Reg. No. : E N G G T R E E . C O M

Question Paper Code : 40557

B.E./B.Tech. DEGREE EXAMINATIONS, NOVEMBER/DECEMBER 2024

Third/Fourth Semester

Mechanical Engineering

CE 3491 – STRENGTH OF MATERIALS

(Common to Industrial Engineering/Industrial Engineering and Management/Mechanical Engineering (Sandwich)/Safety and Fire Engineering)

(Regulations 2021)

Time : Three hours Maximum : 100 marks

Answer ALL questions.

PART A — (10 × 2 = 20 marks)

1. List any four types of stress.

2. State Hooke's Law.

3. Mention the Types of Beam based on support condition.

4. How the Point of Contra flexure is identified?

5. Write any two assumptions made in Torsion Equation.

6. What is meant by Torsional Rigidity?

7. Compare the Euler's Equation of the various and condition.

8. Prioritize the use of Column in Aircraft.

9. Write the Hoop Stress.

10. Where do we apply the Mohr's Circle?

PART B — (5 × 13 = 65 marks)

11. (a) Derive the relationship between E, G and Poisson's ratio. Obtain E = 9KG(3K+G) from the above derived relation.

Or

(b) Derive a relation for change in length of a bar with uniformly varying diameter, subjected to an axial tensile load P?

12. (a) Calculate the S.F and B.M for the overhanging beam carrying UDL of 2kN/m over the entire length and a point load of 2kN at free end shown in figure. 12 (a)

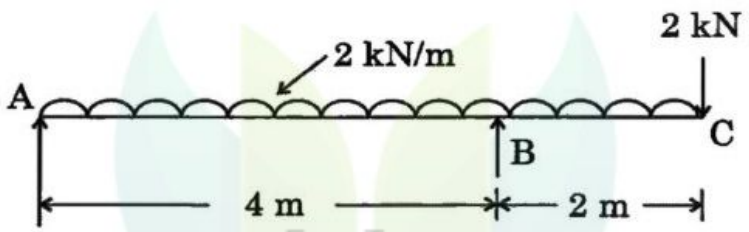

Fig 12(a)

Or

(b) Draw the shear force and bending moment diagram for the simply supported beam carrying UDL over the entire length of the beam.

13. (a) A hollow circular shaft 20 mm thick transmits 300 kW power at 200 r.p.m. Determine the external diameter of the shaft if the shear stain due to torsion is not exceed 0.00086.
Take modulus of rigidity = 0.8×10^5 N/mm².

Or

(b) A close-coiled helical spring has a stiffness of 10N/mm. Its length when fully compressed with adjacent coils touching each other is 400 mm. The modulus of rigidity of the material of the spring is 0.8×10^5 N/mm² Determine the wire diameter and mean coil diameter if the ratio is 1/10.

14. (a) Derive equation for maximum deflection of simply supported beam with an eccentric point load.

Or

(b) Obtain the expression for the crippling load of a column when one end of the is fixed and the other end is hinged.

15. (a) Obtain the change in length and volumetric strain for the effect of internal pressure on the thin cylindrical shell.

Or

(b) The tensile stress at a point across two mutually perpendicular planes are 120N/mm² and 60 N/mm² . Determine the normal, tangential and resultant stress on a plane inclined at 30° to the axis of the minor stress. Use Mohr's Circle method.

PART C — (1 × 15 = 15 marks)

16. (a) In a open coil helical spring consists of 12 coils, the stresses due to bending and twisting are 73 MPa and 92 MPa respectively. When the spring is axially loaded. Find the maximum permissible load and the diameter of wire for a maximum extension of 25 mm. Assume spring index as 9 and E-210 GPa and C = 80 GPa.

Or

(b) At a point in a strained material, the principle stresses are 100 N/mm² (tensile) and 40 N/mm² (compressive). Determine the resultant stress in magnitude and direction on a plane inclined at 60° to the axis of the major principal stress. What is the maximum intensity of shear stress in a material at the point?
