

**B.Tech. – VIEP – MECHANICAL ENGINEERING
(BTMEVI)**

Term-End Examination

June, 2015

00086

BIMEE-006 : TRIBOLOGY

Time : 3 hours

Maximum Marks : 70

Note : Attempt any **seven** questions. Draw neat sketches wherever required. All questions carry equal marks. Assume any missing data.

1. (a) What is stick slip ? Describe the mechanism of stick slip for a block of mass 'm' sticking with a velocity 'V' against a lower surface. 'W' is the normal force acting on the block. How can we prevent stick slip?

5

(b) In a sliding system, a block of mass m of 1 kg contacts a lower surface which is sliding with a velocity 'V' of 10 m/s. The normal load 'W' being applied at the interface is 10 N. The $\mu_k - V$ curve has a negative slope and can be expressed by the equation

$$\mu_k = 0.3 - 0.1 V_r$$

V_r = relative velocity in m/s

If the system stiffness can be modelled with spring constant at 10 N/mm, how much damping coefficient of the system is required to avoid stick slip?

5

2. (a) Distinguish between adhesive and abrasive wear using dissimilar materials as example. 5
- (b) What are the quantitative equations that govern the adhesive wear ? If k is the non-dimensional wear coefficient, what are its value range for mild and severe wear ? 5
3. (a) Obtain the quantitative expression for abrasive wear during ploughing by considering a sample set-up of hard conical asperities sliding over a flat surface. 5
- (b) Distinguish between rolling contact, fatigue wear and impact wear giving a suitable example. 5
4. (a) What are the different techniques employed in analysing the size, shape, structural and chemical details of wear particle ? Give a detailed description of any one of them. 5
- (b) Describe the laws of wear formulated by J.T. Burwell and Strang based theories. 5
5. (a) Describe the physico-mechanical properties of surface layers using a neat sketch. 5
- (b) What are the assumptions on which Hertz Analysis is based ? Using these assumptions calculate the real area of contact between two cylindrical surfaces. 5

6. (a) What are the techniques employed in the measurement of the real area of contact ? Describe in detail any one of them. 5
- (b) What is surface topography ? Using a neat illustration give the basic components of surface texture. 5
7. (a) What is viscosity ? Explain the effect of temperature, pressure and shear rate on viscosity. 5
- (b) What are the principal classes of lubricants ? Give three examples of each along with their respective uses. 5
8. (a) What will happen if the lubricating oil is in excess quantity in the crank case ? Explain. 5
- (b) The critical flow velocity at which turbulence is initiated is based on which number ? Give the empirical relationship of this number and its importance. 5
9. (a) What are Bearing Ratings and how are they described ? 5
- (b) How do speed and environment affect the choice for selection of a bearing ? 5

10. (a) A load of 12.5 kN is supported by a bearing which is 75 mm both in diameter and length and has a clearance of 0.75 mm. The lubricant in the bearing has absolute viscosity of 0.01 poise at the operating temperature. Calculate the power loss and coefficient of friction if the journal rotates at 1800 rpm. 5
- (b) Differentiate between stable and unstable lubrication. 5
-