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10ME62

Sixth Semester B.E. Degree Examination, June/July 2016
Design of Machine Elements – II

Time: 3 hrs. Max. Marks:100

Note: *1. Answer any FIVE full questions, selecting atleast TWO questions from each part.*
2. Use of Design hand book is permitted.
3. Missing data, is any may be suitably assumed.

PART – A

1 a. Determine the dimensions of the curved bar shown in Fig.Q1(a). Assume σ_{yt} = 400 MN/m^2 and FOS = 3.5. **(10 Marks)**

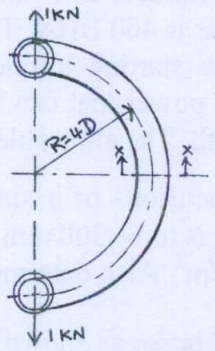

Fig.Q1(a)

b. A circular plate made of steel and of diameter 200 mm with thickness 10 mm is subjected to a load inducing a pressure of 4 MN/m^2. Taking E = 201 kN/mm^2, Poisson's ratio 0.3, determine (i) Maximum stress, its location and maximum deflection when the edges of the plate are supported. (ii) Maximum stress, its location and maximum deflection when the edges of the plate is fixed. **(10 Marks)**

2 a. A flat belt 200 mm wide weighing 20 N/m connecting a 300 mm diameter pulley to a 900 mm diameter driven pulley at a shaft spacing of 6 m, transmits 55.2 kW at a belt speed of 25 m/sec (i) Calculate the belt length and the a angles of wrap (ii) Compute the belt tensions based in a coefficient of friction 0.38. **(10 Marks)**

b. A V-belt drive is required to transmit 15 kW at 210 mm sheave running at 750 rpm to another pulley to run at 375 rpm. The belt used is 30 mm wide at top, 21 mm thick with V-angle 40°. The allowable stress for belt material is 2 MPa. Centre distance is 1.2 m. Specific weight of belt material is 1.1 gm/cc. Coefficient of friction of smaller pulley is 0.3 and for large pulley is 0.25. Find the number of bnelts of given cross-section required for this application. **(10 Marks)**

3 a. Derive an expression for the stress induced in a helical spring with usual notations. **(07 Marks)**

b. Write a note on Wahl stress correction factor. **(03 Marks)**

c. A semi-elliptical leaf spring has a span of 1.8 m. The spring carries a helical spring upon which is imposed an impact of 3 kN-m. The laminated spring has 8 graduated and 3 full length leaves each 60 mm wide and 6 mm thick. The coil spring has 9 coil of 12.5 mm wire diameter and a spring index of 7. Find the stresses induced in each spring. Take G = 80×10^3 MPa, E = 206×10^3 MPa. **(10 Marks)**

4 a. State any four advantages of gear drive over other types of drives. **(04 Marks)**

b. A pair of spur gears with 20° full depth involute teeth consists of a 20 teeth pinion meshing with a 41 teeth gear. The module is 3 mm while the face width is 40 mm. The material for the pinion as well as the gear is steel with an ultimate tensile strength of 600 MN/m^2. The gears are heat treated to a surface hardness of 400 BHN. The pinion rotates at 140 rpm and the service factor for the application is 1.75. Assume that the velocity factor accounts for the dynamic load and the factor of safety is 1.5. Determine the rated power that the gears can transmit. **(16 Marks)**

PART – B

5 a. A two teeth right hand worm transmits 2 kW at 1500 rpm to a 36 teeth wheel. The module is 5 mm and pitch diameter of worm is 60 mm. The pressure angle is 14.5°. The co-efficient of friction is found to be 0.06. Find :

i) The centre distance, lead and lead angle ii) The efficiency of the drive iii) The forces. **(10 Marks)**

b. A pair of bevel gear wheels with 20° pressure angle consists of 20 teeth pinion meshing with 30 teeth gear. The module is 4 mm while the face width is 20 mm. Surface hardness for both pinion and gear is 400 BHN. The pinion rotates at 500 rpm and receives power from an electric motor. The starting torque of the motor is 30% greater than the mean torque, Determine the safe power that can be transmitted. Considering dynamic load, wear strength and bending strength. The allowable bending stress may be taken as 240 MPa. **(10 Marks)**

6 a. Determine the dimensions of a simple cone clutch to transmit 20 kW at 1000 rpm. The minimum diameter is to be 300 mm and the cone angle 20°. Assume $\mu = 0.2$ and permissible pressure = 0.1 MN/m^2. Also determine the axial force required to engage the clutch. **(10 Marks)**

b. A differential band brake as shown in Fig.Q6(b), has an angle of contact of 225°. The band has a compressed woven lining and bears against a cast iron drum of 350 mm diameter. The brake is to sustain a torque of 350 N-m and the coefficient of friction between the band and the drum is 0.3. Find (i) the necessary force P for the clockwise and anticlockwise rotation of the drum. (ii) The value of 'OA' for the brake to be self locking when the drum rotates clockwise. **(10 Marks)**

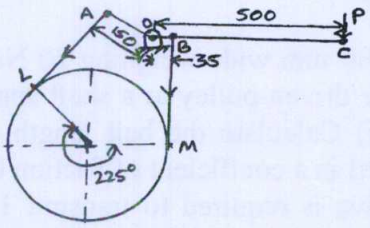

Fig.Q6(b)

7 a. Derive Petroff's equation for coefficient of friction for hydrodynamic bearing. **(08 Marks)**

b. The thrust of a propeller shaft in a ship engine is taken by a number of collars integral with the shaft which is 300 mm diameter. The thrust on the shaft is 200 kN and speed is 75 rpm. Bearing pressure is 0.3 MN/m^2. Find (i) the number of collar required if the outside diameter is 500 mm. (ii) Power lost in friction assuming uniform wear (iii) Heat generated in the bearing. **(12 Marks)**

8 Design a connecting rod for a petrol engine from the following data:

Cylinder bore or diameter of piston = 100 mm. Length of connecting rod = 350 mm

Maximum gas pressure = 3 N/mm^2 Length of stroke = 150 mm

Engine speed = 1500 rpm Weight of reciprocating parts = 25 N

Compression ratio = 4 : 1

Compression rod is made of steel and assume 'I' section. Assume any further data required for the design. **(20 Marks)**

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