

PARUL UNIVERSITY
FACULTY OF AGRICULTURE
B.Tech. (Agriculture/Dairy Technology) Winter 2019 - 20 Examination

Semester: 1 / 2

Subject Code: 20103106

Subject Name: Heat and Mass Transfer

Date: 26/11/2019

Time: 10.30 am To 12.30 pm

Total Marks: 50

Instructions

1. All questions are compulsory.
2. Figures to the right indicate full marks.
3. Make suitable assumptions wherever necessary.
4. Start new question on new page.

Q.1**A) Fill in the blanks (Each of 0.5 Mark) (05)**

- i) In _____ heat transfer, the heat is moved through bulk transfer of a non-uniform temperature fluid.
- ii) _____ is a well-tabulated property for a large number of materials.
- iii) In electrical analogy, $R = L/kA$ is known as _____.
- iv) _____ are used in a large number of applications to increase the heat transfer from surfaces.
- v) Heat transfer between a solid surface and a moving fluid is governed by the _____
- vi) In the _____-flow arrangement, the hot and cold fluids enter at the same end, flow in the same direction, and leave at the same end.
- vii) All bodies radiate energy in the form of _____.
- viii) The general function of a heat exchanger is to transfer _____ from one fluid to another.
- ix) Typically, the fin material has a high _____.
- x) Radiation is the only method for heat transfer in _____.

B) Multiple Choice Questions (Each of 0.5 Mark) (10)

- i) **Upto the critical radius of insulation,**
 - a) Added insulation will increase heat loss, b) Added insulation will decrease heat loss, c) Convective heat loss will be less than conductive heat loss, d) Heat flux will decrease
- ii) **Unit of thermal diffusivity is**
 - a) m^2/hr b) $m^2/hr \text{ } ^\circ C$ c) $kcal/m^2 \text{ hr}$ d) $kcal/m. \text{ hr } ^\circ C$
- iii) **Thermal conductivity of wood depends on**
 - a) Moisture b) Density c) Temperature d) All of the above
- iv) **The unit of overall coefficient of heat transfer is**
 - a) W/m^2K b) W/m^2 c) W/mK d) W/m
- v) **LMTD in case of counter flow heat exchanger as compared to parallel flow heat exchanger is**
 - a) Higher b) Lower c) Same d) Depends on the area of heat exchanger
- vi) **The transfer of heat by molecular collision is smallest in**
 - a) Solids b) Liquids c) Gases d) None of these
- vii) **In a shell and tube heat exchanger, baffles are provided on the shell side to**
 - a) Improve heat transfer b) Provide support for tubes c) Prevent stagnation of shell side fluid d) All of these
- viii) **Joule sec is the unit of**
 - a) Universal gas constant b) Kinematic viscosity

- c) Thermal conductivity d) Planck's constant
- ix) **The product of Reynolds number and Prandtl number is known as**
 a) Stanton number b) Biot number c) Peclet number
 d) Grashoff number
- x) **Which of the following is the case of heat transfer by radiation?**
 a) Blast furnace b) Heating of building c)
 Cooling of parts in furnace d) Heat received by a person from fireplace
- xi) **Thermal conductivity of water _____ with rise in temperature.**
 a) Remain same b) Decreases c) Increases
 d) May increase or decrease depending upon temperature
- xii) **Pick up the wrong case. Heat flowing from one side to other depends directly on**
 a) Face area b) Time c) Thickness
 d) Temperature difference
- xiii) **The automobile radiator is a heat exchanger of**
 a) Parallel flow type b) Counter flow type c) Cross flow type
 d) Regenerator type
- xiv) **Which of the following is a case of steady state heat transfer?**
 a) I.C. engine b) Air preheaters c) Heating of building in winter
 d) None of the above
- xv) **Fouling factor is used**
 a) In heat exchanger design as a safety factor b) In case of Newtonian fluids
 c) When a liquid exchanges heat with a gas d) None of the above
- xvi) **The natural convection air cooled condensers are used in**
 a) Domestic refrigerators b) Water coolers c) Room air
 conditioners d) All of these
- xvii) **Thermal conductivity of air with rise in temperature**
 a) Increases b) Decreases c) Remain constant
 d) May increase or decrease depending on temperature
- xviii) **The concept of overall coefficient of heat transfer is used in heat transfer problems of**
 a) Conduction b) Convection c) Radiation d) Conduction and convection
- xix) **In a heat exchanger with one fluid evaporating or condensing, the surface area required is least in**
 a) Parallel flow b) Counter flow c) Cross flow
 d) All of these
- xx) **According to Stefan Boltzmann law, the total radiation from a black body per second per unit area is directly proportional to the**
 a) Absolute temperature b) Square of the absolute temperature
 c) Cube of the absolute temperature d) Fourth power of the absolute temperature

Q.2

A) **Define the following (Any five out of seven questions)** **(05)**

- (1) What is driving potential for mass transfer?
- (2) Give some examples related to heat transfer from the routine life.
- (3) State the various modes of heat transfer.
- (4) 'It is desirable to use two thin glasses for window instead of one thick glass'. Justify.
- (5) What are the main purposes to study 'Heat Transfer'?
- (6) State and write the governing equation for heat transfer by conduction.
- (7) What do you mean by monochromatic radiation?

B) Answer the following (Any five out of seven questions) (05)

- (1) Give some examples related to mass transfer from the routine life.
- (2) 'In summer, one should wear white clothes instead of black one.' Why?
- (3) Give some examples of direct contact type of heat exchangers.
- (4) Define heat exchangers.
- (5) A plane wall of thickness 5mm have temperature difference across the two boundaries of 50°C . The thermal conductivity of the wall is 10 watt/m-K. Calculate the heat transfer rate per unit area through the wall.
- (6) State and write the governing equation for heat transfer by convection.
- (7) What is driving potential for heat transfer?

Q.3 Write Short notes (Any five out of six questions) (10)

- (1) Differentiate between heat transfer and mass transfer.
- (2) Differentiate between conduction and radiation.
- (3) Differentiate between free convection and forced convection.
- (4) Differentiate between counter-flow and parallel flow heat exchanger.
- (5) Differentiate between steady and unsteady state heat transfer.
- (6) Differentiate between Nusselt number and Reynolds number.

Q.4 Long Questions (Any three out of four questions) (15)

- (1) Write the most general equation in Cartesian co-ordinates for heat transfer by conduction. Deduce above equation for the following cases;
 - (i) Steady state, one dimensional heat transfer with internal heat generation,
 - (ii) Two dimensional heat transfer without heat generation, and
 - (iii) Steady state, one dimensional heat transfer without internal heat generation.
- (2) Using dimensional analysis, obtain a general form of equation for Natural Convective heat transfer.
- (3) What is meant by thermal resistance? Explain the electrical analogy for solving heat transfer problems.
- (4) What is the significance of 'Heat Transfer' in your branch? Explain in details with suitable examples.