CLASS: B. TECH   SEMESTER : V
BRANCH: MECHANICAL   SESSION : MO/2023

SUBJECT: ME367 INDUSTRIAL TRIBOLOGY

TIME: 3 Hours   FULL MARKS: 50

INSTRUCTIONS:
1. The question paper contains 5 questions each of 10 marks and total 50 marks.
2. Attempt all questions.
3. The missing data, if any, may be assumed suitably.
4. Before attempting the question paper, be sure that you have got the correct question paper.
5. Tables/Data hand book/Graph paper etc. to be supplied to the candidates in the examination hall.

			CO	BL
Q.1(a)	State the role of solid mechanics, fluid mechanics, thermodynamics and materials science in tribology.	[2]	1	2
Q.1(b)	Distinguish between skewness and kurtosis.	[3]	1	4
Q.1(c)	Describe the methodology for determining surface flatness.	[5]	1	2

			CO	BL
Q.2(a)	Explain the stick-slip phenomenon that leads to friction induced instability.	[2]	2	2
Q.2(b)	A hard ball is slid against a soft and flat surface at two different loads. At one load, the coefficient of friction is 0.20 and the groove width is 0.5 mm and at another load, the coefficient of friction is 0.25 and the groove width is 1 mm. Calculate the radius of the ball and the adhesive component of the coefficient of friction. Assume that the dominant sources of friction are adhesion and plowing and that these are additive.	[3]	2	3
Q.2(c)	Account for the limitations overcome by the modified junction growth theory compared to the simple adhesion theory. Formulate the relationship for the coefficient of friction given by junction growth theory along with the conclusions.	[5]	2	3

			CO	BL
Q.3(a)	State the recommendations given by systems approach to wear reduction.	[2]	3	2
Q.3(b)	A milling cutter was used to saw through a medium carbon steel bar (H = 3 GPa) of 10 mm diameter with a width of cut of 0.5 mm. It took 10 minutes to saw and the energy expended was 50 W (Nm/s). The coefficient of friction between the saw and the steel bar is 0.3. Calculate the wear coefficient of the steel bar during the cutting process.	[3]	3	3
Q.3(c)	A bronze annulus has an outside and inside diameter 24 mm and 12 mm respectively. The flat face of the annulus is resting on a flat carbon steel plate under a normal load of 10 N and rotated about its axis at 100 rpm for 50 hours. As a result, the mass losses of the bronze and steel are 25 mg and 1 mg respectively. Calculate the wear coefficients for bronze and steel. Consider hardness and density of steel as 2.5 GPa and 7.8 Mg/m^3 respectively. The hardness and density of bronze is 0.8 GPa and 8.5 Mg/m^3 respectively.	[5]	3	4

			CO	BL
Q.4(a)	Explain acidity and alkalinity of a lubricant.	[2]	4	2
Q.4(b)	Demonstrate with a neat sketch the working of a capillary type of viscometer.	[3]	4	3
Q.4(c)	Through Petroff's formulation, show that the coefficient of friction is directly proportional to the Bearing Characteristics Number.	[5]	4	4

			CO	BL
Q.5(a)	Outline the tribological challenges in a cylinder liner along with the commonly used materials.	[5]	5	4
Q.5(b)	Identify the common tribological requirements of a piston ring. State the materials used for lubricated piston rings and surface coatings used.	[5]	5	4