

**B.Tech. MECHANICAL ENGINEERING
(COMPUTER INTEGRATED
MANUFACTURING)**

Term-End Examination

00583

June, 2017

BME-027 : HEAT AND MASS TRANSFER

Time : 3 hours

Maximum Marks : 70

Note : Answer any *seven* questions. All questions carry equal marks. Use of scientific calculator is permitted.

1. (a) What is meant by heat transfer ? 2
- (b) Derive the 'Stefan-Boltzmann' equation for radiation. 8
2. (a) Explain any one numerical method for heat transfer conduction. 5
- (b) Differentiate between parallel flow and counter flow heat exchangers. 5
3. (a) Derive a relation for critical thickness of insulation for a cylinder. 6
- (b) Explain the conduction, convection and radiation of heat transfer. 4

4. (a) Using Buckingham π -theorem, show that the free convection heat transfer, $Nu = BGr^a Pr^b$. 8
- (b) Define drag coefficient and drag force. 2
5. (a) What is Fick's law ? Explain. 4
- (b) Define the effectiveness of a heat exchanger. Also explain the rating and sizing problem for a heat exchanger. 6
6. (a) What are the different types of evaporators ? Explain any one of them with a neat diagram. 5
- (b) Describe the working principle of a surface condenser with a neat diagram. 5
7. A surface as a blackbody emits radiation at 2000 K. What is the rate per unit area (W/m^2) at which it emits radiation in directions corresponding to $0^\circ \leq \theta \leq 60^\circ$ and in the wavelength interval $3 \mu m \leq \lambda \leq 5 \mu m$? 10
8. (a) What is radiation intensity ? Explain radiosity, emission and spectral intensity. 5
- (b) Explain with the help of a diagram, the concept of hydrodynamic and thermal boundary layer for a laminar flow over a thin plate. 5

9. (a) Explain Lumped Capacitance method. What are the assumptions associated with this method? 5
- (b) Derive the continuity equation for a binary mixture. 5
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