

**3RD SEM./AERO./AIRCRAFT.MAINT./AUTO./ DIP IN MECH./
MECH(MAINT.)/MECH(PROD.) / MECH(SAND.) / MECH./
MECH.(IND. INT.) / 2024(W)**

TH2 STRENGTH OF MATERIAL

Full Marks: 80

Time- 3 Hrs

Answer any five Questions including Q No.1& 2

Figures in the right hand margin indicates marks

1. Answer **All** questions 2 x10
 - a. Define stress and strain. Write down the SI units of stress and strain.
 - b. State Hooke's law.
 - c. Define point of contra-flexure.
 - d. Define cantilever beam with examples.
 - e. What is section modulus? Write down the expression for section modulus of rectangular section.
 - f. What is column? Write down with suitable example.
 - g. Define Torsion. Write down the formula Torque transmitted by a hollow circular shaft.
 - h. What is thin cylinder shell?
 - i. Write two assumptions in Theory of bending.
 - j. What is Mohr's circle?

2. Answer **Any Six** Questions 5 X 6
 - a. Show diagrammatically different types of beams and loads.
 - b. Derive the expressions for hoop stress for thin cylindrical shell.
 - c. Write down the assumption taken for finding out the torsion formula.
 - d. Find the young's modulus of a brass rod of diameter 25mm and of length 250mm which is subjected to a tensile load of 50KN when the extension of the rod is equal to 0.3mm.
 - e. The tensile stresses at a point across two mutually perpendicular planes are 120N/mm^2 and 60N/mm^2 . Determine the normal, tangential and resultant stresses on a plane inclined at 30° to the axis of the minor stress.
 - f. Find the maximum shear stress induced in a solid circular shaft of diameter 15cm when the shaft transmits 150KW power at 180 r.p.m.
 - g. Derive the relation between three elastic constants.

Answer **Any Three** Questions

3. Define buckling load. State and explain the formula for buckling load in column with various end conditions. 10
4. A steel rod 15m long is at a temperature of 15°C . Find the free expansion of the length when the temperature is raised to 65°C . Find the temperature stress produced when: 5+5
- (i) The expansion of the rod is prevented;
 - (ii) The rod is permitted to expand by 6mm.
- Take: $\alpha = 12 \times 10^{-6} \text{ per } ^{\circ}\text{C}$
 $E = 200 \text{ GN/m}^2$
5. A simply supported beam of length 6m, carries point load of 3kN and 6kN at distances of 2m and 4m from the left end. Draw the shear force and bending moment diagrams for the beam. 10
6. Prove the relation 10
- $$M/I = \sigma/y = E/R$$
- Where M= Bending moment
I= moment of inertia
 σ = Bending stress in a fibre at a distance 'y' from the neutral axis.
E= young's modulus
And R= radius of curvature
7. A cylindrical pipe of diameter 1.5m and thickness 1.5cm is subjected to an internal fluid pressure of 1.2 N/mm^2 . 5+5
- Determine
- (i) Longitudinal stress developed in the pipe, and
 - (ii) Circumferential stress developed in the pipe.