

**BACHELOR OF ENGINEERING IN PRODUCTION**  
**ENGINEERING EXAMINATION, 2017**

( 4th Year, 2nd Semester, Old )

**TRIBOLOGY**

Time : Three hours

Full Marks : 100

Answer *any five* questions :

1. a) Derive the co-efficient of ploughing or grooving component of friction for three basic asperity shapes. (Sphere, cylinder and cone). 15
- b) What is solid lubricant ? 15
2. a) Elucidate the importance of studying “Stribeck Curve”. 10
- b) What is Tribology ? Discuss its role in industry. 2+8
3. a) Define a bearing criterion, the P-V factor, for plastic bearings. 2
- b) Derive the relationship between wear rate and the P-V factor for two basic bearing configurations. Also show typical limiting P-V curve of PTFE based material for wear rates of 25  $\mu\text{m}$  in 100 hours. 18
4. A machine journal bearing has a journal diameter of 150 mm and length of 120 mm. The bearing diameter is 150.24 mm. It is operating with SAE 40 oil at 65°C. The shaft is carrying a

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load of 8 kN and rotates at 960 rpm. Estimate the bearing co-efficient of friction and power loss. Show the derivative of each equation used by you for solving the problem. Also state the assumption. 20

5. A journal of a stationary oil engine is 80 mm in diameter and 40 mm long. The radial clearance is 0.060 mm. It supports a load of 9 kN when the shaft is rotating at 3600 rpm. The bearing is lubricated with SAE 40 oil supplied at atmospheric pressure and average operating temperature is about 65°C. Assuming that it is working under steady state condition, determine

- i) Co-efficient of friction
- ii) flow requirement in litres/min
- iii) minimum oil film thickness
- iv) maximum film pressure developed in the oil film
- v) Heat generated due to friction
- vi) Power wasted in friction. 20

6. a) Explain the following :

- i) Hypothesis of Holm model
- ii) hypothesis of Burwell and strong model 10

b) Discuss Rabinowicz's quantitative law for abrasive wear.

10

7. The following table shows the values of hardness (H), Young's modulus (E), Critical load ( $L_c$ ) and co-efficient of friction ( $\mu$ ) for 12 coating materials used on cutting tools for improving thin performance. Make an eclectic decision.

Table : Tribological characteristics of coatings materials :

Coating materials	H(GPa)	E(GPa)	$L_c$ (N)	$\mu$
1	34	380	30	0.60
2	31	380	50	0.49
3	20	280	41	0.45
4	23	300	46	0.45
5	19	270	22	0.45
6	30	270	87	0.52
7	19	340	90	0.51
8	25	280	46	0.45
9	17	370	67	0.50
10	23	300	54	0.52
11	20	260	37	0.43
12	19	290	41	0.45