# Dec. 2025

## B.Tech. (ME/ME, HINDI MEDIUM)

## (Fifth Semester)

## Heat and Mass Transfer (PCC-ME-501-21)

*Time : 3 Hours*]                    [*Maximum Marks :* 75

**Note :** It is compulsory to answer all the questions (1.5 marks each) of Part A in short. Answer any *four* questions from Part B in detail. Different sub-parts of a question are to be attempted adjacent to each other.

## Part A

1. (a) Define steady state.                                        1.5

   (b) Compare work and heat.                                  1.5

   (c) Write Fourier's conduction law.                      1.5

   (d) Define Radiation Shape factor.                       1.5

   (e) Compare White, Grey and Black bodies.  1.5

   (f) Define condensation heat transfer.             1.5

   (g) Define BIoT number and its significance.  1.5

(h) Write applications (at least three) of Heat Exchangers. **1.5**

(i) What do you understand by effectiveness of a Fin ? **1.5**

(j) Define local Boiling. **1.5**

## Part B

2. (a) Derive solution of the boundary layer equation by Von karman approximate method. **5**

(b) Air at 20KPa and 5°C enters a 2.5 cm diameter tube at a velocity of 1.5m/s, using a flat plate analysis estimate the distance from the entrance at which the flow becomes fully developed. **10**

3. (a) A composite wall is formed of a 2.5 cm copper plate (K = 350 W/m°C), a 3.2 mm layer of asbestos(K = 0.17W/m°C) and a 5cm layer of fiber glass(K = 0.035W/m°C). The wall is subjected to an overall temperature difference of 560°C, calculate the heat flow per unit area through the composite structure. **8**

(b) Define conduction-convection system. Derive heat transfer when the fin is finite length and the insulated at the tip (end). 7

4. (a) 20 by 20 cc slab of copper 5 cm thick at a uniform temperature of 200°C suddenly has its surface temperature lowered to 35°C, find the time at which the center temperature becomes 90°C, = 8900 kg/m³, $C_p$ = 0.38 Kj/ Kg°C and K = 370W/m°C. 8

(b) Define lumped heat capacity system and derive lumped heat capacity analysis. 7

5. (a) Explain Wien's displacement law. Also Explain the significance of the law. 10

(b) Two concentric cylinder having diameter of 10 cm and 20 cm, calculate the shape factor between open ends of the cylinder. If $L/r_2$ = 20/10 and $r_1/r_2$ = 0.5, from table Use $F_{21}$ = 0.4126 and $F_{22}$ = 0.3286. 5

6. (a) Define diffusion process in solids and liquids. 5

 (b) Define boiling heat transfer phenomena and it's different regimes. 10

7. (a) Analyze the design of heat exchanger with LMTD method. 10

 (b) Define over all heat transfer coefficient for a heat exchanger. 5

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