E

APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2015

Mechanical Engineering

(Machine Design)

01ME6107 Industrial Tribology

Max. Marks:60 Duration: 3 Hours

(Answer any two questions from Part A, Part B and Part C)

Part A (Modules I and II)

1. (a) Explain the principle of working of a Taylor HobsenTalysurf.
   (b) Explain the different methods of quantifying surface roughness.
2. (a) Explain the origin of Micro/Nanotribology.
   (b) Describe with figure the Atomic force microscope.
3. Discuss the various friction theories and write the merits and demerits.

(2 x 9 = 18 Marks)

Part B (Modules III and IV)

4. Write in brief the various types of wear encountered in engineering surfaces under relative motion.
5. Derive Hagen Poiseuille equation applied to flow through a capillary tube.
6. Derive Reynolds equation from basic principles and describe the physical meaning of each term.

(2 x 9 = 18 Marks)

Part C (Modules V and VI)

7. A circular hydrostatic pad has a constant flow rate Q. The circular pad is supporting a load of W = 5000N. The outside disk diameter is 200 mm and the diameter of the circular recess is 100 mm.The oil viscosity is $\mu = 0.005$ Ns/m^2. The pad is operating with a clearance of 120 μm.
   a. Find the recess pressure, P_r.
   b. Calculate the constant flow rate of the oil through the bearing to maintain the clearance.
   c. Find the effective area of this pad.
   d. Find the stiffness of the circular pad operating under the condition in this problem.

8. (a) Derive Petroff's equation from fundamentals.
   (b) A radial hydrodynamic bearing has the following operational data:
   - i. Radial load = 3.5 kN
   - ii Journal diameter = 50 mm
   - iii Bearing length = 50 mm
   - iv Journal speed = 1500 rpm
   - v Radial clearance = 0.05 mm
   - vi Viscosity, mass density and specific heat = 25 cp, 900 kg/m^3 and 1700 J/kg °C.

   Total oil flow is sufficient to carry the heat generated. Determine the following parameters.
   - a. Coefficient of friction
   - b. Power lost in friction
   - c. Minimum oil film thickness
   - d. Oil flow requirement and
   - e. Rise in bearing temperature.

9. A 30s work cycle consists of the following two parts:

	Part I	Part II
Duration (s)	10	20
Radial load (KN)	45	15
Axial load (KN)	12.5	6.25
Speed (rpm)	720	1440

For this application the static and dynamic load capacities of a single row deep groove ball bearing are 50 and 68KN respectively. Calculate the life of the bearing in hours.

(2 x12 = 24 Marks)