CBCS SCHEME

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BMT701

Seventh Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Thermal Engineering

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.

		Module – 1	M	L	C
Q.1	a.	Differentiate : i. Microscopic and Macroscopic approach in thermodynamics ii. Intensive and Extensive properties.	10	L2	CO1
	b.	State Zeroth law of thermodynamics. Explain thermodynamic equilibrium.	6	L2	CO1
	c.	Explain Quasistatic Process with neat sketch.	4	L2	CO1
		OR			
Q.2	a.	Derive an expression for displacement work with PV diagram for the following process : i. Isobaric Process ii. Isochoric Process.	10	L2	CO1
	b.	Explain the following types of work transfer : i. Electrical work ii. Shaft work iii. Flow work.	10	L2	CO1
		Module – 2			
Q.3	a.	Derive an expression for Steady Flow Energy Equation (SFEE) with suitable assumption.	10	L2	CO2
	b.	With P-V diagram, explain the first law of thermodynamics under cyclic process.	10	L2	CO2
		OR			
Q.4	a.	Define the following : i. Thermal reservoir ii. Heat engine iii. Coefficient of performance iv. PMM-I v. PMM-II.	10	L2	CO2
	b.	Prove that $(COP)_{HP} = 1 + (COP)_{Ref}$.	4	L2	CO2
	c.	A heat engine working on Carnot cycle converts one fifth of the heat input into work. When the sink temperature is reduced by 70°C the heat engine efficiency gets doubled. Determine temperature of the source and sink.	6	L2	CO2
		Module – 3			
Q.5	a.	Explain Carnot cycle with P-V and T-S diagram. Derive an expression for its efficiency.	10	L2	CO2
	b.	A diesel engine has a compression ratio of 14 and cutoff takes place at 6% of the stroke. Find the air standard efficiency.	10	L2	CO2

		OR			
Q.6	**a.**	Describe boundary conditions of 1st, 2nd and 3rd kind with figures.	**8**	**L2**	**CO2**
	b	A surface having an area of 1.5 m^2 and maintained at 300°C exchanges heat by radiation with another surface at 40°C. The value of factor due to the geometric location and emissivity 0.52. determine : i. Heat lost by radiation ii. The value of thermal resistance iii. The value of equivalent convection coefficient.	**12**	**L3**	**CO2**
		Module – 4			
Q.7	**a.**	Derive one dimensional heat conduction equation for plane wall, with necessary assumption.	**10**	**L2**	**CO3**
	b.	A slab of 40 mm thick (K = 20 W/m°C) is placed between 2 fluids having temperature 120°C and 25°C respectively. If the corresponding heat transfer coefficient are 250 W/m^2°C and 500 W/m^2°C respectively. Find the heat flow rate.	**10**	**L2**	**CO3**
		OR			
Q.8	**a.**	Explain physical significance of the following : i. Reynolds number ii. Prandtl number iii. Nussult number iv. Stanton number v. Grasshoff number.	**10**	**L2**	**CO3**
	b.	Using Buckingham's π theorem method for natural convection show that $N_u = f(Gr, Pr)$.	**10**	**L2**	**CO3**
		Module – 5			
Q.9	**a.**	Distinguish between forced and free convection heat transfer.	**6**	**L2**	**CO4**
	b.	Air at 25°C and atmospheric pressure is following over a flat plate at a velocity of 4 m/sec. if the plate is 20 cm wide and 65°C. Calculate the following quantities at a distance of 40 cm from the leading edge. i. Thermal boundary layer thickness ii. Local shear stress iii. Local heat transfer coefficient iv. Total drag force and heat transfer.	**14**	**L3**	**CO4**
		OR			
Q.10	**a.**	State and explain the following with equations : i. Stefon Boltzman Law ii. Plank's Law iii. Kirchoff's Law iv. Wein Displacement Law.	**12**	**L2**	**CO4**
	b.	Define Emissivity. Explain Grey body and Black body emissivity.	**8**	**L2**	**CO4**

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