Registration no: | | | | | | | | | | |

Total Number of Pages: 2 **M.TECH**

P2MYCC08

2nd Semester Regular Examination 2016-17

Bearings & Lubrication

BRANCH(S): DESIGN AND DYNAMICS, MECH. SYSTEMS DESIGN & DYNAMICS

Time: 3 Hours

Max Marks: 100

Q.CODE: Z801

Answer Question No.1 which is compulsory and any FOUR from the rest.

The figures in the right hand margin indicate marks.

Q1 **Answer the following questions:** (2 x 10)

a) State the important characteristics of viscous flow.

b) State Petroff's law and explain its significance.

c) Explain the significance of Sommer field number in distinguishing bearings.

d) State the effect of temperature and pressure on viscosity of a fluid.

e) What are conformability and embedability with respect to bearing materials? Explain.

f) Enumerate the important advantages of hydrostatic sliders over hydrodynamics ones.

g) Discuss locating centre of pressure in fixed show slider bearing.

h) What is a self-lubricating bearing and how does it function?

i) List the commonly used bearing materials.

j) State the principle by which a shaft rotating at high speed to float in a journal bearing.

Q2 a) Derive the Reynold's equation in 3D flow, giving the various assumptions used for deriving the same. (10)

b) A machine journal bearing has a journal diameter of 150 mm and length of 120 mm. The bearing diameter is 150.24 mm. It is operating with SAE 40 oil at 65^{o}C. The shaft is carrying a load of 8 kN and rotates at 960 rpm. Estimate the bearing coefficient of friction and power loss using Petroff's equation. (10)

Q3 a) Briefly describe the mechanism of pressure build-up in a hydrodynamic bearing with relevant figures. (7)

b) A journal of a stationary oil engine is 80 mm in diameter. and 40 mm long. The radial clearance is 0.060mm. It supports a load of 9 kN when the shaft is rotating at 3600 rpm. The bearing is lubricated with SAE 40 oil supplied at atmospheric pressure and average operating temperature is about 65^{o}C. Using Raimondi- Boyd charts analyze the bearing assuming that it is working under steady state condition. (13)

Q4 a) A sleeve bearing is 40 mm in diameter. and has a length of 20 mm. The clearance ratio is 1000, load is 2.5 kN, and journal speed is 1200 rpm. The bearing is supplied with SAE 30 oil. The ambient temperature is 35^{o}C. Determine the average oil film temperature in equilibrium condition, assuming that the bearing is lubricated by an oil bath in moving air. (13)

b) Briefly describe about Elasto-hydrodynamic lubrication. (7)

Q5 a) A journal bearing has to support a load of 6000N at a speed of 450 r/min. The diameter of the journal is 100 mm and the length is 150mm.The temperature of the bearing surface is limited to 50 ºC and the ambient temperature is 32 ºC. Select a suitable oil to suit the above conditions. (12)

b) Explain the working principle of hydrostatic thrust bearing with figures. (8)

Q6 a) A journal bearing of a centrifugal pump running at 1740 rpm has to support a steady load of 8kN. The journal diameter from trial calculation is found to be 120 mm. Design suitable journal bearing for the pump to operate under hydrodynamic condition. (15)

b) Explain the properties of a good bearing material. (5)

Q7 **Distinguish between:** (5 x 4)

a) Dynamic and kinematic viscosity
b) Full and partial journal bearing.
c) Newtonian and non-Newtonian fluid
d) Fluidity and viscosity