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10ME62

**Sixth Semester B.E. Degree Examination, Dec.2019/Jan.2020**  
**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 Data handbook is permitted.**  
**3. Missing data may be assumed suitably.**

**PART – A**

- 1 a. Differentiate between a straight beam and a curved beam. (04 Marks)  
 b. A small hand operated punching machine has circular cross-section of 15mm diameter and is loaded as shown in Fig.Q1(b). Taking the permissible tensile stress as 55 MPa for the material, determine the largest allowable distance 'x' from the line of action of 220 N forces to the plane containing the centre of curvature of the punch. (10 Marks)

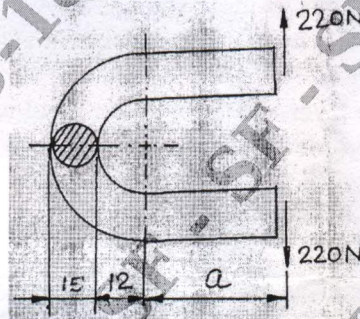


Fig.Q1(b)

All dimension are in mm  
 unless otherwise specified

- c. A flat circular plate of 350 mm diameter is supported around the edge and is subjected to a uniform pressure of 2 N/mm<sup>2</sup>. Determine the thickness of the steel cover plate required, if the allowable stress is limited to 80 N/mm<sup>2</sup>. Take Poisson's ratio as 0.3. (06 Marks)
- 2 a. List out the merits and demerits of a chain drive. (05 Marks)  
 b. Two shafts one metre apart are connected by a V-belt drive to transmit 90 kW at 1200 rpm of a driver pulley of 300mm effective diameter. The driven pulley rotates at 400 rpm. The groove angle is 38° and coefficient of friction between belt and pulley is 0.25. Area of cross-section of the belt is 400mm<sup>2</sup> and permissible stress is 2.1 MPa. Density of belt material is 1100 kg/m<sup>3</sup>. Find the number of belts required and length of each belt. (15 Marks)
- 3 a. Derive the expression for the shear stress in a coil spring  

$$\tau = \frac{8FDK}{\pi d^3}$$
 (08 Marks)  
 b. A truck spring has 12 numbers of leaves, 2 of which are of full length. The spring supports are 1.05m apart and the central b and is 85mm wide. The central load on the spring is 5400 N with a permissible stress of 280 MPa. The ratio of total depth to width of the spring is 3 and modulus of elasticity of spring material is 210 GPa. Determine  
 (i) Thickness and width of steel leaf spring  
 (ii) Maximum deflection of the spring. (12 Marks)



- 4 a. Explain formative number of teeth in helical gears. (05 Marks)
- b. Design a pair of spur gears to transmit 20 kW from a shaft rotating at 1000 rpm to a parallel shaft which is to rotate at 310 rpm. Assume number of teeth on pinion to be 31 and 20° full depth involute tooth form. The material of the pinion is C-40 steel and that of gear is Cast steel 0.20% C untreated. (15 Marks)

**PART - B**

- 5 a. Derive the expression for formative number of teeth in a bevel gear. (05 Marks)
- b. Design a worm gear drive to transmit 40 kW at 500 rpm of worm. The speed ratio is 25. Material for the gear is Phosphor Bronze and that of worm is hardened steel. Also determine the efficiency of the drive. (15 Marks)
- 6 a. A cone clutch has a semi-cone angle of 12° to transmit 10 kW at 750 rpm. The width of the face of clutch is one fourth of the mean diameter of friction lining. If the normal intensity of pressure between the contacting surface is not to exceed 0.085 N/mm<sup>2</sup>, assuming uniform wear criterion and taking coefficient of friction as 0.2, calculate the dimensions of the clutch. (10 Marks)
- b. A 360 mm radius brake drum contacts a single shoe as shown in Fig.Q6(b). The brake resists a torque of 225 N-m at 500 rpm. The coefficient of friction is 0.3. Determine
- (i) The normal reaction on the shoe.
  - (ii) The force to be applied at the lever end for counter clockwise rotation of the drum.
  - (iii) The dimension required to be modified to make the brake self-locking assuming other dimensions remain as shown in figure. (10 Marks)

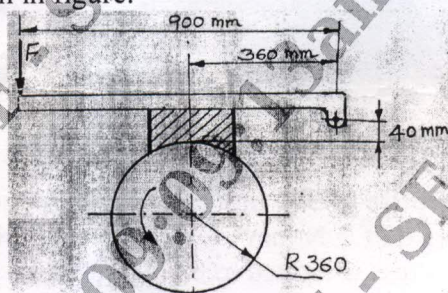


Fig.Q6(b)

- 7 a. Explain the significance of the bearing characteristic number in the design of sliding contact bearings. (05 Marks)
- b. A turbine shaft 60mm in diameter rotates at a speed of 10000 rpm. The load on each bearing is estimated at 2 kN and the length of the bearing is 80mm. Taking radial clearance as 0.05mm and SAE-20 oil for lubrication determine the coefficient of friction, power loss, minimum film thickness and the oil flow rate. The temperature of the bearing is not to exceed 50°C. (15 Marks)
- 8 Design the connecting rod of a slow speed diesel engine for following specifications :
- Length of connecting rod = 3 metres
  - Yield stress of material of C.R. = 350 N/mm<sup>2</sup>
  - Factor of safety required = 5
  - Bore of cylinder = 900 mm
  - Stroke of cylinder = 1200 mm
  - Maximum combustion pressure = 4.8 N/mm<sup>2</sup>
  - Speed of the engine = 1500 rpm. (20 Marks)

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