CBCS SCHEME

USN 1 AY 15 AU 002

15AU63

Sixth Semester B.E. Degree Examination, Dec.2023/Jan.2024
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. Use of design data handbook is permitted.
3. Missing data, if any, may be suitably assumed.

Module-1

1 a. List the difference between straight and custard beam. **(06 Marks)**

b. Determine the stresses induced in a circular ring of circular cross section of 25mm diameter subjected to a tensile load of 6500N. The inner diameter of the ring is 60mm. **(10 Marks)**

OR

2 a. Derive an equation of deflection of Helical spring of circular cross section wire. **(06 Marks)**

b. A loaded narrow gauge car weighs 18kN and moving at a velocity of 80m/min is brought to rest by a buffer consists of two helical springs. In bringing the car to rest the spring undergoes a compression of 200mm. the allowable shear stress is 0.3GPa and the spring index is 8. Design a suitable spring. Take G = 84GPa. **(10 Marks)**

Module-2

3 Design a pair of spur gear to transmit 18 kW at 3000 rpm of pinion. The velocity ratio required is 6:1. The design should be as compact as possible. Take α = 20° FDI, $\sigma_p = \sigma_g = 450$ MPa. $Z_1 = 20$ teeth. $c_s = 1.5$. **(16 Marks**

OR

4 a. Define formative no of teeth for helical gears. **(04 Marks)**

b. Find the suitable module for a pair of helical gears to transmit 18 kW from a pinion speed of 4000 rpm. The gear is top rotate at 800 rpm. The helix angle is not to be greater than 30°. The teeth are 20° stub involute in diametral place. Take $\sigma_g = \sigma_p = 51.7$ MPa. Assume $Z_1 = 20$. **(12 Marks)**

Module-3

5 A pair of straight bevel gears are to transmit 15 KW at 1500 rpm input speed. The number of teeth on pinion is 20 and the speed ratio is 5. Design the gears assuming 14½ full depth form. Consider material for pinion and gear as forged steel 0.3%C heat treated with allowable stress, $\sigma_{d_1} = \sigma_{d_2} = 220$ MPa and $BHN_1 = BHN_2 = 200$. **(16 Marks)**

OR

6 Design a worm gear drive to transmit 5 KW at 1200 rpm. The speed ratio is to be 25 and the centre distance 250 mm. The worm wheel is made from phosphor bronze with permissible strength of 82.4 N/mm^2 and hardness 100 BHN, while the worm is made from steel 45 with permissible stress 233.4 N/mmm^2 and 200 BHN. Load factor $K_t = 1.25$, $\alpha = 14.5°$. **(16 Marks)**

Module-4

7 a. Design a single plate clutch to transmit 12 kW at 2000 rpm. Select leather for friction lining. $\mu = 0.4$, $P = 0.2$ MPa, $\tau_s = 65.72$ MPa . Assume $D_2 = 3D_1$. **(12 Marks)**

b. Explain types of clutches. **(04 Marks)**

OR

8 a. A single block brake with drum diameter of 350 mm is shown in Fig.Q8(a) below. The angle of contact is 90°. $\mu = 0.33$. Determine the safe power that can be absorbed at 1440 rpm. **(12 Marks)**

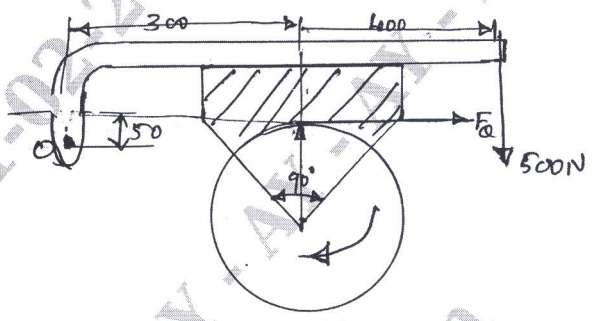

Fig.Q8(a)

b. Sketch and explain simple bond brake. **(04 Marks)**

Module-5

9 a. What is lubricant? List the types and properties of lubricant. **(06 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 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. **(10 Marks)**

OR

10 a. Derive the Petroff's equation. **(06 marks)**

b. Design a full journal bearing subjected to 6000N 1000rpm of the journal. The journal is of hardened steel and the bearing is of Babbitt metal. The bearing is operating with SAE 40 oil at 70°C and the ambient temperature is 30°C. Also determine the amount of artificial cooling required. **(10 Marks)**

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