

1. Derive the Torsion equation.
2. a) Write the assumptions of pure torsion.
b) A hollow circular shaft 20mm thick transmits 294 kW at 200rpm. Determine the diameters of the shaft if the shear strain due to torsion is not to exceed 8.6×10^{-4} . Take Modulus of Rigidity as 80 GN/m^2
3. A solid circular shaft of diameter d has the same weight as a hollow circular shaft of mean diameter d . Assuming the same maximum shear stress in both the cases; determine the ratio of torques transmitted by the two shafts. Also compare the angles of twist per unit length in these two shafts.
4. A shaft transmits 300KW power at 120rpm. Determine the necessary diameter of solid circular shaft and the necessary diameter of hollow circular section, the inside diameter being $2/3$ of the external diameter. The allowable shear stress is 70 N/mm^2 . Taking the density of material as 77 N/m^3 , calculate the % saving in the shaft if hollow shaft is used.
5. a) A hollow shaft is to transmit 325 kW at 120 rpm. If the shear stress is not to exceed 70 N/mm^2 and the internal diameter is 0.6 of the external diameter, find the internal and external diameters by assuming the maximum torque is 1.4 times the average torque
b) A leaf spring carries a central load of 2.5 kN. It is made of 10 steel plates of 5 cm wide and 6 mm thick. If the bending stress is limited to 120 N/mm^2 , find the length of the spring and deflection at the centre of the spring. Take $E = 200 \text{ GPa}$
6. a) A Solid Circular shaft transmits 75 KW power at 200rpm. Calculate the shaft diameter, if the shaft is not to exceed 1 degree in 2 mts length of shaft, and shear stress is limited to 50 MN/m^2 . Take $G = 100 \text{ GPa}$.
b) A railway wagon weighing 40kN and moving with a speed of 8 KMPH is stopped by a buffer of 4 springs whose allowable maximum compression is 150 mm. Find out the number of turns in each spring, if the diameter of the spring wire is 14 mm and the diameter of coil is 80mm. Assume $G = 84 \text{ GPa}$
7. a) A weight of 200 N is dropped on to a helical spring made of 15 mm wire closely coiled to a mean diameter of 120 mm with 20 coils. Determine the height of drop if the instantaneous compression is 80mm. Take $G = 84 \text{ GPa}$
b) A Hollow shaft is to transmit 300 KW power at 80rpm. If the shear stress is not to exceed 60 MPa and internal diameter is 0.6 of the external diameter, find the external and internal diameter assuming that the maximum torque is 1.4 times the mean.
8. a) A Hollow shaft, having an inside diameter 0.6 of its outer diameter is to replace a solid shaft transmitting the same power at the same speed. Calculate the percentage saving in material to be used is also the same.
b) A Carriage spring is to be 600 mm long and made of 9.5mm thick steel plates and 50mm broad. How many plates are required to carry a load of 4.5 kN, without the

stress exceeding 230MPa .What would be central deflection and the initial radius of curvature ,if plates straighten under the load ?Take $E= 200\text{GPa}$

9. a) A solid shaft 6m long is securely fixed at each end . A Torque of 1250 N-m is applied to the shaft at a section 2.4m from one end .What are the fixing torque set up at the ends of the shaft ? If the diameter of the shaft is 40mm what are the maximum shear stresses in the two portions ? Calculate also the the angle of twist for the section where the torque is applied . Take $G=84\text{ GPa}$
- b) A composite spring has two close – coiled connected in series , one spring has 12coils of a mean diameter of 25 mm and wire diameter 2.5mm .Find the wire diameter of the other spring , if it has 15 coils of mean diameter 40mm .The stiffness of the composite spring is 1.5 KN/m. Determine the greatest load that can be carried by the composite spring and the corresponding extension if maximum stress is 250 MPa .Take $G= 80\text{ GPa}$.
10. a) A Closed coil helical spring is made with 12mm diameter wire and its having mean diameter of 150mm and 10 complete turns .The modulus of rigidity of the material of the material of spring is 80KN/mm^2 .When a load of 450N is applied ,find (i)Maximum Shear Stress (ii) Strain Energy stored (iii) Deflection produced (iv) Stiffness of the Spring.
- b) A Hollow circular shaft 2m long is required to transmit 1000KW power when running at a speed of 300rpm .If the outer diameter of the shaft is 150mm and inner diameter is 120mm , find the maximum shear stress and strain energy stored in the shaft.

NOTE : ASSIGNMENT II should be submitted on or before 15/05/2021 .All of you send the Assignment to my Email address girimtm@gmail.com only in A4 sheets .Mention your name and Registered number on each paper otherwise your assignment will be rejected .

STAY HOME
STAY SAFE