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06ME61

Sixth Semester B.E. Degree Examination, June 2012
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: ***1. Answer FIVE full questions, selecting at least TWO from each part A and B.***
2. Use of data hand book permitted.
3. Missing data, if any, may be suitably assumed.

PART – A

1 a. Compare the stresses due to a bending moment applied on a straight beam and a curved beam. **(05 Marks)**

b. The parallel sides of a trapezoidal cross section of a crane hook of capacity 50 kN are 100 mm and 60 mm. the depth of the section being 120 mm. The radius of curvature of the inner fibre is 150 mm as shown is the Fig.Q1(b). Determine the stresses at the extreme fibres of the cross section of the crane hook. **(15 Marks)**

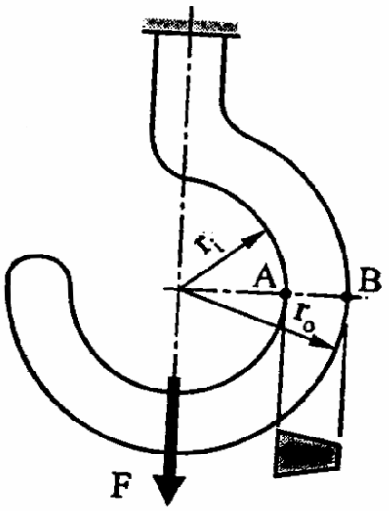

Fig.Q1(b)

2 a. In an air operated press, the piston rod of the operating cylinder must exert a force of 4000 N. The air pressure in the cylinder is 0.7 MPa. Calculate the bore of the cylinder, assuming that overall friction due to stuffing box and piston packing is equivalent to 8% of the maximum force exerted by the piston rod. Determine the thickness of the cylinder assuming that it is a seamless tubing with an allowable stress of 21 MPa. **(06 Marks)**

b. A steel hub 440 mm out side diameter, 250 mm inside diameter and 300 mm length has an interference fit with a shaft of 250 mm diameter. The torque to be transmitted is 30×10^4 N-m. The permissible stress for the material of the shaft and hub is 120 MPa. The coefficient of friction is 0.18. Determine:

i) The contact pressure
ii) Interference required
iii) The tangential stress at the inner and outer surface of the hub.
iv) Force required to assemble
v) Radial stress at the outer and inner diameter of the hub. **(14 Marks)**

3 a. Derive an expression for the stress induced is a helical spring, with usual notations. **(06 Marks)**

b. A carriage weighing 25000 N is moving on track with a linear velocity of 3.6 km/hour. If is brought to rest by two helical compression springs is the from of a bumper by under going a compression of 180 mm. The springs may be assumed to have a spring index of 6 and a permissible shear strength of 450 MPa. Design the spring and determine the diameter of the wire, mean coil diameter and the length of the spring. Assume the modulus of rigidity of the spring material as 81.4 GPa. **(14 Marks)**

4 a. Sketch and explain the different forms of involute gear tooth. **(05 Marks)**

b. A cast steel pinion with an allowable stress of 103 MPa rotating at 900 r/min is to drive a cast iron gear at 1440 r/min. The teeth are 20° stub involute and the maximum power to be transmitted is 25 kW. The allowable stress for cast iron gear is 56 MPa. Determine the module, number of teeth on the gears and face-width from the stand point of strength, dynamic load and wear. **(15 Marks)**

PART – B

5 a. Explain the advantages of worm drive. Write a note on materials used for worm and worm wheel. **(05 Marks)**

b. A speed reduced unit is to be designed for an input power of 0.75 kW with a transmission ratio of 27. The speed of the hardened worm is 1750 r/min. The worm wheel is made of phosphor bronze. The tooth form is to be $14\frac{1}{2}^{\circ}$ involute. The allowable stress for the wheel may be taken as 80 MPa. **(15 Marks)**

6 a. A multiplate clutch consists of five steel plates and four bronze plates. The inner and outer diameter of friction disks are 75 mm and 150 mm respectively. The coefficient of friction is 0.1 and the intensity of pressure is limited to 0.3 N/mm^2. Assuming uniform wear theory. Calculate:
i) The required operating force ii) Power transmitting capacity at 750 r/min. **(10 Marks)**

b. A differential band brake is shown is Fig.Q6(b). The width and thickness of the steel band are 100 mm and 3 mm respectively. The permissible tensile stress is the band is limited to 50 MPa. The coefficient of friction between the friction lining and the drum is 0.25.
Calculate:
i) Tensions is the band ii) The actuating force iii) Torque capacity of the brake. **(10 Marks)**

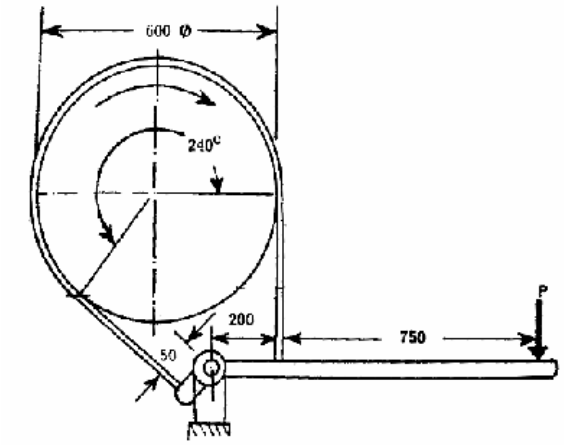

Fig.Q6(b)

7 a. Explain the properties a good bearing material should posses. List the different types of bearing materials. **(06 Marks)**

b. The following data are given for a full journal bearing:
Radial load: 25 kN
L/d ratio: 1:1
Unit bearing pressure: 2.5 MPa.
Viscosity of the lubricant: 20 Cp.
Class of fit: H7 e7.
Calculate:
i) Dimensions of the bearing
ii) Minimum oil film thickness.
iii) Requirement of oil flow.
Assume that the process to clearance is centered. **(14 Marks)**

8 a. Explain the advantages and applications of chain drives. **(05 Marks)**

b. The layout of the leather belt drive transmitting 15 kW power is shown in Fig.Q8(b). The centre distance between the pulleys is twice the diameter of the big pulley. The belt should operate at a velocity of 20 m/sec and the stresses in the belt should not exceed 2.25 MPa. The density of the leather belt is 0.95 g/cc and the coefficient of friction is 0.35. The thickness of the belt is 5 mm.
Calculate:
i) Diameter of the pulleys
ii) The length and width belts.
iii) Belt tensions.

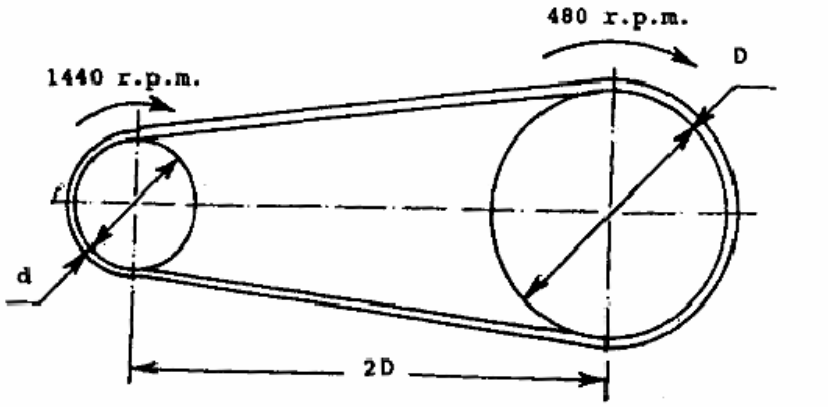

Fig.Q8(b)

(15 Marks)

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