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**UNIVERSITY**

(Karunya Institute of Technology & Sciences)

(Declared as Deemed-to-be University under Sec.3 of the UGC Act, 1956)

Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_\_

**End Semester Examination – Nov/Dec - 2016**

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|  |  | **Semester :** | **2016-17 ODD** |
| **Code :** | **12AE221** | **Duration :** | **3 hrs** |
| **Sub. Name :** | **Heat and Mass Transfer** | **Max. marks :** | **100** |

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| **Q. No.** | **Questions** | **Marks** |
| **PART-A(10X1=10 MARKS)** | | |
| 1. | The driving force for heat transfer is \_\_\_\_\_\_\_\_\_\_\_\_ | (1) |
| 2. | Define overall heat transfer coefficient. | (1) |
| 3. | What is periodic heat flow? | (1) |
| 4. | What is the significance of Biot number? | (1) |
| 5. | Define Nusselt number. | (1) |
| 6. | What is thermal boundary layer? | (1) |
| 7. | What is emissivity? | (1) |
| 8. | Define mole fraction. | (1) |
| 9. | What is ablative heat transfer? | (1) |
| 10. | Write any two factors influencing injector behavior. | (1) |

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| **PART B(5 X 3= 15 MARKS)** | | |
| 11. | State Fourier law of heat conduction. | (3) |
| 12. | What are Heisler chart? | (3) |
| 13. | State Newton’s law of cooling. | (3) |
| 14. | Define transmissivity. | (3) |
| 15. | Write the assumptions made for analyzing heat transfer in rocket nozzle. | (3) |

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| **PART C(5 X 15= 75 MARKS)** | | |
| 16. | Derive the general heat conduction equation in Cartesian coordinates. | (15) |
| (OR) | | |
| 17. | Calculate the rate of heat loss through the vertical walls of a boiler furnace of size 4 m by 3 m by 3 m high. The walls are constructed from an inner fire brick wall 25 cm thick of thermal conductivity 0.4 W/mK, a layer of ceramic blanket insulation of thermal conductivity 0.2 W/mK and 8 cm thick, and a steel protective layer of thermal conductivity 55 W/mK and 2 mm thick. The inside temperature of the fire brick layer was measured at 600o C and the temperature of the outside of the insulation 600 C. Also find the interface temperature of layers. | (15) |
| 18. | A 12 cm diameter long bar initially at a uniform temperature of 40oC is placed in a medium at 650oC with a convective co efficient of 22 W/m2K calculate the time required for the bar to reach 255oC. Take k = 20W/mK, ρ = 580 kg/m3 and c = 1050 J/kg K. | (15) |
| (OR) | | |
| 19. | A aluminium sphere mass of 5.5 kg and initially at a temperature of 290oC is suddenly immersed in a fluid at 15oC with heat transfer coefficient 58 W/m2 K. Estimate the time required to cool the aluminium to 95o C for aluminium take ρ = 2700 kg/m3 , c = 900 J /kg K, k = 205 W/mK. | (15) |
| 20. | Air at 25 oC flows past a flat plate at 2.5 m/s. the plate measures 600 mm X 300 mm and is maintained at a uniform temperature at 95 oC. Calculate the heat loss from the plate, if the air flows parallel to the 600 mm side. How this heat loss would be affected if the flow of air is made parallel to the 300 mm side. | (15) |
| (OR) | | |
| 21. | When 0.6 kg of water per minute is passed through a tube of 2 cm diameter, it is found to be heated from 20oC to 60oC. The heating is achieved by condensing steam on the surface of the tube and subsequently the surface temperature of the tube is maintained at 90o C. Determine the length of the tube required for fully developed flow. | (15) |
| 22. | Two large plates are maintained at a temperature of 900 K and 500 K respectively. Each plate has area of 6 m2. Compare the net heat exchange between the plates for the following cases. (i) Both plates are black (ii) Plates have an emissivity of 0.5 | (15) |
| (OR) | | |
| 23. | A vessel contains a binary mixture of O2 and N2 with partial pressure in the ratio of 0.21 and 0.79 at 15oC. The total pressure of the mixture is 1.1 bar. Calculate Molar concentration, Mass densities, Mass fractions and Molar fractions. | (15) |
| 24. | Explain the different types of cooling thrust chambers. | (15) |
| (OR) | | |
| 25. | Explain in detail about ablative heat transfer. | (15) |

ALL THE BEST