Paper / Subject Code: 35007 / Elective : I - Tribology

Q. P. Code: 25698

(03 Hours) [Total Marks: 80]

N.B.:
(1) Attempt any four questions.
(2) Assumption made should be clearly stated.
(3) Use of Design Data Book is permitted.

1. A. Write short note on the followings: **10**
   i. Hysteresis friction mechanism
   ii. Externally pressurized gas lubricated bearings
   B. Derive Petroff's equation giving coefficient of friction in journal bearings. State assumptions made while deriving it. **10**

2. A. Write short note on the followings: **10**
   i. Stick-slip friction mechanism
   ii. Viscosity index
   B. The axle of a railway wagon supports 80 kN load and transmits to the wheels through rolling contact bearings. The wheels rotate at 500 RPM. Select suitable type and size of bearing if it is required to have a life of 20,000 hours with the probability of survival 92%. **10**

3. A. Write short note on the followings: **10**
   i. Deformation theory of friction
   ii. Atomic force microscope
   B. Derive equation for the flow rate of a viscous fluid through a rectangular slot having length l, width b, and gap h. Let ΔP be the pressure difference between the two ends of the slot and Z be the absolute viscosity of the fluid. **10**

4. A. Write short note on the followings: **10**
   i. Theory of adhesive friction
   ii. Tribo-chemical wear mechanism
   B. A deep groove ball bearing having SKF No. 6312 is subjected to a load cycle as shown below, which is repeated. **10**

Phase	Radial Load	Axial Load	Speed	Period
I	3 kN	1.5 kN	300 RPM	20%
II	5 kN	2 kN	280 RPM	35%
III	8 kN	3 kN	250 RPM	Remaining

   Under each phase the loads are with high shock, outer race under rotation, under operating temperature 140 °C. Determine expected life of the bearing in hours with R_{92}.

5. A. Write short note on the followings: **10**
   i. Scanning tunneling microscope
   ii. Solid lubricants
   B. Explain the significance and three distinct actions of Couette term appearing in the Reynold's three dimensional equation for the fluid flow in a journal bearing. **10**

6. A. Write short note on the followings: **10**
   i. Bearing modulus
   ii. Lubricant additives
   B. Design a full journal bearing for a machine tool. Radial load acting is 15 kN and speed is 1,500 RPM. Do not check the performance for C_{min} and C_{max}. **10**