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

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

**SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY: PUTTUR**

(AUTONOMOUS)

**B.Tech III Year I Semester Regular Examinations March-2023**

**HEAT AND MASS TRANSFER**

(Mechanical Engineering)

Time: 3 hours Max. Marks: 60

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

UNIT-I

| | | | | | |
|---|---|---|---|---|---|
| 1 | a | What is Fourier's law of conduction? State the assumption and essential feature of it. | CO1 | L1 | 6M |
| | b | Define the following terms i)Thermal Conductivity ii) Thermal Resistance | CO1 | L2 | 6M |
| | | OR | | | |
| 2 | a | Distinguish between conduction, convection and radiation modes of heat transfer. | CO1 | L4 | 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 °C and the other face at 50 °C. Take thermal conductivity of copper as 370 W/m °C | CO1 | L1 | 6M |

UNIT-II

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|---|---|---|---|---|---|
| 3 | a | Derive the expression for the overall heat transfer coefficient for a composite Wall. | CO2 | L3 | 6M |
| | b | What is lumped system analysis? Derive the expression for it. | CO2 | L3 | 6M |
| | | OR | | | |
| 4 | a | Calculate the critical radius of insulation for asbestos (k = 0.172 W/m K) surrounding a pipe and exposed to room air at 300 K with h = 2.8 W/m K. Calculate the heat loss from a 475 K, 60 mm diameter pipe when covered with the critical radius of insulation and without insulation. | CO2 | L4 | 6M |
| | b | What is lumped system analysis? Derive the expression for it. | CO2 | L4 | 6M |

UNIT-III

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|---|---|---|---|---|---|
| 5 | | 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 °C and the following water is heated from the inlet temperature 15 °C to an outlet temperature of 45 °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 | CO3 | L4 | 12M |
| | | OR | | | |
| 6 | | A cylinder body of 300 mm diameter and 1.6 m height is maintained at a constant temperature of 36.5 °C. The surrounding temperature is 13.5 °C. Find out the amount of heat to be generated by the body per hour if ρ = 1.025 kg/m3, ν = 15.06 x10-6 m 2 /s, cp = 0.96 kJ/kg°C and k = 0.0892 kJ/mh 0C and β=1/298 K-1V. Assume $Nu=0.12(Gr.Pr)^{1/3}$ | CO3 | L3 | 12M |

UNIT-IV

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|---|---|---|---|---|---|
| 7 | a | Explain briefly the various regimes of saturated pool boiling with diagram. | CO4 | L2 | 6M |
| | b | What are the applications of boiling and condensation process? | CO4 | L1 | 6M |
| | | OR | | | |
| 8 | a | Explain Stefan Boltzmann Law, Kirchhoff's Law. | CO4 | L4 | 6M |
| | b | Differentiate between the mechanism of film wise and drop wise condensation. | CO4 | L4 | 6M |

UNIT-V

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|---|---|---|---|---|---|
| 9 | | Derive the expression for Logarithmic Mean Temperature Difference (LMTD) in case of parallel flow. | CO5 | L3 | 12M |
| | | OR | | | |
| 10 | | Explain fick's law of diffusion with a neat diagram. | CO5 | L3 | 12M |

*** END ***