QP Code: RD22BTECH059 | Reg. No | | | | | | | | | | | AY 22

# GIET UNIVERSITY, GUNUPUR – 765022

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

## 22BCVPC23001 – Mechanics of Materials

(Civil)

Time: 3 hrs | Maximum: 70 Marks

**Answer all questions**

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

**PART – A** **(2 x 5 = 10 Marks)**

| Q.1. Answer ***ALL*** questions | CO # | Blooms Level |
|---|---|---|
| a. Calculate the diameter of a circular bar of length 10m, if the elongation of the bar due to an axial load of 100kN is 0.15mm. E=200GN/$m^2$. | CO1 | K2 |
| b. Differentiate between varying loads and uniformly distributed loads. | CO1 | K2 |
| c. What is the section modulus of a rectangular and circular sections? | CO2 | K2 |
| d. What is the radius of Mohr's circle? | CO3 | K2 |
| e. Define Torsion. | CO4 | K2 |

**PART – B** **(15 x 4 = 60 Marks)**

| Answer ***ALL*** questions | Marks | CO # | Blooms Level |
|---|---|---|---|
| 2. a. In an experiment, a bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.09 mm and the change in diameter is 0.0039 mm. Calculate the Poisson's ratio and the values of the three moduli. | 10 | CO1 | K3 |
| b. In an experiment an alloy bar 1 m long and 20 mm × 20 mm in section was tested to increase through 0.1 mm, when subjected to an axial tensile load of 6.4 kN. If the value of bulk modulus for the bar is 133 GPa, find the value of Poisson's ratio. | 5 | CO1 | K3 |
| (OR) | | | |
| c. A compound bar 2 m long is made up of two parts of aluminium and steel and that cross-sectional area of aluminium bar is 2.5 times that of the steel bar. The rod is subjected to an axial tensile load of 250 kN. If the elongations of aluminium and steel parts are equal, find the lengths of the two parts of the compound bar. Take E for steel and aluminium are as 200 GPa and 70 GPa. | 10 | CO1 | K3 |
| d. Two circular bars A and B of the same material are subjected to the same pull (P) and are deformed by the same amount. What is the ratio of their length, if one of them has a constant diameter of 60 mm and the other uniformly tapers from 80 mm from one end to 40 mm at the other ? | 5 | CO1 | K3 |
| 3.a. A timber beam of rectangular section carries a load of 2 kN at mid-span. The beam is simply supported over a span of 3.6 m. If the depth of section is to be twice the breadth, and the bending stress is not to exceed 9 MPa, determine the cross-sectional dimensions. | 8 | CO2 | K3 |
| b. A rectangular beam of width 200 mm and depth 300 mm is simply supported over a span of 5m. Find the safe uniformly distributed load that the beam can carry per metre length if the allowable bending stress in the beam is 100 MPa. | 7 | CO2 | K3 |
| (OR) | | | |
| c. Compare the moments of resistance of a square section of given material | 10 | CO2 | K3 |

when the beam section is placed such that (i) two sides are parallel and (ii) one diagonal vertical.

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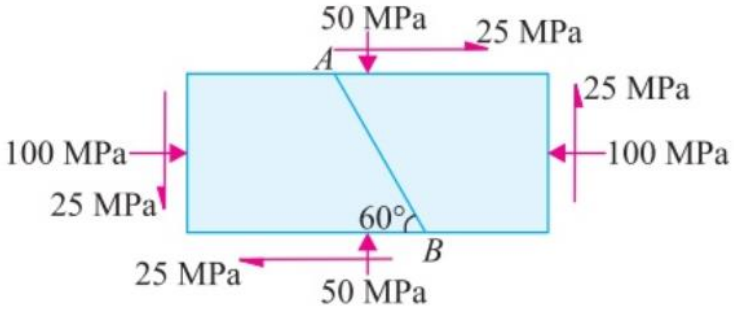
| d. | An I-section has the following dimensions in mm units: Bottom flange = 300 × 100, Top flange = 150 × 50, Web = 300 × 50. Determine the position of centre of gravity of the section. | 5 | CO2 | K2 |
| 4.a. | A machine component is subjected to the stresses as shown in Figure. Find the normal, shearing and resultant stresses on the section AB inclined at an angle of 60º with x-x axis. Also find the principal stress and maximum shear stress. | 10 | CO3 | K3 |

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| b. | A wooden bar is subjected to a tensile stress of 5 MPa. What will be the values of normal and shear stresses across a section, which makes an angle of 30° with the direction of the tensile stress. Also find the resultant stress on that section. | 5 | CO3 | K3 |

(OR)

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| c. | A plane element in a body is subjected to a tensile stress of 100 MPa accompanied by a shear stress of 25 MPa. Find<br>i. the normal, shear and resultant stresses on a plane inclined at an angle of 20° with the tensile stress<br>ii. Principal stresses and maximum shear stress | 8 | CO3 | K3 |
| d. | An element in a strained body is subjected to a tensile stress of 150 MPa and a shear stress of 50 MPa tending to rotate the element in an anticlockwise direction. Find<br>i. the magnitude of the normal and shear stresses on a section inclined at 40° with the tensile<br>ii. the magnitude of principal stresses and maximum shear stress | 7 | CO3 | K3 |
| 5.a. | A solid steel shaft has to transmit 100 kW at 160 r.p.m. 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 | K3 |
| b. | A hollow shaft is to transmit 200 kW at 80 r.p.m. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 of the external diameter, find the diameters of the shaft. | 7 | CO4 | K3 |

(OR)

| | | | | |
|---|---|---|---|---|
| c. | A steam boiler of 1.25 m in diameter is subjected to an internal pressure of 1.6 MPa. If the steam boiler is made up of 20 mm thick plates, calculate the circumferential and longitudinal stresses. Take efficiency of the circumferential and longitudinal joints as 75% and 60% respectively. | 8 | CO4 | K3 |
| d. | A solid steel shaft of 60 mm diameter is to be replaced by a hollow steel shaft of the same material with internal diameter equal to half of the external diameter. Find the diameters of the hollow shaft and saving in material, if the maximum allowable shear stress is same for both shafts. | 7 | CO4 | 3 |

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