Name:

Enrolment No:

UNIVERSITY OF PETROLEUM AND ENERGY STUDIES
End Semester Examination, December 2022

Course : Heat Transfer | **Semester : III**
Program : B. Tech. (APE Gas) | **Time : 03 hrs.**
Course Code: CHCE 2023 | **Max. Marks : 100**

Instructions:

- ✓ Attempt **all** questions from **Section-A** (each carrying 4 marks), **Section-B** (each carrying 10 marks) and **Section-C** (carrying 20 marks).

Assume suitable data wherever necessary. The notations used here have the usual meanings.

SECTION-A

S. No.		Marks	CO
1.	List out the basic laws of heat transfer and state anyone.	4 M	CO1
2.	Define Nusselt number and Reynolds number.	4 M	CO2
3.	Explain subcooled boiling and saturated boiling.	4 M	CO2
4.	Define capacity and economy of multiple effect evaporator.	4 M	CO4
5.	Define view factor.	4 M	CO3
	SECTION-B		
6.	What is critical radius of insulation? Derive critical thickness of insulation expression for a sphere.	10 M	CO1
7.	Water at 75 ^{o}C flows through a 0.01 m diameter tube with a velocity of 1.5m/s. If the tube wall temperature is 25 ^{o}C, make calculations for the heat transfer coefficient. Use the correlation, $Nu = 0.023\ Re^{0.2}\ Pr^{-0.667}$. The thermo-physical properties of water are: Thermal conductivity is 0.647 W/(m.K); Viscosity is 1.977 kg/h.m; Density is 1000 kg/m^3; Specific heat 4.187 kJ/(kg.K).	10 M	CO2
8.	The filament of a 75 W light bulb may be considered as a black body radiation into a black enclosure at 70 ^{o}C. The filament diameter is 0.10 mm and length is 5 cm. Considering the radiation, determine the filament temperature.	10 M	CO3
9.	Show that for parallel flow heat exchanger $\varepsilon = \frac{1-\exp\{-NTU(1+R)]}{1+R}$	10 M	CO4
	SECTION-C		
10.	Consider a shell and tube heat exchanger constructed from a 0.0254m OD tube to cool 6.93 kg/s of a 95% ethyl alcohol solution (C_P 3810 J/kg.K) from 60 ^{o}C to 40 ^{o}C using	20 M	CO4

	6.15 Kg/s of water available at 15 ^oC (C_P 4187 J/kg.K). In the heat exchanger 72 tubes will be used. Assume that the overall heat transfer coefficient based on the outer tube area is 650 W/m^2.K. Calculate the surface area and the length of heat exchanger for each of the following arrangement. a) Parallel flow shell and tube heat exchanger b) Counter flow shell and tube heat exchanger		
11.	a) Derive an expression to determine the rate of heat transfer from a rectangular fin of uniform cross-sectional area with insulated end. b) An aluminium rectangular fin (k = 204 W/m-K) of length 50cm, width 20cm and thickness 2mm is attached to a wall at 350 ^oC and the end of the fin is insulated. The fin surface is exposed to an environment at 25 ^oC with h = 10 W/m^2-.K. Determine the heat transfer from the fin. Calculate the temperature of the fin at the insulated end.	**12+8 M**	**CO1**