Register Number:……………..

KUMARAGURU
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**B.E. DEGREE EXAMINATIONS: NOV/DEC 2023**

(Regulation 2018)

Third Semester

**AERONAUTICAL ENGINEERING**

U18AEI3203: Mechanics of Solids

**COURSE OUTCOMES**

**CO1:** Solve the problems on structural members subjected to Uni-axial load.

**CO2:** Construct Shear Force, Bending moment and Bending stress distribution in beams subjected to transverse load.

**CO3:** Determine the deflection of statically determinant beam.

**CO4:** Solve the problems on torsion Circular Shafts.

**CO5:** Solve the problems on 2d structural element.

**CO6:** Demonstrate the experiments with UTM and Determinate Beam structures to determinate.

**Time: Three Hours** **Maximum Marks: 100**

**Answer all the Questions:-**
**PART A (10 x 2 = 20 Marks)**
**(Answer not more than 40 words)**

| | | | |
|---|---|---|---|
| 1. | A steel rail is 12 m long and is laid at a temperature of 18°C. The maximum temperature expected is 40°C. Estimate the minimum gap between two rails to be left so that the temperature stresses do not develop. | CO1 | [$K_3$] |
| 2. | Calculate the increase in length of a wire of diameter 2.2 mm stretched by a load of 980N. Young's modulus of wire is $12.5 \times 10^{10}\ Nm^{-2}$. | CO1 | [$K_3$] |
| 3. | Draw SFD and BMD for a cantilever beam with tip load. | CO2 | [$K_2$] |
| 4. | Explain: Point of contraflexure | CO3 | [$K_1$] |
| 5. | List the boundary conditions for<br>**(i)** Simply supported beam under mid point load<br>**(ii)** Cantilever beam under tip point load. | CO3 | [$K_2$] |
| 6. | List any four types of beams with neat sketches. | CO3 | [$K_1$] |
| 7. | List the assumptions made while deriving torsional equation. | CO4 | [$K_1$] |
| 8. | Calculate the torque created, if a shaft is transmitting 97.5 kW at 180 r.p.m. | CO4 | [$K_2$] |
| 9. | Explain (i) Neutral Axis (ii) Principal stress | CO5 | [$K_2$] |

10. Draw Mohr's circle for a 2-dimensional stress field subjected to (a) Pure shear (b) Pure biaxial tension CO5 [$K_3$]

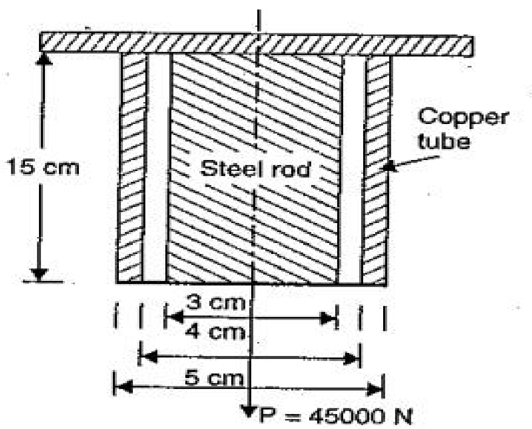
**Answer any FIVE Questions:-**
**PART B (5 x 16 = 80 Marks)**
**(Answer not more than 400 words)**

11. a) A steel rod of 3cm diameter is enclosed centrally in a hollow copper tube of external diameter 5cm and internal diameter of 4cm. The composite bar is then subjected to an axial pull of 45000N. If the length of each bar is equal to 15cm, determine: 10 CO1 [$K_4$]

(i) The stresses in the rod and tube, and

(ii) Load carried by each bar.

