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 **PRESIDENCY UNIVERSITY**

  **Bengaluru**

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| **Ph.D. Course Work End Term Examinations – JAN-FEB 2025** |
| **Date:** 31- 01- 2025 **Time:** 09:30 am – 12:30 pm |

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| **School:** SOE | **Program:** Ph.D. |
| **Course Code :** MEC820 | **Course Name :** Advanced refrigeration system |
| **Semester**:  | **Max Marks**: 100 | **Weightage**: 50%  |

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| **CO - Levels** | **CO1** | **CO2** | **CO3** | **CO4** | **CO5** |
| **Marks** |  |  | **40** | **60** |  |

**Instructions:**

1. *Read all questions carefully and answer accordingly.*
2. *Do not write anything on the question paper other than roll number.*
3. ***Books, notes and data handbooks are allowed.***
4. *Make suitable assumptions wherever required with justification.*

**1.** A cooling tower is used for cooling the condenser water of a refrigeration system having a heat rejection rate of 100 kW. In the cooling tower air enters at 35°C (DBT) and 24°C (WBT) and leaves the cooling tower at a DBT of 26°C relative humidity of 95%. What is the required flow rate of air at the inlet to the cooling tower in m3/s. What is the amount of make-up water to be supplied? The temperature of make-up water is at 30°C, at which its enthalpy (hw) may be taken as 125.4 kJ/kg. Assume the barometric pressure to be 1 atm.

 **[20 M] (CO3) [Application]**

**2.** In an air conditioning system air at a flow rate of 2 kg/s enters the cooling coil at 25°C and 50% RH and leaves the cooling coil at 11°C and 90% RH. The apparatus dew point of the cooling coil is 7°C. Find

 a) The required cooling capacity of the coil,

 b) Sensible Heat Factor for the process, and

 c) By-pass factor of the cooling coil. Assume the barometric pressure to be 1 atm. Assume the condensate water to leave the coil at ADP (hw = 29.26 kJ/kg)

**[20 M] (CO3) [Application]**

**3**. Write the working principal of the Activated Carbon–Methanol Adsorption Ice Maker Driven by a Flat-Plate Type Solar Collector. Draw a schematic diagram also.

**[10 M] (CO4) [Application]**

**4**. An air conditioned room that stands on a well-ventilated basement measures 3 m wide, 3 m high and 6 m deep. One of the two 3 m walls faces west and contains a double-glazed glass window of size 1.5 m by 1.5 m, mounted flush with the wall with no external shading. There are no heat gains through the walls other than the one facing west. Calculate the sensible, latent and total heat gains on the room, room sensible heat factor from the following information. What is the required cooling capacity?

 Inside conditions : 25°C dry bulb, 50 percent RH

 Outside conditions : 43°C dry bulb, 24°C wet bulb

 U-value for wall : 1.78 W/m2K

 U-value for roof : 1.316 W/m2K

 U-value for floor : 1.2 W/m2K

 Effective Temp. Difference (ETD) for wall : 25°C

 Effective Temp. Difference (ETD) for roof : 30°C

 U-value for glass : 3.12 W/m2K

 Solar Heat Gain (SHG) of glass : 300 W/m2

 Internal Shading Coefficient (SC) of glass: 0.86

 Occupancy : 4 (90 W sensible heat/person)

 (40 W latent heat/person)

 Lighting load : 33 W/m2 of floor area

 Appliance load : 600 W (Sensible) + 300 W (latent)

 Infiltration : 0.5 Air Changes per Hour

 Barometric pressure : 101 kPa

**[50 M] (CO4) [Application]**