CBCS SCHEME

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BAU304

Third Semester B.E./B.Tech Degree Examination, Dec.2023/Jan.2024
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 Thermodynamics Data handbook is permitted.

		Module – 1	M	L	C
Q.1	a.	Distinguish between : i) Microscopic and macroscopic approach ii) Intensive and extensive properties iii) Open and closed system iv) Path and point functions v) Cyclic and non-cycle process.	10	L2	CO2
	b.	From the fundamental concepts of temperature scale, for water deduce $T(K) = 273 + 100\left(\frac{L - L_I}{L_S - L_I}\right)$, taking appropriate ice point (L_I) and steam point (L_S).	10	L3	CO3
		OR			
Q.2	a.	Write thermodynamic definition of work and heat, and their sign conventions. Mention any two similarities and dissimilarities between them.	10	L2	CO3
	b.	In an IC Engine, gas expands from 13MPa and 200cm^2 to 1300cm^3, polytropically with an expansion index, n = 1.45. Show this process on an P-V diagram and calculate the expansion work. Comment on the results.	10	L3	CO2
		Module – 2			
Q.3	a.	State the first law of thermodynamics, and explain with a schematic diagram, Joule's experiment to support it.	10	L2	CO2
	b.	From the fundamentals, derive steady flow energy equation for an open system. State the assumptions made.	10	L3	CO3
		OR			
Q.4	a.	Establish the equivalence of Kelvin – Planck and Clausius statements of second law of thermodynamics.	10	L2	CO2
	b.	A heat engine is designed to operate between 327°C and 27°C ambient, receiving 450kJ of heat in a single cycle. Verify the Clausius inequality for the following hypothetical conditions : i) 315 kJ/cycle heat rejected ii) 210kJ/cycle heat rejected iii) 105 kJ/cycle heat rejected.	10	L3	CO4
		Module – 3			
Q.5	a.	Define entropy and explain the principle of increase of entropy, using appropriate plots.	10	L2	CO2
	b.	A 5kg copper block at 200°C is dropped into an insulated tank containing 100kg of oil at 30°C. Find the increase in entropy of the universe during this process, after thermal equilibrium is reached. Assume C_p for copper = 40J/kg.K, C_p for oil = 2.1KJ/kg.K.	10	L3	CO3

		OR			
Q.6	**a.**	Use a P-T plot and represent fusion line, vaporization line, critical point and triple point. Further, define : i) Critical point ii) Triple point iii) Superheated vapour iv) Subcooled liquid.	**10**	**L2**	**CO3**
	b.	A spherical shell of 80cm diameter contains a mixture of saturated steam and water at 250°C. Calculate the mass of each if their volumes are equal.	**10**	**L3**	**CO4**
		Module – 4			
Q.7	**a.**	Sketch and explain the working of a vapour absorption refrigeration system. Label all the major components.	**10**	**L2**	**CO2**
	b.	Using a schematic sketch, explain the working of a vapour compression refrigeration system and analyze the same for condenser, evaporator and compressor work.	**10**	**L4**	**CO3**
		OR			
Q.8	**a.**	Define the following terms : i) Ton of refrigeration ii) Wet bulb temperature iii) Specific humidity iv) COP v) Dew point temperature.	**10**	**L2**	**CO3**
	b.	Determine : i) Partial pressure of dry air ii) Specific humidify iii) Mass of water vapour and dry air iv) Relative humidity, for a mixture of dry air and water vapour at 16°C. The partial pressure of water vapour is 1.817kN/m^2.At 22°C DBT, the saturation pressure of water vapour is 2.64kN/m^2. Assume atmospheric pressure as 100kN/m^2.	**10**	**L4**	**CO2**
		Module – 5			
Q.9	**a.**	Analyze a standard otto cycle and show that its thermal efficiency is a function of volume compression ratio and isentropic index γ.	**10**	**L2**	**CO3**
	b.	A Carnot engine rejects heat to the sink at 32°C and has a thermal efficiency of 52.3%. The work output from the engine is 120kJ. Determine: i) The maximum working temperature of the engine ii) The heat added in kJ iii) The change in entropy during heat rejection.	**10**	**L3**	**CO4**
		OR			
Q.10	**a.**	With a schematic diagram explain how air consumption is measured in an IC engine using an air-box method.	**10**	**L2**	**CO2**
	b.	A six cylinder 4-stroke IC engine develops 60KW of IP at mean effective pressure of 7 bar. The bore and stroke of the engine is 70mm and 100mm respectively. If the engine speed is 3700rpm, find : i) Average misfires/min ii) Actual power developed.	**10**	**L3**	**CO3**

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