COLLEGE OF ENGINEERING, PUNE

(An Autonomous Institute of Government of Maharashtra.)
SHIVAJI NAGAR, PUNE - 411 005

END Semester Examination

(PE(DE)-14003) Tribology in Manufacturing

Course: B.Tech   Branch: Production Engineering (Sandwich)

Semester: Sem VII

Year: 2014-2015   Max.Marks:60

Duration: 3 Hours   Time:- 10.00am - 1.00pm   Date:29/11/2014

Instructions: MIS No. ☐☐☐☐☐☐☐☐☐

1. Figures to the right indicate the full marks.
2. Mobile phones and programmable calculators are strictly prohibited.
3. Writing anything on question paper is not allowed.
4. Exchange/Sharing of anything like stationery, calculator is not allowed.
5. Assume suitable data if necessary.
6. Write your MIS Number on Question Paper

Q 1	a)	States various theories of friction and explain modified adhesion theory of friction in details.	6
	b)	Explain Chemical and Fatigue wear. Also states various factors for prevention of these wear.	6
Q 2	a)	What is the function of lubricants? Discuss various types of lubricants.	6
	b)	Derive Petroff's equations for lightly loaded bearings. State the assumptions.	6

Q 3   Solve any Two

a) Derive expression for the total load carrying capacity of infinitely short   **6**
hydrodynamic journal bearing starting with following pressure distribution
equation.

$$p = \frac{3\eta U \in \sin\theta}{r c^2 (1 + \in \cos\theta)^3} \left[\frac{l^2}{4} - z^2 \right]$$

Where η - viscosity of oil
$\in$ − eccentricity ratio
U − linear speed of journal
r − radius of journal
c − radial clearance and
l − length of bearing.

b) Derive an expression for the load carrying capacity of a narrow width taper   **6**
pad hydrodynamic bearing (plane slider) bearing with a fixed shoe.

c) A rectangular hydrodynamic slider bearing with fixed shoe is operating under **6** the following conditions: Bearing length=60mm
Bearing width=160mm
Sliding speed=3.0m/s
Absolute viscosity of oil=0.02Pa s
Minimum oil film thickness=0.03mm
Maximum oil film thickness=0.06mm
Find:
(a) The load carrying capacity
(b) The pressure at a distance 50mm measured from the maximum film thickness point. Neglect side leakage.

Q 4 **Solve any Two**

a) Derive the expressions for rate of flow of oil and load carrying capacity for a **6** hydrostatic step bearing.

b) A hydrostatic step bearing has the following characteristics. **6**
Shaft diameter : 140 mm
Diameter of pocket : 60 mm :
Shaft speed = 1800 rpm
Inlet oil pressure = 3.75 MPa
External pressure - 0 (atmospheric)
Expected mean oil film temperature :60^0C
Lubricating oil is SAE 60 of viscosity 0.03 Pas
Desirable oil film thickness :0.0875 mm
Determine:
i) Load the bearing can support
ii) Rate of oil flow through the bearing
iii) Power loss due to viscous friction

c) Describe the basic phenomenon of hydrostatics squeeze film and derive **6** following expression for time of approach in case of parallel circular plate.

$$\Delta t = \frac{3\pi\eta R^4}{4W}\left(\frac{1}{h_2^2} - \frac{1}{h_1^2} \right) \text{ with usual notations.}$$

Q 5 Write a short note on **(Any Four)**: **12**
(i) Viscosity of oil
(ii) Lubricants used in Metal cutting;
(iii) Ferrography;
(iv) Rigidity of Hydrostatics bearing;
(v) "Pin-on Disc" method of Friction Measurement.
(vi) Advantages and Limitations of Rayleigh Step Bearing

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