

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. Differentiate between macro and micro/nanotribology. (3 marks)
b. Explain the terms physisorbed layer, chemisorbed layer and Beilby layer in a solid surface. (6 marks)
2. a. What are the different surface roughness measuring methods? (6 marks)
b. Explain the different theories of friction. (3 marks)
3. a. With the help of neat sketches, explain the working of Friction Force Microscope (FFM). (5 marks)
b. What are the surface parameters specified in order to define a real surface? (4 marks)

PART B

4. a. Explain the various stages of wear and the mechanisms of wear. (5 marks)
b. Discuss viscosity and its variables. (4 marks)
5. a. State the assumptions and derive the Slot equation. (6 marks)
b. Explain squeeze film lubrication. (3 marks)
6. a. State the important assumptions and derive Reynold's equation from the first principles. (9 marks)

PART C

7. a. Describe the mechanism of hydrodynamic oil film formation. (4 marks)

- b. A journal bearing 50mmx50mm has a journal speed of 3600rpm. The radial load on the bearing is 4.5kN. Oil used is SAE 10 at an average temperature of 60°C. If $h_0/c=0.5$ calculate the radial clearance, heat loss, the side flow and the minimum film thickness. (8 marks)
8. a. Explain the working of a hydrostatic thrust bearing and derive the equation to calculate the bearing supply pressure, quantity of flow and film thickness. (6 marks)
- b. A ball bearing is required to resist a radial load of 10kN and a thrust load of 5kN. The life of the bearing is to be 5000hrs with inner race rotation at 980rpm. What basic dynamic load rating must be used in selecting the bearing? If this bearing is to have a life of 5000hrs at a reliability of 96%, what is the basic dynamic load rating? (6 marks)
9. a. Derive the equation for the probability of survival of a rolling element bearing using Weibull distribution. (4 marks)
- b. A hydrostatic thrust bearing of a generator consists of 6 pads. The total thrust load is 900kN and the film thickness is 0.05mm. The viscosity of the lubricant is 300 SUS. Neglecting the flow over corners, each pad can be approximated as a circular area of 500mm and 100mm as outer and inner diameters respectively. The density of the lubricating oil is 0.9g/cc. Calculate :
1. The supply pressure
 2. The flow requirement (5 marks)
- c. Differentiate between fixed and pivoted shoe bearings. (3 marks)

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