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06ME61

Sixth Semester B.E. Degree Examination, June/July 2018
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: *1. Answer FIVE full questions, selecting atleast TWO questions from each part.*
2. Use of machine data hand book is 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)**

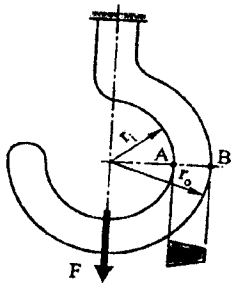

Fig.Q1(b)

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. List the advantages and disadvantages of helical gears. **(03 Marks)**

b. It is required to transmit 15 kW power from a shaft running at 1200 rpm to a parallel shaft with speed reduction of 3. The centre distance of shafts is to be 300mm. The material used for pinion in steel (σ_d = 200 MPa) and for gear is CI (σ_d = 140 MPa). Service factor is 1.25 and tooth profile is 20° full depth involute. Design the spur gear and check the design for dynamic load and wear. **(17 Marks)**

PART – B

5 a. List the advantages and disadvantages of worm gear drive. **(03 Marks)**

b. A pair of straight tooth bevel gears at right angles is to transmit 5 kW at 1500 rpm of the pinion at a speed ratio of 3. Diameter of the pinion is 75mm. The tooth form is 14½ involute. Pinion is made of steel (σ_d = 160 MPa) and gear of CI (σ_d = 80 MPa). Design the gear pair and check the design for dynamic load and wear. **(17 Marks)**

6 a. Derive power transmitting capacity of a single plate clutch for
i) Uniform pressure condition and ii) Uniform wear condition. **(10 Marks)**

b. A single block brake with a torque capacity of 250 N.m is shown Fig.Q6(b). The brake drum rotates at 100 rpm and the coefficient of friction is 0.35. Calculate:
i) The actuating force and the hinge-pin reaction. ii) the rate of heat generated during the braking action and iii) The dimensions of the block, if the intensity of pressure between the block and brake drum is 1 MPa. The length of the block is twice its width. **(10 Marks)**

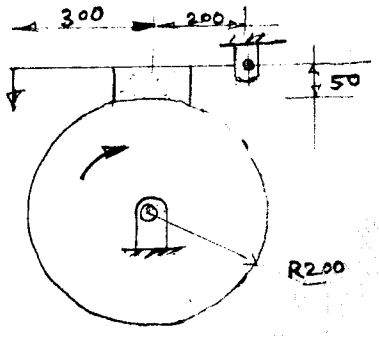

Fig.Q6(b)

7 a. Discuss the mechanism of fluid film lubrication. **(04 Marks)**

b. Design a journal bearing to withstand a load of 5886 N. speed of the journal is 1000 rpm. The journal is made of hardened steel and bearing is made of babbit. Operating temperature is 70°C and ambient temperature is 30°C. Check the design for thermal equilibrium and also determine the power loss at the bearing. The lubricant used is of grade SAE 40 .ℓ/d = 1.5. **(16 Marks)**

8 a. Select a V belt drive to transmit a power of 6 kW from a shaft rotating at 1500 rpm to a parallel shaft to be run at 375 rpm. The distance between the shaft centers is 500 mm. The pitch dia of the smaller grooved pulley car be taken to be 150 mm. The factor of application is to be taken as 1.2. **(10 Marks)**

b. Select a standard v–belt to transmit 30 kW from an AC induction motor rotating at 1500 rpm to a centrifugal pump rotating at 750 rpm. The drive operates continuously for 8 hr /day. Calculate the number of belts. **(10 Marks)**

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