Seat No: _____ **Enrollment No: _____**

PARUL UNIVERSITY

FACULTY OF ENGINEERING & TECHNOLOGY

B.Tech. Summer 2018 - 19Examination

Semester: 4 **Date:03/05/2019**
Subject Code: 03103253 **Time:02:00pm 04:30pm**
Subject Name: Heat Transfer Operations **Total Marks: 60**

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 Objective Type Questions- (All are compulsory) **(15)**

1. 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 (e) depends on temperature conditions.

2. The amount of radiation mainly depends upon the_____
(a) Nature of the body (b) Temperature of the body
(c) type of surface of the body (d) All of these.

3. Unit of thermal conductivity is ……..

4. What is flux?

5. Planck's law holds good for
(a) black bodies (b) polished bodies (c) all coloured bodies (d) all of the above (e) none of the above

6. All radiations in a black body are …….
(a) reflected (b) refracted (c) transmitted (d) absorbed (e) partly reflected

7. A non-dimensional number generally associated with natural convection heat transfer is
(a) Grashof number (b) Nusselt number (c) Prandtl number (d) Reynold number.

8. The ratio of the emissive power and absorptive power of all bodies is the same and is equal to the emissive power of a perfectly black body. This statement is known as (a) Planck's law (b) Stefan's law (c) Wien' law (d) Krichoff's law (e) Black body law

9.Thermal conductivity of solid metals ……with rise in temperature

10. Heat transfer is more in counter current heat exchanger. **True/False**

11. Write Prandlt number……..

12.Emissivity of a white polished body in comparison to a black body is
(a) higher (b) lower (c) same (d) depends upon the shape of body

13. Write Fourier's law for conduction……..

14. …….. and …… are two types of condensation

15. The value of the wavelength for maximum emissive power is given by (a) Stefan's law (b) Planck's law (c) Fourier's law (d) Wien's law (e) Kirchhoff's law.

Q.2 Answer the following questions. (Attempt any three) **(15)**

A) Define the following
1. Black body 2. Radiation 3. Absorptivity 4. Grey body 5. Emmisivity

B) It is true that insulation is provided to reduce heat transfer rate but due to insulation heat transfer rate is not reduced always" Justify the statement analytically.

C) Classify only, the heat exchanger based on

1) Nature of heat exchange process and

2) Direction of fluid flow

D)Define following:

1) Nusselt number **2)** Reynolds number **3)** Grashoff number

4) Prandtl number **5)** Thermal diffusivity

Q.3 **A)** Define boiling? Draw boiling curve which shows all the boiling regimes and explain nucleate boiling regime in brief **(07)**

B) Derive equations of temperature distribution and heat transfer for composite cylinder separating two fluids considering heat flow in radial direction **(08)**

OR

B) Explain lumped heat capacity method and state its assumptions. **(08)**

Q.4 **A)** Hot water at 2.5 kg/s and 100°C enters a concentric tube counter flow heat exchanger having a total area of 23m^2. Cold water at 20°C enters at 5 kg/s and the overall heat transfer coefficient is 1000 W/m^2K. Determine the total heat transfer rate and the outlet temperature of hot and cold fluids. **(07)**

OR

A) Estimate the time required to cook a carrot in boiling water at atmospheric pressure. The carrot is initially at room temperature 32 °C and the cooking requirement stipulates that a minimum temperature of 97 °C is reached at the center of carrot. Treat the carrot as a long cylinder of 18 mm diameter and having the following properties: ρ=1025 kg/m3, Cp = 4000 J/kg.K, k= 3.45 W/m-K, convective heat transfer coefficient h = 60 W/m^2-K **(07)**

B) A composite flat wall of a furnace is made of two materials A and B. The thermal conductivity of A is twice of that of material B, while the thickness of layer A is half of that of B. If the temperatures at the two sides of the wall are 400K and 1200K, then calculate the temperature drop (in Kelvin) across the layer of material A. **(08)**