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MRW-002

**MASTER OF SCIENCE (RENEWABLE
ENERGY AND ENVIRONMENT)
(MSCRWEE)**

**Term-End Examination
June, 2023**

MRW-002 : HEAT TRANSFER

Time : 3 Hours

Maximum Marks : 70

Note : *Answer any **seven** questions. All questions carry equal marks. Use of scientific calculator is permitted.*

1. (a) Discuss the applications of heat transfer with some practical examples. 5
(b) Describe some key features of the Fourier's law. 5
2. (a) Define thermal conductivity. How can thermal conductivity be measured experimentally ? 5
(b) Explain the difference between surface and volumetric radiation. 5

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3. (a) An immersion water heater of surface area 0.1 m^2 and rating 1 kW is designed to operate fully submerged in water. Estimate the surface temperature of the heater when the water is at 40°C and the heat transfer coefficient is $300 \text{ W/m}^2\text{K}$. If this heater is by mistake used in air at 40°C with $h = 9 \text{ W/m}^2\text{K}$, what will be its surface temperature ? 5
- (b) Enlist a few ways for enhancing the effectiveness of a fin. 5
4. Define the following : 10
- (i) Biot number
 - (ii) Nusselt number
 - (iii) Prandtl number
 - (iv) Reynolds number
5. Explain the following terms : 10
- (i) Radiation Intensity
 - (ii) Radiosity
 - (iii) Emission
 - (iv) Spectral Intensity

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6. (a) Two black square plates are placed parallel to each other. One plate is maintained at a temperature of 900°C and the other at 400°C . Find the net exchange of energy due to radiation between the two plates. Shape factor $F_{12} = 0.415$. 5
- (b) Derive the expression for the net radiative heat transfer rate from an opaque surface. 5
7. Discuss, in detail spiral plate heat exchanger along with its technical features. 10
8. Explain thermal insulation and also discuss the classification of insulating materials. 10
9. Write short notes on any *two* of the following : 5+5
- (a) Radiation shield
- (b) Horizontal tube natural circulation evaporator
- (c) Absorption
- (d) Straight tube boiler

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