A **Reg. No. :** | | | | | | | | | | |

Question Paper Code:55903

B.E./B.Tech. DEGREE EXAMINATION, NOV 2018

Fifth Semester

Chemical Engineering

15UCH503-HEAT TRANSFER

(Use of HMT data book is permitted)

(Regulation 2015)

Duration: Three hours Maximum: 100 Marks

Answer ALL Questions

PART A - (10 x 1 = 10 Marks)

1. Which of the following metal has high thermal conductivity value? CO1- R

   (a) Copper (b) Steel (c) Aluminum (d) Silver

2. The efficiency of the fin is CO1- R

   (a) Q_{max}/Q (b) Q_{max}/Q_{min} (c) Q_{min}/Q_{act} (d) Q_{act}/Q_{max}

3. The fluid flow in which the fluid particles in one layer do not mix with the fluid particles in the other layer is called as CO2- R

   (a) Laminar flow (b) Turbulent flow (c) Layer flow (d) Steady flow

4. The ratio of the thickness of thermal boundary layer to the thickness of hydrodynamic boundary layer is equal to (Prandtl number)^n, where n is equal to CO2- U

   (a) -1/3 (b) -2/3 (c) 1 (d) -1

5. Heat transfer without medium is known as CO3- R

   (a) Conduction (b) Convection (c) Free convection (d) Radiation

6. The product of maximum wavelength and absolute temperature is equal to constant is known as CO3- R

   (a) Wien's Law (b) Stefan's Law (c) Planck's Law (d) Prevost Theory

7. _____ occur when a liquid is forced through a channel which is maintained at a temperature higher than the saturation temperature of the liquid. CO4- R

(a) Film boiling (b) Nucleate boiling (c) Pool boiling (d) Flow boiling

8. The heat transfer co-efficient in film type condensation is _____ that for drop wise condensation. CO4- R

(a) Greater than (b) Lower than (c) Half (d) Is same as

9. LMTD in case of counter flow heat exchanger as compared to parallel flow heat exchanger is CO5- U

(a) Higher (b) Lower

(c) Same (d) Depends on the area of heat exchanger

10. Automobile radiator is a heat exchanger of CO5- U

(a) Counter flow type (b) Parallel flow type

(c) Regenerator type (d) Cross flow type

PART – B (5 x 2= 10 Marks)

11. State Fourier's law of heat conduction. CO1- R

12. Write the significance of Reynolds number. CO2- R

13. Define Emissivity of a surface. CO3- R

14. Differentiate between pool boiling and flow boiling. CO4- R

15. What is fouling factor ? CO5- R

PART – C (5 x 16= 80 Marks)

16. (a) Derive the General heat conduction equation in Cartesian Co-ordinates. CO1 U (16)

Or

(b) A pipe carrying steam at 230°C has an internal diameter of 12 cm and the pipe thickness is 7.5 mm. The conductivity of the pipe material is 49 W/mK. The convective heat transfer coefficient on the inside is 85 W/m^2K. The pipe is insulated by two layers of insulation one of 5 cm thickness of conductivity 0.15 W/mK and over it another 5 cm thickness of conductivity 0.48 W/mK. The outside is exposed to air at 35°C with a convection coefficient of 18 W/m^2K. Determine the heat loss for 5 m length. Also determine the interface temperatures. CO1- App (16)

17.	(a)	In a process, water at 30°C flows over a plate maintained at 10°C with a freestream velocity of 0.3 m/s. Determine the hydrodynamic boundary layer thickness, thermal boundary layer thickness, local and average values of friction coefficient, heat transfer coefficient.	CO2- App	(16)
		Or		
	(b)	Derive a correlation for heat transfer coefficient using dimensional analysis method for free convection equation.	CO2- U	(16)
18.	(a)	(i) Define absorptivity, reflectivity and transmissivity.	CO3- U	(6)
		(ii) State and prove Kirchoff's law.	CO3- U	(10)
		Or		
	(b)	Emissivities of two large parallel plates maintained at 800^{o} C and 300^{o} C are 0.3 and 0.5 respectively. Find the net radiant heat exchange per square meter of the plates. If a polished aluminum shield (Є = 0.05) is placed between them. Find the percentage of reduction in heat transfer.	CO3- Ana	(16)
19.	(a)	Explain in detail about the construction and working principle of different types of condensers.	CO4- U	(16)
		Or		
	(b)	With neat sketches, explain the working of different types of evaporators.	CO4- U	(16)
20.	(a)	With neat sketches. explain the classification of heat exchangers.	CO5- U	(16)
		Or F		
	(b)	Determine the area required in parallel flow heat exchanger to cool oil from 60°C to 30°C using water available at 20°C. The outlet temperature of the water is 26°C. The rate of flow of oil is 10 kg/s. The specific heat of the oil is 2200 J/kg K. The overall heat transfer coefficient U = 300 W/m^2 K. Compare the area required for a counter flow exchanger.	CO5- App	(16)