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10ME62

Sixth Semester B.E. Degree Examination, Dec.2013/Jan.2014
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting at least TWO questions from each part.*
2. Use of data handbook is permitted.
3. Missing data may be suitably assumed.

PART – A

1 a. A curved link mechanism made from a round steel bar is shown in Fig.Q1(a). The material for link is plain carbon steel 30C8 with an allowable yield strength of 400 MPa. Determine the factor of safety. **(10 Marks)**

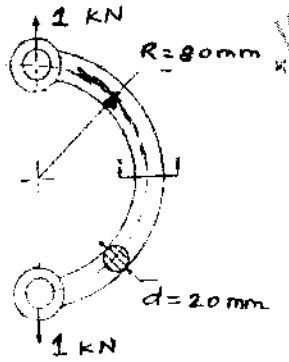

Fig.Q1(a)

b. A high pressure cylinder consists of a steel tube with inner and outer diameter of 20 mm and 40 mm respectively. It is jacketed by an outer steel tube with an outer diameter of 60 mm. The tubes are assembled by shrinking process in such a way that maximum principal stress induced in any tube is limited to 100 MPa. Calculate the shrinkage pressure and original dimensions of the tubes. Take the Young's modulus as 207 GPa. **(10 Marks)**

2 a. Write a note on construction of flat and 'V' belt. **(05 Marks)**

b. It is required to design a 'V' belt drive to connect a 7.5 kW, 1440 r/min induction motor to a fan, running at approximately 480 r/min for a service of 24 hr/day. Space is available for a centre distance of about 1 m. Determine the pitch length of the belt and number of belts required. **(15 Marks)**

3 a. Enumerate the applications of springs. Also derive an expression for the deflection of a close coiled helical spring. **(06 Marks)**

b. A spring is subjected to a load varying from 500 N and 1200 N. It is to be made of oil tempered cold drawn wire. Design factor based on Wahl's line is 1.25. The spring index is to be 6. The compression in the spring for the maximum load is 30 mm. Determine the wire diameter, mean coil diameter and free length of the spring. Take the yield stress in shear as 700 MPa and endurance stress in shear as 350 MPa for the material of the wire. **(14 Marks)**

4 a. Write a note on design of gears based on dynamic loading and wear. **(06 Marks)**

b. A cast steel 24 teeth spur pinion operating at 1150 r/min transmits 3 kW to a cast steel 56 teeth spur gear. The gears have the following specifications:

Module : 3 mm	Allowable stress : 100 MPa
Face width : 35 mm	Tooth form : 14½° full depth profile
Factor of dynamic loading, C= 350N/mm	Wear load factor, K = 0.28 MPa.

Determine the induced stress in the weaker gear. Also determine the dynamic load and wear load. Comment on the results. **(14 Marks)**

PART – B

5 a. Write a note on formative number of teeth in bevel gear. **(04 Marks)**

b. Hardened steel worm rotates at 1250 r/min and transmits power to a phosphor bronze gear with a transmission ratio of 15:1. The centre distance is to be 225 mm. Design the gear drive and give estimated power input ratings from the stand point of strength, endurance and heat dissipation. The teeth are of 14½° full depth involute. **(16 Marks)**

6 a. A cone clutch has a semi cone angle of 12°. It is to transmit 10 kW power at 750 r/min, the width of the face is one fourth of the mean diameter of friction lining. If the normal intensity of pressure between contacting surfaces is not to exceed 0.085 N/mm^2 and the coefficient of friction is 0.2, assuming uniform wear conditions, calculate the dimensions of the clutch. **(10 Marks)**

b. A band break arrangement is shown in Fig.Q6(b). It is used to generate a maximum braking torque of 200 N-m. Determine the actuating force 'P', if the coefficient of friction is 0.25. The angle of wrap of the band is 270°. Determine the maximum intensity of pressure, if the band width is 30 mm. **(10 Marks)**

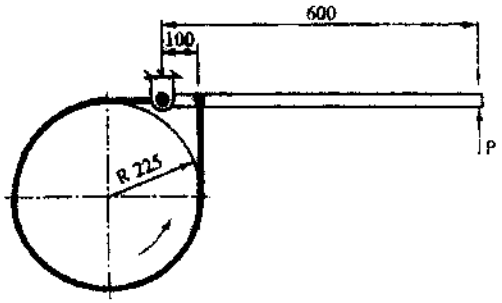

Fig.Q6(b)

7 a. Explain the following types of lubrication:
(i) Hydrodynamic lubrication (ii) Hydrostatic lubrication
(iii) Boundary lubrication (iv) Elasto hydro dynamic lubrication. **(08 Marks)**

b. The following data are given for a 360° hydro-dynamic bearing:

Bearing diameter : 50.02 mm	Journal diameter : 49.93 mm
Bearing length : 50 mm	Journal speed : 1440 r/min
Radial load = 8 kN	Viscosity of lubricant : 12 cp.

The bearing is machined on a lathe from bronze casting, while the steel journal is hardened and ground. The surface roughness values for turning and grinding are 0.8 and 0.4 microns respectively. For thick film lubrication the minimum film thickness should be five times the sum of surface roughness values for the journal and the bearing. Calculate:
(i) The permissible minimum film thickness
(ii) The actual film thickness under the operating conditions
(iii) Power loss in friction.
(iv) Flow requirement. **(12 Marks)**

8 a. Explain the considerations given in the design of pistons for IC engines. **(05 Marks)**

b. Design a trunk piston for an IC engine. The piston is made of cast iron with an allowable stress of 38.5 MPa. The bore of the cylinder is 200 mm and the maximum explosion pressure is 0.4 MPa. The permissible bending stress of the material of the gudgeon pin is 100 MPa. The bearing pressure in the gudgeon pin bearing of the connecting rod is to be taken as 200 MPa. **(15 Marks)**

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