CBCS SCHEME

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BAU601

Sixth Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Heat Transfer

Time: 3 hrs. Max. Marks: 100

Note: 1. Answer any FIVE full questions, choosing ONE full question from each module.
2. M : Marks , L: Bloom's level , C: Course outcomes.
3. Use of data hand book is permitted.

		Module – 1	M	L	C
Q.1	a.	What are three modes of heat transfer? What are the laws governing these modes?	10	L2	CO1
	b.	A horizontal steel pipe of 50 mm diameter maintained at 60°C is kept in a large room at 22°C. Assuming surface emissivity of steel rod as 0.8 and coefficient of air as 6.5 W/m^2 °C. calculate the total heat lost by the pipe per unit length.	10	L3	CO2
		OR			
Q.2	a.	Derive 3D heat conduction equation in Cartesian Coordinate.	10	L2	CO2
	b.	A wire of 0.5 mm in diameter in stretched along the axis of the cylinder 50 mm diameter and 25 mm long. The temperature of the wire is 750 K while the cylinder is at 250 K and gas it has K = 0.0251 W/m K. Find the heat transfer through the gas by conduction and by radiation if the wire is black.	10	L3	CO3
		Module – 2			
Q.3	a.	Derive one dimensional Fin equation.	10	L3	CO2
	b.	In a conductivity measuring experiment two identical long rods are used. One rod is made of aluminium (K = 200 W/mK) the other rod is specimen rod. One end of both rods are fixed to a wall at 100°C, while the other end is suspended in air at 25°C. The steady temperature at same distance along the rods were measured and found to be 75°C on aluminium rod and 60°C on specimen rod. Find K for the specimen.	10	L4	CO2
		OR			
Q.4	a.	Find the expression for temperature distribution for lumped mass system.	10	L4	CO1
	b.	Aluminium sphere of mass 5.5 kg and initially at a temperature of 290°C is suddenly immersed in a fluid at 15°C. The connective heat transfer coefficient is 58W/m^{2}K. Estimate the time required for the sphere to reach 95°C, using lumped heat capacity method of analysis. Take the properties of aluminium ρ = 2500 kg/m^3, c_p = 900 J/kgK , K = 205 W/mK.	10	L3	CO3
		Module – 3			
Q.5	a.	What are the significance of various non dimensional numbers in free convection heat transfer. Discuss.	10	L1	CO3
	b.	A steam pipe 100 mm in diameter maintained at 170°C is exposed to air at 30°C. The length of the pipe is 2 m and is kept horizontal. Determine the heat lost by the pipe per hour.	10	L3	CO1

		OR			
Q.6	**a.**	Deduce $N_u = \text{Constant} (Re)^a (Pr)^{(b)}$ for forced convection by dimensional analysis method.	10	L4	CO3
	b.	A fine wire having a diameter of 3.94×10^{-5} m is placed in a 1 bar air stream at 25°C having a velocity of 50 m/s perpendicular to the wire. An electric current is passed through the wire raising the temperature to 50°C. Calculate the heat lost per unit length.	10	L3	CO4
		Module – 4			
Q.7	**a.**	What is LMTD for (i) parallel flow (ii) counter flow heat exchanger. Deduce. Also find the heat transfer expression.	10	L1	CO3
	b.	Water enters a counter flow double pipe heat exchanger at 15°C flowing at a rate of 1300 kg/hr. It is heated by oil (c_p = 2000 J/kgK) flowing at a rate of 550 kg/hr from an outlet temperature of 94°C for an area of 1 cm^2 and overall heat transfer coefficient of 1075 W/m^2K. Determine the total heat transfer and outlet temperature of water and oil. Take c_p of water = 4186 J/kgK.	10	L3	CO4
		OR			
Q.8	**a.**	Discuss various regimes in boiling heat transfer.	10	L2	CO3
	b.	A vertical square plate 30×30 cms is exposed to steam at atmospheric pressure. The plate temperature is 98°C. Calculate the heat transfer and the mass of steam condensed per hour. Assume condensate film is laminar.	10	L3	CO4
		Module – 5			
Q.9	**a.**	State and explain the following laws relating to thermal radiation: (i) Stefan – Boltzmann Law (ii) Planck's Law (iii) Lamberts Cosine Law (iv) Wein's Displacement Law (v) Kirchoff's Law	10	L1	CO2
	b.	The temperature of a black surface 0.2 m^2 in area is 540°C. Calculate (i) The total rate of energy emission (ii) The intensity of normal radiation (iii) Wavelength of maximum monochromatic emissive power.	10	L3	CO2
		OR			
Q.10	**a.**	Find the expression for heat exchange between two infinite parallel planes.	10	L4	CO2
	b.	Consider two large parallel plates, one at 1000 K with emissivity 0.8 and other is at 300 K having emissivity 0.6. A radiation shield is placed between them. The shield has emissivity as 0.1 on the side facing hot plate and 0.3 on the side facing cold plate. Calculate percentage reduction in radiation heat transfer as a result of radiation shield.	10	L3	CO3

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