Reg. No. : | | | | | | | | | | | | |

**Question Paper Code: R3103**

B.E./B.Tech. DEGREE EXAMINATION, NOV 2025

Third Semester

R21UCE303- STRENGTH OF MATERIALS

Civil Engineering

(Regulations R2021)

Duration: Three hours | Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 2 = 20 Marks)

| | | |
|---|---|---|
| 1. | Young's modulus of elasticity and Poisson's ratio of a material are $1.25x10^{2}$ MPa and 0.34 respectively. The modulus of rigidity of the material is _. | CO3-App |
| 2. | Define stress and thermal stress | CO1-U |
| 3. | Sagging, the bending moment occurs at the ___of the beam. Which of the statement correct? Justify?<br>a) At supports<br>b) Mid span<br>c) Point of contra flexure<br>d) Point of emergence. | CO4-Ana |
| 4. | Discriminate the types of beam with neat sketch | CO1-U |
| 5. | Calculate the maximum deflection of a fixed beam carrying Point load of 5kN/m. The span of beam is 6 m. Take E = $200kN/m^2$&I =$5\times10^7mm^4$ | CO3-App |
| 6. | A beam 6 metres long is fixed at it ends. It carries a udl of 5 kN/m. Find the maximum bending moment in the beam. Choose the correct answer & Justify your answer?<br>(a)15k (b) 20k (c) 35 kNm (d) 40 kNm | CO4-Ana |
| 7. | Differentiate short and long column. | CO1-U |
| 8. | Draw the End Conditions of Euler's theory of column. | CO1-U |
| 9. | Write shear center formula for I section and Channel Section. | CO1-U |
| 10. | State the Winkler-Bach formula for a curved beam. | CO1-U |

PART – B (5 x 16= 80 Marks)

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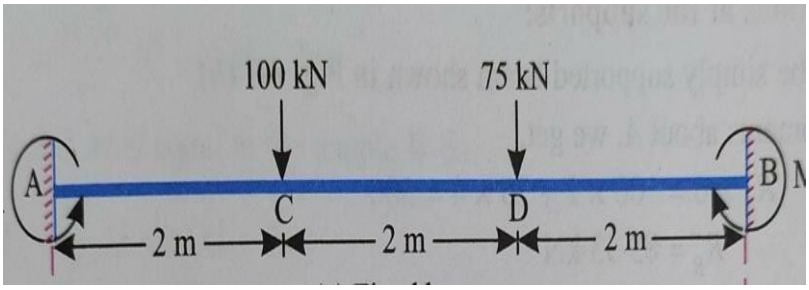
|---|---|---|---|---|
| 11. | (a) | Find the young's modulus and poisons ratio of a metallic bar of a length 300 mm , breadth 40 mm , depth 40 mm when the bar is subjected to an axial load of 400 kN. Decreasing length this 0.75 mm and the increase in breath d this 0.03 mm. Also find the modulus of rigidity of the bar. | CO3-App | (16) |
| | | Or | | |
| | (b) | A bar of 30 mm diameter is subjected to a pull of 60 kN. The measured extension on gauge length of 200 mm is 0.1 mm and changing diameter is 0.004 mm. Calculate Young's modulus, Poisson ratio and bulk modulus. | CO3-App | (16) |
| 12. | (a) | A beam of length 6m is simply supported at its ends and carries two point loads of 48 kN and 40 kN at a distance of 1 m and 3 m respectively from the left support. Use Macaulay's method. Find,<br>a) Deflection under each load<br>b) Maximum deflection<br>c) The point at which maximum deflection occurs.<br>d) Given $E=2*10^5$ N/mm$^2$and $I=85*10^6$ mm$^4$. | CO2-App | (16) |
| | | Or | | |
| | (b) | A cantilever beam 2.5m long is loaded with point load of 1kN, 2 kN and 3 kN at 1m and 1.5m from left end . Draw SFD and BMD. | CO2-App | (16) |
| 13. | (a) | A fixed beam AB of length 6m carries point loads of 160 kN and 120 kN at a distance of 2m and 4m from the left end A. Find the fixed end moments and the reactions at the supports. Draw B.M and S.F diagrams. | CO2-App | (16) |
| | | Or | | |
| | (b) | A fixed beam AB of length 6m as shown in fig. Draw BMD and SFD. | CO2-App | (16) |



14. (a) A steel tube 4.5m long , 30 mm external diameter and 3mm thickness is used as a strut .Calculate the Euler's crippling load for the following end conditions. E=2 X$10^5$. CO3-App (16)

a) When both ends hinged
b) When one end is hinged and other fixed
c) When one end is fixed and the other free
d) When both ends are fixed

Or

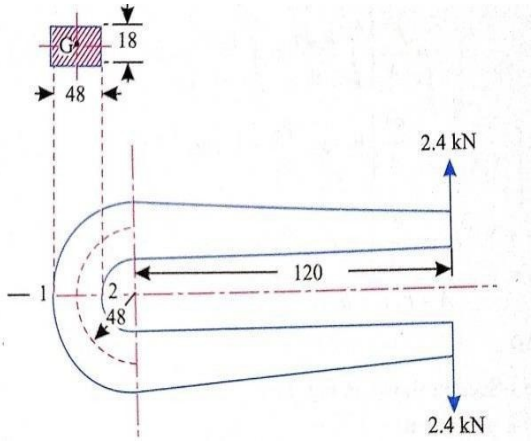
(b) Compare the crippling loads given by Euler's and Rankine's formula for a tubular cast iron strut 3 m long having outer diameter and inner diameter 40 mm and 30 mm loaded through pin joints at the ends .Take E=1.2X$10^5$ N/$mm^2$, $\sigma$ = 550 N/$mm^2$ and $\alpha$ = 1/1600 CO4-Ana (16)

15. (a) A cylindrical shaft made of steel having tensile yield strength of 800 MPa and compressive yield strength of 1000 MPa .It is subjected to bending moment of 15kNm and torsional moment of 25kNm.Consider FOS 2.5 .Determine diameter of the shaft by using CO3-App (16)

i) Maximum shear stress theory
ii) Maximum distortion energy theory

Or

(b) A fig. shows a frame subjected to a load of 2.4 KN. CO5-Ana (16)




Find (i)The resultant stresses at point 1 and 2
(ii) Position of neutral axis