

## B.E. Mechanical Engineering - Third Year - Second Semester Examination – 2019

Subject: PRINCIPLES OF ENGINEERING TRIBOLOGY

Time: Three hours

Full Marks: 100

Answer any five questions.Different parts of the same question should be answered together.

Q. 1	<p>a) Explain Skewness and Kurtosis for a rough surface.</p> <p>b) For a Gaussian distribution, evaluate the ratio of RMS to CLA roughness.</p> <p>c) Explain Auto Correlation Function. How does it distinguish between open and closed texture.</p> <p>d) Explain the working of a surface profilometer.</p>
Q. 2	<p>a) State the assumptions of Greenwood-Williamson contact model.</p> <p>b) Explain how the load and contact area can be evaluated in elastic-plastic contact situation.</p> <p>c) Define plasticity index. Explain its physical significance.</p>
Q. 3	<p>a) What is adhesion? Explain the factors influencing adhesion.</p> <p>b) Compare JKR, DMT and MD models of adhesion.</p> <p>c) Explain Bowden and Tabor's adhesion theory of friction.</p>
Q. 4	<p>a) Deduce the expression for ploughing component of friction using a conical asperity model.</p> <p>b) A hard conical slider of semi-apex angle <math>80^\circ</math> is slid across a soft metal surface and produces a groove of 3 mm width. For a measured coefficient of friction of 0.45, calculate the adhesive contribution to the coefficient of friction.</p> <p>c) Explain how the friction of self-mated copper depends on normal load and sliding speed.</p>
Q. 5	<p>a) Explain Archard's theory of adhesive wear.</p> <p>b) Explain Delamination theory of wear.</p> <p>c) In a pin-on-disk wear test, a bronze pin of radius 10 mm is placed with its flat face resting on a steel plate under a normal load of 100 N and at a distance of 200 mm from the centre of the steel plate, which rotates about its axis at 5 Hz for 20 hours. At the end of the test, the specimens are separated and weighed and it is found that the mass losses of the bronze and steel are 250 mg and 10 mg respectively. Calculate the wear coefficients for bronze and steel if hardness and density of steel and bronze are 2.4 GPa, 0.8 GPa, 7.8 gm/cc and 8.4 gm/cc, respectively.</p>
Q. 6	<p>a) Explain the use of radiation detectors in measurement of surface temperature in sliding.</p> <p>b) Explain the difference between CVD and PVD.</p> <p>c) Explain briefly the need for surface engineering.</p>
Q. 7	<p>a) Explain the mechanism of boundary lubrication.</p> <p>b) State the advantages and disadvantages of gas lubrication.</p> <p>c) State the fundamental principles of gas lubrication analysis.</p> <p>d) What is Elastohydrodynamic lubrication?</p>
Q. 8	<p>Write short notes on:</p> <p>a) Stribeck Diagram</p> <p>b) Surface treatments</p> <p>c) Hutching's equation for erosive wear</p> <p>d) Wear debris analysis</p>