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Roll No .....

ME - 605

B.E. VI Semester

Examination, December 2013

Heat and Mass Transfer

Time : Three Hours

Maximum Marks : 70

Note: 1. Answer five questions one from each unit.
2. Use of steam table and HMT data book permitted.

Unit - I

1. a) Define thermal conductivity and overall heat transfer coefficient. 4

   b) Explain significance of critical thickness of Insulation. 4

   c) A brick wall (k = 0.7 w/mk) is 0.30 m thick. If the temperatures of inner and outer surfaces are maintained at 50°C and 30°C respectively, calculate the heat loss through one square meter area. 6

OR

2. a) What is critical thickness of insulation on a pipe, Explain its physical significance and derive an expression for the same. 6

   b) Derive an expression for general heat conduction equation in rectangular co-ordinates. 8

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Unit - II

3. a) Define Fin efficiency and Fin effectiveness. 4

   b) Derive the equation for heat dissipation by a fin with an insulated tip $Q=\sqrt{hPKA}(T_0 - T_{00})\tanh(ML)$ by integrating the convective losses along its surfaces. 10

OR

4. a) Estimate the energy input required to solder together two very long pieces of bare copper 0.1625 cm in diameter with a solder that melts at 195°C. The wire are positioned vertically in air at 24°C and heat transfer coefficient on the wire surface is 17 w/m^2 – deg. For the wire alloy the thermal conductivity 335 w/m-deg. 8

   b) Explained lumped capacity analysis. For the sphere shape body of infinite thermal conductivity. 6

Unit - III

5. a) Distinguish between Natural and Force convection heat transfer. 4

   b) Estimate the heat transfer from a 40 W incandescent bulb at 125°C to 25°C in quiescent air. Approximate the bulb as a 50mm diameter sphere. What percent of the power is lost by free convection. 10

OR

6. a) State the Buckingham's π theorem. Using dimension analysis obtained an expression for Nusselt number in terms of Grashot and prandtl number. 10

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b) Distinguish thermal and Hydraulic boundary layer thickness. 4

Unit - IV

7. a) What is LMTD correction factor? When is LMTD method most suitable for the heat exchanger design calculation. 7

b) In a double pipe counter flow heat exchanger 8000 Kg/h of an oil having a specific heat of 2000 J/Kg k is cooled from 90°C to 55°C. Determine the heat exchanger area for an overall heat transfer coefficient of 300 m/m²k. Take C_p for water 4180 J/Kg.k. 7

OR

8. a) Explain Fick's law of diffusion in the mass transfer analysis. 4

b) Explain diffusion coefficient. 3

c) Discuss the advantage of NTU method over the LMTD of heat exchanger design. 7

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Unit - V

9. a) Define radiation intensity. Prove that the intensity of radiation is given by $I_b = E_b/\pi$. 7

b) Consider radiative heat transfer between two large parallel planes of surface emissivities 0.8 hour many thin radiation shields of emissivity 0.05 be placed between the surfaces to reduce the radiation heat transfer by a factor 75. 7

OR

10. a) What is Plank's Law of distribution? 4

b) Discuss briefly the various regimes in boiling heat transfer. 5

c) Distinguish between film wise and drop wise condensation. 5

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