Exam. Code: 0942
Sub. Code: 33872

2015
B.E. (Mechanical Engineering)
Sixth Semester
MEC-601: Design of Machines Elements – II

Time allowed: 3 Hours **Max. Marks: 50**

NOTE: ***Attempt five questions in all, including Question No. 1 (Part-A) which is compulsory and selecting two questions each from Part B & C. Assume any suitable data, wherever not given. Supplement your answer with suitable sketches wherever required. Use of design data book is allowed.***

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Part-A

1. (i) How does tension affect the design and performance of flat belts?
(ii) How does backlash affect the design and performance of gears?
(iii) What are the primary functions of mechanical springs?
(iv) What are the main differences between radial and thrust rolling contact bearings in terms of design and application?
(v) How does heat dissipation affect the design and performance of brakes?

(2 x 5 = 10 Marks)

Part-B

2. Suggest the suitable size of 6 × 19 hoisting steel wire rope for an inclined mine shaft of 900 m length and inclination of the rails 60° with the horizontal. The weight of the loaded skip is 100 kN. The maximum acceleration is limited to 2 m/s^2. The diameter of the drum on which the rope is being wound may be taken as 80 times the diameter of the rope. The car friction is 20 N / kN of weight normal to the incline and friction of the rope on the guide roller is 50 N / kN of weight normal to the incline. Assume a factor of safety of 5. The following properties of 6 × 19 flexible hoisting rope are given:

The diameter of the rope (d) is in mm. The weight of the rope per metre = 0.0334 d^2 N; breaking load = 500 d^2 N; wire diameter = 0.063 d mm; area of wires in rope = 0.38 d^2 mm^2; equivalent elastic modulus = 82 kN/mm^2.

(10 Marks)

3. Desing a helical gear set that is required to transmit 10 horsepower at 1440 rpm with a service factor of 1.5. The pinion has 20 teeth, a helix angle of 20 degrees, and a diametral pitch of 8.

(10 Marks)

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4. Design a leaf spring that is required to support a load of 2000 N with a safety factor of 1.8. The spring should have 6 leaves maximum, each with a width of 50 mm and a thickness of 8 mm to fulfill the space constraints.

(10 Marks)

Part-C

5. A journal bearing with a diameter of 200 mm and length 150 mm carries a load of 20 kN, when the journal speed is 150 r.p.m. The diametral clearance ratio is 0.0015. If possible, the bearing is to operate at 35°C ambient temperature without external cooling with a maximum oil temperature of 90°C. If external cooling is required, it is to be as little as possible to minimize the required oil flow rate and heat exchanger size.
(i) What type of oil do you recommend?
(ii) Will the bearing operate without external cooling?
(iii) If the bearing operates without external cooling, determine the operating oil temperature?
(iv) If the bearing operates with external cooling, determine the amount of oil in kg/min required to carry away the excess heat generated over heat dissipated, when the oil temperature rises from 85°C to 90°C, when passing through the bearing.

(10 Marks)

6. A roller bearing is designed to support a radial load of 8000 N and an axial load of 5000 N. The bearing has 20 rollers, each with a diameter of 10 mm. Determine the dynamic radial load capacity of the roller bearing and the dynamic axial load capacity of the roller bearing.

(10 Marks)

7. A flywheel of mass 100 kg and radius of gyration 350 mm is rotating at 720 r.p.m. It is brought to rest by means of a brake. The mass of the brake drum assembly is 5 kg. The brake drum is made of cast iron FG 260 having specific heat 460 J / kg°C. Assuming that the total heat generated is absorbed by the brake drum only, calculate the temperature rise.

(10 Marks)

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