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

III B. Tech II Semester Supplementary Examinations, November -2018

HEAT TRANSFER

(Mechanical Engineering)

Time: 3 hours Max. 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)	State the Newton's law of cooling.	[3M]
	b)	Under what conditions can a plane wall be treated as a semi-infinite medium?	[4M]
	c)	How is Reynolds analogy expressed? What is the value of it? What are its limitations?	[3M]
	d)	What is forced convection? How does it differ from natural convection? Is convection caused by winds forced or natural convection?	[4M]
	e)	Can the logarithmic mean temperature difference of a heat exchanger be a negative quantity? Explain	[4M]
	f)	State and explain Planck, Wien, Kirchoff laws.	[4M]

PART -B

2	a)	Distinguish between the basic laws of heat transfer with examples?	[4M]
	b)	An insulated pipe of 50 mm outside diameter (€=0.8) is laid in a room at 30^0C. If the surface temperature is 250^0C and the convective heat transfer coefficient is 10 W/m^2K. Calculate the heat loss per unit length of pipe.	[8M]
	c)	Consider an alloy of two metals whose thermal conductivities are k_1 and k_2.will the thermal conductivity of the alloy be less than k_1, greater than k_2, or between k_1 and k_2.Explain.	[4M]
3	a)	Explain how biot number help in transient conduction problem.	[3M]
	b)	Derive expression for critical thickness of insulation for a cylinder.	[8M]
	c)	What are heisleir charts? Under what conditions heislier charts are used in heat transfer problems.	[5M]
4	a)	Discuss the formation of velocity boundary layer for flow of fluid through a circular cross section pipe.	[8M]
	b)	Air at 1atm and 30^0C is forced through a horizontal 30mm diameter 0.5m Long at an average velocity of 0.25m/s. The tube wall is maintained at 137^0C. Calculate i) the heat transfer coefficient and ii) percentage error if the calculation is made strictly on the basis of laminar forced convention.	[8M]
5	a)	Derive NTU of parallel flow and counter flow heat exchangers.	[8M]
	b)	A flow of 0.1kg/s of exhaust gases at 70^0K from a gas turbine is used to preheat the incoming air, which is at the ambient temperature of 30^0K. It is desired to cool the exhaust to 40^0K and it is estimated that an overall heat coefficient of 30W/m^2K can be achieved in an appropriate exchanger. Determine the area required for a counter flow heat exchanger. Take the specific heat of exhaust gasses the same as for air, Which is1000J/kg.K.	[8M]

6 a) Distinguish between filmwise and dropwise condensation. Which of the two gives a higher heat transfer coefficient? Why? [8M]

b) Determine the stable film boiling heat transfer coefficient for the film boiling of saturated water at atmospheric pressure on an electrically heated 1.6 mm diameter horizontal platinum wire with a temperature difference $T_s - T_{sat}$ = 225 ºC. What would be power dissipation per unit length of the heater? [8M]

7 a) Distinguish between [8M]
i) A black body Vs gray body
ii) Specular Vs diffuse surfaces
iii) Absorptivity Vs emissivity of a surface
iv) Total emissivity Vs equilibrium emissivity

b) A pipe carrying steam having an outside diameter 20cm runs in a large room, and is exposed to air at a temperature of 30ºC. The pipe surface temperature is 200ºC. Find the heat loss per meter length of the pipe by convection and radiation taking the emissivity of the pipe surface as 0.8. [8M]

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