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15ME64

Sixth Semester B.E. Degree Examination, Jan./Feb.2021 Design of Machine Elements – II

Time: 3 hrs.

Max. Marks: 80

- Note:** 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. Assume missing data suitably.
3. Design DHB is permitted to refer.

Module-1

- 1 a. Determine the dimensions of I-section, as shown in Fig. Q1 (a) in which maximum fiber stresses are numerically equal in pure bending. Given $b_1 + b_0 = 120$ mm (12 Marks)

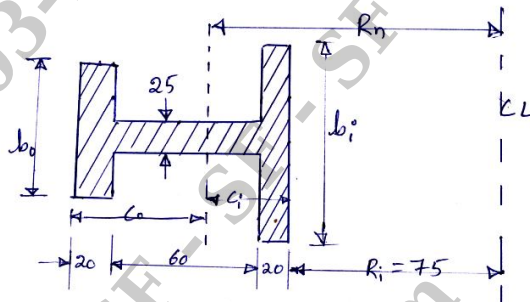


Fig. Q1 (a)

- b. A thin cylinder of diameter 600 mm and 10 mm wall thickness is subjected to internal pressure of 1.5 MPa. Find the stresses induced in the wall. (04 Marks)

OR

- 2 a. A 100 mm inside and 150 mm outside sleeve is press fitted on to a shaft of 100 mm diameter, take $E = 210$ GPa, Poissons ratio of 0.28. The contact pressure is not to exceed 60 MPa. Determine
- (i) The tangential stresses at the inner and outer surface of the sleeve and outside diameter of the shaft.
 - (ii) The radial stresses in the sleeve and shaft.
 - (iii) The original diameters of the shaft and hub before press fit. (12 Marks)
- b. Discuss the differences between straight and curved beam. (04 Marks)

Module-2

- 3 a. A leathers belt $9\text{mm} \times 250\text{mm}$ is used to drive a cast iron pulley 90 cm in diameter at 336 rpm. If the active arc of contact on the smaller pulley is 120° and the stress in the tight side is 2 MPa, find the power capacity of the belt which weighs 0.00098 kg/cm^3 , $m = 0.35$ of leather. (12 Marks)
- b. Discuss types of power transmission chaines. (04 Marks)

OR

- 4 The inlet valve of an IC engine operated by a spring exerts a force of 250 N when the valve is closed and 450 N when the valve is open. The lift is 8 mm. The material test gives the following results. $\tau_y = 600$ MPa, Endurance stress in torsion $\tau_{-1} = 450$ MPa, $G = 80$ GPa,

$$C = \frac{D}{d} = 6, \text{ F.S} = 1.5$$

(16 Marks)

Module-3

- 5 Design a pair of spur gears to transmit 24 kW at 1000 rpm to a parallel shaft to be rotated at 400 rpm. The center distance between the shaft is 175 mm. Assume $\alpha = 20^\circ$ FDI. Select cast steel for both gears ($\sigma_p = \sigma_g = 138$ MPa). (16 Marks)

OR

- 6 a. Define formative number of teeth for Bevel gears. (02 Marks)
 b. A pair of Bevel gears transmitting 7.5 kW at 300 rpm of pinion. The pressure angle is 20° . The pitch diameters of pinion and gear at their large ends are 150 mm and 200 mm respectively. The face width of the gear is 40 mm. Determine the components of the resultant gear tooth forces acting on the pinion and the gear. (14 Marks)

Module-4

- 7 Design a worm gear drive to transmit 12 kW at 1200 rpm. The speed reduction designed is 30 : 1. The worm is made of hardened steel of $\sigma_0 = 210$ MPa and gear of phosphor bronze of $\sigma_0 = 90$ MPa. The teeth are $14 \frac{1}{2}^\circ$. Check the heat capacity of the gear. (16 Marks)

OR

- 8 a. Discuss the types of clutches and their applications. (06 Marks)
 b. A simple Band brake of drum, diameter 600 mm has a band passing over it with an angle of contact 225° . While one end is connected to the fulcrum, the other end is connected to the Break lever at a distance of 400 mm from the fulcrum. The brake lever is 1 m long. The brake is to absorb a power of 15 kW at 720 rpm. Design the break lever of rectangular cross section, assuming depth to be thrice the width. Take $\sigma_b = 80$ MPa. (10 Marks)

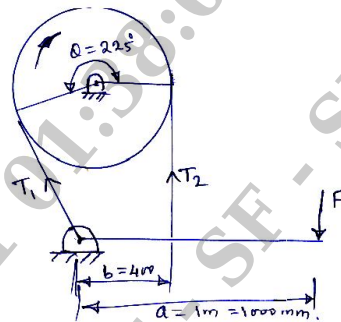


Fig. Q8 (b)

Module-5

- 9 a. A Journal bearing 75 mm 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 still air is at 20°C . (12 Marks)
 b. Explain types of roller contact bearings. (04 Marks)

OR

- 10 Select a suitable ball-bearing required to be mounted on a shaft of diameter 45 mm to withstand a radial load of 6 kN and a load of 3 kN at a rated speed of 300 rpm. The bearing works for 50 hours/week for 3 years. Assume light shocks. (16 Marks)

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