

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

Semester	: II(V Dean)	Academic Year	: 2023-2024
Course No.	: DE-205	Course Title	: Heat and mass transfer
Credits	: 1+1=2	Total Marks	: 50
Day & Date	: Wednesday; 07/08/2024	Time	: 2.00 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) Define the following. (05)
- i) Heat Flux
 - ii) Conduction
 - iii) Thermal diffusivity
 - iv) Forced convection
 - v) Heat transfer coefficient
- B) Answer in one line. (05)
- i) What is the Reynolds number?
 - ii) What is specific heat?
 - iii) What is the formula for critical thickness of insulation of cylinder and sphere?
 - iv) What is unit of thermal diffusivity?
 - v) Give two example of extended surface heat exchanger.
- Q.2 A) State whether True or False. If false, rewrite the statement after making necessary corrections in the underlined word. (05)
- i) The insulating ability of an insulator with the presence of moisture would decrease.
 - ii) In conduction, the rate of transfer of heat is maximum.
 - iii) Prandtl number (Pr) is defined as the ratio of momentum diffusivity (kinematic viscosity) to thermal diffusivity.
 - iv) The unit of overall heat transfer coefficient is W/m²/K.
 - v) If the concentration at any given point of a body changes with time, unsteady state mass transfer occurs.
- B) Choose the most appropriate answer from the options given below. (05)
- i) thermometer work on the principle of Seeback effect.
 - a) Pyrometer
 - b) RTD
 - c) Thermocouple
 - d) Thermistor
 - ii) The purpose of using fins in intercooler is to reduce
 - a) Temperature
 - b) Pressure
 - c) Volume
 - d) Entropy
 - iii) of solids is a basic physical property representing the dimensional changes in a solid induced by a change in temperature.
 - a) Thermal composition
 - b) Thermal metre
 - c) Thermal pressure
 - d) Thermal expansion

(P.T.O.)

- iv) Compared to counter flow heat exchanger, LMTD in case of parallel flow heat exchanger is
- a) Higher
 - b) Lower
 - c) Equivalent
 - d) Depends upon condition
- v) As the temperature increases, the thermal conductivity of a gas
- a) Increases
 - b) Decreases
 - c) Remains constant
 - d) increases up to a certain temperature and then decreases

SECTION –‘B’

- Q. 3 A) Derive the expression for Log mean temperature difference (LMTD) for co-current and counter current heat exchanger. (05)
- B) Explain different modes of heat transfer with examples and law governing them. (05)
- Q. 4 A) What is critical thickness of insulation, give expression critical thickness of insulation of slab and sphere? (05)
- B) Derive the expression for steady state unidirectional heat flow through composite slab and cylinder. (05)
- Q. 5 A) Discuss heat transfer through plain wall and cylinder. (03)
- B) Explain the concept of unsteady and steady state heat transfer. (03)
- C) A brick wall having area 10m^2 is having outside temperature of 50°C and inside temperature of 30°C . The thermal conductivity of wall is $10\text{W/m}^\circ\text{C}$. Calculate the heat flow through wall? (04)
- Q. 6 A) Give significance of Reynolds number and explain how turbulent flow enhances heat transfer rate. (03)
- B) An oil cooler in a high performance engine has an outside surface area 0.12m^2 and surface temperature of 65°C . The air is flowing over the surface of the cooler at a temperature of 30°C , with heat transfer coefficient of $45.4\text{W/m}^2\text{K}$. Calculate the heat transfer rate from the cooler? (03)
- C) Explain different types of fins and write the expression for effectiveness and efficiency of fins. (04)
- Q. 7 Classify the heat exchangers commonly used in food and dairy industry and explain any two with neat sketch. (10)
