Industrial Tribology Machine Dynamics and Maintenance Engineering Centre (ITMMEC)
I. I. T. Delhi, New Delhi, India

Major Examination-2006
ITL 703 Fundamental of Tribology

Time: 2 hours (10.30 AM to 12.30PM) M. Marks: 40

Note: Attempt all five questions. Marks (RHS) have been indicated against each question. Any missing data in a question may be suitably assumed and it should be stated clearly in beginning of that question.

Q.1 (a) List six components or products that exclusively rely on friction for their operation. Write a sentence or two about each item describing how it works. **(2)**

(b) Wear is usually an unwelcomed guest, but numerous manufacturing processes depend on the gradual removal of material (i.e. wear). List at least five manufacturing cases and explain why wear is to be welcomed there with open arms. **(2)**

© Lubrication, by definition, is the means by which friction is reduced. Lubricants may be in the forms of solids, liquids, or gases. Please list a few lubricated systems in each class. **(2)**

(d)Human body is a machine ever designed to survive and multiply on this planet. List few limbs or organs of the human body that function as tribological elements and describe their forms and functions. **(2)**

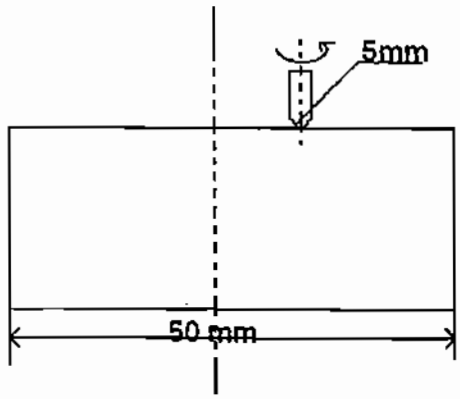
(e) What do you understand by 'Nano-Tribology". Present its overview in brief. **(2)**

Q.2 (a) Explain the wear mechanisms of the followings in details. Illustrate your answers with diagrams. Moreover mention the means through which following wears can be controlled. **(3+3+3+3+3+3)**

Abrasive, Adhesive, Fretting, Corrosive, and Fatigue

(b) Explain what is meant by the "Wear coefficient" of a material combination. Discuss the factors, which influence the wear coefficient. **(1+1)**

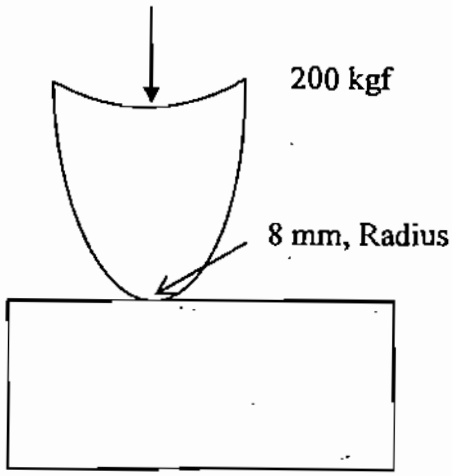
Q.3 In a three pin-on-disc wear test polymeric pins of hardness 30 Mpa are loaded against a steel disc rotating at 600 rpm at a diameter 30 mm with a load of 60 N as shown in the following figure. **(2+2)**



After 100 hrs of running, the worn volume of polymeric material is found to be 0.2 cm^3. Estimate the wear coefficient of the material. If the journal bearing of width 40 mm is made of above polymeric material to support a 40 mm diameter shaft rotating dry at 800 rpm. Estimate the useful life of bearing if the acceptable linear wear is 0.5 mm and the bearing load is 5 kN.

Q.4 The pivot shown in the following figure has a cylindrical tip with radius 8 mm. It rests on a flat surface and supports a mass of 200 kg. Both surfaces are of hardened steel and the allowable compressive stress at the point is 1600 Mpa. What length is required for the pivot? Estimate the stress at a depth of 0.5 mm below the contact line.

(3)



Q.5 Explain the Greenwood and Williamson model of contact of rough surfaces. Develop the expressions for computing the numerical values of n (number of contacts), A (total area of contact), and W (total load).

(6)

End