



10ME62

Sixth Semester B.E. Degree Examination, June/July 2023
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. Usage of design data handbook is permitted.

PART – A

- 1 a. A crane hook has a trapezoidal section of sides 90 mm and 25 mm and depth of 116 mm with the inner radius of curvature as 65 mm. Determine the maximum fibre stresses developed in the hook while lifting a load of 90 kN. (12 Marks)
b. A steel plate of 10 mm thick is used to cover a cylinder of diameter 120 mm. The deflection in the plate fixed at the circumference is to be limited to 0.06 mm. Determine the safe internal pressure that can be withstood by this plate limiting the stress to 90 MPa. (08 Marks)
- 2 a. Design a flat belt to drive a winch from an electric motor of 12 KW having a speed ratio of 3. The speed of the motor shaft is 900 rpm. Assume a service factor of 1.5. (14 Marks)
b. A 8 × 19 steel wire rope is to hoist 50 kN of load from a depth of 1000 m. Determine the number of ropes required of the maximum speed is 2.5 m/s and acceleration is 1.25 m/s², assuming the rope to be made of 25 mm diameter. Neglect the weight of the thekle. (06 Marks)
- 3 a. A helical valve spring is to be designed for an operating load between 100 N to 150 N. The valve lift is 7.5 mm in this load range. Assuming $c = 10$, design the spring assuming the allowable shear stress as 785 MPa. (10 Marks)
b. A Belleville spring is made of 3 mm steel sheet with inside and outside diameters as 50 mm and 130 mm. The spring is dished by 5 mm. The maximum stress is to be 600 MPa. Determine:
(i) Safe load that can be carried.
(ii) The deflection at this load.
(iii) The stress produced at the outer edge. (10 Marks)
- 4 a. Explain virtual or formative number of teeth with reference to Helical Gears. (06 Marks)
b. Specify the details of a spur gear to transmit 20 KW at 1200 rpm. The teeth are of 20° full depth involute system having 16 teeth on pinion and speed ratio of 3:1. Assume that the starting torque is 20% greater than the mean torque. (14 Marks)

PART – B

- 5 a. Two shafts intersect at right angles and connected by a pair of bevel gear of gear ratio 2.5 : 1. The module for 20° full depth involute teeth at outer radius is 5 mm and the number of teeth on pinion is 30. If 10 KW of power is to be transmitted at 400 rpm of pinion and face width of 67 mm. Determine :
(i) Tangential force at mean radius
(ii) Axial thrust on pinion
(iii) Axial thrust on gear (08 Marks)
b. Design a worm gear drive to transmit 2 KW of power at 1200 rpm. The speed ratio is 30 and the center distance is 160 mm. (12 Marks)

- 6 a. For a plate clutch subjected to uniform pressure, prove that the torque transmitted is $T = \frac{1}{2} f F_a D_m$ where $D_m = \frac{2}{3} \left[\frac{D_o^3 - D_i^3}{D_o^2 - D_i^2} \right]$. (10 Marks)
- b. A single block brake of drum diameter 350 mm contacts a single shoe as shown in Fig.Q6(b). The angle of contact is 90° . Coefficient of friction is 0.33. Determine the safe power that can be absorbed at 1440 rpm.

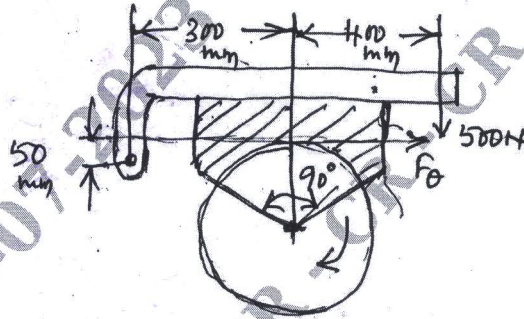


Fig.Q6(b)

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(10 Marks)

- 7 a. Derive Petroff's equation for coefficient of friction. (08 Marks)
- b. The operating condition of a journal bearing for a centrifugal pump are as follows:
 Load on the journal = 11.5 kN
 Speed of journal = 1440 rpm
 Diameter of journal = 75 mm
 Operating temperature = 70°C
 Ambient temperature = 40°C
 Design the bearing. (12 Marks)
- 8 Design an aluminium alloy piston for a single acting four-stroke petrol engine for the following data:
 Cylinder bore = 0.3 m
 Stroke = 0.375 m
 Maximum gas pressure = 8 MPa
 Speed = 50 rev/min
 Break mean effective pressure = 1.15 MPa
 Fuel consumption = 0.22 kg/KW/hr (20 Marks)
