**Q.P. Code: 18ME3105** **R18**

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

## SIDDHARTH INSTITUTE OF ENGINEERING & TECHNOLOGY::PUTTUR
## (AUTONOMOUS)
### M.Tech I year II Semester (R18) Regular Examinations June 2019
### (For Students admitted in 2018 only)

**Time: 3 hours** **Advanced Heat Transfer** **Max. Marks: 60**

**(Thermal Engineering)**

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

**UNIT I**

**1** Derive general heat conduction equation in Cartesian co-ordinates **12M**

**OR**

**2** **a.** Define transient, Non periodic and periodic heat conduction with examples? **6M**

**b** A 50cm x 50cm copper slab 6.25 mm thick has a uniform temperature of $300^0$C. Its temperature is suddenly lowered to $36^0$C. Calculate the time required for the plate to reach the temperature of $108^0$C. Take ρ= 9000 kg/$m^3$ , c= 0.38 kJ/ kg$^0$C; k= 370 W/ m$^0$C and h = 90 W/ $m^2$ $^0$C **6M**

**UNIT II**

**3** **a.** What is convective heat transfer? Distinguish between free and forced convection **6M**

**b.** Air at atmospheric pressure and $200^0$C flows over a plate with a velocity of 6m/s. The plate is 16mm wide and is maintained at a temperature of $120^0$C. Calculate the thickness of hydrodynamic and thermal boundary layers and the local heat transfer coefficient at a distance of 0.6m from the leading edge. Assume that flow is on one side of the plate. ρ=0.815kg/$m^3$ ; μ= 24.5 x $10^{-6}$ Ns/$m^2$ ; Pr = 0.7; k =0.0364 W/m K **6M**

**OR**

**4** Explain hydrodynamic and thermal boundary layer with reference to flow over flat plate **12M**

**UNIT III**

**5** **a.** Distinguish between i) Boiling and Condensation ii) Pool boiling and flow boiling **6M**

**b.** A nickel wire 1mm diameter and 400 mm long, carrying current is submerged in a water bath which is open to atmospheric pressure. Calculate the voltage at the burn out point if at this point the wire carries a current of 190A. **6M**

**OR**

**6** A 750mm square plate, maintained at $28^0$C is exposed to steam at 8.132kPa. Calculate the following i)The film thickness, local heat transfer coefficient and mean flow velocity of condensate at 400 mm from the top of the plate. ii) The average heat transfer coefficient and total heat transfer from the entire plate. iii) Total steam condensate rate and iv) The heat transfer coefficient if the plate is inclined at $25^0$C with the horizontal plane. **12M**

**UNIT IV**

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| **7** | | 16.5 kg/s of the product at $650^0C(C_p = 3.55\ kJ/kg^0\ C)$ in a chemical plant are to be used to heat 20.5 kg/s of the incoming fluid from $100^0C(C_p = 4.2\ kJ/kg^0\ C)$. If the overall heat transfer coefficient is 0.95 $kW/m^2\ {}^0C$ and the installed heat transfer surface is $44m^2$ , calculate the fluid outlet temperatures for the counter flow and parallel flow arrangements. | **12M** |
| | | **OR** | |
| **8** | | Derive an expression for LMTD in the case of parallel flow heat exchanger | **12M** |

**UNIT V**

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| **9** | **a.** | Define emissivity, absorptivity and reflectivity. | **6M** |
| | **b.** | What is Stefan Boltzmann Law? Explain the concept of total emissive power of a surface | **6M** |
| | | **OR** | |
| **10** | | Two circular discs of diameter 20 cm are placed 2m apart. Calculate the radiant heat exchange for these discs if these are maintained at 800°C and 300°C. respectively and their corresponding emissivity's are 0.3 and 0.5. | **12M** |

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