

Enroll No.....

ME-102

M.Tech.(Thermal)–I Sem (Reg./ Ex.)

Examination, March-2021

Heat & Mass Transfer

Time: Three Hours

Maximum Marks:70

Note: Attempt any five questions. (Each question carries equal marks)

Q.1 (a) How does thermal conductivity of materials vary with temperature?

(b) Derive the general three dimensional heat conduction equations in Cartesian co-ordinates system

Q.2 (a) A plane brick wall 25 cm thick is faced with 15 cm thick concrete layer. If temperature of exposed brick face is 70°C and that of concrete is 250°C , find out the heat lost per hour through a wall of $15\text{m}\times 10\text{m}$. Also determine the interface temperature. Thermal conductivity of brick & concrete are 0.7W/mK and 0.95W/mK

(b) What do you understand by critical radius of insulation? Derive an expression for critical radius of insulation in case of cylinders.

(2)

- Q.3 (a) Define effectiveness of fin. Does the effectiveness of a fin always increase?
- (b) Derive an expression for heat transfer for finite length long fin with insulated tip. $Q = \sqrt{hPKAc} \times (T_0 - T_a) \times \tanh h (ml)$
- Q.4 (a) State the assumption made in lumped heat capacity method for analysis of transient heat conduction. Also derive $(T - T_\infty) / (T_i - T_\infty) = \exp(-hAt / \rho c V)$
- (b) State the significance of Biot number and Fourier number.
- Q.5 (a) Discuss the concept of thermal boundary layer in case of flow over the plates. How does it differ from velocity boundary layer?
- (b) Discuss velocity distribution in circular pipes during boundary layer development.
- Q.6 (a) What do you understand by boiling and condensation?
- (b) Discuss in details the various regimes of pool boiling.

(3)

- Q.7 (a) State & prove Wien's displacement law.
- (b) State the Planck's law of radiation and explain.
- Q.8 (a) Define mass transfer? State the modes of mass transfer.
- (b) Explain mass transfer by molecular diffusion with the help of examples.
