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

Question Paper Code: 2033211

B.E. / B.Tech. DEGREE EXAMINATIONS, NOV/ DEC 2024
Third Semester
Chemical Engineering
U20CH302 – MECHANICS OF SOLIDS FOR CHEMICAL ENGINEERS
(Regulation 2020)

Time: Three Hours Maximum: 100 Marks

Answer ALL questions

PART – A (10 x 2 = 20 Marks)

1. Define modulus of Elasticity.
2. Define stress & strain.
3. How to classify the beams according to its supports?
4. Differentiate between hogging and sagging bending moment.
5. Explain double integration method.
6. Distinguish between actual beam and conjugate beam.
7. What is section modulus?
8. Draw the shear stress distribution diagram for a beam of rectangular cross section.
9. Define: Eccentrically loaded short columns.
10. Explain why Euler's formula is applicable only for long column.

PART – B (5 x 16 = 80 Marks)

11. (a) The following observations were made during a tensile test on a mild steel specimen 40 mm in diameter and 200 mm long. Elongation with 40 KN load (within limit of proportionality) δl = 0.0304 mm, Yield load = 161 KN, Maximum load = 242 KN, Length of specimen at fracture= 249 mm. Examine:
(i) Young's modulus of elasticity,
(ii) Yield point stress,
(iii) Ultimate stress, and
(iv) Percentage elongation. (16)

(OR)

(b) A steel bar is placed between two copper bars, each having the same area and length as steel bar at 20°C. At this stage, they are rigidly connected together at both the ends. When the temperature is raised to 320°C, the length of the bars increases by 1.5 mm. Obtain the original length and final stresses in the bars. Take: E_s =220 GN/m^2; E_c = 110 GN/m^2; α_s=0.000012 per°C.; α_c = 0.0000175 per°C. (16)

12. (a) A beam of length 10 m is simply supported at its ends carries two concentrated loads of 5 KN each at a distance of 3 m and 7 m from the left support and also a UDL load of 1 KN/m between the point loads. Draw the SFD and BMD. Identify the maximum bending moment. (16)

(OR)

(b) A cantilever AB of span 7 m is fixed at the end A and the end B is free. It carries a point load, of 30 KN at 4 m from A. Identify the reaction and draw S.F. and B.M. diagrams. (16)

13. (a) A beam is simply supported at its ends over a span of 10 m and carries two concentrated loads of 100 kN and 60 kN at a distance of 2 m and 5 m respectively from the left support. Evaluate
(i) Slope at the left support;
(ii) Slope and deflection under the 100 kN load.
Assume EI = 36 x 104 kN/m^2. (16)

(OR)

(b) A beam AB of span 6m is simply supported at its ends is subjected to a point load of 20kN at C at a distance of 2m from left end. Using moment area method, Evalute the deflection at the point C, slope at the points A, B and C. Tak I = 6x10^8 mm^4 and E = 200 GPa. (16)

14. (a) Two wooden planks 150 mm x 50 mm each are connected to form a T-section of a beam. If a moment of 3.4 kNm is applied around the horizontal neutral axis, inducing tension below the neutral axis, determine the stresses at the extreme fibres of the cross-section. Also examine the total tensile force on the cross-section. (16)

(OR)

(b) A steel beam of I section is 600 mm deep. Each flange is 250 mm wide and 25 mm thick. The web is 15mm thick. The beam section is subjected to a shear force of 500 kN. Determine the shear stress distribution of the beam section. (16)

15. (a) Derive the Euler's equation for column with two ends fixed. (16)

(OR)

(b) A shaft has to transmit 245 kW power at 240 rpm. The maximum torque may be 1.5 times the mean torque. The shear stress in the shaft is not to exceed 40 N/mm2 and the twist must not exceed 10 per metre length, find a suitable diameter if a) The shaft is solid. b) The shaft is hollow with external diameter twice the internal diameter. Take C = 8 x 104 N/mm^4. (16)

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