MASTER OF TECHNOLOGY IN ENERGY SCIENCE & TECHNOLOGY
EXAMINATION, 2024
(1st Semester)
ENERGY CONVERSION SYSTEM-I (OLD)

Time: Three hours   Full Marks: 100

Use separate answer script for each Part

Part-I (60 marks)

Answer *any three* from the following questions.

1. (a) What are different modes of heat transfer? Define the terms, Thermal conductivity and Convective Heat transfer co-efficient. Explain the concept of Overall Heat Transfer co-efficient or U value.   8

   (b) A large steel frying pan of thickness 0.5 cm, initially at 15 °C, is placed on the stove. The bottom of the pan is subjected to a uniform heat flux of 400 W/m^2 and the top exposed to cool ambient air at 20 °C. The heat transfer co-efficient between the pan and the ambient air is 40 W/(m^2.°C). Calculate the temperature of the pan at 5 and 8 min after the start of heating. [For steel, k = 70 W/(m.°C), ρ = 7840 kg/m^3, and c = 450 J/(kg.°C).]   8

   (c) What is the use of *Biot Number*? Explain Newton's Law Cooling.   4

2. (a) Derive one-dimensional heat conduction equation for cylindrical coordinates with energy generation.   10

   (b) A wall of building is made of 8 cm. of building brick [k = 0.69 W/(m.°C)], 2 cm. of Celotex [k = 0.048 W/(m.°C)] and 2 cm of an asbestos cement board [k = 0.74 W/(m.°C)]. Glass wool [k = 0.38 W/(m.°C)] is to be added between the Celotex and Asbestos cement board to reduce the heat flow rate through the wall by 75 percent. Determine the thickness of the glass wool.   10

3. (a) How do you classify fluids? Explain the physical significance of Reynolds No., Nusselt No. and Pr No.   8

   (b) Explain the methods to determine convective heat transfer co-efficient of a body subjected to forced convection on its entire surface.   12

4. (a) What do you understand by black body emissive power? Explain.   4

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(b) Explain Wien's Displacement Law

(c) Explain the different radiation properties of a surface.

(d) Calculate the black body emissive power E_b (T) at 25°C, 50°C and 5500 °C.

(e) What is Gray body? Explain the concept of View Factor?

M.TECH. ENERGY SCIENCE AND TECHNOLOGY

FIRST YEAR FIRST SEMESTER – 2024

Subject : ENERY CONVERSION SYSTEMS I (OLD)

Time : Three hours (Part I + Part II)   Full Marks : 100

Part - II (40 Marks)

*Attempt any **two** of the following : -*

1. Draw a schematic diagram of a flat plate collector? What are the key considerations in designing a flat plate collector? What are the main components of flat plate collectors? What is the principle of solar distillation? Draw and label properly a 'Solar Still'.   **(5X4=20)**

2. What are the advantages and disadvantages of Concentrating Collectors? What are the basic parameters of a concentrating collector? Define them with proper equation. Draw and describe Linear Fresnel lens collector. What is the use of a booster mirror in a modified fat plate collector?   **(4+2+6+6+2=20)**

3. Write short notes on any *four*:-   **(4x5=20)**

   a) Pyranometer
   b) Pyrheliometer
   c) Sunshine Recorder
   d) Solar Azimuth Angle
   e) Surface Azimuth angle
   f) Rotors in Wind Machines