FACULTY OF ENGINEERING

B.E. 3/4 (M/P) II – Semester (Main) Examination, May / June 2015
Subject : Machine Design

Time : 3 hours   Max. Marks : 75

Note: Answer all questions from Part-A. Answer any FIVE questions from Part-B.

PART – A (10 x 2 ½ = 25 Marks)

1 What is the effect of pre loading of tension springs?
2 What are concentric springs and where they are used? Explain.
3 Sketch the spur and bevel gears and show the forces and their analysis.
4 Sketch the worm gear and show the forces acting on the gear and write the wear load capacity of the worm drive.
5 Differentiate between static and dynamic load carrying capacities of rolling contact bearings.
6 A radial ball bearings has a basic load rating of 50 KN. If the desired rating life of the bearing is 6000 hours, what equivalent radial load can the bearing carry at 500 rev/min?
7 Discuss strength design and thermal design of piston head.
8 Give the design considerations of crank shaft.
9 Write the relationship between moment and curvature for circular section.
10 Explain the design criteria for machine frame.

PART – B (5 x 10 = 50 Marks)

11 A semi Elliptic laminated spring is made of 5 mm thick steel plate 50mm wide. The length between the supports is 665 mm and the band is 65 mm wide. The spring has two full length and five graduated leaves. A central load of 1600 N is applied. Determine.
   a) The maximum stress in each set of leaves for an initial condition of no stress in the leaves.
   b) The maximum stress if initial stress is provided to cause equal stresses when loaded.
   c) The deflection in above (a) and (b).

12 A pair of helical gears consists of a 20 teeth pinion meshing with a 100 teeth gear. The pinion rotates at 720 rpm. The normal pressure angle is 20^0, while the helix angle is 25^0. The face width is 40 mm, and the normal module is 4 mm. The pinion as well al gear is made of steel having ultimate strength of 600 MPa, and heat treated to a surface hardness of 300 BHN. Taking factor of safety as 2.5, and assuming that the velocity factor accounts for the dynamic load, calculate the power transmitting capacity of the gears.

13 Discuss the design considerations for the following :
   a) Helical and concentric springs   b) Bevel and Worm gears   c) Crank shaft

14 A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.5 N/mm^2. The speed of the journal is 1000 rpm, and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75^{0}C may be taken as 0.011 kg/m-s. The room temperature is 35^{0}C. Determine   i) the amount of artificial cooling required, and   ii) the mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 12^{0}C. Take specific heat of the oil as 1900 J/kg/^{0}C.

15 Design the connection rod for a petrol engine, from the following data :
   Diameter of the piston = 110 mm
   Mass of the reciprocating parts = 2 kg
   Length of the connecting rod = 325 mm
   Stroke length = 150 mm
   Speed = 1500 rpm, with permissible over speed of 2500 rpm
   Compression ratio = 4
   Maximum explosion pressure = 2.5 N/mm^2

16 An electric motor drives a punching machine. A flywheel fitted to the machine has a radius of gyration of 0.5m, and runs at 240 r.p.m. The machine can punch 600 holes per hour; each punching operation taking 1.5 seconds, and requiring 1500 N-m of work. Determine the power required to operate the machine and the mass of the flywheel; if the speed of the flywheel should not drop below   230 r.p.m.

17 Design a crane hook for a lifting capacity of 30 kN with 50 percent over load.

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