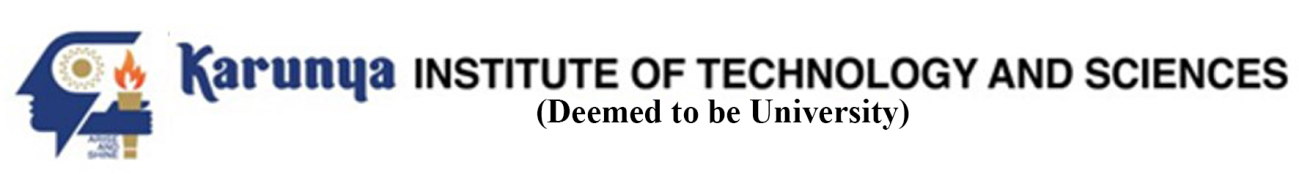
Reg.No. \_\_\_\_\_\_\_\_\_\_\_\_



**End Semester Examination – Nov/Dec 2018**

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| **Code :** | **14FP2005** | **Duration :** | **3hrs** |
| **Sub. Name :** | **HEAT AND MASS TRANSFER** | **Max. marks :** | **100** |

**ANSWER ALL QUESTIONS (5 x 20 = 100 Marks)**

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| **Q. No.** | **Sub Div.** | **Questions** | **Course**  **Outcome** | **Marks** |
| 1. | a. | The maximum tolerable heat loss through a furnace wall is 1.3 kW/m 2. A brick wall is constructed next to the furnace wall to insulate the heat loss. The temperature on either side of the wall is 200°C and 40 °C. What should be the thickness of the brick wall if the thermal conductivity of the brick is 0.72 W/m°C. | CO1 | 10 |
| b. | Derive an expression for heat transfer in conduction through composite wall rectangular wall in series. | CO2 | 10 |
| (OR) | | | | |
| 2. | a. | Describe in detail about conduction in cylinders and spheres. | CO1 | 10 |
| b. | A cold storage wall (3 m X 5 m) is constructed of 10 cm thick concrete (thermal conductivity 1.37 W/m°C). Insulation must be provided to maintain a heat transfer rate through the wall at or below 500 W. If the thermal conductivity of the insulation is 0.04 W/(m°C), compute the required thickness of the insulation. The outside surface temperature of the wall is 40°C, and the inside wall temperature is 5°C. | CO2 | 10 |
|  |  |  |  |  |
| 3. | a. | Orange juice flows in a pipe of 0.023 m inside diameter at a rate of 40 lt/min, while steam is condensing on the outside surface of the pipe. The juice is heated from 50 to 70 °C, while the inside wall temperature is at 80 °C. Calculate i) the heat transfer coefficient and ii) the required length of the pipe.Take, | CO1 | 10 |
| b. | Illustrate the steps for the estimation of overall heat transfer coefficient. | CO3 | 10 |
| (OR) | | | | |
| 4. | a. | Write in detail about convection heat transfer. | CO3 | 10 |
| b. | What is the expected percent increase in convective heat-transfer coefficient if the velocity of a fluid is doubled while all other parameters are kept the same for turbulent flow in a pipe? | CO2 | 10 |
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| 5. | a. | State the following laws of radiation:   1. Stefan-Boltzmann law ii. Plank’s law   iii. Wien’s displacement law iv. Kirchoff’s law | CO1 | 10 |
| b. | Consider a 20 cm diameter spherical ball at 800 K suspended in air. Assuming the ball closely approximates a blackbody, determine (i) the total blackbody emissive power, (ii) the total amount of radiation emitted by the ball in 5 min. | CO2 | 10 |
| (OR) | | | | |
| 6. | a. | A piece of meat carcase is kept in a deep freezer maintained at -18°C. Calculate the radiative heat transfer if the meat carcase is at 25°C and has an average area of 0.045m2 . The emissivity of carcase may be taken as 0.82. | CO2 | 10 |
|  | b. | In a canning process, 100 cans per minute are to be heated from 60°C to 100 °C, and demoistured of the adhering moisture to the cans. Each can contains on average 0.3 m1 of water adhering to it. The cans have an emissivity of 0.7 and an average area of each can is 0.047 m2 , and its weight is 100 g. The specific heat of can material is 0.25 kJ/kg°C. Calculate the temperature of the oven considering the radiative heat transfer only. | CO1 | 10 |
|  |  |  |  |  |
| 7. | a. | Derive an expression for LMTD. | CO2 | 10 |
| b. | Describe with a neat sketch the construction and working of plate heat exchanger. | CO3 | 10 |
| (OR) | | | | |
| 8. |  | Explain with neat diagrams construction and working of the following:   1. 1-2 pass shell and tube heat exchanger. 2. Tubular HE. | CO2 | 20 |
|  | |  |  |  |
|  | | **Compulsory**: |  |  |
| 9. | a. | Explain in detail about film theory of mass transfer. | CO2 | 15 |
| b. | Write a note on convective mass transfer coefficient. | CO3 | 5 |