Note: Answer all questions of Part - A and answer any five questions from Part-B.

PART – A (25 Marks)

1. Define Poisson’s ratio and Bulk modulus. (2)
2. Define point of contraflexure. In what types of beams does it occur. (2)
3. What is the ratio of max. shear stress to average shear stress in a solid triangle of size bxh. (2)
4. Define the term Equivalent B.M. and Equivalent Torque. (2)
5. Explain the terms strain energy and proof resilience. (2)
6. Draw the stress-strain curve for Ductile materials and mark the salient points. (3)
7. A cantilever beam of span 3m is subjected to a point load of 2kN at end. Find SF & BM. (3)
8. Define section modulus, flexural rigidity and moment of resistance. (3)
9. A square beam of 100mm side is used to carry UDL of 1 kN/m over a span of 5m. Find the maximum stress developed in the beam. (3)
10. State the maximum slope and deflection for a simply supported beam carrying UDL throughout the span. (3)

PART – B (50 Marks)

11. A steel bolt 12mm diameter passes through a brass tube of 16mm internal diameter, 250mm long and 20mm external dia. The bolt is tightened by a nut at 15°C, so as to exert a compressive force of 20kN on the tube. Calculate the stresses in each when the temperature of the bolt and tube is raised by 100°C.

\[
E_s = 200 \text{ GPa} \quad \alpha_s = 12 \times 10^{-6} / ^\circ\text{C} \\
E_b = 100 \text{ GPa} \quad \alpha_b = 19 \times 10^{-6} / ^\circ\text{C}
\]

12. Draw SFD and BMD for the beam shown in figure.

[Figure 1]
13 A steel beam of hallow square section of 60mm outside and 50mm inner side dimensions is simply supported on a span of 4m. Find the maximum uniformly distributed load the beam can carry throughout the span, if the bending stress is not to exceed 120MPa.

14 A simply supported beam of span 6m carries 2 point loads of 10kN and 20kN at 2m and 4m from left end respectively. Find the slope at supports and deflection under point loads (EI = constant).

15 A wagon weighing 25kN is moving at a speed of 5kmph. How many springs each of 24 coils will be required in a buffer to absorb the energy?

16 A solid circular shaft is used to transmit a power of 500 HP at 300 rpm. The max. shear stress should not exceed 80 MPa and angle of twist is 2m length of the shaft should not exceed 4°. Determine its diameter.

17 The symmetric I-section shown in figure - 2 is used as a beam. In this is subjected to a shear force ‘F’, find what % of shear is resisted by web.

(Dimension in mm)