BIRLA INSTITUTE OF TECHNOLOGY, MESRA, RANCHI
(END SEMESTER EXAMINATION)

CLASS: B.TECH **SEMESTER : VI**
BRANCH: MECHANICAL **SESSION : SP/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)	Explain the necessity to conceive the tribological aspects in the design stage?	[2]	1	2
Q.1(b)	Show that $R_q/R_a = 1.11$ for a simple sine wave surface profile.	[3]	1	3
Q.1(c)	Distinguish between the shape parameters that can be used to analyze / characterize a rough surface.	[5]	1	4
Q.2(a)	Recommend the use of similar or dissimilar metal pairs for the system design involving a tribo-pair citing appropriate reasons.	[2]	2	5
Q.2(b)	A hard metal ball of 10 mm diameter slid across a soft metal surface, produces a groove of 2 mm width. For a measured coefficient of friction of 0.4, calculate the adhesive contribution to the coefficient of friction.	[3]	2	3
Q.2(c)	Formulate the mathematical relation between the coefficient of friction and the ratio of shear strength of soft material to that of the interface in modified adhesion theory (Junction Growth).	[5]	2	6
Q.3(a)	Analyze if a tribological pair brought up to the hardness and surface finish of the order of a slip gauge, would help in reducing friction and wear?	[2]	3	4
Q.3(b)	A cubic pin with a linear dimension of 1 mm and with hardness H of 0.2 GPa slides upon a surface at a constant velocity V of 0.1 m/s and apparent pressure P_a of 0.001 GPa. The wear coefficient k is = 4×10^{-6}. The failure occurs when the fraction of the volume of 0.1% is worn. Calculate sliding time until failure.	[3]	3	3
Q.3(c)	A cylindrical bronze pin of 1 mm radius rests on a rotating steel disk at a mean radius of 25 mm. The normal load on the pin is 10 N. The rotational speed of the disk is 300 rpm and the test lasts for 10 hours. The mass losses of the pin and disk are 50 mg and 3 mg, respectively. Using the material data given below, calculate the wear coefficients and wear depths for the bronze pin and steel disk. (Hardness of bronze = 0.8 GPa, density of bronze = 8.5 Mg/m^3; hardness of steel = 2.5 GPa, density of steel = 7.8 Mg/m^3). Calculate the wear coefficients for a cylindrical steel pin on a bronze disk under the same test conditions.	[5]	3	3
Q.4(a)	Explain the significance of pour point of a lubricant?	[2]	4	2
Q.4(b)	Demonstrate the principle of a rotating cylinder viscometer with a neat sketch.	[3]	4	3
Q.4(c)	Formulate the relationship between coefficient of friction, bearing characteristics number and radial clearance in a journal bearing. Also state the importance of the relation thereof with respect to variation of coefficient of friction with bearing characteristics number.	[5]	4	6
Q.5(a)	Outline the causes of failure in a cutting tool with respect to tribological aspects. Give suitable examples of tool materials used in different metal cutting processes.	[5]	5	4
Q.5(b)	Demonstrate the role of tribology in metal forming process citing suitable examples of coatings/surface treatments to prevent wear.	[5]	5	3

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