| Reg. No. | | | | | | | | | | |
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# Manipal Institute of Technology, Manipal

(A Constituent Institute of Manipal University)

## VII SEMESTER B.TECH (AUTOMOBILE ENGINEERING)

## END SEMESTER EXAMINATIONS, NOV / DEC 2015

## SUBJECT: TRIBOLOGY [AAE 475]

**REVISED CREDIT SYSTEM**

Time: 3 Hours MAX. MARKS: 50

**Instructions to Candidates:**

- Answer **ANY FIVE FULL** the questions.
- Missing data may be suitable assumed.

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| 1A. | What is Terotechnology? What does this term relate to? | 2M |
| 1B. | Show that journal speed is twice the speed of journal center of a rotating journal bearing. Draw a clear diagram to derive it. | 3M |
| 1C. | Derive the following expressions of hydro-dynamically lubricated Journal bearing<br>i. Bearing Geometry<br>ii. Pressure Distribution | 5M |
| 2A. | What are the different functions of a lubricant | 2M |
| 2B. | Write the different behaviours of Non-Newtonian liquids | 3M |
| 2C. | What are Quasi-Solid Lubricants? On which basis are they assorted? Give some salient features of assorted quasi-solid lubricants. | 5M |
| 3A. | What is the relation of viscosity with change in pressure? How does a lubricant fail functionally due to change in pressure? | 2M |
| 3B. | A car owner removes water using cotton cloth with a speed of 15 cm/s. He is applying a tangential force of 30 dynes. The thickness between the cloth and the car body is 0.9mm. If a soap solution (cleaning agent) spills over the car body which is having a viscosity of 0.58 stokes, what is the force required to maintain the same speed. Viscosity of water is 0.01 Stoke. | 3M |
| 3C. | Derive the following expressions of a Flat hydrostatic Pad Bearing<br>i. Pressure Distribution<br>ii. Load Capacity | 5M |
| 4A. | What is PAO and where is it used? Give an example of it along with chemical formula. | 2M |
| 4B. | Classify different types of lubricants and state few advantages of synthetic oils | 3M |

4C. A billet with a square cross-section is extruded, which is 100 mm long and 20mm in dimension in each side. The extrusion ratio is 3.5. The strength of co-efficient is found to be 300 MPa and the strain hardening component is 0.20. Johnsons formula can be used the strain. The factors a=0.8 and b =1.2. Determine the pressure applied to the billet as the ram is moved. Find the pressure at a regular interval of 25mm and plot a graph to shown the relationship between ram pressure and ram stroke. 5M

5A. What is Springback and give the formula to determine it 2M

5B. What is viscosity Index? Give a brief account on the selection of reference oils 3M

5C. Cold forging process is carried out on a square workpiece, which is possessing a dimension of initial height as 90 mm and a side as 55 mm. The material which is exposed to this process has a flow curve defined by K = 250MPa and strain-hardening exponent as 0.16. The co-efficient of friction is assumed to be 0.2 and the initial strain to be assumed is 0.002. Determine the forging force as the process commences and at a height of 75mm. 5M

6A. Derive Reynolds two-dimension equation with neat diagram. State the assumptions made while deriving the equation. 10M

Can use Leibnitz method for Integration

$$\int_a^b \frac{\partial u(y,x)}{\partial x}\,dy = \frac{d}{dx}\int_a^b u\,dy - u(b,x)\frac{db}{dx} + u(a,x)\frac{da}{dx}$$