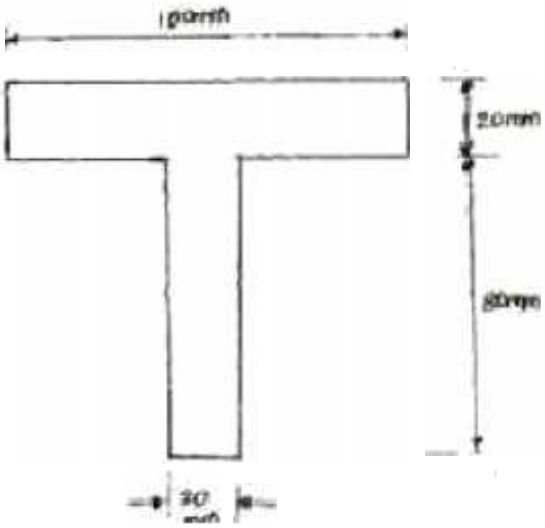

UNIT III
TORSION
PART-A (2 Marks)

1. Define torsional rigidity of the solid circular shaft.

2. Distinguish between closed coil helical spring and open coil helical spring.

3. What is meant by composite shaft?

4. What is called Twisting moment?

5. What is Polar Modulus ?

6. Define: Torsional rigidity of a shaft.

7. What do mean by strength of a shaft?

8. Write down the equation for Wahl factor.

9. Define: Torsional stiffness.

10. What are springs? Name the two important types.

11. How will you find maximum shear stress induced in the wire of a close-coiled helical spring carrying an axial load?

12. Write the expressions for stiffness of a close coiled helical spring.

13. Find the minimum diameter of shaft required to transmit a torque of 29820 Nm if the maximum shear stress is not to exceed 45 N/mm^2.

14. Find the torque which a shaft of 50 mm diameter can transmit safely, if the allowable shear stress is 75 N/mm^2.

15. Differentiate open coiled helical spring from the close coiled helical spring and state the type of stress induced in each spring due to an axial load.

16. What is spring index (C)?

17. State any two functions of springs.

18. Write the polar modulus for solid shaft and circular shaft.

19. What are the assumptions made in Torsion equation

20. Write an expression for the angle of twist for a hollow circular shaft with external diameter *D*, internal diameter *d*, length *l* and rigidity modulus *G*.

PART- B (16 Marks)

1. Determine the diameter of a solid shaft which will transmit 300 KN at 250 rpm. The maximum shear stress should not exceed 30 N/mm2 and twist should not be more than 10 in a shaft length 2m. Take modulus of rigidity = 1×10^5 N/mm^2.

2. The stiffness of the closed coil helical spring at mean diameter 20 cm is made of 3 cm diameter rod and has 16 turns. A weight of 3 KN is dropped on this spring. Find the height by which the weight should be dropped before striking the spring so that the spring may be compressed by 18 cm. Take C= $8x10^4$ N/mm^2.

3. It is required to design a closed coiled helical spring which shall deflect 1mm under an axial load of 100 N at a shear stress of 90 Mpa. The spring is to be made of round wire having shear modulus of 0.8×10^5 Mpa. The mean diameter of the coil is 10 times that of the coil wire. Find the diameter and length of the wire.

4. A steel shaft ABCD having a total length of 2400 mm is contributed by three different sections as follows. The portion AB is hollow having outside and inside diameters 80 mm and 50 mm respectively, BC is solid and 80 mm diameter. CD is also solid and 70 mm diameter. If the angle of twist is same for each section, determine the length of each portion and the total angle of twist. Maximum permissible shear stress is 50 Mpa and shear modulus 0.82×10^5 MPa

5. The stiffness of close coiled helical spring is 1.5 N/mm of compression under a maximum load of 60 N. The maximum shear stress in the wire of the spring is 125 N/mm^2. The solid length of the spring (when the coils are touching) is 50 mm. Find the diameter of coil, diameter of wire and number of coils. C = 4.5.

