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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

First Semester, M.Tech. - Mechanical Engineering (MMDN)

Semester End Examination; April / May -2021

Tribology and Bearing Design

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Explain nature of surface and parameters used in characterizing surface roughness, laws of friction, theories of friction and different wear mechanism.

CO2: Describe the pressure development mechanism in fluid film bearings and develop Reynolds 2D equation.

CO3: Apply Reynolds equation to pad and plain bearings to estimate pressure distribution and load carrying capacity.

CO4: Apply Reynolds equation to hydrostatic bearings and evaluate load carrying capacity, frictional torque.

CO5: Develop governing differential equations for gas and porous bearings.

Note: I) *Answer any* ***FIVE*** *full questions, selecting* ***ONE*** *full question from each unit.*

II) *Any* ***THREE*** *units will have internal choice and remaining* ***TWO*** *unit questions are compulsory.*

III) *Each unit carries 20 marks.* ***IV)*** *Missing data, if any, may suitably be assumed.*

V) *Use of data handbook is permitted.*

Q. No.		UNIT - I	Marks	BL	COs	POs
1	a.	Define wear. Explain Adhesive wear and Abrasive wear.	10	L2	CO1	PO2
	b.	Explain surface analysis in brief.	10	L1	CO1	PO2
		OR				
1	d.	Explain Newton's law of viscous flow.	10	L2	CO1	PO2
	e.	Explain different regines of lubrication.	10	L2	CO1	PO2
		UNIT - II				
2	a.	Derive an expression for flow between stationary parallel plates with assumptions.	10	L2	CO2	PO2
	b.	Tanks *A* and *B* are connected by a capillary tube and the system is filled with a liquid of viscosity 2cP. The manometric pressure in tank *A* and *B* are 0.01 and 0.04 MPa. The outer diameter of tube is 0.000835 mm with wall thickness 0.0001mm. The length of capillary is 2000 mm. assuming laminar flow, determine the rate of flow through the capillary tube.	10	L3	CO2	PO3
		OR				
2	d.	Derive an expression for power loss in lightly loaded journal bearing with assumptions.	8	L2	CO2	PO2
	e.	Derive Reynolds 2D equation with assumptions.	12	L2	CO2	PO2

Contd… 2

UNIT - III

3 a.	Determine the load carrying capacity, frictional force, coefficient of friction and power loss due to friction for an ideal full journal bearing having following specifications: Dia of journal 5 cm, length of the bearing 6.5 cm, speed of journal 1200 rpm, radial clearance 0.0025 cm, average viscosity 1.6×10^{-6} reyn, attitude 0.8.	10	L3	CO3	PO3
b.	List out the steps in design of journal bearing.	10	L1	CO3	PO1

UNIT - IV

4 a.	Derive an expression for load carrying capacity of hydrostatic bearing.	12	L2	CO4	PO2
b.	Explain types of hydrostatic lubrication system.	8	L1	CO4	PO1

OR

4 d.	A hydrostatic circular thrust bearing has the following data: Shaft dia = 300 mm, pocket dia = 200 mm, shaft speed = 100 rpm, pressure at the pocket = 500 kN/m^2. Film thickness = 0.07 mm, viscosity of lubricant = 0.5 Pas. Determine; i) Load carrying capacity ii) Oil flow rate iii) Power loss due to friction	10	L3	CO4	PO3
e.	A hydrostatic step bearing has the following data: Dia of shaft = 150 mm, pocket dia = 100 mm, vertical thrust on bearing = 60×10^3 N, external pressure = atm pressure, shaft speed = 1500 rpm, viscosity of lubricant = 30 cP , desirable oil film thickness = 0.0125 cm Determine; i) Rate of flow of oil ii) Power loss due to friction iii) Coefficient of friction	10	L3	CO4	PO3

UNIT - V

5 a.	Explain with a neat sketch, the working of active magnetic bearing.	10	L2	CO5	PO2
b.	Explain porous bearing with governing differential equation.	10	L2	CO5	PO2

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