

Time : 3 Hours]

[Max. Marks : 100

Instructions to the candidates:

- 1) *Answer any 3 questions from each section.*
- 2) *Answers to the two sections should be written in separate books.*
- 3) *Neat diagrams must be drawn wherever necessary.*
- 4) *Figures to the right side indicate full marks.*
- 5) *Use of Calculator is allowed.*
- 6) *Assume Suitable data if necessary.*

SECTION-I

- Q1)** a) Explain the following theories of friction. **[10]**
i) Tomlinson's theory of molecular attraction.
ii) Coulomb's classical theory.
b) Explain Tribology and discuss the tribological properties of bearing materials. **[6]**
- Q2)** a) Derive Petroff's equation for hydrodynamic journal bearing. State the conditions under which Petroff's equation can be used. What are its limitations? **[10]**
b) Explain stick-slip friction. **[6]**
- Q3)** a) What is infinitely short Journal bearing? State the conditions and write Reynold's equation for short journal bearings. **[10]**
b) The following data is given for a hydrostatic thrust bearing: **[8]**
Thrust load : 500 kN
Shaft speed: 720 rpm
Shaft diameter: 500 mm
Recess diameter : 300 mm
Film thickness: 0.15 mm
Viscosity of lubricant : 29.3 cP
Calculate supply pressure, power loss in pumping and friction and flow requirement in l/min.

Q4) Write short note on: [16]

- a) Methods of calculating heat in bearings.
- b) Idealized bearings.

SECTION-II

Q5) a) Two parallel plates 40 mm long and infinitely wide are separated by an oil film 30 μm thick having viscosity of 0.75 Ns/m^2 . If load per unit width of 18000 N/m is applied to the plates, find the time required to reduce the film thickness to 3 μm and the maximum pressure. [10]

b) Explain any four situations where hydrostatic squeeze film exists. [6]

Q6) a) Using modified Reynold's equation for Elasto-hydrodynamic lubrication, derive Ertel-Grubin equation. [10]

b) Explain thrust bearing with air lubrication. [6]

Q7) a) Derive the equation for pressure and load carrying capacity for flat plate thrust bearing. [12]

b) Explain lubrication of spheres. [4]

Q8) Write short notes on any three below: [18]

- a) Explain Vehicle tyre and rolling mode of resistance.
- b) Tribological aspects of wheel and rail contact.
- c) Explain Hertz theory.
- d) Air lubricated bearings.

