Q.P. Code: 20ME0315 **R20**

Reg. No: | | | | | | | | | | |

SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY:: PUTTUR

(AUTONOMOUS)

B. Tech II Year I Semester Supplementary Examinations November-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	Distinguish between conduction, convection and radiation modes of heat transfer.	L1	6M
	b	Calculate the rate of heat transfer per unit area through a copper plate 45 mm thick, whose one face is maintained at 350 ^{0}C and the other face at 50 ^{0}C. Take thermal conductivity of copper as 370 W/m ^{0}C.	L2	6M
		OR		
2		Derive the general heat conduction equation in Cylindrical coordinate.	L3	12M

UNIT-II

3	a	Derive the expression for the overall heat transfer coefficient for a composite wall.	L1	6M
	b	A cold storage room has walls made up of 220 mm of brick on outside 90 mm of plastic foam and finally 16 mm of wood on the inside. The outside and inside air temperatures are 25 ^{0}C and -3 ^{0}C respectively. If the inside and outside and heat transfer coefficients are 30 and 11 W/m^2 ^{0}C respectively the thermal conductivity of brick, plastic foam and wood are 0.99, 0.02 and 0.17 W/m ^{0}C respectively. Then determine i. The rate of heat removal by the refrigeration, if the total wall area is 85 m^2 ii. The temperature of the inside surface of the brick	L4	6M
		OR		
4	a	Sketch various types of fins. Give examples of use of fins in various engineering applications.	L3	6M
	b	A steel ingot (large in size) heated uniformly to 745 ^{0}C is hardened by quenching it in an oil bath maintained at 20 ^{0}C. Determine the length of time required for the temperature to reach 595 ^{0}C at a depth of 12 mm. The ingot may be approximated as a flat plate. For steel ingot take α (thermal diffusivity) = 1.2x10^{-5} m^2/s.	L4	6M

UNIT-III

5		A cylinder body of 300 mm diameter and 1.6 m height is maintained at a constant temperature of 36.5 ^{0}C. The surrounding temperature is 13.5 ^{0}C. Find out the amount of heat to be generated by the body per hour if ρ = 1.025 kg/m^3,ν = 15.06 x 10^{-6} m^2/s, cp = 0.96 kJ/kg^{0}C and k = 0.0892 kJ/mh ^{0}C and β=1/298 K^{-1}.	L4	12M
		OR		
6	a	Define Nusselt number, Prandtl number and their significance	L1	6M
	b	Air stream at 24 ^{0}C is flowing at 0.4 m/s across a 100 W bulb at 130 ^{0}C. If the bulb is approximately by a 65 mm diameter sphere. Calculate i. The heat transfer rate, ii. The percentage of power lost due to convection. Take k=0.03 w/m ^{0}C, υ = 2.08x10^{-5} m^2/s, Pr = 0.697.	L4	6M
		UNIT-IV		
7		Explain briefly the various regimes of saturated pool boiling with diagram.	L4	12M
		OR		
8	a	What are the applications of boiling and condensation process.	L1	6M
	b	Explain Stefan Boltzmann Law, Kirchhoff"s Law.	L1	6M
		UNIT-V		
9		Derive the expression for Logarithmic Mean Temperature Difference (LMTD) in case of counter flow.	L3	12M
		OR		
10		In a certain double pipe heat exchanger hot water flow at a rate of 5000 kg/h and gas cooled from 95 ^{0}C to 65 ^{0}C. At the same time 50000 kg/h of cooling water at 30 ^{0}C enters the heat exchanger. The flow conditions are that overall heat transfer coefficient remains constant at 2270 W/m^2 K. Determine the heat transfer area required and the effectiveness, assuming two streams are in parallel flow. Assume for the both the streams cp = 4.2 kJ/kg K.	L4	6M

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