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SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

B.Tech II Year I Semester Regular Examinations May-2022

HEAT & MASS TRANSFER

(Agricultural Engineering)

Time: 3 hours Max. Marks: 60

(Answer all Five Units **5 x 12 = 60** Marks)

UNIT-I

1	a	What is convection heat transfer? Explain its parameters.	L1	6M
	b	A wire 1.5 mm diameter and 150 mm long is submerged in water at atmospheric pressure. An electric current passed through the wire and is increased until the water boils at 100 ^{0}C. Under the condition, if convective heat transfer coefficient is 4500W/m^2 ^{0}C. Find how electric power must be supplied to the wire to maintain the wire surface at 120 ^{0}C.	L4	6M

OR

2	a	Write the laws of radiation? Explain its parameters.	L1	6M
	b	A surface having an area of 1.5 m^2 and maintained at 300 ^{0}C exchanges heat by radiation with another surface at 40 ^{0}C. The value factor due to the geometric location and emissivity is 0.52. Determine i).Heat loss by radiation ii).The value of thermal resistance iii).The value of equivalent convection coefficient	L4	6M

UNIT-II

3	a	Obtain the expression of heat conduction through hollow cylinder.	L3	6M
	b	spherical shaped vessel of 1.4 m diameter is 90 mm thick. Find the rate of heat leakage, if the temperature difference between the inner and outer surface is 220 ^{0}C. Thermal conductivity of the material of the sphere is 0.083 W/m ^{0}C.	L4	6M

OR

4	a	Explain the fin effectiveness and fin efficiency.	L2	6M
	b	Calculate the amount of energy required to solder together two very long pieces of bare copper wire 1.5 mm diameter with solder that melts at 190 ^{0}C. The wires are positioned vertically in air at 20 ^{0}C. Assume that the heat transfer coefficient on the wire surface is 20 W/m^2 ^{0}C and thermal conductivity of wire alloy is 330 W/m ^{0}C	L4	6M

UNIT-III

5	a	Derive the expression for Reynolds number and how flows are determined by Reynolds number.	L3	6M
	b	Assuming that a man can be represented by a cylinder 350 mm in diameter and 1.65 m high with a surface temperature of 28 ^{0}C. Calculate the heat he would lose while standing in a 30 km/h wind at 12 ^{0}C. Take k=2.59 x10^{-6} W/m ^{0}C, υ = 15x10-6 m^2/s, Pr = 0.707	L4	6M

OR

6	In a straight tube of 60 mm diameter, water is flowing at a velocity of 12 m/s. The tube surface temperature is maintained at 70 ^{0}C and the following water is heated from the inlet temperature 15 ^{0}C to an outlet temperature of 45 ^{0}C . taking the physical properties of water at its mean bulk temperature, Calculate the following: i. The heat transfer coefficient from the tube surface to the water ii. The heat transferred iii. The length of the tube. Take k=61.718 x10^{-2} W/m ^{0}C, υ = 0.805x10^{-6} m^2/s, Pr = 5.42,ρ=995.7 kg/m^3,Cp=4.174 kj/kg k.	L4	12M

UNIT-IV

7	Calculate the following for an industrial furnace in the form of black body and emitting radiation at 2500 ^{0}C . i. Monochromatic emissive power at 1.2 μm length ii. Wave length at which the emission is maximum iii. Maximum emissive power iv. Total emissive power v. Total emissive power of the furnace if the assumed as a real surface with emissivity equal to 0.9.	L5	12M

OR

8	a	Distinguish between Boiling and Condensation	L1	6M
	b	Assuming the sun to be a black body emitting radiation with maximum intensity at λ = 0.49 μm, calculate the following i)The surface temperature of the sun ii)The heat flux at surface of the sun	L4	6M

UNIT-V

9	a	Which of the arrangement of heat exchangers is better, (i) parallel flow, (ii) Counter flow. Explain the reasons.	L2	6M
	b	A vertical tube of 60 mm outside diameter and 1.2 m long is exposed to steam at atmospheric pressure. The outer surface of the tube is maintained at a temperature of 50 ^{0}C by circulated cold water through the tube. Calculate the following i). The rate of heat transfer to the coolant, and ii). The rate of condensation of steam.	L4	6M

OR

10	Derive the expression for Logarithmic Mean Temperature Difference (LMTD) in case of parallel flow.	L3	12M

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