Date of Examination: 20-02-2018 (AN)
Duration: 2 hrs
Full Marks: 100

Subject No.: ME60404
Subject : Lubrication and Rotor Dynamics

Special Instructions (if any) : Attempt all questions. Symbols have their usual meanings. Please explain your work carefully. Make suitable assumptions wherever necessary. Please state your assumptions clearly.

1. Derive the generalized Reynolds equation starting from Navier-Stokes equation and state clearly the basic assumptions in the theory of hydrodynamic lubrication.

2. For a journal bearing non-dimensionalise the steady state Reynolds equation, then write the non-dimensional equation in algebraic form as applicable for Finite Difference Method and finally formulate expressions for Load carrying capacity, Friction parameter and End flow in non-dimensional form.

3. Find pressure distribution and load carrying capacity for a Rayleigh step bearing considering infinitely long.

4. A rectangular plane slider bearing with fixed shoe is operating under the following conditions:

    $B = 80$mm, $L = 150$mm, $U = 2.0$m/s, $\eta = 0.02$Pa-s, $h_2 = 0.02$mm, $h_1 = 0.05$mm

Find (i) the load carrying capacity and (ii) the pressure at a distance 50mm measured from the maximum film thickness point. Neglect side leakage.

5. Short answer type questions

    a) What is Viscosity Index (V.I.)? How do you find V.I. of an oil?

    b) Explain different lubrication regimes during run-up or run-down of a journal bearing.

    c) Explain oil–whirl and –whip mechanisms in hydrodynamic instability.

    d) Explain the procedure of theoretical and experimental modal analysis.