USN

10ME62

Sixth Semester B.E. Degree Examination, Aug./Sept. 2020
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 hand book is permitted.***
3. ***Missing data if any may be suitably assumed.***

PART – A

1 a. The horizontal cross section of a crane hook is an isosceles triangle of 120 mm deep, the inner width being 90 mm. The hook carries a load of 50 kN. Inner radius of curvature is 100 mm. The load live passes through the centre line of curvature. Determine the stresses at the extreme fibres? **(10 Marks)**

b. A cast iron cylinder of internal diameter 500 mm and 75 mm thick is filled with a fluid of pressure 6 N/mm^2. Determine the tangential and radial stresses at the inner, middle and outer surfaces. Also sketch the tangential stress and radial stress distribution across its thickness L. **(10 Marks)**

2 a. Design a flat belt drive to transmit 25 kW from a motor shaft rotating at 1500 rpm to a compressor running at 500 rpm. The motor pulley is 96 mm effective diameter and centre distance between the shaft is 1.5 m. **(10 Marks)**

b. Select a wire rope to left a load of 10 kN through a height of 500 m from a mine. The weight of bucket is 2.5 kN. The load should attain a maximum speed of 50 m/min in 2 secs. **(10 Marks)**

3 a. A helical value spring is to be designed for an operating load range of approximately 90 to 135 N. The deflection of the spring for the load ranges is 7.5 mm. Assume a spring index of 10 and factor of safety = 2. Design the spring. **(10 Marks)**

b. A multi leaf spring with camber fitted to the chasis of an automobile over a span of 1.2 m to absorb shocks due to a maximum load of 20 kN. The spring material can sustain a maximum stress of 0.46 Pa. All the leaves of spring were to receive the same stress. The spring is required at least 2 full length leaves out of 8 leave. The leaves are assembled with both over a span of 150 mm width at the middle. Design the spring for a maximum deflection of 50 mm. **(10 Marks)**

4 a. Derive the Lewis equation for the beam strength of a gear tooth. Also list the assumptions. **(04 Marks)**

b. A pair of carefully cut spur gear with 20° full depth involute profile is used to transmit 12 kW at 1200 rpm of pinion. The gear has to rotate at 300 rpm. The material used for both pinon and gear is medium carbon steel whose allowable bending stress may be taken as 230 MPa. Determine the module and facewidth of the spur pinion and gear. Suggest suitable hardness. Take 24 teeth on pinion, modulus of elasticity may be taken as 210 GPa. **(16 Marks)**

PART – B

5 a. A pair of bevel gear transmitting 7.5 kW at 300 rpm of pinion. The pressure angle is 20°. The pitch diameter of pinion and gear at their large ends are 150 mm and 200 mm respectively. The face width of the gears is 40mm. Determine the components of the resultant gear tooth force and draw a free body diagram of forces acting on the pinion and gear. **(10 Marks)**

b. A two teeth right hand worm transmits 2 kW at 1500 rpm to a 36 teeth wheel. The module of the wheel is 5 mm and the pitch diameter of the worm is 60 mm. The normal pressure angle is 14.5° The coefficient of friction is found to be 0.06. (i) Find the centre distance, the lead and lead angle (ii) Determine the forces (iii) Determine the efficiency of the drive. **(10 Marks)**

6 a. Design a cone clutch to transmit a power of 40 kW at a rated speed of 750 rpm. Also determine
   (i) Axial force necessary to transmit torque.
   (ii) Axial force to necessary to engage the cone clutch. **(10 Marks)**

b. A single block brake with a torque capacity of 250 N-mt as shown in figure Fig. Q6 (b) below. The brake drum rotates at 100 rpm and the coefficient of friction is 0.35. Calculate
   (i) Actuating force and hinge pin reaction.
   (ii) Rate of heat generated during braking action.
   (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)**

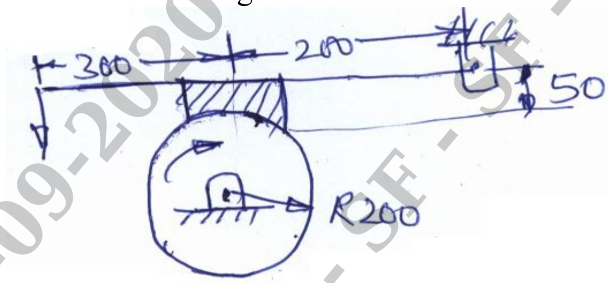

Fig. Q6 (b)

7 a. Derive Petroff's equation for a coefficient of friction of a lightly loaded journal bearing. **(05 Marks)**

b. A 75 mm diameter full journal bearing supports a radial load of 3500 N. The bearing is 75 mm long and the shaft operates at 400 rpm. Assume a permissible minimum film thickness of 0.02 mm and normal running fit for the bearing bore. Using Raimodi and Boyd curves determine
   (i) Absolute visocosity of the oil.
   (ii) Coefficient of friction.
   (iii) Heat generated.
   (iv) Amount of oil pumped through bearing.
   (v) Amount of end leakage.
   (vi) Temperature rise of the oil flowing through the bearing. **(15 Marks)**

8 Design a connecting rod for a petrol engine from the following data:
Cylinder bore or diameter of the piston = 100 mm
Length of connecting rod = 350 mm
Maximum gas pressure or explosion pressure = 3 N/mm^2.
Length of stroke = 150 mm
Engine speed = 1500 rpm
Weight of reciprocating parts = 25 N
Compression ratio = 4 : 1
Assume any further data required for design. **(20 Marks)**

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