
Answer Any Five Question
All Question Carry Equal Mark

- 1 a. Sketch and explain Biaxial and Tri-axial stresses, Stress Tensor and Principal stresses.
- b. A rectangular bar of section 50×25 mm is subjected to a tensile load of 25 kN. Determine the values of normal and shear stresses on a plane 30° with the vertical. Also calculate the magnitude and direction of the maximum shear stress.
- c. Briefly explain design codes and standards.
- 2 a. State and explain theories of failure.
- b. Briefly explain the impact strength of a bar subjected to axial, bending and torsional loading.
- c. An infinite plate with an elliptical cutout having major axis 50 mm and minor axis of 25 mm, is subjected to tensile load F . Determine the stress concentration factor when i) the load is perpendicular to major axis ii) the load is parallel to the major axis.
- 3 a. Explain the significance of Goodman and Soderberg relations.
- b. A rough finished steel rod having $s_u = 620$ MPa, $s_y = 40$ MPa, and $s_e = 345$ MPa, is subjected to completely reversed bending moment of 400 N-m. Determine the diameter of the rod Required based on a factor of safety of 2.5.
- 4 a. Explain the stresses induced in a screw fastening subjected to static, dynamic and impact loading.
- b. A bolt subjected to initial loading of 5 kN and final tensile load of 9 kN. Determine the size of the bolt, if the allowable stress is 80 MPa and $k = 0.05$.
- 5 a. Compare the strength of a hollow shaft with that of a solid for the same diameter and material. The diameter ratio of hollow shaft is 0.75.
- b. A steel shaft (C45) transmitting 15 kW at 210 rpm is supported between two bearings 1000 mm, apart. On this, two spur gears are mounted. The gear having 80 teeth of module 6 mm is located 10 mm to the left of the right bearing and receives power from a driving gear such that the tangential force acts vertical. The pinion having 24 teeth and module 6 mm is located 20 mm to the right of the left bearing and delivers power to a gear mounted behind it. Taking combined shock and fatigue factors 1.75 in bending and 1.25 in torsion, determine the shaft diameter.
- 6 a. A rigid coupling has four bolts on a pitch circle of 125 mm diameter and is transmitting 20 kW power at 70 rpm. The bolts are made of carbon steel (C45) and has the factor of safety 3. Determine the diameter of the bolt.
- b. Design a bush pin type flexible coupling to transmit 25 kW at 500 rpm. Select suitable materials for shaft, key and bolts.
- 7 a. Design a riveted lap joint with chain riveting for a mild steel plates of 20 mm thick taking the allowable values of stress in shear, tension and compression to 60, 90 and 120 MPa respectively.
- b. A mild steel plate of 15 mm thickness is welded to another plate by two parallel welds to Carry a load of 50 kN. Determine the length of weld required:
- i) load is static
- ii) load is dynamic.
- 8 a. Explain self locking and over haul of screw jack.
- b. Design a screw jack for a capacity of 10 kN, to lift 200 mm height. Select suitable materials and factor of safety.