Code: 13A03604 **R13**

B.Tech III Year II Semester (R13) Regular Examinations May/June 2016

DESIGN OF MACHINE MEMBERS – II

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

Use of design data books is permitted in the examination hall

Assume necessary data if required

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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) When chain drives are preferred over belt drives? Mention two applications for chain drive?

(c) How are wire ropes constructed? List some applications of rope drives.

(d) State the importance of following: (i) Spring Index in coil spring. (ii) Nipping in leaf spring.

(e) Give the applications of self-aligning ball bearings.

(f) State the hydrodynamic action in the journal bearings using neat sketches.

(g) When are nonmetallic gears preferred? Give some applications for non-metallic gears.

(h) When do you prefer helical gears than spur gears? Mention one application for each type of helical gear.

(i) I cross section is preferred for connecting rods. Justify I section requirement.

(j) Name the various types of cranks shafts and state the various stresses induced in these crank shafts.

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 V-belt drive for the following specifications: 15 kW power from an electrical motor is to be transmitted to industrial machinery. The speed ratio required is 3.5. The smaller pulley diameter is 360 mm and its rotational speed is 1400 rpm. The distance between the shafts is 1.5 m. The machinery produces mild shock to the belt drive during power transmission and working for one shift per day.

UNIT – II

4 Design a valve spring for an automobile engine when engine valve is closed, the spring produces a force of 44 N and when valve open, produces a force of 54 N. The spring must fit over the valve bush which has an outside diameter of 20 mm and must go inside a space of 35 mm. The lift of the valve is 6 mm. The spring index is 12. The allowable stress may be taken as 325 N/mm^2. Modulus of rigidity may be assumed as 80×10^3 N/mm^2.

OR

5 The following data apply to the C-clamp shown in figure:

Pitch of the single start square thread is 2 mm

The outside diameter of the thread is 12 mm.

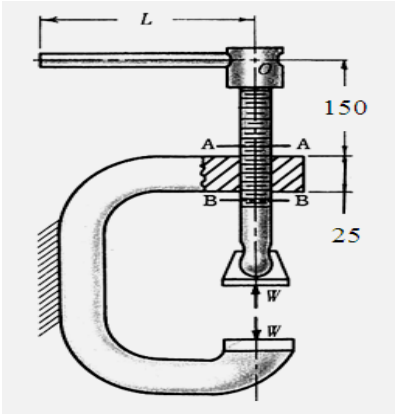
The coefficient of thread friction is 0.12

Coefficient of collar friction is 0.25.

The mean collar radius is 6.5 mm

Load acting on the clamp is 2500 N.

The operator exerts a force of 45 N at end of the handle.



Find:

(a) What is the length of handle *L?*

(b) What is the maximum shear stress in the body of the screw and where does this exist?

(c) What is the bearing pressure *p*, on the threads?

Contd. in page 2

UNIT – III

6 Specify suitable materials for ball bearing components and give reasons for their selection. Select a ball bearing for a drilling machine spindle rotating about 2000 rpm. It is subjected to an axial load of 1.5 kN and a radial load of 3 kN. It has to work for 50 hours per week for two years. Take diameter of the spindle as 45 mm. Also calculate the actual life of the selected bearing.

OR

7 A 100 MW turbine, rated at speed of 1800 rpm has two 225 mm by 450 mm bearings. The pressure on these bearing is slightly below 0.7 MN/m^2. The temperature of the bearings is 80°C and the oil temperature is 95°C when oil similar to SAE 40 is used. The clearance is 0.002 mm per mm of journal diameter. Considering the bearing to be an average industrial bearing, determine whether artificial cooling is used on this turbine bearing and if so, the approximate amount of heat per minute to be dissipated by the bearing cooling medium if the room temperature is 25°C.

UNIT – IV

8 A compressor running at 350 rpm is driven by 5 kW, 1400 rpm motor through 20° full depth spur gears. The motor pinion is to be of C30 forged steel hardened and tempered, and the driven gear is to be of cast iron grade 35. Assuming medium shock condition, design the gear drive completely. Take minimum number of teeth is 18 for the pinion. The gears are working for one shift per day in an industrial atmosphere and to work for two years before their replacement.

OR

9 A pair of helical gears in a milling machine is used to transmit 4.5 kW at 1000 rpm of the pinion and the velocity ratio is 3:1. The helix angle of the gear is 15^o and both gears are made of steel C45. The gears are 20^o FDI and the pinion is to have minimum of 20 teeth. The gear is to work 8 hrs/day for 3 years. Design the helical gears. Take the required hardness for both gears is more than 350 BHN.

UNIT – V

10 The following data is given for the piston of a four stroke diesel engine:

Cylinder bore = 250 mm
Material of piston rings = Gray cast iron
Allowable tensile stress=100N/mm^2
Allowable radial pressure on cylinder wall = 0.03 MPa
Thickness of piston head = 42 mm and No of piston rings = 4

Calculate: (i) Radial with of piston rings. (ii) Axial thickness of piston rings. (iii) Gap between the ends of piston rings before and after assembly. (iv) Width of the top land. (v) Width of the ring grooves. (vi) Thickness of the piston barrel and thickness of the barrel open end.

OR

11 A connecting rod for a high speed IC engine uses following data:

Cylinder bore = 125 mm
Length of CR = 300 mm
Maximum gas pressure = 3.5 MPa
Length of stroke = 125 mm
Mass of the reciprocating parts = 1.6 kg
Engine speed = 2200 rpm

Calculate: (i) Size of cross section of the connection rod.
(ii) Sizes of the big and small end bearings.

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