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15AU63

# Sixth Semester B.E. Degree Examination, June/July 2019
## Design of Machine Elements - II

Time: 3 hrs. Max. Marks: 80

**Note: Answer any FIVE full questions, choosing ONE full question from each module.**

Important Note : 1. On completing your answers, compulsorily draw diagonal cross lines on the remaining blank pages.
2. Any revealing of identification, appeal to evaluator and /or equations written eg, 42+8 = 50, will be treated as malpractice.

### 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 a. Explain the law of gearing with a neat sketch. **(04 Marks)**

b. A pair of carefully cut [class – II] spur gear transmit 20kW at 230rpm of the gear. Reduction ratio is 5:1. The pinion is made of cast steel heat treated with allowable stress 197MN/m$^2$. Gear is made of cast iron with allowable stress 56MN/m$^2$. Determine module, face width and number of teeth on pinion and Gear. Also suggests suitable surface hardness for the gear pair. Pitch line velocity of pinion is not to exceed 7.5 m/sec. **(12 Marks)**

**OR**

4 Design a pair of helical gear transmit 12kW at 2400 rpm of pinion. The velocity ratio required is 4:1, Helix angle is 23°. The centre distance is to be around 300mm. Pressure angle in the normal plane is 14½° involutes. Pinion material is cast steel ASTM class B. Gear material is cast iron better grade. **(16 Marks)**

### Module-3

5 Design a pair of bevel gears to transmit 12kW at 300rpm of the gear and 1470 rpm of the pinion. The angle between the shaft axes is 90°. The pinion has 20 teeth and the material for gears is cast steel ($\sigma$ = 183.3N/mm$^2$ BHN 320). Take service factor as 1.25 and check the gears for wear and dynamic load. Suggest suitable surface hardness for the gear pair. Assume $\alpha$ = 20° full depth. **(16 Marks)**

**OR**

6 Complete the design and determine i/p capacity of worm gear speed reducer unit which consists of hardened steel worm and phosphor bronze gear having 20° stub involutes teeth. The centre distance is to be 200mm and transmission ratio is 10. Speed of worm is 200rpm. **(16 Marks)**

## Module-4

7 a. A 25 KW at 3000rpm is to be transmitted by a multiplate friction clutch. The plates have friction surface of steel and phosphor bronze alternatively and run in oil. Design the clutch for 25% overload. Take C30 steel and factor of safety is 3. Efficiency 75%. **(08 Marks)**

b. Design a cone clutch to transmit a power of 40 KW at a roted speed of 750 rpm. Also determine : i) Axial force necessary to transmit torque ii) Axial force necessary to engage the core clutch. **(08 Marks)**

**OR**

8 a. Explain block brake and band brake with neat sketch. **(04 marks)**

b. A simple band brake has a drum diameter of 500mm. A vertical passing through the centre of drum also passes through the fulcrum which is 350mm below the centre of drum. The length of brake lever is 800mm. one end of the band is attached to the brake lever at a distance of 250mm from the fulcrum end and the other end is attached to the fulcrum. Power absorbed is 30 KW at a rated speed of 1000 rpm. Selecting suitable materials and assuming an appropriate value for the factor of safely. Determine :

i) Dimensions of rectangular cross-section of the brake lever assuming that the depth is twice the width.

ii) Dimensions of the rectangular cross–section of the bond assuming that the width is ten times the depth. **(12 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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