ANNA UNIVERSITY : CHENNAI

B.E.(Full-time) DEGREE EXAMINATIONS May 2011

Fourth Semester

Industrial Engineering

ME 9305 Design of Machine Elements

Time : 3 hours Maximum : 100 marks

Answer ALL Questions

PART – A **10 X 2 = 20 Marks**

1. Distinguish between fits and tolerances
2. Write a note on the theories of failure
3. Explain the term whirling. What is meant by critical speed?
4. Distinguish between rigid and flexible couplings Explain with a neat sketch.
5. Explain with a neat sketch the following terms
   a) Single riveted lap joint
   b) Double riveted (chain) butt joint with double straps
6. Write a note on eccentric loading of bolted joints. Explain with an example.
7. Why are concentric springs used? Explain with an example.
8. Why are fly wheels used? Explain with an example.
9. Write a note on the hydrodynamic theory of lubrication.
10. Why are rolling contact bearings selected and not manufactured Explain.

PART – B **5 X 16 = 80 Marks**

11. If a circular shaft is subjected to simple torsion, determine the design shear stress for the shaft from the data obtained from a simple tension test. The tension test gives elastic limit of material as 100 N/mm^2.

12. a) A solid shaft is supported on two bearings 1800 mm apart and rotates at 250 rpm. A 20° involute gear D, 300 mm diameter is keyed to the shaft at a distance of 150 mm to the left of the right hand bearing. Two pulleys B and C are located on the shaft at distances of 600 mm and 1350 mm respectively to the right of the left hand bearing. The diameters of the pulleys B and C are 750 mm and 600 mm respectively. 40 H.P. is supplied to the gear, out of which 25 H.P. is taken off in the pulley C and 15 H.P. from B. The drive from B is vertically downward while from C the drive is downward at an angle of 60° to horizontal. In both cases the tension ratio is 2 and the angle of lap is 100°. The combined fatigue and shock factors for torsion and bending may be taken as 1.5 and 2.0 respectively. Design a suitable shaft taking working stress to be 42 N/mm^2 in shear at 84 N/sq.mm in tension.

(OR)

b) A power of 5 kW at 12 rps is transmitted through a flange coupling Materials for bolts, shaft and key, and flange are C 60, C 40 and CI grade 30 respectively. Design the coupling.

13. a) A casting weighing 30 kN is lifted by means of an eye bolt of 30 mm nominal diameter. The bolt extends 40 mm into the casting. Determine direct tensile and shear stresses in the threaded portion of the bolt.

(OR)

b) An eccentrically loaded plate is welded to a frame as shown in Fig. Design the welded joint if the tensile stress in the plate should not exceed 100 N/mm^2 and that in weld 80 N/mm^2.

14. a) Design a spring for spring-loaded safety valve for the following conditions: Operating pressure 100 N/cm^2. Diameter of valve seat 100 mm. Design shear stress for the spring is 400 N/mm^2, $G = 0.86 \times 10^5$ N/mm^2. The spring is to be kept in a casing of 120 mm inner diameter and 400 mm long. The spring should be at maximum lift of 6 mm when the pressure is 107.5 N/cm^2.

(OR)

b) Design a set of concentric springs for an aircraft engine valve to exert a maximum force of 6000 N under a deflection of 40 mm. allowable shear stress in the springs is 850 N/mm^2.

15. a) Design a journal bearing for a centrifugal pump to the following specifications.

Diameter of the journal	=	75 mm
Speed of the journal	=	1140 rpm
Load on each journal	=	11500 N

(OR)

b) A bearing for an axial flow compressor is to carry a radial load of 2500 N and thrust of 1500 N. The service imposes light shock and the bearing will be in use of 40 hours/week for 5 years. The speed of the shaft is 1000 r.p.m. Select suitable ball bearing for the purpose and give the required tolerances on the shaft and the housing. Diameter of the shaft is 50 mm.