

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

**Major Examination-2006
ITL 810 Bearing Lubrication**

Time: 2 hours (8.00 AM to 10.00 AM)

M. Marks: 50

Note: Attempt all 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) Describe cavitations in journal bearings and discuss the cavitations boundary conditions.

(5)

(b) A hydrodynamic journal bearing has a diameter of 40 mm, a length of 10 mm and a radial clearance of $20 \mu\text{m}$. The bearing is lubricated with mineral oil of viscosity $0.01 \text{ Pa}\cdot\text{s}$ at the working temperature. If the load to be carried is steady and have value 375 N where the shaft rotate at 3000 rpm what will be the eccentricity and attitude angle. State all the assumptions and justify them. Assume cavitation occurs at an absolute pressure 10^4 Pa .

(10)

Q.2 The stiffness “k” of a journal bearing can be defined either as the load “W” divided by the deflection of the journal center “e”, or as “W” divided by the component of “e” in the direction of the load. For both definitions derive “k” as a function of eccentricity ratio “e” for a short bearing. For the case when “e” is small do the two stiffnesses increase or decrease with increasing “e”.

(10)

Q.3 Answer the followings:

(5 x 2=10)

- (a) Under what level of pressure does elastohydrodynamic lubrication occur? Can water sustain elastohydrodynamic lubrication?
- (b) Why is the interaction between a lubricant with pressure dependent viscosity and elastic deformation of a sphere or disc contacting a plane of such great practical significance?
- (c) Name an important advantage of rolling bearings over plain bearings.
- (d) Suggest a practical reason why the Michell pad is superior to rolling bearings for support of rotor load in a hydroelectric power station.
- (e) Draw a typical pressure profile in EHL line contacts.

Q.4 Considering a single normal line load “W” per unit length applied at point “O” in the plane (XY) of a semi-infinite solid and have same values for all values of “Z”. Derive the relation for elastic stress field in the plane “XY”. (Show major steps only).

(15)

End