Code No: R1622352 **R16** SET - 1

II B. Tech II Semester Regular Examinations, April- 2018
HEAT AND MASS TRANSFER
(Agricultural Engineering)

Time: 3 hours Max. Marks: 70

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

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PART –A

1.	a)	Illustrate the importance of heat transfer in various fields of engineering.	(2M)
	b)	Explain the terms thermal conductance and thermal resistance.	(2M)
	c)	Distinguish between a black body and gray body.	(2M)
	d)	Explain and discuss the significance of Grashoff number.	(3M)
	e)	Explain the importance of LMTD in heat exchanger analysis.	(3M)
	f)	Define convective mass transfer coefficient and what are its units?	(2M)

PART -B

2.	a)	Define thermal conductivity and explain the various factors on which it depends.	(7M)
	b)	A 1mm thick copper plate having thermal conductivity, k=386 W/m K is sandwiched between two 5mm thick epoxy boards having thermal conductivity, k=0.3 W/m K, 15 x 20 cm^2 in size. If the thermal contact conductance on both sides of the Copper plate is 4000 $W/m^2{}^0C$, determine the rate of heat transfer per temperature difference of 100^0C across the plate.	(7M)
3.	a)	Explain the electrical analogy of heat transfer. Illustrate the concept of electrical analogy considering a multi layer composite wall.	(7M)
	b)	Hot water at 60^0C is flowing through a 10m length steel pipe (thermal conductivity, k=38 W/m K) whose inner and outer diameters are 5cm and 5.4cm respectively. The pipe is exposed to outside environment at 20^0C with a convective heat transfer coefficient of 15 W/m^2 K. Find the rate of heat loss from the water and interface temperature.	(7M)
4.	a)	What is the Stefan-Boltzmann law? Explain the concept of total emissive power of a surface.	(7M)
	b)	A diffuse reflector of area $0.2m^2$ is receiving radiation from a source with an intensity of 145 W/m^2. Calculate the absorptivity of the reflector surface if it reflects 54.5W.	(7M)
5.	a)	Derive the expression for temperature as a function of time 't' in lumped heat capacity system.	(7M)
	b)	A long rod whose one end is inserted into a furnace and the other end is exposed to surroundings at 25^0C. Under steady state condition at two points on the rod 100mm apart, the temperatures were found to be 120^0C and 100^0C respectively. If the diameter of the rod is 20mm and the convective heat transfer coefficient with the surroundings is 5 W/m^2 K determine the thermal conductivity of the rod.	(7M)
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6. a) Derive the expression for effectiveness in terms of NTU for a counter flow heat exchanger. (7M)
   b) Water at 50^0C enters a 1.5cm diameter and 3m long tube with a velocity of 1 m/s. The tube wall is maintained at a constant temperature of 90^0C. Calculate the heat transfer coefficient and the total amount of heat transferred if the exit water temperature is 64^0C. (7M)

7. a) State Fick`s first and second laws of diffusion. (6M)
   b) Estimate the diffusion rate of water from the bottom of a test tube 10mm in diameter and 15cm long into dry atmospheric air at 25^0C. Take the diffusion coefficient of water through air as 0.225 x 10^4 m^2/s. (8M)