

Code No: J1504/R16

M. Tech. II Semester Regular Examinations, May-2017

TRIBOLOGY

(Common to Machine Design(15), Mechanical Engg. Design (14), Computer Aided Analysis & Design (16))

Time: 3 Hours

Max. Marks: 60

Answer any FIVE Questions
All Questions Carry Equal Marks

1. a In general, how many temperatures are needed to specify the viscosity of an oil and why? 4
- b An oil has a viscosity ν at $100^{\circ}\text{C} = 23 \text{ cS}$, a viscosity index of $VI = 92$ and density of $\rho = 900 \text{ kg/m}^3$. What is the dynamic viscosity of this oil at 20°C . 8
2. a Define static and dynamic load carrying capacities of a rolling contact bearing and write the corresponding equations to calculate them. 6
- b A taper roller bearing has a dynamic load capacity of 26 kN. The desired life for 90% of the bearings is 8000 hours and the speed is 300 rpm. Calculate the equivalent radial load that the bearing can carry. 6
3. a What are different types of rolling contact bearings? Write their advantages, disadvantages and applications. 6
- b Explain in detail the shock pulse method used for condition monitoring. 6
4. a Give examples of operating conditions under which the application of hydrostatic bearings would be necessary or highly desirable. 4
- b The following data is given for a hydrostatic thrust bearing: 8
 Thrust load = 500 kN; Shaft speed = 720 rpm; Shaft diameter = 300 mm
 Film thickness = 0.15 mm; Viscosity of lubricant = 160 SUS
 Specific gravity = 0.86;
 Calculate
 (i) Supply pressure
 (ii) Flow requirement in litres/min
 (iii) Power loss in pumping and
 (iv) Frictional power loss
5. Draw neat sketch showing the pressure distribution in hydrostatic bearing. Derive equation for its load bearing capacity. 12
6. a Explain the distribution of radial and axial pressure in case of hydrodynamic bearing with the help of a neat sketch. 5
- b Explain the effect of clearance, L/D ratio, temperature, speed and minimum film thickness on the performance of hydrodynamic bearings. 7

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7. The following data is given for a 360° hydrodynamic bearing: 12

Radial load = 30 kN; Journal diameter = 75 mm; Bearing length = 75 mm

Journal speed = 3600 rpm; Radial clearance = 0.15 mm; Inlet temperature = 40°C

The temperature-viscosity relationship is as follows:

$T(^{\circ}\text{C})$	40	41	42	43	44	45	46	47	48	49	50
$z(\text{cP})$	52.5	50	47.5	45	43	41	39	37.5	36	34	33

Assume that the total heat produced in the bearing is carried by the total oil flow. The specific gravity and specific heat of the lubricant are 0.86 and $1.76 \text{ kJ/kg}^\circ\text{C}$ respectively. Calculate the power lost in friction and the requirement of oil flow.

8. a What are the key factors for selecting a proper seal for a bearing? 6
 b Discuss about the material selection for a dry bearing. 6
