Code No: RT32035 **R13** **SET - 1**

III B. Tech II Semester Supplementary Examinations, November - 2017
HEAT TRANSFER
(Mechanical Engineering)

Time: 3 hours Maximum Marks: 70

Note: 1. Question Paper consists of two parts (**Part-A** and **Part-B**)
2. Answering the question in **Part-A** is compulsory
3. Answer any **THREE** Questions from **Part-B**

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PART –A

1	a)	Define Conduction, Convection and Radiation heat transfers and give examples for each case.	[3M]
	b)	Explain the significance of Biot and Fourier numbers used in unsteady state heat transfer.	[4M]
	c)	Distinguish the Forced and Natural convections and give example for each.	[3M]
	d)	Discuss the relative growth of hydrodynamic and thermal boundary layer growths with respect to Prandtl number.	[4M]
	e)	What is meant by fouling and give the causes for fouling in Heat exchangers.	[4M]
	f)	Explain the Planck's law of distribution and what is meant by monochromatic emissive power.	[4M]

PART -B

2	a)	Give the governing laws for three basic modes of heat transfer.	[4M]
	b)	A composite slab consists of 250mm fire clay brick (k = 1.09 W/mk) inside, 100 mm fired earth brick (k = 0.26 W/mK) and the outer layer of common brick (k = 0.6 W/mK) of thickness 50 mm. If the inside surface is at 120^0 C and outside surface is at 100 C find (i) heat flux (ii) the temperature of the interfaces and (iii) the temperature at 200 mm from the outer surface of the wall.	[8M]
	c)	Calculate the critical radius of insulation for asbestos surrounding a pipe and exposed to room air at 30 ^{0}C with h=3 W/m^{2}K.	[4M]
3	a)	What is a Fin? Discuss different types of fins used in engineering applications.	[4M]
	b)	Derive the equation for heat dissipated by a fin with an insulated tip.	[6M]
	c)	A Carbon steel rod (k = 55 W/m C) has been attached to a plane wall which is maintained at a temperature of 35^0 C. The rod is 8cm long has the cross section of an equilateral triangle with each side is 5mm. Determine the heat dissipation from the rod if it is exposed to a convection environment at 25 C with unit surface conductance 100 W/m^{2}C. Consider end surface loss to be negligible.	[6M]
4	a)	Using dimensional analysis, obtain an expression for relation among the different non dimensional numbers in the case of forced convection.	[8M]
	b)	A thin flat plate has been placed longitudinally in a stream of air at 20°C which flows with undisturbed velocity of 7.5 m/s. The surface of the plate is maintained at a uniform temperature of 120°C, i) Calculate the heat transfer coefficient 0.8m from the leading edge of the plate. ii) Also calculate the rate of heat transfer from one side of the plate to the air over the first 0.8m length. Assume unit width of the plate.	[8M]

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5 a) Explain the natural convection heat transfer on a Vertical hot plate with the help of velocity and temperature profiles. [8M]

b) Estimate the heat transfer coefficient for a laminar fully developed fluid (k=0.175W/mK) inside a 6mm inner diameter tube under uniform wall temperature boundary condition. Also compute heat transfer rate between the tube wall and the fluid for a length of 8m if the mean temp difference between the wall and the fluid is 50^0C. [8M]

6 a) Draw pooling boiling curve and discuss the difference regimes in it. [8M]

b) A double pipe parallel flow heat exchanger is employed in a food processing unit to heat the brine solution from -6.5^0C to 12^0C by means of water flowing at the rate of 540 kg/h. The water enters at 35^0C and leaves at 20.5^0C. If the overall heat transfer coefficient is 860 W/m^{2}K, calculate the heat transfer area. [8M]

7 a) What is Stefan Boltzman law and prove Stefan Boltzman constant 5.67 x 10^{-8} W/m^2 K. [8M]

b) A black body having surface area 0.2m^2 has an effective temperature 800 K. Determine the following (i) total emission (ii) intensity of radiation (iii) wavelength for maximum spectral emissive power. [8M]

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