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10AU63

Sixth Semester B.E. Degree Examination, June/July 2019
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 handbook is permitted.

PART – A

- 1 a. The horizontal cross section of a crane hook in an isosceles triangle of 120mm deep, the inner width being 90mm. The hook carries a load of 50 kN. Inner radius of curvature is 100mm. The load line passes through the centre line of curvature. Determine the stresses at the extreme fibres. (10 Marks)
- b. An offset bar is loaded as shown in Fig.Q1(b). What is the maximum offset distance 'X'. If the allowable stress in tension is limited to 50 MPa. (10 Marks)

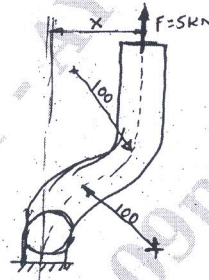


Fig.Q1(b)

- 2 a. Define hoop stress and longitudinal stress. (04 Marks)
- b. A thick cylindrical shell of internal and external diameters of 300mm and 400mm made of steel having allowable stress of 60 MPa. Find the safe internal pressure that can be carried by this cylinder if the external pressure is 3 MPa. (10 Marks)
- c. A steel plate 10mm thick is used to cover a cylinder of diameter 120mm. The deflection in the plate fixed at the circumference is to be limited to 0.06mm. Determine the safe internal pressure that can be withstood by this plate limiting the stress to 90 MPa. (06 Marks)
- 3 a. Write the types of springs. (02 Marks)
- b. A closed helical spring is to have a stiffness of 1 N/mm, maximum load of 40 N and maximum shear stress of 130 MPa. The solid length is 45mm. Find the diameter of wire and number of coils required. Take $G = 80 \text{ GPa}$. (08 Marks)
- c. A multi leaf spring with camber is fitted to the chasis of an automobile over a span of 1.2 m to absorb shocks due to maximum load of 20 kN. The spring material can sustain a maximum stress of 0.4 GPa. All the leaves of the spring were to receive the same stress. The spring is required at least 2 full length leaves out of 8 leaves. The leaves are assembled with bolts over a span of 150mm width at the middle. Design the spring for a maximum deflection of 50 mm. (10 Marks)

- 4 a. Design a single plate clutch to transmit 30 kW at 1200 rpm. The outside diameter of friction lining is 1.5 times the inside diameter. It is lined with asbestos having allowable pressure of 0.24 MPa and coefficient of friction is 0.3. (10 Marks)
- b. A band brake shown in Fig.Q4(b) uses a V-belt. The pitch diameter of the V-pulley is 400mm. Groove angle is 40° and coefficient of friction is 0.3. Determine the power rating of the brake. (10 Marks)

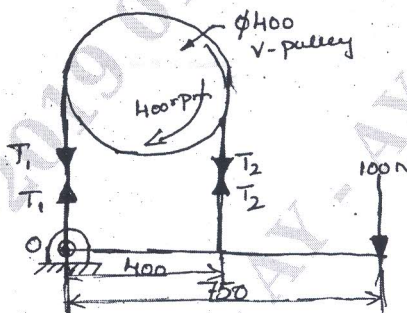


Fig.Q4(b)

PART - B

- 5 Design a pair of helical gears to transmit 33 kW of power at 1500 rpm of pinion. The pinion has 24 teeth of 20° FD system. Helix angle is 30° . Both the pinion and gear are made of CI grade 35. (20 Marks)
- 6 A pair of 20° full depth involute teeth bevel gears are to be designed to connect two shafts at right angles having velocity ratio 4 : 1. The gear is made of cast steel 0.2% untreated and the pinion material is of C30 steel, heat treated. The pinion has 20 teeth and transmits 40 kW at 720 rpm. Design the gears. (20 Marks)
- 7 a. Derive Petroff's equation for coefficient of friction. (06 Marks)
- b. A journal bearing 75mm long supports a load of 7.3 kN on a 50 mm diameter journal turning at 750 rev/min. The diametral clearance is 0.07 mm. What should be the viscosity of the oil if the operating temperature of the bearing surface is to be limited to 75°C when stir air is at 20°C ? (14 Marks)
- 8 a. Select a V-belt to transmit 10 kW of power from a pulley of 200 mm diameter mounted on an electric motor running at 720 rpm to another pulley mounted on compressor running at 200 rpm. The service is heavy duty varying from 10 hours per day and centre distance between centre of pulleys is 600 mm. (12 Marks)
- b. Derive an expression of ratio of tension in flat belt drive. (08 Marks)
