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APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY

FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2017

Mechanical Engineering

(Machine Design)

01ME6107 INDUSTRIAL TRIBOLOGY

Answer *any two full* questions from *each* part

Limit answers to the required points.

Use of **Design Data Hand Book** is permitted

Max. Marks: 60 Duration: 3 hours

PART A

1. a. How the surface roughness affects the tribological properties of surfaces? **(5 marks)**

   b. Explain the various regimes of fluid friction. **(4 marks)**

2. a. Briefly explain the Bowden and Tabor hypthoesis. **(5 marks)**

   b. Stick slip behavior in friction. **(4 marks)**

3. a. Compare the operating parameters of SFA, STM and AFM/FFM. **(5 marks)**

   b. With the help of a neat sketch, explain the working of Surface Force Apparatus. **(4 marks)**

PART B

4. a. Differentiate between adhesive and abrasive wear. **(5 marks)**

   b. Explain the term viscosity index and viscosity index improvers. **(4 marks)**

5. a. Describe the phenomenon of 'Pitting'. **(3 marks)**

   b. With the help of a neat sketch, explain the working of a viscometer. **(6 marks)**

6. a. Show that the pressure at a point (distance r from the centre) in the incompressible fluid of viscosity μ between two parallel circular plates (radius R and film thickness h) that approach each other with a velocity V is given by $p=\frac{3\mu V}{h^3}(R^2-r^2)$ and estimate the load carrying capacity. **(6 marks)**

   b. State the assumptions of Reynold's equation. **(3 marks)**

PART C

7. a. Explain the terms eccentricity, attitude and attitude angle with the help of neat sketches. **(3 marks)**

   b. Derive the load carrying capacity of a hydrostatic thrust bearing. **(7 marks)**

   c. The role of restrictors in hydrostatic bearings. **(2 marks)**

8. a. Derive the relation between the life, load and strength for a rolling element bearing. **(3 marks)**

   b. A 45 BC 03 single row deep groove ball bearing which is to operate at 2000rpm is acted by a 10kN radial load and an 8kN thrust load. The bearing is subjected to a light shock and the outer ring is rotating. Determine the rating life of the bearing. **(6 marks)**

   c. What are the different failure modes of rolling element bearings. **(3 marks)**

9. a. Explain the terms Reynold's boundary condition, full Sommerfeld boundary condition and half Sommerfeld boundary condition. **(3 marks)**

   b. In a journal bearing, diameter of the shaft is 75mm, L/D=1, radial clearance is 0.05 mm, h_0=0.02mm, speed of journal=400rpm, radial load=3.5kN, specific gravity of oil=0.9 and specific heat of oil=1.75kJ/kg/°C. Calculate the viscosity of a suitable oil, power lost in friction and the resultant temperature rise. **(7 marks)**

   c. Advantages of pivoted shoe bearing. **(2 marks)**