6. Calculate the power that can be transmitted at a 300 r.p.m. by a hollow steel shaft of 75 mm external diameter and 50 mm internal diameter when the permissible shear stress for the steel is 70 N/mm2 and the maximum torque is 1.3 times the mean. Compare the strength of this hollow shaft with that of an solid shaft. The same material, weight and length of both the shafts are the same.

7. A solid cylindrical shaft is to transmit 300 kN power at 100 rpm. If the shear stress is not to exceed 60 N/mm^2, find its diameter. What percent saving in weight would be obtained if this shaft is replaced by a hollow one whose internal diameter equals to 0.6 of the external diameter, the length, the material and maximum shear stress being the same.

8. A helical spring of circular cross-section wire 18 mm in diameter is loaded by a force of 500 N. The mean coil diameter of the spring is 125mm. The modulus of rigidity is 80 kN/mm2. Determine the maximum shear stress in the material of the spring. What number of coils must the spring have for its deflection to be 6 mm?

9. A close coiled helical spring is to have a stiffness of 1.5 N/mm of compression under a maximum load of 60 N. the maximum shearing stress produced in the wire of the spring is 125

N/mm^2 .The solid length of the spring is 50mm. Find the diameter of coil, diameter of wire and number of coils .C = 4.5 xl04N/mm^2.

10. A closely coiled helical spring of round steel wire 10 mm in diameter having 10 complete turns with a mean diameter of 12 cm is subjected to an axial load of 250 N. Determine
    I. the deflection of the spring
    II. maximum shear stress in the wire and
    III. stiffness of the spring and
    IV. frequency of vibration. Take C = 0.8 x 10^5 N/mm^2 .

UNIT IV
DEFLECTION OF BEAMS
PART-A (2 Marks)

1. State the condition for the use of Macaulay's method.
2. What is the maximum deflection in a simply supported beam subjected to uniformly distributed load over the entire span?
3. What is crippling load? Give the effective length of columns when both ends hinged and when both ends fixed.
4. Find the critical load of an Euler's column having 4 m length, 50 mm x 100 mm cross section and hinged at both the ends E = 200 kn/mm2.
5. Calculate the maximum deflection of a simply supported beam carrying a point load of 100 KN at mid span. Span = 6 m, E= 20000 kn/m2.
6. A cantilever beam of spring 2 m is carrying a point load of 20 kn at its free end. Calculate the slope at the free end. Assume EI = 12 x 10^3 KNm^2.
7. Calculate the effective length of a long column, whose actual length is 4 m when : a. Both ends are fixed b. One end fixed while the other end is free.
8. A cantilever is subjected to a point load W at the free end. What is the slope and deflection at the free end?
9. What are the methods for finding out the slope and deflection at a section?
10. Why moment area method is more useful, when compared with double integration?
11. Explain the Theorem for conjugate beam method?
12. What are the points to be worth for conjugate beam method**?**
13. What are the different modes of failures of a column?
14. Write down the Rankine formula for columns.
15. What is effective or equivalent length of column?
16. Define Slenderness Ratio.
17. Define the terms column and strut.
18. What are the advantages of Macaulay method over the double integration method, for finding the slope and deflections of beams?
19. State the limitations of Euler's formula
20. A cantilever beam of spring 4 m is carrying a point load of $2x10^3$Nat its free end. Calculate the slope at the free end. Assume EI = $2X10^5$ N/mm^2

PART-B (16 Marks)

1. A beam AB of length 8 m is simply supported at its ends and carries two point loads of 50 kN and 40 kN at a distance of 2 m and 5 m respectively from left support A. Determine, deflection under each load, maximum deflection and the position at which maximum deflection occurs. Take E = 2 x 10^5 N/mm^2 and I = 8.5 $X10^6$ mm^4 .

2. A 1.2 m long column has a circular cross section of 45 mm diameter one of the ends of the column is fixed in direction and position and other ends is free. Taking factor of safety as 3, calculate the safe load using