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माला - 008

ELECTIVE- I
Tribology
(1040)

P. Pages : 3

Time : Three Hours

Max. Marks : 100

Instructions to Candidates :

1. Do not write anything on question paper except Seat No.
2. Answersheet should be written with blue ink only. Graph or diagram should be drawn with the same pen being used for writing paper or black HB pencil.
3. Students should note, no supplement will be provided.
4. Answer any **five** questions.
5. Neat diagrams must be drawn whenever necessary.
6. Figures to the right indicate full marks.
7. Use of electronic pocket calculator is allowed.
8. Assume suitable data, if necessary.

1. a) Explain deformation theory of friction. 6
- b) Discuss the effects of the following parameters on wear rate: 8
 - i) Load
 - ii) Temperature
 - iii) Surface films
 - iv) Compatibility
- c) What are the minor forms of wear? Explain in brief any three forms. 6
2. a) Explain: Viscosity, Kinematic viscosity and dynamic viscosity. 6
- b) Explain effect of temperature on viscosity. 7
- c) Write the equation for Hagen Poiseulle law with limitations. 7
3. a) State the important characteristics of viscous flow. 5
- b) State and explain the following special cases for Reynolds equation 8
 - i) Pure tangential motion under steady state

- ii) Pure sliding fluid motion
- iii) Flow with no side leakage.
- iv) For incompressible fluid.
- c) Differentiate between infinitely long and short journal bearings. 7
4. a) Explain with neat sketch the regimes of hydrodynamic lubrication. 6
- b) Show that in an infinite width tapered pad bearing of length L , the pressure is maximum at a distance of $\frac{nL}{(n+1)}$ from the leading edge. 8
- c) What do you mean by elastohydrodynamic lubrication? How elastohydrodynamic lubrication differs from hydrodynamic lubrication? 6
5. a) What are hydrodynamic thrust bearings? Explain the types of hydrodynamic thrust bearings. 6
- b) Briefly explain the different regimes in EHL contact. 6
- c) A fixed pad hydrodynamic thrust bearing of length 'L' and width 'B' has a fluid film shape given by relation $h = h_0 e^{-ax}$ where, h_0 = minimum fluid film thickness and a = constant Assuming side leakage as zero, Derive the expressions for Load carrying capacity. 8
6. a) State the procedure for the design of hydrodynamic journal bearings. 6
- b) Explain how selection of following parameters affect performance of hydrodynamic journal bearing: 8
- i) Length of diameter ratio
- ii) Unit bearing pressure
- iii) Radial clearance
- iv) Minimum oil-film thickness
- c) Draw radial pressure distribution and axial pressure distribution for hydrodynamics journal bearing. 6

7. a) Explain in brief the construction, advantages and applications of hydrostatic lubrication system. 6
- b) State advantages and disadvantages of gas lubricated bearings. 6
- c) Derive an expression for normal load carrying capacity of parallel plate near a plane. 8
8. Write short notes on any **four** of the following 20
- i) Knudsen number
 - ii) Power losses in hydrostatic step bearing
 - iii) Practical situations of hydrostatic squeeze film lubrication
 - iv) Measurement of viscosity
 - v) Mechanism of adhesive wear
 - vi) Effect of surface roughness on gas lubricated bearings.
