Seat No.: _____ Enrolment No._____

# GUJARAT TECHNOLOGICAL UNIVERSITY

**BE - SEMESTER–VII EXAMINATION – WINTER 2015**

**Subject Code: 171905** **Date: 04/12/2015**

**Subject Name: Industrial Tribology**

**Time: 10:30am to 1:00pm** **Total Marks: 70**

**Instructions:**

1. **Attempt all questions.**
2. **Make suitable assumptions wherever necessary.**
3. **Figures to the right indicate full marks.**
4. **Use of PSG or any other standard design data book is permitted.**
5. **Draw neat sketches where required to justify the answer.**

**Q.1** **(a)** State the different theories of friction and explain the junction growth theory with neat sketch. **07**

**(b)** Explain the factors to be considered while selecting the suitable bearing. **07**

**Q.2** **(a)** State the general requirements of bearing materials. Explain the different types of bearing materials in brief (any THREE). **07**

**(b)** Explain the optimum design of hydrostatic step bearing. **07**

**OR**

**(b)** The hydrostatic thrust bearing ( circular type ) of a generator consists of six pads has the following data: **07**

Total thrust load = 900 kN shaft diameter = 500 mm
Viscosity of the lubricant = 30 cP recess diameter =200 mm
Shaft speed =720 r.p.m. Density of the lubricant = 900 kg/m$^3$
Specific heat of lubricant = 2.09 kJ/kg $^0$c
oil film thickness = 0.15 mm
Neglecting the flow over corners and each pad can be approximated as circular area of outer and inner diameters, Find (i) supply pressure (ii) total power loss.

**Q.3** **(a)** Derive Reynold's equation for 3-D hydrodynamic lubrication form first fundamentals. Also state the assumptions made in this derivation. **07**

**(b)** The following data refers to a 360$^0$ hydrodynamic bearing: **07**

Journal diameter = 50 mm Bearing length = 50 mm
Radial load = 15 kN Journal speed = 1450 r.p.m.
Radial clearance = 0.02 mm oil viscosity = 25 cP
Specific heat of lubricant = 2.09 kJ/kg $^0$c
Specific gravity of the lubricant = 0.86
Eccentricity ratio = 0.75
Find the minimum oil film thickness, friction coefficient and oil flow required.

| l/d | $h_0$/c | S | CFV= f(r/c) | FV = Q /rcnl |
|---|---|---|---|---|
| 1 | 0.2 | 0.0446 | 1.7 | 4.62 |
| | 0.4 | 0.121 | 3.22 | 4.33 |
| | 0.6 | 0.264 | 5.79 | 3.99 |

**OR**

**Q.3** **(a)** Derive the equation of pressure distribution for infinitely short hydrodynamic journal bearing. State the assumptions made in its derivation. **07**

**(b)** Explain the different regimes of hydrodynamic lubrication with the help of plot of coefficient of friction V/s bearing characteristic number? **07**

**Q.4** **(a)** Differentiate clearly between hydrostatic and Elasto hydrodynamic lubrication. **07**

| | | | |
|---|---|---|---|
| | **(b)** | Explain the following parameters used for measurement of surface properties:<br>a. CLA roughness (Centre line average)<br>b. RMS roughness (root mean square)<br>c. PSDF (power spectrum density function) | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.4** | **(a)** | Define wear and state different types of wear. Briefly discuss the measurement of wear. | **07** |
| | **(b)** | Explain the EHD (Elasto hydrodynamic) lubrication in detail Stating different examples of it. | **07** |
| **Q.5** | **(a)** | State and discuss the lubricants and lubrication methods used for the IC Engines? | **07** |
| | **(b)** | What is multi grade oil? Explain SAE grading of oils. Why the additives are added to lubricants? | **07** |

**OR**

| | | | |
|---|---|---|---|
| **Q.5** | **(a)** | State the advantages and disadvantages air/gas lubricated bearing. Explain the working of air/gas lubricated bearing with a neat sketch. | **07** |
| | **(b)** | Explain the need for recycling of used oil? Discuss the different methods of recycling of used oil? | **07** |

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