CBCS SCHEME

USN ☐☐☐☐☐☐☐☐☐☐   **15AU63**

Sixth Semester B.E. Degree Examination, Feb./Mar. 2022
Design of Machine Elements – II

Time: 3 hrs.   Max. Marks: 80

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

Module-1

1 a. Explain and differentiate the stress in curved beams and straight beams. **(06 Marks)**
   b. Determine the combined stress of the inner and outer fiber at the centroidal section of a crane hook, which is required to lift load upto 50 kN. The hook has trapezoidal C/S with inner and outer of 90 mm and 40 mm sides respectively. The depth is 120 mm, center of curvature of the section and the load line pass through the same line. Determine FoS according to maximum shear stress theory if τ_{all} = 80 MPa. **(10 Marks)**

OR

2 a. Briefly discuss the types of springs with example. **(06 Marks)**
   b. Design a leaf spring for the following specifications:
   Total load = 140 kN, number of springs = 4, maximum number of leaves = 10, span of spring = 1000 mm, permissible deflection = 80 mm, E = 200 kN/mm^2, σ_{allow} = 600 MPa. **(10 Marks)**

Module-2

3 A bronze spur pinion rotating at 600 rpm, drives a cast iron spur gear at a transmission ratio of 4:1. The allowable static stresses for the bronze pinion and CI gear are 84 MPa and 105 MPa respectively. The pinion has 16 standard 20° full depth involute teeth of module 8 mm. The face width of both gear is 90 mm. Find the power that can be transmitted from the stand point of strength. **(16 Marks)**

OR

4 A helical cast steel gear with 30° helix angle has to transmit 35 KW at 1500 rpm. If the gear has 24 teeth, determine the necessary module, pitch diameter and face width for 20° full depth teeth. The static stress for cast steel may be taken as 56 MPa. The width of face may be taken as 3 times the normal pitch. What would be the end thrust on the gear? Tooth factor for 20° full depth involute gear may be taken as $0.154 - \dfrac{0.912}{T_E}$ where T_E – equivalent number of teeth. **(16 Marks)**

Module-3

5 a. Define formative number of teeth for Bevel gears with equation. **(04 Marks)**
   b. Discuss the strength of Bevel gear and Forces acting on a bevel gear with equations. **(12 Marks)**

OR

6   a.   Discuss the applications of worm gears.   (04 Marks)
    b.   A worm drive transmits 15 KW at 2000 rpm to a machine carriage at 75 rpm. The worm is triple threaded has 65 mm pitch dia. The worm gear has 90 teeth of 6 mm module. The tooth form is to be 20° full depth involute. The c of between the mating teeth may be taken as 0.10. Find :
        (i)   Tangential force acting on the worm
        (ii) Axial thrust and separating force on worm
        (iii) Efficiency of the worm drive   (12 Marks)

Module-4

7   A single plate clutch, effective on both sides is required to transmit, 25 KW at 3000 rpm. Determine the outer and inner diameters of frictional surface if the coefficient of friction is 0.255 ratio of diameters is 1.25 and the maximum pressure is not to exceed 0.1 N/mm^2. Also determine the axial thrust to be provided by springs. Assume uniform wear theory.
                                                                                                (16 Marks)

OR

8   A rope drum of an elevator having 650 mm diameter is fitted with a break drum of 1m diameter. The break drum is provided with four cast iron break shoes each subtending on angle of 45°. The mass of the elevator when loaded is 2000 kg and moves with a speed of 2.5 m/s. The break has a sufficient capacity to stop the elevator in 2.75 meters. Assuming the coefficient of friction between the break drum and shoes as 0.2. Find:
        (i)   Width of the shoe if the allowable pressure on the break shoe is limited to 0.3 N/mm^2
        (ii) Heat generated in stopping the elevator.   (16 Marks)

Module-5

9   Write notes on:
    a.   Types of sliding contact bearings   (04 Marks)
    b.   Assumptions in hydrodynamic lubrication   (06 Marks)
    c.   Properties of lubricants   (06 Marks)

OR

10 a.   What is Sommerfeld number and its use in lubrication, define with equation.   (04 Marks)
    b.   A 150 mm diameter shaft supporting a load of 10 kN has a speed of 1500 rpm. The shaft runs in a bearing whose length is 1.5 times the shaft diameter. If the diameteral clearance of the bearing is 0.15 mm, and the absolute viscosity of the oil at the operating temperature is 0.011 kg/m-s, find the power wasted in friction.   (12 Marks)

* * * * *