

**VIT**Vellore Institute of Technology
(Deemed to be University under section 3 of UGC Act, 1956)**SCHOOL OF MECHANICAL ENGINEERING
CONTINUOUS ASSESSMENT TEST – II
WINTER SEMESTER 2021-2022**

Programme Name & Branch: B.Tech., (BME) Course Code: MEE2005
Course Name: Heat Transfer Class Numbers: VL2021220502888,
VL2021220502894
Faculty Names: Dr. S. Senthur Prabu, Slot: A1+TA1+V1
Dr. N Govindha Rasu
Exam Duration: 90 mins Maximum Marks: 50

General instruction (s):

1. Make suitable assumptions, if required.
2. HMT Data book is permitted

Answer All Questions (5 X 10 = 50 Marks)

Q. No.	Questions	Marks	CO	BL
1.	During the manufacture of plastic sheets of 10 cm thickness, the sheets are brought from a uniform temperature of 175°C and then allowed to cool to a temperature of 52°C in the air at 38°C, before further processing. Determine the time required for cooling, if natural convection technique is employed with average heat transfer coefficient of 11 W/m ² K. Also determine the temperature at the center of the plastic sheet, when the surface temperature has reached 52°C. The properties of material can be taken as: Density (ρ) = 1280 kg/m ³ , Specific heat (C) = 1600 J/kg-K, Thermal conductivity (k) = 0.27 W/m-K.	10	1	L3
2.	A block of steel is initially at 35°C. The surface temperature is suddenly raised and maintained at 250°C. Calculate the temperature at a depth of 2.5 cm after a time of 30 s. The thermal diffusivity and thermal conductivity of steel are 1.4×10^{-5} m ² /s and 45 W/m-K, respectively.	10	2	L4
3.	Air at 40°C flows over a tube with a velocity of 30 m/s. The tube surface temperature is 120°C, calculate the heat transfer coefficient for the following cases. i) Square tube with a side of 6 cm ii) Circular tube with diameter 6 cm	10	3	L5
4.	Combustion air in a manufacturing facility is to be preheated by hot water flowing through the tube banks located in a duct before entering a furnace. The tube surface is at 95°C, and air	10	2	L4

	enters the tubes at 25°C, 1 atm with a mean velocity of 4 m/s. The air flows over the tubes in the normal direction. The outer diameter of tubes is 2 cm, and tubes are arranged in a staggered manner with a longitudinal and transverse pitch of 6 cm respectively. There are 8 rows of tubes in flow direction with 8 tubes in each row. Determine the heat transfer rate per unit length of the tubes.			
5.	A square channel of side 15 mm and length 2 m carries water at a velocity of 6 m/s. The inlet temperature of water along the length of the channel is found to be 30°C, while the inner channel surface temperature is 70°C. Calculate (i) Reynolds number (ii) Heat transfer coefficient from the channel wall to water (iii) Rate of heat transfer. Use suitable heat transfer correlation, and take equivalent diameter as characteristic length of the channel. Assume fully developed flow.	10	3	L5