FACULTY OF ENGINEERING

B.E. 3/4 (Mech./Prod.) II Semester (Old) Examination, April / May 2013

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 (10x2.5 = 25 Marks)

1. What is meant by nipping of lead springs?

2. Mention the role of shot peening in improving the fatigue strength of a spring wire.

3. Distinguish between spur and helical gears.

4. What are the various types of failures in gear tooth?

5. What is meant by "self contained bearings"?

6. Give the applications and limitations of sliding contact bearings.

7. Mention the various considerations in the design of connecting rod.

8. What are the functions of a valve spring in an IC engine?

9. Briefly discuss the effect of initial curvature on the analysis of theory of bending of beams.

10. Mention the factors to be considered in the design of crane hooks.

PART – B (50 Marks)

11. A safety value of 60 mm diameter is to blow off at a pressure of 1.2 N/mm^2. It is held on its seat by a close coiled helical spring. The maximum left of the valve is 10 mm. Design a suitable compression spring of spring index 5 and providing an initial compression of 35 mm. The maximum shear stress in the material of the wire is limited to 500 MPa. The modulus of rigidity for the spring material is 80 kN/mm^2. Calculate
    (a) Diameter of the spring wire
    (b) Mean coil diameter
    (c) Number of active turns and
    (d) Pitch of the coil.

12. A truck spring has 12 number of leaves, two of which are full length leaves. The spring supports are 1.05 m apart and the central band is 85 mm wide. The central load is to be 5.4 kN with a permissible stress of 280 MPa. Determine the thickness and width of the steel spring leaves the ratio of the total depth to the width of the spring is 3. Also determine the deflection of the spring.

13. A reciprocating compressor is to be connected to an electric motor with the help of spur gears. The distance between the shafts is to be 500 mm. The speed of the electric motor is 900 rpm and the speed of the compressor shaft is desired to be 200 rpm. The torque to be transmitted is 5000 N.m. Taking starting torque as 25% more than the normal torque, determine:
    (a) Module and face width of the gears using 20° stub teeth, and
    (b) Number of teeth and pitch circle diameter of each gear. Assume suitable values of velocity factor and Lewis factor.

14. A pair of helical gears are to transmit 15 kW. The teeth are 20° stub in diametral plane and have a helix angle of 45°. The pinion runs at 10,000 rpm and has 80 mm pitch diameter. The gear has 320 mm pitch diameter. If the gears are made of cast steel having allowable static strength of 100 Mpa; determine a suitable module and face width from static strength considerations and check the gears for wear, given σ_{es} = 618 Mpa.

… 2.

15.(a) A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diametral clearance of the bearing is 0.15 mm and the absolute viscosity of the oil at the operating temperature is 0.011 Kg/m-s, find the power wasted in friction. (5)

(b) A 80 mm long bearing supports a load of 2800 N on a 50 mm diameter shaft. The bearing has a radial clearance of 0.05 mm and the viscosity of the oil is 0.021 Kg / m-s at the operating temperature. If the bearing is capable of dissipating 80 J/S, determine the max-safe speed. (5)

16. A four stroke diesel engine has the following specifications:
    Brake power = 5 kW
    Speed = 1200 rpm
    IMEP = 0.35 N/mm^2
    η_{mech} = 80%
    Determine:
    (a) bore and length of cylinder
    (b) thickness of the cylindrical head and
    (c) size of studs for the cylinder head

17. Design a crane hook with the useful load lifting capacity of the crane as 100 kW. The weight of the hook is 20 kN.

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