CBCS SCHEME

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BAU304

Third Semester B.E./B.Tech. Degree Examination, June/July 2025
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. Missing data, if any, may be suitably assumed.

		Module – 1	M	L	C
Q.1	a.	What is thermodynamic state and process? What is Quasi-Static process? Explain.	10	L1	CO3
	b.	Explain thermodynamic equilibrium.	10	L1	CO1
		OR			
Q.2	a.	The temperature 't' on a certain Celsius thermodynamic scale is given by means of property through a relation $t = a \ln P + b$ where 'a' and 'b' are constants and P is the property of the fluid. If at the ice point and steam points the values of P are to found to be 4 and 20 respectively, what will be the temperature reading corresponding to a reading of P = 16?	10	L3	CO1
	b.	What are point and path functions? Explain.	10	L2	CO1
		Module – 2			
Q.3	a.	Derive steady flow energy equation.	10	L4	CO1
	b.	A steam turbine operating under steady flow conditions receiver 4500 kg of steam per hour. The steam enters the turbine at a velocity of 42 m/s at the elevation of 4m and a specific enthalpy of 2800 kJ/kg. It leaves the turbine at a velocity of 9.4 m/s at an elevation of 1 m and specific enthalpy of 2262 kJ/kg. The heat losses from the turbine to the surroundings amounts to 16780 kJ/hr. Determine the power output of the machine.	10	L4	CO1
		OR			
Q.4	a.	Prove Carnot theorem.	10	L3	CO1
	b.	A reservoirs heat engine operates between two reservoirs at temperatures of 600°C and 40°C the engine drives a reversible refrigerator, which operates between 40°C and – 20°C. The heat transfer to the engine is 2000 kJ and network output from combined engine and refrigerator system is 360 kJ. Calculate heat transfer to the refrigerator and net heat transfer to the refrigerator and net heat transfer to the reservoir at 40°C.	10	L2	CO1
		Module – 3			
Q.5	a.	State and prove clausius theorem and clausius inequality.	10	L3	CO1
	b.	A 30 kg steel ball at 427°C dropped in 150 kg oil at 27°C, the specific heat of steel and oil are 0.5 kJ/kg K and 2.5 kJ/ kg K respectively. Estimate the entropy change of steel, oil and that of system containing oil and steel.	10	L3	CO1
		OR			
Q.6	a.	Sketch and explain P-V-T surface for a pure substance that expands on freezing.	10	L2	CO3
	b.	One kg of super heated steam at 0.2 MPa and 200°C is contained in a piston cylinder arrangement at 300 K. Steam is condensed to saturated liquid at constant pressure. Calculate the change in entropy of the universe associated with this process.	10	L3	CO3

		Module – 4			
Q.7	**a.**	Sketch and explain vapour compression refrigeration system.	**10**	**L2**	**CO2**
	b.	A reversed cycle has refrigerating COP of 4. Determine : i) The ratio of T_2/T_1 or T_{max}/T_{min} ii) If the work done on the cycle is 20 KW, determine the maximum refrigeration effect in ton iii) If this cycle is used as heat pump, determine the COP and heat delivered.	**10**	**L3**	**CO2**
		OR			
Q.8	**a.**	Define and explain following terms : i) Specific humidity ii) Relative humidity iii) Dew point temperature iv) Degree of saturation v) Wet bulb temperature.	**10**	**L1**	**CO2**
	b.	The humidity ratio or specific humidity of atmospheric air at 30°C is 0.016 kg/kg of determine : i) Partial pressure of vapour ii) The relative humidity iii) Dew point temperature Assume standard barometric pressure of 760 mm if Hg.	**10**	**L3**	**CO2**
		Module – 5			
Q.9	**a.**	Discuss : i) OTTO cycle ii) Diesel cycle with P-V diagrams.	**10**	**L1**	**CO3**
	b.	An air standard diesel cycle operates with a compression ratio of 18 and maximum and minimum temperature of 1700 K and 300 K respectively. at the beginning of the compassion proce3ss, the pressure is 1 atm. Assume $\gamma = 1.4$, $C_p = 1.005$ kJ/kg K and R = 0.287 kJ/kg K. Determine : Pressure and temperature at each point in the cycle i) Specific net work output ii) Thermal efficiency iii) Work ratio iv) Mean effective pressure.	**10**	**L1**	**CO4**
		OR			
Q.10	**a.**	What is meant by : i) Willan's line ii) Heat balance sheet. Explain.	**10**	**L2**	**CO3**
	b.	The following observations were rewarded in a test of one hour duration on a single cylinder oil engine working on four strokes : Bore = 300 mm, Stroke = 450 mm, Fuel used = 8.8 kg, C.V of the fuel = 41800 kJ/kg, Average Speed = 200 rpm, MEP = 5.8 bar, brake friction load = 1860 N. Diameter of the Brake wheel = 1.22 m. Calculate : i) Mechanical efficiency ii) Brake thermal efficiency iii) BSFC iv) BMEP.	**10**	**L3**	**CO4**

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