Code: 13A03604 **R13**

B.Tech III Year II Semester (R13) Supplementary Examinations December 2016

DESIGN OF MACHINE MEMBERS – II

(Mechanical Engineering)

Time: 3 hours Max. Marks: 70

PART – A

(Compulsory Question)

Use of design data book 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) Mention any four practical examples of curved beams.

(b) Mention the limitation of the belt drive.

(c) Explain the terms 'surge' in springs.

(d) What is Whal's correction factor?

(e) Why are square threads preferable to V- threads for power transmission?

(f) What are the effects of clearance on the performance of a bearing?

(g) What are the four parts of a ball bearing?

(h) List the types of gear materials.

(i) What gear tooth profiles are commonly used in real time applications?

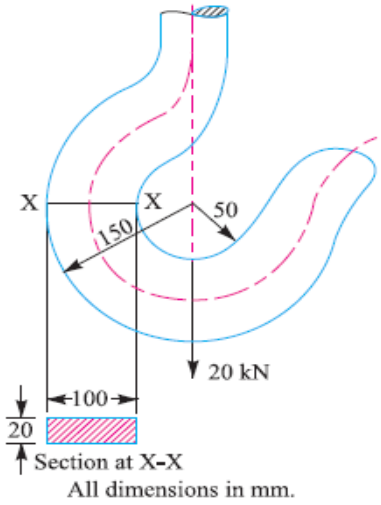
(j) What are crank shaft bearings?

PART – B

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

UNIT – I

2 The crane hook carries a load of 20 kN as shown in figure below. The section at X-X is rectangular whose horizontal side is 100 mm. Find the stresses in the inner and outer fibers at the given section.



OR

3 Design a V belt drive and calculate the actual belt tensions and average stress for the following data. Diameter of driven = 500 mm, distance between the parallel shaft is 925 mm, speed of the driver pulley is 1000 rpm, speed of the driven pulley is 300 rpm and the power to be transmitted is 7.5 kW.

Contd. in page 2

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 spring index is 5, determine: (i) Wire diameter. (ii) Total number of coils. (iii) Free length and (iv) Pitch. Draw a neat sketch of spring with necessary dimensions.

OR

5 The 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.

UNIT – III

6 A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm^2. The speed of the journal is 900 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°C may be taken as 0.011 kg/m-s. The room temperature is 35°C. Find: (i) The amount of artificial cooling required. (ii) The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C. Take specific heat of the oil as 1850 J/kg/°C.

OR

7 A shaft rotating at constant speed is subjected to variable load. The bearings supporting the shaft are subjected to stationary equivalent radial load of 3 kN for 10 per cent of time, 2 kN for 20 per cent of time, 1 kN for 30 per cent of time and no load for remaining time of cycle. If the total life expected for the bearing is 20×10^6 revolutions at 95 per cent reliability, calculate dynamic load rating of the ball bearing.

UNIT – IV

8 Design a spur gear drive to transmit a power of 8 kW at pinion speed of 746 rpm. The speed ratio is 2. The gears are made of C45 steel.

OR

9 A pair of helical gears are to transmit a power of 15 kW. The teeth are 20º stub in diametral plane and have helix angle of 45º. 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 assuming σ_{es} = 618 MPa.

UNIT – V

10 Design a I-section of a connecting rod for an I.C engine using the following data:
Piston diameter = 125 mm
Stroke = 150 mm
Length of connecting rod = 300 mm
Gas pressure = 5 N/mm^2
Speed of engine = 1200 rpm
Factor of safety = 5 and material is steel 35 NiCr60.

OR

11 Design a cast iron piston for a single acting four stroke engine for the following data:
Cylinder bore = 100 mm
Stroke = 125 mm
Maximum gas pressure = 5 N/mm^2
Indicated mean effective pressure = 0.75 N/mm
Mechanical efficiency = 80%
Fuel consumption = 0.15 kg per brake power per hour
Higher calorific value of fuel = 42×10^3 kJ/kg
Speed = 2000 rpm
Tensile stress for cast iron (σ_t) = 38 MPa. Any other data required for the design may be assumed.

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