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10ME62

Sixth Semester B.E. Degree Examination, Dec.2017/Jan.2018

**Design of Machine Elements – II**

Time: 3 hrs.

Max. Marks:100

- Note:** 1. Answer any FIVE full questions, selecting at least TWO questions from each part.  
 2. Use of design data hand book is permitted.  
 3. Missing data can be suitable assumed.

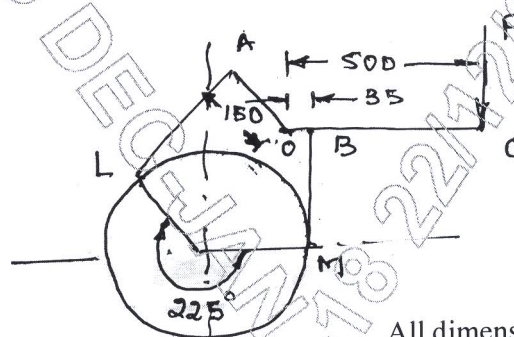
**PART – A**

- 1 a. A chain link is made up of 40 mm diameter rod is semicircle at each end. The mean diameter of which is 80 mm. The straight side of the link are also 80 mm. If the link carry a load of 90 kN, estimate the tensile and compressive stresses in the link along the section of load line. Also find the stresses at a section  $90^\circ$  away from the load line. (15 Marks)
- b. A cast steel cylinder of 300 mm internal diameter is to contain liquid at a pressure of  $12.5 \text{ N/mm}^2$ . It is closed at both ends by unstayed flat cover plates rigidly bolted to the shell flange. Determine the thickness of the cover plates if the allowable working stress for the cover material is  $75 \text{ N/mm}^2$ . (05 Marks)
- 2 a. A belt drive of two V-belt in parallel on ground pulleys of the same size. The angle of the groove is  $30^\circ$ . The cross section area of each belt is  $750 \text{ mm}^2$  and  $\mu = 0.12$ . The density of the belt material is  $1.2 \text{ g/cc}$  and the mass safe stress in the material is  $1.2 \text{ g/cc}$  and the mass of safe stress in the material is  $7 \text{ MPa}$ . Calculate the power that can be transmitted between pulleys of 300 mm diameter rotating at 1500 rpm. Find the shaft speed at which power transmitted would be a maximum. (15 Marks)
- b. Derive an expression for centrifugal tension in belt drive. (05 Marks)
- 3 a. Helical compression spring is subjected to 1960 N force, as to deflect by 50 mm. Under this load the outside diameter is not to exceed 70 mm and inside diameter not less than 20 mm. Take allowable shear stress is 430 MPa, spring index is 6. Design the spring. (12 Marks)
- b. Derive an expression of deflection in helical spring. (08 Marks)
- 4 A pair of steel helical gear is to transmit 15 kW at 5000 rpm of the pinion both the gears are made of the same material, hardened steel with allowable bending stress of 120 MPa. The gears are to be operated at a centre distance of 200 mm, speed reduction ratio is 4:1. The teeth are  $20^\circ$  FDI profile on transverse plane (diameter plane), helix angle is  $45^\circ$ . The gears are manufactured to class-3 accuracy (precision class). Face width can be taken as 16 times the normal module. The wear strength has to be more than the dynamic load. (20 Marks)

**PART – B**

- 5 a. Under what circumstances the bevel gears are used. Give a detailed classification of Bevel gears. (05 Marks)
- b. Design a worn gear reducer unit which consists of a hardened steel worn and a phosphor bronze gear having  $20^\circ$  stub involute teeth. The centre distance is to be 200 mm and the transmission ratio is 10 and the worn speed is 2000 rpm. Assuming the temperature of gear and ambient temperature as  $65^\circ$  and  $25^\circ$  respectively. (15 Marks)

- 6 a. A cone clutch has a semi-cone angle of  $12^\circ$  to transmit 10 KW at 750 rpm. The width of the face is one fourth of the mean diameter of friction lining. If the normal intensity of pressure between the contacting surface is not to exceed 0.85 bar, assuming uniform wear criterion and taking  $\mu = 0.2$ , calculate dimensions of clutch. Also find the axial force while running. (10 Marks)
- b. A differential band brake as shown in Fig.Q6(b), has an angle of contact of  $225^\circ$ . The band has a compressed woven lining and bears against a CI 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, F for the clockwise and anticlockwise rotation of the drum and (ii) The value of "OA" for the brake to be self locking, when the drum rotates clockwise.



All dimensions are in mm.

Fig.Q6(b)

(10 Marks)

- 7 a. Derive Petroff's equation for a lightly loaded bearing. (05 Marks)
- b. A bearing for an axial flow compressor is to carry a radial load of 4905 N and thrust load of 2452 N. The service imposes light shock and the bearing is used for 40 hr/week for 5 years. The speed of shaft is 300 rpm and diameter of shaft is 60 mm. Select a suitable bearing. (15 Marks)
- 8 a. The following data is given for the piston of a four-stroke diesel engine. Cylinder bore = 250 mm, maximum gas pressure = 4 MPa, bearing pressure at small end of connecting rod = 15 MPa, length of piston pin in bush of small end =  $0.45D$ , ratio of inner of outer diameter of piston pin = 0.6, mean diameter of piston boss =  $1.4 \times$  outer diameter of piston pin, allowable bending stress for piston pin =  $84 \text{ N/mm}^2$ . Calculate:  
 i) Outer diameter of the piston pin  
 ii) Inner diameter of the piston pin  
 iii) Mean diameter of the piston boss  
 iv) Check the design for bending stress. (16 Marks)
- b. List and explain the functions of parts of internal combustion engine. (04 Marks)

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