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

II B. Tech II Semester Supplementary Examinations, November - 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) What is heat flux? How it is related to the heat transfer? (3M)
   b) What is meant by critical thickness? What is its importance in heat transfer (3M)
   c) What is meant by total emissive power and Monochromatic emissive power (2M)
   d) List out the uses of fins (2M)
   e) List out the differences between the parallel flow and counter flow heat exchangers (2M)
   f) Enumerate the applications of mass transfer (2M)

PART –B

2. The rate of heat generation in a slab thickness 140 mm (k=190 W/m^{0}C) in 1.4 x 10^6 W/m^3. If the temperature of each of the surface of solid is 125^{0}C, determine: (14M)
   (i) The temperature at the mid and quarter planes
   (ii) The heat flow rate and temperature gradients at the mid and quarter planes

3. The interior of a refrigerator having inside dimensions of 0.5m x 0.5m base area and 1m height is to be maintained at 6^{0}C. The wall of the refrigerator are constructed of two mild steel sheets 3m thick (k= 46.5 W/m^{0}C) with 50 mm of glass wool insulation (k=0.046 W/m^{0}C) between them. If the average heat transfer coefficients at the inner and outer surfaces are 11.6W/m^2 ^{0}C and 14.5 W/m^2 ^{0}C respectively, calculate (14M)
   (i) The rate at which heat must be removed from the interior to maintain the specified temperature in the kitchen at 25^{0}C, and
   (ii) The temperature on the outer surface of the metal sheet

4. a) State the Plank's law. Derive the expression for radiation intensity of a black body. (7M)
   b) Assuming the sun to be a black body emitting radiation with maximum intensity at λ=0.49μm, Calculate the following : (7M)
   (i) The surface temperature of the sun, and
   (ii) The heat flux at surface of the sun.
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5. A thermocouple junction is in the form of 8 mm diameter sphere. Properties of material are C=420 J/kg ^{0}C; ρ = 8000 kg/m^3 k= 40 W/m^{0}C and h= 40 EW/m^2 ^{0}C (14M)
   (i) Time constant of the thermocouple
   (ii) The thermocouple is taken out from the hot air after 10 seconds and kept in still at 30^{0}C.Assuming the heat transfer coefficient in air 10 W/m^{20}C,find the temperature attained by the junction 20 seconds after removing from the hot air

6. A counter heat exchanger is to heat air entering at 400^{0}C with a flow rate of 6 kg/s by the exhaust gas entering at 800^{0}C with a flow rate of 4 kg/s. The overall heat transfer coefficient is 100 W/m^{2}K and the outlet temperature of the air is 551.5^{0}C.Specific heat at constant pressure for both air and exhaust gas can be taken as 1100 J/kg K. Calculate: (14M)
   (i) The heat transfer area needed
   (ii) The number of transfer units

7. a) Explain about the steady state equimolar counter diffusion with an suitable example (7M)
   b) Explain about Fick's law and state the important aspects of Fick's law (7M)