APJ ABDUL KALAM TECHNOLOGICAL UNIVERSITY
FIRST SEMESTER M.TECH DEGREE EXAMINATION, DECEMBER 2018
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 Handbook** is permitted

Max. Marks: 60   Duration: 3 hours

PART A

1. a. Explain the terms physisorbed layer, chemisorbed later and deformed layer in a solid surface.   (6 marks)

    b. Explain the significance micro/nanotribology.   (3 marks)

2. a. With the help of neat sketches, explain Friction force microscope (FFM). (6 marks)

    b. Write a short note on microscale friction.   (3 marks)

3. a. Briefly explain theory of adhesive friction.   (5 marks)

    b. Explain how friction varies in metals and ceramic materials. (4 marks)

PART B

4. a. Explain the various stages of wear and the mechanisms of wear. (5 marks)

    b. Discuss the importance of viscosity in lubricant selection. (4 marks)

5. a. Discuss the wear testing methods in Tribology.   (4 marks)

    b. Explain any two methods for measuring viscosity?   (5 marks)

6. a. Derive an expression for rate of flow between parallel plates of length "L". (7 marks)

    b. State the assumptions of Reynolds's equation   (2 marks)

PART C

7. a. Write a short note on classification of bearings.   (4 marks)

    b. With the help of a neat sketch explain the terms eccentricity, pressure distribution, attitude and attitude angle.   (5 marks)

    c. Discuss the role of restrictors in the design of hydrostatic bearings. (3 marks)

8. a. A full journal bearing of 50 mm diameter and 100 mm long has a bearing pressure of 1.4 N/mm². The speed of the journal is 900 r.p.m. and the ratio of journal diameter to the diametral clearance is 1000. The bearing is lubricated with oil whose absolute viscosity at the operating temperature of 75°C may be taken as 0.011 kg/m-s. The room temperature is 35°C. (7 marks)
    Find :
    1. The amount of artificial cooling required, and
    2. The mass of the lubricating oil required, if the difference between the outlet and inlet temperature of the oil is 10°C. Take specific heat of the oil as 1850 J/kg/°C.

    b. What are hydrostatic thrust bearings? How are they classified? (5 marks)

9. a. Discuss the failure modes of rolling element bearings. (3 marks)

    b. Design a self-aligning ball bearing for a radial load of 7000 N and a thrust load of 2100 N. The desired life of the bearing is 160 millions of revolutions at 300 r.p.m. Assume uniform and steady load. (6 marks)

    c. Differentiate between pivoted and fixed shoe bearings. (3 marks)