

THE KAVERY ENGINEERING COLLEGE
(An Autonomous Institution)

M.E DEGREE END SEMESTER THEORY EXAMINATIONS, APRIL-MAY 2025

First Semester

Product Design and Development

ED4080 - Tribology in Design

Tribology Handbook Permitted

Regulations - 2021

Duration : 3 Hrs

**Maximum : 100
Marks**

PART – A (ANSWER ALL QUESTIONS) (Marks 10*2=20)

Q.No	Questions	BLT	CO	Marks
1.	Distinguish between surface skewness and kurtosis.	L2	1	2
2.	State the assumptions made in Amonton's laws of friction.	L1	1	2
3.	Differentiate fatigue wear and fretting wear.	L2	2	2
4.	How the lubrication regimes are classified?	L2	2	2
5.	Distinguish half sommerfeld boundary condition and Reynolds boundary condition for a journal bearing.	L2	3	2
6.	State four lubricant supply groove geometry.	L1	3	2
7.	Differentiate hydrostatic lubrication and hydrodynamic lubrication.	L2	4	2
8.	List the suitable situations where rolling element bearings can be used.	L1	4	2
9.	How bearing vibration measurements can be done?	L2	5	2
10.	State the reason for initial deformation starts underneath of contact point.	L1	5	2

PART – B (ANSWER ALL QUESTIONS) (Marks 5*16 = 80)

Q.No	Questions	BLT	CO	Marks
11.	a Elucidate the following in detail:			
	i. Surface features and their effects in tribology.	L2	1	8
	ii. Surface topography measurement techniques.	L2	1	8
	Or			
	b Explain different friction models and measuring techniques.	L2	1	16
12.	a Discuss different wear mechanisms with respective example.	L2	2	16
	Or			
	b Derive the Reynold's equation for pressure distribution in fluid film lubrication using Navier – stokes and continuity equations	L3	2	16

13.	a	Derive the squeeze load carrying capacity of an infinitely long journal bearing.	L3	3	16
Or					
	b	A full journal bearing of width 100 cm operates with a shaft of 20 cm diameter rotating at 1200 rpm and having a diametral clearance of 200 μ m. The lubricating oil has an absolute viscosity at an inlet temperature 20° C is 40 cP. For an eccentricity ratio of 0.7. Calculate minimum film thickness, attitude angle, maximum film pressure its location and load capacity.	L3	3	16
14.	a	A hydrostatic circular step thrust bearing has outside pad diameter of 300 mm and recess diameter of 200 mm. Calculate: i. The recess pressure for a thrust load of 100 kN ii. The oil flow rate to maintain the film thickness of 120 μ m with an oil viscosity of 0.03 Pa-s iii. The film stiffness iv. The pumping loss and v. The oil temperature rise. Take mass density of oil as 880 kg / m ³ and specific heat as 1.88J/g-K.	L4	4	16
Or					
	b i	Discuss the advantages and disadvantages of using rolling element bearings and list any four materials used for manufacturing.	L3	4	8
	ii	Elaborate the various failure modes in rolling element bearings.	L3	4	8
15.	a i	Find the contact parameters for a steel ball on a flat steel plate. The normal force is 10 N, the radius of the ball is 10 mm, the Young's modulus for ball and plate is 210 GPa and the Poisson's ratio is 0.3.	L3	5	8
	ii	Brief the term elastic – plastic contact in asperity level.	L2	5	8
Or					
	b	Explain in detail about: i. Bearing performance measurements ii. Bearing vibration measurements	L2 L2	5 5	8 8