Code: 15A03602 **R15**

B.Tech III Year II Semester (R15) Regular Examinations May/June 2018

DESIGN OF MACHINE MEMBERS – II

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

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1 Answer the following: (10 X 02 = 20 Marks)

(a) How does the curvature of the beam affect the stress distribution across its cross-section under bending?

(b) What is the selection criterion for rope drives?

(c) State the importance of following:

(i) Spring index in coil spring.

(ii) Nipping in leaf spring.

(d) What is a self-locking screw? (OR) In what condition, a power screw will become a self-locking screw.

(e) List the important physical characteristics of a good bearing material.

(f) Explain the following terms as applied to journal bearing:

(i) Bearing modulus and

(ii) Bearing characteristic number.

(g) Write expressions for static limiting wear load, dynamic load for gear tooth of spur gear. Explain various terms used there in.

(h) Explain the following terms used in helical gears:

(i) Helix angle. (ii) Axial pitch.

(i) State the function of the following for an IC engine piston:

(i) Piston rings. (ii) Piston skirt.

(j) Explain the various types of cylinder liners.

PART – B

(Answer all five units, 5 X 10 = 50 Marks)

UNIT – I

2 The horizontal section of crane hook is symmetrical trapezium 120 mm deep, the inner width being 90 mm and outer width being 30 mm. The hook is made of plain carbon steel $45C8$ ($S_{yt} = 380\ N/mm^2$) and the factor of safety is 3.5. Determine the load carrying capacity of the hook. Also draw the crane hook and show the location at which maximum stress is acting.

OR

3 Design a flat belt drive for a fan running at 360 rpm which is driven by a 10 kW, 1440 rpm motor. The belt drive is open type and space available for centre distance is 2 m approximately.

UNIT – II

4 It is required to design a helical compression spring with plain ends, made of cold drawn plain carbon steel, for carrying a maximum pure static force of 1000 N. The ultimate tensile strength and modulus of rigidity for spring material are 1430 N/mm^2 and 85 N/mm^2 respectively. The spring rate is 48 N/mm. If the spring index is 5, determine: (i) Wire diameter. (ii) Total number of coils. (iii) Free length. (iv) Pitch. Draw a neat sketch of spring with necessary dimensions.

OR

5 A lead screw of a lathe has Acme threads of 50 mm outside diameter and 8 mm pitch. It drives the tool carriage and exerts an axial pressure of 2500 N. A collar bearing with outside diameter 110 mm, and inside diameter 55 mm is provided to take up the thrust. If the lead screw rotates at 30 rpm. Find:

(i) The power required to drive screw.

(ii) The efficiency of the power screw. Assume a coefficient of friction of 0.15 for power screw and 0.12 for the collar.

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UNIT – III

6 Select a ball bearing to carry satisfactorily a 65 kN radial load together with 10 kN of thrust load. The journal supported by the bearing rotates at 1400 rpm for an estimated 0.1 million hours of life. The journal diameter is 100 mm.

OR

7 A journal bearing, 100 mm in diameter and 150 mm long, carries a radial load of 7 kN at 1200 rpm. The diametral clearance is 0.075 mm. Find the viscosity of the oil being used at the operating temp, if 1.2 kW power is wasted in friction.

UNIT – IV

8 A pair of spur gears transmitted power from motor to pump impeller shaft is to be designed with as small centre distance as possible. The forged steel pinion ($S_0 = 160\ MN/m^2$) is to transmit 45 kW at 600 rpm to a cast steel gear ($S_0 = 100\ MN/m^2$) with a transmission ratio 9/2 to 1, and 20° full depth involute teeth are to be used. Determine the necessary face width and module.

OR

9 A pair of helical gears with a 23° helix angle is to transmit 2.5 kW at 100000 rpm of the pinion. The velocity ratio of 4:1. Both the gears are made of hardened steel with an allowable stress ($S_0 = 100\ MN/m^2$) for each gear. The gears are 20° stub and the pinion is to have 24 teeth. Determine the minimum-diameter gear that may be used, and the required BHN.

UNIT – V

10 Design the cylinder and cylinder liner of a four stroke diesel engine which has the following specifications: Maximum gas pressure = 3500 kN/m^2, break power = 6.5 kW at 800 rpm, average 1 MEP = 525 kN/m^2, mechanical efficiency = 78%, allowable strength of cylinder material = 75 N/mm^2, allowable strength of cylinder liner material = 130 N/mm^2, allowable strength of bolt material = 75 N/mm^2, increase in temperature = 130℃.

OR

11 Design an over hung crank for the following data maximum load on the crank pin when the crank and the connecting rod are at right angle is 44000 N. The crank radius is 16 mm and the distance between centers of crank pin and main bearing is 24 cm. The crank pin is hydraulically pressed in the position and web is keyed to the crank shaft. Design the crank pin and the web makes a tension of 5000 N/mm^2 in shear, bearing pressure of the crank pin 700 N/mm^2.

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