2023
B.E. (Mechanical Engineering)
Sixth Semester
MEC-601: Design of Machine Elements - II

Time allowed: 3 Hours

Max. Marks: 50

*NOTE: Attempt **five** questions in all, including Question No. I which is compulsory and selecting two questions from each Part. Use of design data book is allowed.*

x-x-x

I.   Write briefly:

a. State any two advantages of helical gears over spur gears.
b. What are rigid drives. How are they different than flexible drives.
c. What do you understand by rated life of a rolling contact bearing.
d. Explain the significance of using Wahls factor in spring design.
e. What do you understand by self locking in differential band brake .

(2x5)

PART A

II.   A pair of helical gears consists of 30 teeth pinion rotating at 4000 rpm and supplying 10kW power to a gear. The speed reduction is 4.5:1. The normal pressure angle and helix angle are 20° and 45° respectively. Both the gears are made up of hardened steel (S_{ut}= 600MPa). The service factor and factor of safety are 1.5 and 2 respectively. Assume that the velocity factor accounts for the dynamic load and the face width is 10 times the normal module, estimate the normal module if the pitch line velocity is 10m/s.   (10)

III.   a. Design a chain drive to actuate a compressor from 15 kW electric motor running at 1000 r.p.m., the compressor speed being 350 r.p.m. The minimum centre distance is 500 mm. The compressor operates 16 hours per day. The chain tension may be adjusted by shifting the motor on slides.   (8)

       b. What is meaning of 6 X 37 wire rope.   (2)

IV.   a. A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm². The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 kg/m-s. The room temperature is 35°C. Find :   (8)
       1. The amount of artificial cooling required, and 2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C. Take specific heat of the oil as 1850 J / kg / °C.

b. For a ball bearing explain (i) static load carrying capacity (ii) dynamic load (2) carrying capacity.

PART-B

V. a. What is nipping. Explain the objective of nipping of a leaf spring. (4)

b. Design a helical spring for a spring loaded safety valve for the following (6) conditions :

Operating pressure = 1 N/mm^2

Maximum pressure when the valve blows off freely = 1.075 N/mm^2

Maximum lift of the valve when the pressure is 1.075 N/mm^2 = 6 mm

Diameter of valve seat = 100 mm

Maximum shear stress = 400 MPa

Modulus of rigidity = 86 kN/mm^2

Spring index = 5.5

VII. Determine the principal dimensions of a cone clutch faced with leather to (10) transmit 30 kW at 750 r.p.m. from an electric motor to an air compressor. Sketch a sectional front view of the clutch and provide the main dimensions on the sketch. Assume : semi-angle of the cone = 12 1/2°, μ = 0.2 ; mean diameter of cone = 6 to 10 d where d is the diameter of shaft; allowable normal pressure for leather and cast iron = 0.075 to 0.1 N/mm^2; load factor = 1.75 and mean diameter to face width ratio = 6.

VIII. Design a connecting rod for an I.C engine running at 1500 r.p.m and (10) developing a maximum pressure of 3 N/mm^2. The diameter of piston is 100mm, mass of reciprocating parts per cylinder 2.25kg , length of connecting rod=380mm ,stroke of piston=190mm and compression ratio is 6:1.Take factor of safety =6, length to diameter ratio for big end bearing is 1.3 and for the small end bearing as 2 and the corresponding bearing pressure are 10MPa and 15 MPa respectively. The density of the rod material may be taken as 8000kg/m^3 and the allowable stress in bolts and cap as 50MPa and 75Ma respectively.

x-x-x