B.E / B.Tech (Full Time) DEGREE END SEMESTER EXAMINATIONS, APRIL / MAY 2011

INDUSTRIAL ENGINEERING BRANCH

FIFTH SEMESTER – (REGULATION 2004)

ME 552 – 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 What are the different types of loads that can act on machine components?

2 Give some methods of reducing stress concentration.

3 What is the main use of woodruff keys?

4 What are the purposes in machinery for which couplings are used?

5 What is buckling of springs?

6 What are the various application of springs?

7 What are the required properties of bearing materials?

8 Classify the types of bearings

9 Why is face of a pulley is crowned?

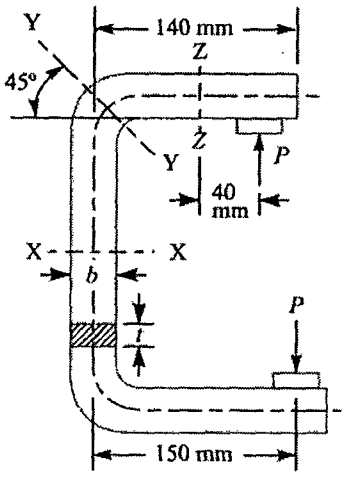
10 Explain different causes of gear tooth failure.

PART B (5 x 16 = 80 Marks)

11. A machine shaft 800 mm long transmitting 15kW at 400 rpm is supported at two bearing at the two ends. A gear wheel having 80 teeth and 500 mm pitch circle diameter is mounted at 200mm from the left hand side bearing and receives power from a pinion meshing with it. The axis of pinion and gear lie in the horizontal plane. A pulley of 300mm diameter is mounted at 200 mm from right hand side bearing

and is used for transmitting power by a belt. The belt drive is inclined at 30° to the vertical in the forward direction. The belt lap angle is 180°. The coefficient of friction between belt and pulley is 0.3. Design and sketch the arrangement of the shaft assuming the values of safe stresses in shear and tension as 55MPa and 80 MPa respectively. (16)

12a A C-clamp as shown below, carries a load P=25kN. The cross section of the clamp at X-X is rectangular having width equal to twice thickness. Assuming that the clamp is made of steel casting with an allowable stress of 100MPa, find its dimensions. Also determine the stresses at sections Y-Y and Z-Z.



(16)

[OR]

12b A hot rolled steel shaft is subjected to a torsional moment that varies from 330Nm clockwise to 110 Nm counter clockwise and an applied bending moment at a critical section varies from +440 Nm to -220 Nm. The shaft is of uniform cross section and no keyway is present at the critical section. Determine the required shaft diameter. The material has an ultimate strength of 550 MN/m^2 and a yield strength of 410MN/m^2. Take the endurance limit as half the ultimate strength, factor of safety of 2, size factor of 0.85 and surface finish factor of 0.62. (16)

13a Design a concentric spring for an air craft engine valve to exert a maximum force of 5000N under a deflection of 40 mm. Both the springs have same free length, solid length and are subjected to equal maximum shear stress of 850 MPa. The spring index for both the springs is 6. (16)

[OR]

13b A carriage spring 800 mm long is required to carry a proof load of 5000N at the centre. The spring is made of plates 80 mm wide and 7.5 mm thick. If the maximum permissible stress for the material of the plates is not to exceed 190 MPa, determine: (i) the number of plates required, (ii) the deflection of the spring and (iii) the radius to which the plates must be initially bent.
The modulus of elasticity may be taken as 205kN/mm^2. (16)

14a A rolling contact bearing is subjected to the following work cycle:
(a) Radial load of 6000N at 150 rpm for 25% of the time; (b) Radial load of 7500 N at 600 rpm for 20% of the time and (c) Radial load of 2000N at 300 rpm for 55% of the time.
The inner ring rotates and loads are steady. Select a bearing for an expected average life of 2500 hours. (16)

[OR]

14b A tentative design of journal bearing results in a diameter of 75mm and a length of 125mm for supporting a load of 20kN. The shaft runs at 1000rpm. The bearing surface temperature is not to exceed 75°C in a room temperature of 35°C. The oil used has an absolute viscosity of 0.01kg/m-s at the operating temperature. Determine the amount of artificial cooling required in watts. Assume d/c=1000. (16)

15a Design a chain drive to actuate a compressor from 15kW electric motor running at 1000rpm, the compressor speed being 350 rpm. The minimum centre distance is 500 mm. The compressor operates 16 hours per day. The chain tension may be adjusted by shifting the motor on slides.

(16)

[OR]

15b A V-belt drive consists of three V-Belts in parallel on grooved pulleys of the same size. The angle of groove is 30° and the coefficient of friction 0.12. The cross sectional area of each belt is 800 mm^2 and the permissible safe stress in the material is 3 MPa. Calculate the power that can be transmitted between two pulleys 400 mm in diameter rotating at 950 rpm.

(16)