B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, NOV/DEC 2011

INDUSTRIAL ENGINEERING BRANCH

FOURTH SEMESTER – (REGULATION 2008)

ME 9305 – DESIGN OF MACHINE ELEMENTS

Use of approved design data book permitted.

Time : 3 hr. Max. Mark :100

Answer ALL Questions

Part A (10 x 2 = 20 Marks)

1 Describe material properties hardness, stiffness and resilience.

2 What are the various factors considered in deciding the selection of materials for design of machine elements?

3 Differentiate between repeated stress and reversed stress.

4 What is low and high cycle fatigue?

5 Define the term self locking of power screws.

6 Differentiate with a neat sketch the fillet weld subjected to parallel loading and transverse loading.

7 What is shear stress correction factor according to the Wahl's hypothesis?

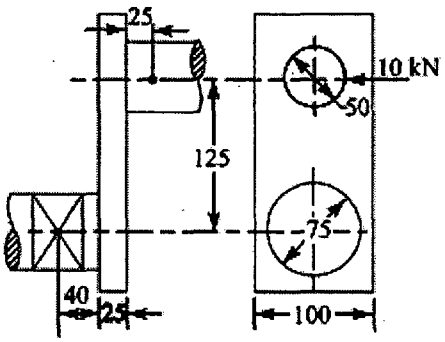
8 Explain some of the method of avoiding the tendency of a compression spring to buckle.

9 List four important physical characteristics of a good bearing material.

10 What are rolling contact bearing? State atleast their 4 advantages over sliding contact bearings.

PART B (5 x 16 = 80 Marks)

11 (i) An overhang crank as shown below, carried a tangential load of 10kN at the centre of the crankpin. Find the maximum principal stress and the maximum shear stress at the centre of the crank-shaft bearing.



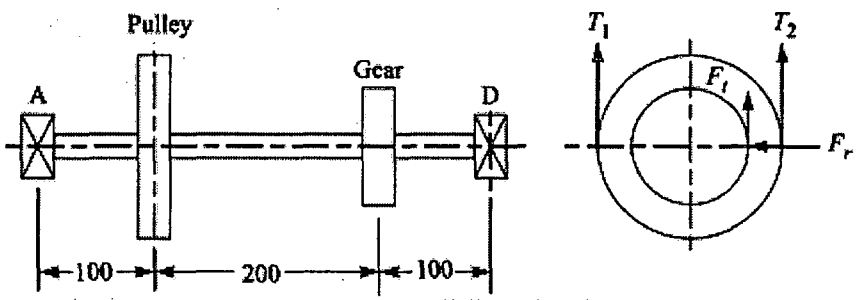
All dimensions in mm.

(8)

(ii) Find the diameter of a shaft to transmit twisting moments varying from 800N-m to 1600 N-m. The ultimate tensile strength for the material is 600 MPa and yield stress is 450 MPa. Assume the stress concentration factor=1.2, surface finish factor=0.8 and size factor = 0.85.

(8)

12a The shaft made of steel receives 7.5kW power at 1500 rpm. A pulley mounted on the shaft as shown in the figure below has ratio of belt tensions 4. The gear forces are as follows: Tangential force (F_t) = 1590 N ; Radial force (F_r) = 580 N. Design the shaft diameter by maximum shear stress theory. The shaft material has the following properties: Ultimate tensile strength = 720 MPa; Yield strength= 380 MPa and factor of safety = 1.5



All dimensions in mm.

(16)

[OR]

12b Design a compression coupling for a shaft to transmit 1300 Nm. The allowable shear stress for the shaft and key is 40 MPa and the number of bolts connecting the two halves are 4. The permissible tensile stress for the bolts materials is 70 MPa. The coefficient of friction between the muff and the shaft surface may be taken as 0.3. (16)

13a Two mild steel tie bars for a bridge structure are to be joined by a double cover butt joint. The thickness of the tie bar is 20 mm and carried a tensile load of 400 kN. Design the joint if the allowable stresses are : σ_t= 90 MPa; τ= 75 MPa and σ_c= 150 MPa. Assume the strength of rivet is double shear to be 1.75 times that of in single shear. (16)

[OR]

13b A knuckle joint is required to withstand a tensile load of 25kN. Design the joint if the permissible stresses are:. σ_t= 56 MPa; τ= 40 MPa and σ_c= 70 MPa. (16)

14a Design a helical tension spring for a spring loaded safety valve so as to meet the following requirements:

Diameter of the valve seat = 60 mm

Operating pressure (when the valve begins to lift) = 0.75 N/mm^2

Maximum pressure (when the valve blow off freely) = 0.80 mm^2

Lift of the valve during change of pressure = 4mm

Permissible shear stress = 400 MPa

Take G= 0.84 x 10^5 MPa and spring index = 6 (16)

[OR]

14b A leaf spring for a small trailer is to support a load of 10KN.The spring has 10 graduated leaves and 2 free full length leaves of spring steel of safe stress 360MPa.The overall length 1.25 m and the central band is 100 mm wide. Taking ratio of total depth to width of leaves as 3. Design the spring and also determine the deflection of the spring. Take, $E=2.1X10^5MPa$.

(16)

15a A full journal bearing of 100 mm diameter and 150mm long , supports a radial load of 6kN. The shaft rotates at 560rpm. The diametral clearance is 0.15. The room temperature is 35 degrees, and the temperature of the bearing is limited to 70 degrees centigrade. The bearing is well ventilated and so no artificial cooling is required. Suggest suitable oil to meet the requirements. (16)

[OR]

15b A connecting rod is required to be designed for a high speed, four stroke IC engine. The following data are available.

Diameter of piston = 88 mm; mass of reciprocating parts= 1.6 kg; length of connecting rod (centre to centre) = 300mm; stroke =125 mm; rpm = 2200 (when developing 50kW); possible over speed = 3000 rpm; compression ration = 6.8:1 ; probable maximum explosion pressure (assumed shortly after dead centre, say about 3°)=3.5 N/mm^2. Draw fully dimensioned drawing of the connecting rod showing the provision for the lubrication (16)