4E2049

B.Tech. (Sem.IV) (Main/Back) Examination, June -2013
Mechanical Engineering
Design of Machine Elements-I

[Time : 3 Hours]

[Total Marks : 80]
[Min. Passing Marks : 24]

Instructions to Candidates :
Attempt any five questions, selecting one question from each unit. All questions carry equal marks. Schematic diagrams must be shown wherever necessary. Any data you feel missing suitably be assumed and stated clearly. Units of quantities used/ calculated must be stated clearly.

Unit - I

1. (a) What are the factors to be considered for the selection of materials for the design of machine elements? Discuss each factor in short giving suitable examples. [8]
   (b) (i) How is grey cast iron designated in Indian standards? [4]
   (ii) What is shaft basis system? Explain briefly. [4]

OR

1. What are the practical considerations in order to design a casting and a forging? Support your answer with suitable sketches. [16]

Unit - II

2. (a) Write the design procedure of socket and spigal cotter joint. [8]
   (b) Define 'factor fo safety' and 'working stress'. On what factors does the factor of safety depend? [8]

OR

2. (a) Differentiate between :
   (i) Strength and stiffness
   (ii) Static and fatigue failures. [4]
   (b) Design a cottor joint for the transmission of 25 kN tensile or compressive load. Allowable stresses for all the three components i.e. socket, spigot and cotter may be taken as follows :

   $\sigma_{at} = 50 \text{ N/mm}^2$, $P_a = 80 \text{ N/mm}^2$, $\tau_a = 40 \text{ N/mm}^2$ [12]

Unit - III

3. (a) Define lever. Explain the principle of lever on which it works. Compare various sections used for levers. [8]
   (b) Design and draw a bell crank lever to raise a load of 1 tonne. The longer and shorter arms of the lever are 750 mm and 250 mm respectively. [8]

OR

3. (a) What is nipping in a leaf spring? Explain briefly. Explain the utility of U-clamp and rebound clip in a leaf spring. [6]
   (b) Design a laminated (leaf) spring for the following specifications :
   Total load = 10 tonnes
   Number of springs supporting load = 4
   Max No. of leaves in a spring = 6
   Span at the spring = 1.2 m
   Permissible deflection = 80 mm
   Clearly mention the material selected. Sketch the spring designed. [10]

Unit - IV

4. (a) Explain various types of coupling with neat sketch. [8]
   (b) Prove that a hollow shaft has greater strength and stiffness than a solid shaft of equal weight. [8]

OR

4. (a) State important design considerations and causes of failure of shafts. [4]

   (b) Design a bushed pin tape flexible coupling for transmission of 30 kW from a motor to a centrifugal pump shaft, at 1,440 rpm. The following data are given :

    Diameter of motor shaft = 36 mm

    Diameter of pump shaft = 30 mm

    Allowable bearing pressure in rubber bush = 0.5 MPa

    Allowable stress in pins = 50 MPa [12]

Unit - V

5. (a) How the transverse and torsional deflections can be calculated during the desing of shaft ? [8]

   (b) A Mone propeller shaft for a launch is to transmit 75 kW at 120 rev/min without a significant bending moment. The efficiency at the propeller is 70% at 10 knots (1 knot is 1.85 km per hr.) If L/K α 40, what should be the diameter? Follow the 'Codi' procedure. [8]

OR

5. (a) Describe the force analysis of square threads. [8]

   (b) A double threaded power screw, with ISO metric trapezoidal threads, is used to raise a load of 300 kN. The nominal diameter is 100 mm and pitch is 12 mm. The coefficient of friction at screw threads is 0.15. Neglecting collor friction. calculate

    (i) Torque required to raise the load.

    (ii) Efficiency of the screw. [8]