Roll No. | | | | | | | | | | | | |

Total No. of Pages : 02

Total No. of Questions : 09

B.Tech. (ME) (Sem.–5)

MACHINE DESIGN-I

Subject Code : ME-301

Paper ID : [A0814]

Time : 3 Hrs. Max. Marks : 60

INSTRUCTIONS TO CANDIDATES :

1. **SECTION-A is COMPULSORY consisting of TEN questions carrying TWO marks each.**
2. **SECTION-B contains FIVE questions carrying FIVE marks each and students have to attempt any FOUR questions.**
3. **SECTION-C contains THREE questions carrying TEN marks each and students have to attempt any TWO questions.**

SECTION-A

1. **Write briefly :**
   a) How do you classify machine design?
   b) What is a tolerance?
   c) What do you mean by the term "Mechanical properties of material"?
   d) What are preferred numbers?
   e) What is fatigue failure? How it happens?
   f) Write down various forces acting on sunk keys.
   g) What are the two major groups of metals? Define them?
   h) What do you mean by term factor of safety?
   i) What are the various stresses induced in shafts?
   j) What do you mean by endurance strength?

SECTION-B

2. What are the factors to be considered for the selection of materials for the design of machine elements? Discuss.

3. A bar 3 m (figure l)long is made of two bars, one of copper having E = 105 GN/m^2 and the other of steel having E = 210 GN/m^2. Each bar is 25 mm broad and 12.5 mm thick. This compound bar is stretched by a load of 50 kN. Find the increase in length of the compound bar and the stress produced in the steel and copper. The length of copper as well as of steel bar is 3 m each.

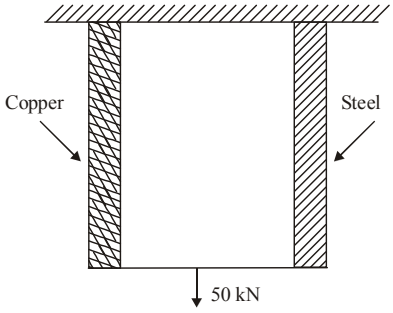

Fig.1

4. Determine the size of a piston rod subjected to a total load of having cyclic fluctuations from 15 kN in compression to 25 kN in tension. The endurance limit is 360 MPa and yield strength is 400 MPa. Take impact factor = 1.25, factor of safety = 1.5, surface finish factor = 0.88 and stress concentration factor = 2.25.

5. A solid rectangular shaft of cross-section 80 mm × 50 mm is welded by a 5 mm fillet weld on all sides to a flat plate with axis perpendicular to the plate surface. Find the maximum torque that can be applied to the shaft, if the shear stress in the weld is not to exceed 85 MPa.

6. A steel spindle transmits 4 kW at 800 r.p.m. The angular deflection should not exceed 0.25° per metre of the spindle. If the modulus of rigidity for the material of the spindle is 84 GPa, find the diameter of the spindle and the shear stress induced in the spindle.

SECTION-C

7. Find the maximum principal stress developed in a cylindrical shaft, 8 cm in diameter and subjected to a bending moment of 2.5 kNm and a twisting moment of 4.2 kNm. If the yield stress of the shaft material is 300 MPa. Determine the factor of safety of the shaft according to the maximum shearing stress theory of failure.

8. Design a bushed pin type flexible coupling used to transmit 40kW power for connecting a motor shaft running at 1000rpm to a pump shaft. The diameter of motor and pump shaft is 45mm. Assume the allowable stress in pins is 60MPa, bearing pressure on the rubber bush 0.7MPa, allowable shear stress in flange material 15MPa, allowable shear stress of 45 MPa and crushing stress 100 MPa for shaft and key materials.

9. Design completely a square flanged pipe, for pipes of internal diameter 50 mm subjected to a fluid pressure of 24 N/mm^2. The pipes used are seamless steel tubing. The flanges are of mild steel screwed on the pipes and the joint is secured by four bolts.