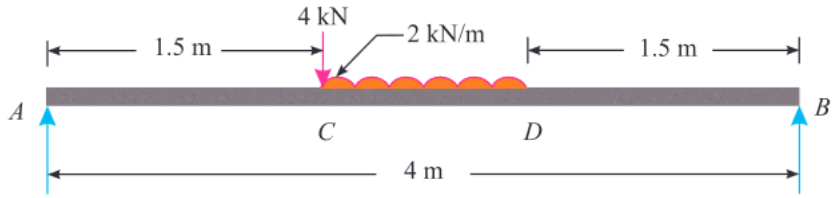


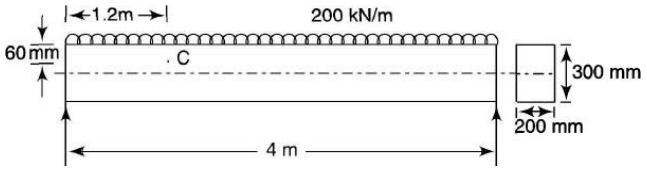

| | | | | |
|---|---|---|---|---|
| b. | A bar 12 mm in diameter is acted open by an axial load of 20kN. The change in diameter is measured as 0.003 mm. Determine the<br>(i) poisons ratio<br>(ii) the modulus of Elasticity and the bulk modulus<br>The value of the modulus of rigidity is 80 GPa | 7 | CO1 | K2 |

(OR)

| | | | | |
|---|---|---|---|---|
| c. | A brass bar having cross-sectional area of 500 $mm^2$ is subjected to axial forces as shown in Fig. Find the total elongation of the bar. Take E = 80 GPa. | 8 | CO1 | K2 |
| d. | A circular rod of 25 mm diameter and 500 mm long is subjected to a tensile force of 60 kN. Determine modulus of rigidity, bulk modulus and change in volume if Poisson's ratio =0.3and Young's modulus E = 2 × 105 $N/mm^2$. | 7 | CO1 | K2 |
| 3.a. | A rectangular bar of cross-sectional area 10000 $mm^2$ is subjected to an axial load of 20kN. Determine the normal and shear stresses on a section which is inclined at an angle of 30 degree with normal cross-section of the bar. | 7 | CO2 | K2 |
| b. | A cast iron cylinder of 200 mm inner diameter and 12.5 mm thick is closely wound with a layer of 4 mm diameter steel wire under a tensile stress of 55 $MN/mm^2$. Determine the stresses setup in the cylinder and steel wire if water under a pressure of 3$MN/mm^2$ is admitted in the cylinder. Take $E_{CI}$ = 100 $GN/m^2$; $E_S$ = 200 $GN/m^2$; μ = 0.25. | 8 | CO2 | K2 |
| | (OR) | | | |
| c. | A simply supported beam of 4 m span is carrying loads as shown in Fig. Draw shear force and bending moment diagrams for the beam. | 7 | CO2 | K2 |
| d. | Deduce expressions for stresses on an inclined plane in a body subjected to a bi-axial stress condition. | 8 | CO2 | K2 |
| 4.a. | The Figure shows a simply supported 200 mm wide 300 mm deep and 4 m long beam. Determine the bending moment and bending stress at the point C which is 60 mm below the top surface and 1.2 m from the left support. | 15 | CO3 | K2 |




(OR)

| | | | | |
|---|---|---|---|---|
| b. | A simply supported beam of 2m span carries a uniformly distributed load of 140kN per mover the whole span. The cross-section of the beam is a T-section with a flange width of 120 mm, web and flange thickness of 20mm and overall depth of 160 mm. Determine the maximum shear stress in the beam and draw the shear stress distribution for the section. | 15 | CO3 | K2 |
| 5.a. | The outer and the inner diameters of a hollow steel shaft are 120 mm and 60 mm respectively. The shaft transmits 800 kW at a speed of 400 rpm while an end thrust of 70 kNacts on the shaft. Determine the bending moment which can safely be applied to the shaft if the maximum principal stress does not exceeds 80 MPa. | 8 | CO4 | K2 |
| b. | A solid circular shaft of 100 mm diameter is transmitting 120 kW at 150 rpm. Find the intensity of shear stress in the shaft. | 7 | CO4 | K2 |
| | (OR) | | | |
| c. | A solid steel shaft has to transmit 100kW at 160 rpm. Taking allowable shear stress as 70 MPa, find the suitable diameter of the shaft. The maximum torque transmitted in each revolution exceeds the mean by 20 %. | 8 | CO4 | PO2 |
| d. | A hollow shaft is to transmit 200kW at 80 rpm. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 of the external diameters, find the diameters of the shaft. | 7 | CO4 | K2 |

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