[03 – 3211]

III/IV B.E. DEGREE EXAMINATION.

Second Semester

Mechanical Engineering

DESIGN OF MACHINE ELEMENTS — I

(Common with Metallurgical Engineering)

(Effective from the admitted batch of 2006–2007)

Time : Three hours Maximum : 70 marks

Question No. 1 is compulsory.

Answer any FOUR question from the remaining.

All questions carry equal marks.

Answer to question No. 1 must be at one place.

Assume suitable data wherever necessary.

Data books are not allowed.

1. Write a short note on the following:
   (a) What are the pre-requisites of Good couplings?
   (b) Explain the terms Spring rate and Spring Index.
   (c) What type of threads are used in Power screws and discuss?
   (d) Clearly differentiate Strength Hardness and Toughness.
   (e) Design for Manufacturing.

7. A semi-elliptical laminated vehicle spring to carry a load of 6000 N is to consist of seven leaves 65 mm wide, two of the leaves extending the full length of the spring. The spring is to be 1.1 m in length and attached to the axle by two U-bolts 80 mm apart. The bolts hold the central portion of the spring so rigidly that they may be considered equivalent to a band having a width equal to the distance between the bolts. Assume a design stress for spring material as 350 MPa. Determine

   (a) Thickness of leaves,

   (b) Deflection of spring,

   (c) Diameter of eye,

   (d) Length of leaves, and

   (e) Radius to which leaves should be initially bent.

   Sketch the semi-elliptical leaf-spring arrangement. The standard thickness of leaves are: 5, 6, 6.5, 7, 7.5, 8, 9, 10, 11 etc. in mm.

8. Write a short note on:

   (a) Surge in Springs

   (b) Collar Friction

   (c) Stress Concentration

   (d) Overhauling of screws.

(f) On what basis steels are designated?

(g) Why reinforcement is normally required in welded Joints?

2. (a) Write a short note on theory of failures under static Load.

(b) The load on a bolt consists of an axial pull of 10 kN together with a transverse shear force of 5 kN. Find the diameter of bolt required according to any two theories of failures.

3. (a) Compare Gerber, Goodman and Soderberg Equations.

(b) A bar of circular cross-section is subjected to alternating tensile forces varying from a minimum of 200 kN to a maximum of 500 kN. It is to be manufactured of a material with an ultimate tensile strength of 900 MPa and an endurance limit of 700 MPa. Determine the diameter of bar using safety factors of 3.5 related to ultimate tensile strength and 4 related to endurance limit and a stress concentration factor of 1.65 for fatigue load. Use Goodman straight line as basis for design.

4. Sketch the stress flow lines in different types of welded joints. A solid circular shaft of 25 mm diameter acting as a cantilever of 100 mm length is welded to a support by means of a fillet weld all round. The free end vertical downward load acting on the cantilever is of 5 KN. Determine the leg dimensions of the weld if permissible shear stress is 95 N/mm^2.

5. Design a knuckle joint to transmit 150 kN. The design stresses may be taken as 75 MPa in tension, 60 MPa in shear and 150 MPa in compression.

6. Design a shaft to transmit power from an electric motor to a lathe head stock through a pulley by means of a belt drive as shown in Fig 1. The pulley weighs 200 N and is located at 300 mm from the centre of the bearing. The diameter of the pulley is 200 mm and the maximum power transmitted is 1 kW at 120 r.p.m. The angle of lap of the belt is 180° and coefficient of friction between the belt and the pulley is 0.3. The shock and fatigue factors for bending and twisting are 1.5 and 2.0 respectively. The allowable shear stress in the shaft may be taken as 35 MPa.

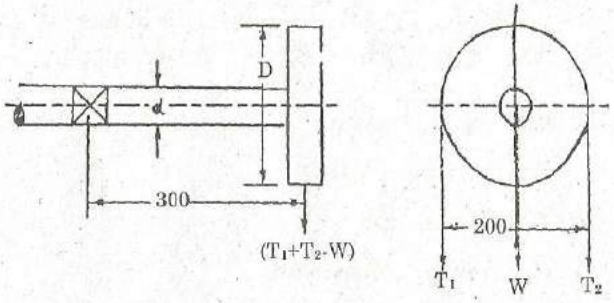

Fig. 1