Roll No.												

PRESIDENCY UNIVERSITY

BENGALURU

Mid - Term Examinations – MARCH 2026

Date: 10 – 03- 2026 **Time:** 02:00pm – 03:30pm

School: SOE	**Program:** B.Tech	
Course Code: MEC3003	**Course Name:** Heat and Mass Transfer	
Semester: VI	**Max Marks**: 50	**Weightage**: 25%

CO - Levels	CO1	CO2	CO3	CO4	CO5
Marks	26	24	-	-	-

Instructions:

(i) Read all questions carefully and answer accordingly.

(ii) Do not write anything on the question paper other than roll number.

Part A

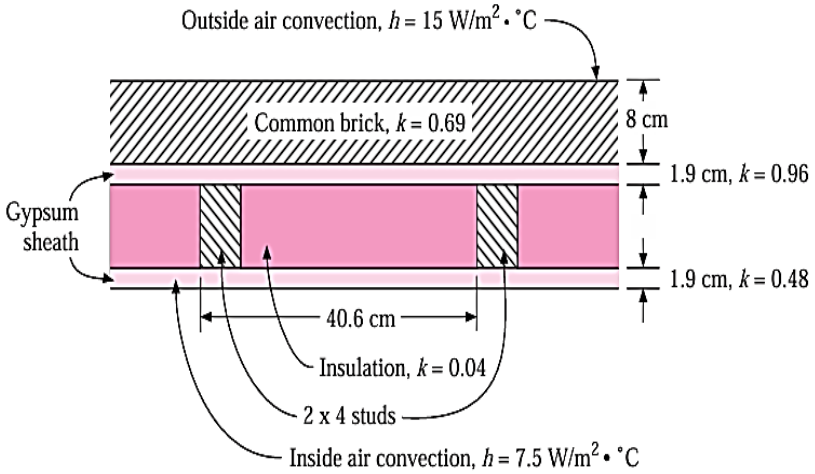
Answer ALL the Questions. Each question carries 2marks. **5Q x 2M=10M**

1	Define thermal conductivity.	**2 Marks**	**L1**	**CO1**
2	Define the convection heat-transfer coefficient.	**2 Marks**	**L1**	**CO1**
3	Describe the mechanism of thermal conduction in gases and solids.	**2 Marks**	**L2**	**CO2**
4	Explain when one may expect radiation heat transfer to be important?	**2 Marks**	**L2**	**CO2**
5	Distinguish is the order of magnitude of thermal conductivity for (a) metals, (b) solid insulating materials, (c) liquids, (d) gases?	**2 Marks**	**L2**	**CO1**

Part B

Answer the Questions. **Total Marks 40M**

6.	**a.**	Think of Thermodynamics and Heat Transfer as two different ways of looking at a road trip. Thermodynamics tells you how much fuel you need to get from Point A to Point B, while Heat Transfer tells you exactly how fast you'll be driving and which route you're taking. While they are closely related, the distinction lies in time and process. Explain this distinction further with suitable example.	**10 Marks**	**L3**	**CO1**
	b.	Derive the one-dimensional unsteady-state heat conduction equation, apply the Law of Conservation of Energy (First Law of Thermodynamics) to a small control volume within a plane slab. State the assumptions.	**10 Marks**	**L3**	**CO1**
Or					
7.	**a.**	Prepare the expression for the convective heat transfer coefficient using dimensional analysis and show how Nusselt, Reynolds, and Prandtl numbers are related in convection heat transfer.	**10 Marks**	**L3**	**CO1**
	b.	Interpret the mechanism of convection heat transfer. Distinguish clearly between forced convection and natural convection, with neat sketches and practical examples.	**10 Marks**	**L3**	**CO1**

8.	Heat Transfer Through a Composite Wall "Two-by-four" wood studs have actual dimensions of 4.13 x 9.21 cm and a thermal conductivity of 0.1 W/m °C. A typical wall for a house is constructed as shown in Figure below. Calculate the overall heat-transfer coefficient and R value of the wall by plotting the Thermal resistance diagram for the same.  	**20 Marks**	**L3**	**CO2**
Or				

9.	Air at 25°C flows with a free-stream velocity of 6 m/s over a flat plate of length 1.2 m and width 0.6 m. The surface of the plate is maintained at a constant temperature of 75°C. Properties of air at mean film temperature are given as: • Thermal conductivity, k = 0.028 W/m·K • Kinematic viscosity, $\nu = 16 \times 10^{-6}$ m^2/s • Prandtl number, Pr = 0.71 a) Calculate the Reynolds number at the trailing edge and comment on the nature of flow over the plate. b) Calculate the average Nusselt number for the plate. c) Calculate the average convective heat transfer coefficient. d) Calculate the total heat transfer rate from the plate to air.	**20 Marks**	**L3**	**CO2**