

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY-GURUJADA VIZINAGARAM
III B. Tech II Semester Regular/Supplementary Examinations, April -2025
HEAT TRANSFER
(Mechanical Engineering)

Time: 3 hours

Max. Marks: 70

Answer any **FIVE** Questions **ONE** Question from **Each unit**

All Questions Carry Equal Marks

		<u>UNIT-I</u>	
1.	a)	Discuss the function of extended surfaces (fins) in heat transfer and categorize different types of fins along with their applications.	[7M]
	b)	The boiler wall is made up of two layers, A & B. Thickness & Thermal conductivity of A are 240 mm and 0.2 W/m °C respectively. For B, thickness & thermal conductivity are 525 mm and 0.3 W/m °C respectively. Inner surface of A is maintained at 1000 °C and outer surface of B is maintained at 250 °C. If there is contact thermal resistance of 0.05 °C/W per unit area exists at the interface. Calculate (i) The heat lost per m ² area. (ii) The temperature drop at the interface.	[7M]
		(OR)	
2.	a)	Explain the concept of heat conduction through a composite wall. Derive the equation for the overall heat transfer rate through a composite wall consisting of three layers with different thermal conductivities.	[7M]
	b)	Derive the general heat conduction equation in Spherical coordinates.	[7M]
		<u>UNIT-II</u>	
3.	a)	Explain the Buckingham π theorem and its role in dimensional analysis for convective heat transfer.	[7M]
	b)	What is a semi-infinite body in transient conduction? Explain with an example.	[7M]
		(OR)	
4.	a)	Find out the temperature distribution equation for lumped parameter analysis.	[7M]
	b)	Describe the concept of a semi-infinite body in transient conduction and explain its practical applications in engineering.	[7M]
		<u>UNIT-III</u>	
5.	a)	Describe the empirical correlations used for convective heat transfer in flat plates and cylinders.	[7M]
	b)	Water enters a 2.5 cm internal diameter thin copper tube of a heat exchanger at 15 °C at a rate of 0.3 kg/s, and is heated by steam condensing outside at 120°C. If the average heat transfer co-efficient is 800 W/m ² .K, determine the length of the tube required in order to heat the water to 115°C.	[7M]
		(OR)	
6.	a)	Compare the heat transfer characteristics of forced convection in	[7M]

		cylinders and flat plates.	
	b)	Explain the concept of free convection and the role of boundary layers along a vertical plate.	[7M]
		<u>UNIT-IV</u>	
7.	a)	Explain the classification of heat exchangers based on their function and construction.	[7M]
	b)	In an oil cooler of the counter flow type, 5000 kg per hour of oil of specific heat 2.51 kJ/kg K is cooled from 40 °C to 24 °C by means of 6000 kg per hour of water which enters at 15 °C. Find the cooling surface required if the overall coefficient of heat transmission is 3.489 kW/m ² °C.	[7M]
		(OR)	
8.	a)	Compare the LMTD method and the NTU method used in heat exchanger analysis.	[7M]
	b)	Differentiate between film-wise and drop-wise condensation with examples.	[7M]
		<u>UNIT-V</u>	
9.	a)	Define emissivity and explain how it affects radiation heat transfer.	[7M]
	b)	Two large parallel planes having emissivities at 0.3 and 0.5 are maintained at temperature of 800 °C and 300 °C respectively. A radiation shield having an emissivity of 0.05 is placed in between them. Calculate- (i) Heat transfer per unit area without shield (ii) The temperature of the shield (iii) Heat transfer per unit area with shield.	[7M]
		(OR)	
10.	a)	What are shape factors in radiation heat exchange? Explain their significance.	[7M]
	b)	Two parallel black surfaces at different temperatures exchange radiation. Derive the formula for net heat exchange using the Stefan-Boltzmann law.	[7M]
