CBCS SCHEME

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BAU304

Third Semester B.E./B.Tech. Degree Examination, Dec.2025/Jan.2026
Engineering Thermodynamics

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 Thermodynamic data handbook is permitted.
4. Missing data can be suitably assumed.

		Module – 1	M	L	C
Q.1	a.	Explain i) Point function ii) path function iii) Process iv) quasi static process v) cyclic and noncyclic process	10	L2	CO1
	b.	Sir Isaac Newton proposed a linear temperature scale where in the ice point and normal human body temperature were assumed as the two fixed points and assigned temperature of 0° and 12° respectively. If the temperature of the human body on Fahrenheit scale is 98° F, obtain the relation between the Newton scale and the Fahrenheit scale.	10	L2	CO1
		OR			
Q.2	a.	Define i) Work ii) Heat thermodynamics. Also find the expression for displacement and shaft work.	10	L2	CO1
	b.	A perfect gas is undergoing a process in which $T \alpha V^{-2/5}$. Calculate the work done by the gas going from state 1 in which pressure is 100 bar and volume is $4m^3$ to the state 2 in which volume is $2m^3$. Also calculate the final pressure.	10	L3	CO1
		Module – 2			
Q.3	a.	Find the expressions for work and heat for a Isothermal and Adiabatic processes in case of non flow processes.	10	L1	CO1
	b.	At the inlet to a certain nozzle, the enthalpy of the fluid is 3025 kJ/kg and the velocity of 60 m/s. At the exit of the nozzle, the enthalpy is 2790 kJ/kg. The nozzle is horizontal and there is a heat loss of 100 kJ/kg from it. Calculate the velocity of fluid at nozzle exit. Also find the mass flow rate of fluid if the inlet area is 0.1 m^2 and specific volume at the inlet is 0.19 m^3/kg.	10	L3	CO1
		OR			
Q.4	a.	What are Kelvin – Planck and Clausius statements of second law of thermodynamics prove their equivalence.	10	L2	CO1
	b.	A reversible engine works between three thermal reservoirs A, B and C. the engine absorbs an equal amount of heat from the thermal reservoirs A and B kept at temperatures T_A and T_B respectively and rejects heat to a thermal reservoir C kept at temperature T_C. The efficiency of the engine is α times the efficiency of a reversible engine which works between the two reservoirs A and C. Show that $\frac{T_A}{T_B} = (2\alpha - 1) + 2(1-\alpha)\frac{T_A}{T_C}$.	10	L2	CO1

		Module – 3			
Q.5	**a.**	What is Clausius inequality? Prove it.	**10**	**L2**	**CO1**
	b.	A system at 500 K receives 7200 kJ/min from a source at 1000K. The temperature of atmosphere is 300K. Assuming that temperature of the system and source remain constant during the heat transfer find out i) the net change of entropy during the heat transfer ii) decrease in available energy after the heat transfer.	**10**	**L3**	**CO1**
		OR			
Q.6	**a.**	Draw P – V – T surface for a substance that expands on freezing. What are its salient features?	**10**	**L1**	**CO1**
	b.	A rigid vessel of $2m^3$ volume is filled with super heated steam at 20 bar and 300°C. The vessel is cooled until the steam is dry saturated. Calculate the mass of steam in the vessel, the final pressure of steam and the amount of energy transferred as heat to the surroundings. Represent the process on T – S diagram.	**10**	**L3**	**CO1**
		Module – 4			
Q.7	**a.**	Sketch and explain a vapour compression refrigeration system.	**10**	**L2**	**CO2**
	b.	A carnot refrigerator extracts 8 kJ/S of heat from a room maintained at 260K. The heat is discharged to the surrounding atmosphere at 300K. Determine the power required to run the compressor.	**10**	**L3**	**CO2**
		OR			
Q.8	**a.**	Define and explain : i) Dew point temperature ii) Dry bulb temperature iii) Wet bulb temperature iv) Specific humidity v) Relative humidity.	**10**	**L2**	**CO2**
	b.	Atmospheric air at 40°C and 40% R.H is to be cooled to a state of saturated air at 10°C by dehumidification. The mass flow rate of entering the humidifier is 0.8 kg/s neglecting any pressure drop, determine i) mass of water removed ii) quantity of heat removed.	**10**	**L3**	**CO2**
		Module – 5			
Q.9	**a.**	Derive an expression for thermal efficiency of a engine working on OTTO – cycle.	**10**	**L2**	**CO4**
	b.	An engine operating on the ideal diesel cycle has compression ratio of 16:1. Heat is added during the constant pressure process upto 8% of the stroke. If the engine inhales $0.04m^3/s$ at 101 kPa and 25°C, determine i) the maximum pressure and temperature in the cycle ii) the thermal efficiency of the engine iii) power developed.	**10**	**L3**	**CO4**
		OR			

Q.10	**a.**	Explain with sketch of following Absorption dynamometer : i) Rope brake ii) Prony brake iii) Hydraulic dynamometer	**10**	**L2**	**CO4**
	b.	The following observations were made during one hour test on a single cylinder 4 stroke oil engine. Bore = 300 mm , Stroke = 450 mm , Mass of fuel used = 8.8 kg , Calorific value = 41800 kJ/kg , Average speed = 200 rpm , Mean effective pressure = 5.8 bar , Break load = 1860 N , Mass of cooling water circulated = 650 kg , Temperature rise = 22°C , Diameter of the brake drum = 1.22 m. Calculate i) Mechanical efficiency ii) Brake thermal efficiency iii) Draw the heat balance sheet.	**10**	**L3**	**CO4**

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