Take E for steel = $2\times10^5$ N/mm$^2$ and for copper = $1.1\times10^5$ N/mm$^2$.




b) A tensile load of 50kN is suddenly applied to a circular bar of 5cm diameter and 4m long. Determine: 6 CO1 [$K_3$]

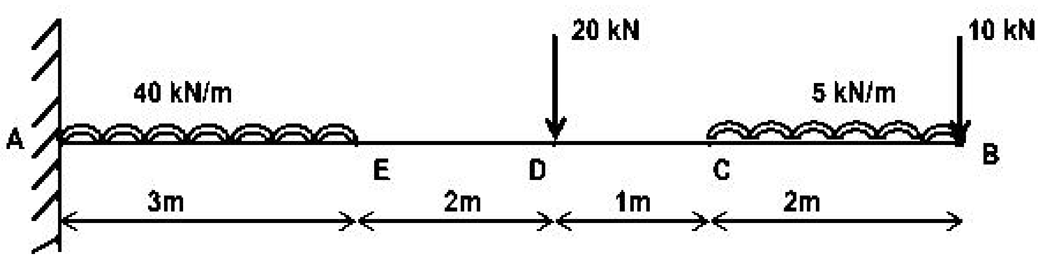
(i) Maximum instantaneous stress induced.

(ii) Instantaneous elongation in the rod.

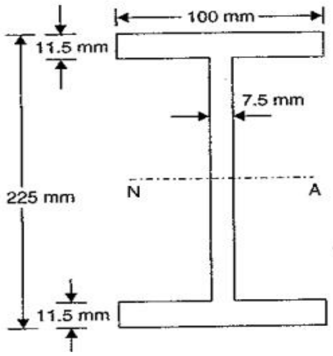
(iii)Strain energy absorbed in the rod.

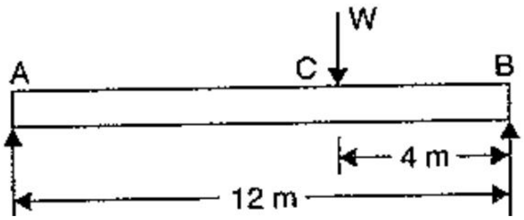
Take E = $2\times10^5$ N/mm$^2$.

12. Draw SFD and BMD for the cantilever beam given below. CO2 [$K_3$]

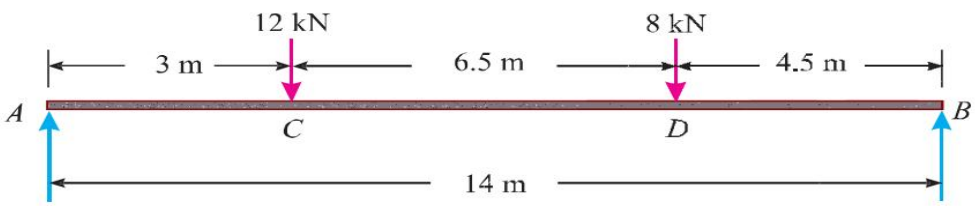


13. An I section shown in figure below is simply supported over a span of 12m. If the maximum permissible bending stress is 80N/mm$^2$, what concentrated load can be carried at a distance of 4m from one support? CO2 [K3]



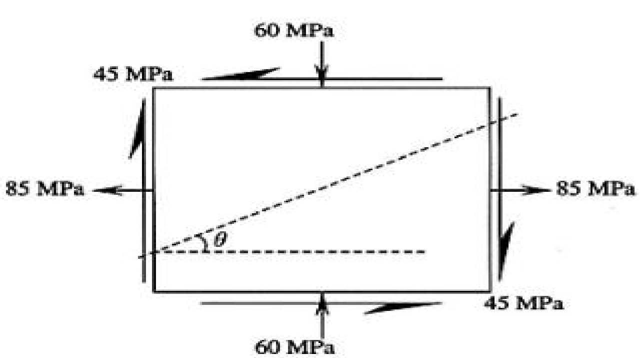




14. A horizontal steel grider having uniform cross section is 14m long and is simply supported at its ends. It carries two concentrated loads as shown in figure. Calculate the deflections of the beam under the loads at C and D. Take E = 2×10$^5$ N/mm$^2$ and I = 160 ×10$^6$ mm$^4$. CO3 [K3]




15. A shaft is made from tube. The ratio of the inside diameter to the outside diameter is 0.6. The material must not experience a shear stress greater than 500kPa. The shaft must transmit 1.5MW of mechanical power at 1500rpm. Calculate the shaft diameters. CO4 [K3]

16. For the state of stress shown in figure, determine the principal stresses and locate principal planes. Also obtain maximum tangential stress and locate corresponding planes. CO5 [K4]

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