

MAHARASHTRA ANIMAL AND FISHERY SCIENCES UNIVERSITY, NAGPUR
SEMESTER END THEORY EXAMINATION, B. TECH. (D. T.)

Semester	: II (V Dean)	Academic Year	: 2021-2022
Course No.	: DE- 205	Course Title	: Heat and Mass Transfer
Credits	: (2+1=3)	Total Marks	: 50
Day & Date	: Thursday, 10/11/2022	Time	: 02.30 Hrs.

- Note :**
- 1) All questions from **Section 'A'** are compulsory.
 - 2) Solve **Any Three** questions from **Section 'B'**.
 - 3) Draw neat and well labelled diagram wherever necessary.

SECTION - 'A'

Q. 1 A) Choose the most appropriate answer from the options given below. (05)

- i) The heat transfer is constant when
 - a) Temperature remains constant with time
 - b) Temperature increases with time
 - c) Temperature decreases with time
 - d) None of the above
- ii) With usual notation $\Delta x/kA$ is called as
 - a) Thermal conduction of wall
 - b) Heat flux density
 - c) Thermal resistance of wall
 - d) Thermal loading of wall
- iii) The term $\rho v l / \mu$ is called as
 - a) Reynolds number
 - b) Prandtl number
 - c) Froude number
 - d) Nusselt number
- iv) The radial heat transfer rate through hollow cylinder increases as the ratio of outer radius to inner radius
 - a) Increases
 - b) Decreases
 - c) Constant
 - d) None of the above
- v) For laminar flow, Reynolds number is
 - a) $Re > 2500$
 - b) $Re < 2500$
 - c) $Re < 2100$
 - d) $Re > 4000$

B) Define the following (05)

- i) Natural Convection heat transfer
- ii) Black body
- iii) Thermal conductivity
- iv) Thermal resistance
- v) Fouling factor

Q. 2 A) Give the formula for the following. (05)

- i) Nusselt number
- ii) One dimensional heat transfer through hollow cylinder
- iii) Stefan Boltzman's expression
- iv) Thermal diffusivity
- v) Grashoff number

(P.T.O.)

- B) State whether the following statements are True or False. If false, rewrite the statement after making necessary corrections. (05)
- i) Unsteady state flow means constant heat flow rate with time.
 - ii) An automobile radiator is an example of parallel flow heat exchanger.
 - iii) Conduction heat transfer takes place in liquid only.
 - iv) Temperature gradient is the driving force for transfer of heat.
 - v) The effectiveness of heat exchanger is defined as ratio of actual heat transfer rate to the maximum possible heat transfer rate.

SECTION – 'B'

- Q. 3 A) Discuss in detail about Stefan Boltzmann's law of radiation heat transfer with suitable examples. (05)
B) State Fourier's law and derive Fourier's equation of heat transfer in Cartesian coordinates. (05)
- Q. 4 A) Derive an expression for heat transfer by conduction through a flat composite wall. (05)
B) What are the different modes of heat transfer? Explain the mechanism of each mode of heat transfer with its governing laws. (05)
- Q. 5 A) Explain mass transfer and Fick's law of diffusion. (03)
B) Explain the analogy between flow of heat and electricity. (03)
C) The outer surface of 0.20 m thick concrete wall (10 m x 3 m) is kept at a temperature of 5 °C while the inner surface is kept at a temperature of 30°C. (04)
The thermal conductivity of concrete is 1.2 W/mK. Determine the thermal resistance and conductance of wall and heat loss through it.
- Q. 6 A) Differentiate between steady state and unsteady state heat transfer. (03)
B) Explain in brief about application of different types of heat exchangers in dairy and food industry. (03)
C) Derive the equation of LMTD for parallel flow type heat exchanger. (04)
- Q.7 Differentiate between free convection and forced convection heat transfer. Prove that $Nu = f(Pr, Re)$ with the help of dimensional analysis for forced convection heat transfer. (10)
