

TRIBOLOGY
(Common to MD and MED)

Time: 3 Hours

Max Marks: 60

Answer any FIVE questions
All questions carry EQUAL marks

Note: (Design Data Book permitted)

1. a) What is boundary lubrication? Describe its characteristics.
b) Derive the governing equations of linear sliding wear and Bushing wear.
2. List the properties of the following bearing materials
 - a) Steel
 - b) Bronze
 - c) Porus materials
 - d) Plastics
3. Select a single row deep groove ball bearing with the operating cycle listed below, which will have a life of 15 000 hours.

<u>Fraction of cycle</u> <u>Service factor</u>	<u>Type of load</u>	<u>Radial(rpm)</u>	<u>Thrust</u>	<u>Speed</u>
1/10 3.0	Heavy shocks	2000	1200	400
1/10 1.5	Light shocks	1500	1000	500
1/5 2.0	Moderate shocks	1000	1500	600
3/5 1.0	No shock	1200	2000	800

Assume radial and axial load factors to be 1.0 and 1.5 respectively and inner race rotates.

4. The rolling contact ballbearing are to be selected to support the overhung countershaft. The shaft speed is 720 r.p.m. The bearings are to have 99%reliability corresponding to a life of 24 000 hours. The bearing is subjected to an equivalent radial load of 1 kN. Consider life djustment factors for operating condition and material as 0.9 and 0.85 respectively. Find the basic dynamic load rating of the bearing from manufacturer's catalogue, specified at 90% reliability.

Subject Code: H1507/R13

5. A 100 mm long and 60 mm diameter journal bearing supports a load of 2500 N at 600 r.p.m. If the room temperature is 20°C, what should be the viscosity of oil to limit the bearing surface temperature to 60°C? The diametral clearance is 0.06 mm and the energy dissipation coefficient based on projected area of bearing is 210 W/m²/°C.
6. A footstep bearing supports a shaft of 150 mm diameter which is counterbored at the end with a hole diameter of 50 mm. If the bearing pressure is limited to 0.8 N/mm² and the speed is 100 r.p.m.; find : 1. The load to be supported; 2. The power lost in friction; and 3. The heat generated at the bearing. Assume coefficient of friction = 0.015.
7. Discuss the following in detail
- a) Optimum film thickness in journal bearings
 - b) Fixed tilting pads
 - c) Single and multiple pad bearings
8. Discuss in detail the following
- a) Failure analysis of gears and seals
 - b) Oscillatory journal bearings
 - c) Mechanical piston rod packings and labyrinth seals

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