JYOTHI ENGG. COLLEGE LTD. THRISSUR EDUCATIONAL TRUST

Reg No.:_____ Name:_____

**APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY**

Third Semester B.Tech Degree Regular and Supplementary Examination December 2022 (2019 scheme)

**Course Code: CET201**

**Course Name: MECHANICS OF SOLIDS**

Max. Marks: 100 Duration: 3 Hours

**PART A**

***Answer all questions. Each question carries 3 marks*** Marks

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|---|---|---|
| 1 | Draw the stress strain diagram of mild steel and mark its salient points. | (3) |
| 2 | Define Young's modulus of elasticity. | (3) |
| 3 | Evaluate the volumetric strain of a rectangular bar whose dimensions are L x B x D. | (3) |
| 4 | Define strain energy and proof resilience. | (3) |
| 5 | Write the relationship between load, shear force and bending moment. | (3) |
| 6 | What is meant by point of contra flexure. | (3) |
| 7 | State the assumptions made in moment – curvature relationship. Write down the basic differential equation for calculating the deflection of beam | (3) |
| 8 | Show that the maximum shear stresses in a rectangular cross section is 1.5 times the average stress. | (3) |
| 9 | Define Kern of section. | (3) |
| 10 | Explain the limitation of Eulers formula | (3) |

**PART B**

***Answer any one full question from each module. Each question carries 14 marks***

**Module 1**

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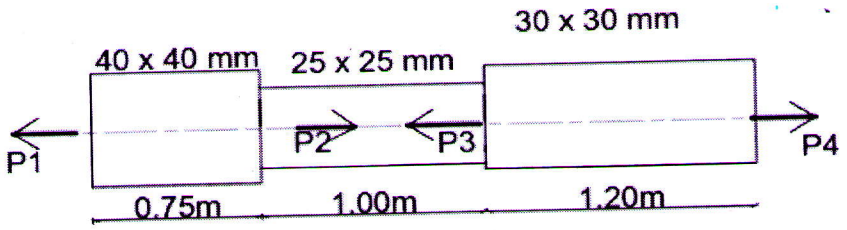
|---|---|---|
| 11. | A steel bar ABCD consists of three sections: AB is of 20 mm diameter and 200 mm long, BC is 25 mm square and 400 mm long and CD is of 12 mm diameter and 200 mm long. The bar is subjected to an axial compressive load which induces a stress of 30 $MN/m^2$ on the largest cross section. Determine total decrease in length of the bar when the load is applied. E = 210 GPa | (14) |
| 12. | A member ABCD is subjected to point loads $P_1$, $P_2$, $P_3$, $P_4$ as shown in figure. Calculate the force $P_3$ necessary for equilibrium if $P_1$ = 120 kN ; $P_2$ = 220 kN and | (14) |

$P_4$ = 160 kN. Determine also the net change in length of member. E = 200 GPa




**Module 2**

13 A brass bar of 25 mm diameter is enclosed in a steel tube of 25 mm internal diameter and 50 mm external diameter. Both of them are 1m long at room temperature and fastened rigidly to each other at the ends. If the room temperature is 20°C, find to what temperature the assembly should be heated so as to generate a compressive stress of 48.7 $MN/m^2$ in brass. What is the stress in steel at this temperature? Assume Es =200 $GN/m^2$; $E_b$ =100 $GN/m^2$; $\alpha_s$ = 11.6 x $10^{-6}$ /°C , $\alpha_B$ = 18.7 x $10^{-6}$ /°C (14)

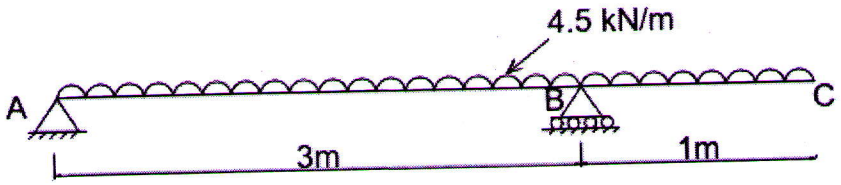
14.a A steel flat 150 mm wide, 15 mm thick and 6 m long carries a pull of 270 kN. Find the extension in the length & the contraction in width and thickness under the pull. Given $\mu$ = 0.3 & E = 200 $GN/m^2$. Also calculate the change in volume. (8)

14.b A rod 12.5 mm in diameter is stretched 3.2 mm under a steady load of 10 KN. What stress would be produced in the bar by a weight of 700 N falling through 75 mm before commencing to stretch, the rod being initially unstressed. E = 210GPa. (6)

**Module 3**

15 Draw the SFD and BMD for a simply supported beam of length 9 m and carrying a uniformly distributed load of 10 kN/m for a distance of 6 m from the left end. Also calculate the maximum B M on the section. (14)

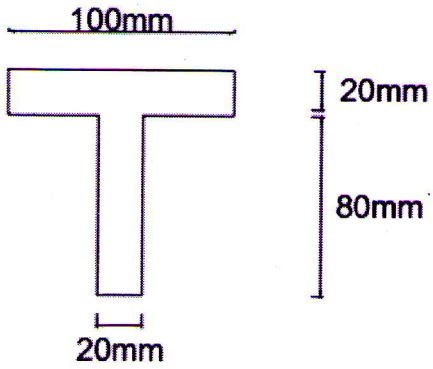
16 An overhanging beam ABC is loaded as shown in figure. Draw the SFD and BMD (14)



## Module 4

17 A timber beam 150 mm x 200 mm is used as a simply supported beam of span 3m. Find the maximum uniformly distributed load that can be applied in addition to a concentrated load of 5 kN acting at the mid span, if the maximum bending stress and shear stress in the beam are not exceed 15 $N/mm^2$ and 2 $N/mm^2$ respectively. Neglect self-weight of the beam. (14)

18 A cast iron beam is of T section as shown in figure. The beam is simply supported on a span of 8m. The beam carries a uniformly distributed load of 1.5 kN/m length on the entire span. Determine the maximum tensile and maximum compressive stresses. (14)




## Module 5

19 A point is subjected to a tensile stresses of 50 $N/mm^2$ and 10 $N/mm^2$, acting on two mutually perpendicular planes. A shear stress of 20 $N/mm^2$ is acting on these planes. Determine the principal stresses and the maximum shear stresses and its planes (14)

20 A short column of rectangular cross section 80 mm x 60 mm carries a load of 40 kN at a point 20 mm from the longer side and 35 mm from the shorter side. Determine the maximum compressive and tensile stresses in the section (14)

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