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P.E.S. College of Engineering, Mandya - 571 401

(An Autonomous Institution affiliated to VTU, Belagavi)

Third Semester, B.E. - Automobile Engineering

Semester End Examination; March - 2021

Thermodynamics

Time: 3 hrs *Max. Marks: 100*

Course Outcomes

The Students will be able to:

CO1: Design and Implement standard data structures like stack using recursion.
CO2: Design and implement operations on linked list.
CO3: Develop programs to implement different queues.
CO4: Design and implement different tree traversal techniques using iteration and recursion.
CO5: Implement sorting and searching techniques.

Note: ***I) PART - A*** *is compulsory.* ***Two*** *marks for each question.*
II) PART - B*: Answer any* ***Two*** *sub questions (from a, b, c) for Maximum of* ***18 marks*** *from each unit.*
III) *Assume suitably missing data if any.* ***IV)*** *Use of Thermodynamic data and book is permitted.*

Q. No.		Questions	Marks	BLs	COs	POs
		I : PART - A	**10**			
I	a.	Define thermodynamic equilibrium.	2	L1	C1	P1
	b.	Write study flow energy equation for Nozzle.	2	L1	C2	P1
	c.	Define heat pump and define refrigerator.	2	L1	C3	P1
	d.	Define thermal efficiency.	2	L1	C4	P1
	e.	Unit of refrigeration.	2	L1	C5	P1
		II : PART - B	**90**			
		UNIT - I	**18**			
1	a.	Explain the terms: macroscopic and microscopic point of view, system, state, cycle and property.	9	L1	C1	P1
	b.	Define a new temperature scale say "B" in which boiling point of water are 600°B and 100°B respectively " i) Correlate this scale with centigrade scale ii) Reading on the scale is same number on the corresponding absolute temperature scale, what is the absolute temperature on °B?	9	L2	C1	P2
	c.	A home cooler has fan of 170 watts rating and a water circulating pump of 50 watts rating. If the cooler operates for 10 hrs, find the energy consumed by the cooler.	9	L2	C1	P2
		UNIT - II	**18**			
2	a.	State and explain the first law of thermodynamics for a closed system undergoing cyclic process. Show that energy is a property of the system.	9	L2	C2	P1
	b.	Apply steady flow energy equation for the following systems: i) Air compressor ii) IC engine	9	L2	C2	P2

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c.	In a non-flow reversible process, the pressure and volume are related by, $p = V^2 + \frac{20}{V}$ where pressure P is in bar and V is in m^3. During the process the volume changes from 2 m^3 to 6 m^3 and heat added is 9000 kJ. Determine the changes in internal energy.	9	L3	C2	P2
	UNIT - III	**18**			
3 a.	State second law of thermodynamics and prove that they are equivalent.	9	L2	C3	P1
b.	Define irreversibility and mention the factors which render a process irreversible.	9	L1	C3	P1
c.	A reversible heat engine receives heat from a mixture of water vapour and liquid water under a pressure of 1.013 bar and rejects 50 kJ of heat per second to a mixture of ice and liquid water at 0.00602 bar pressure. Determine the power delivered by the engine.	9	L3	C3	P2
	UNIT - IV	**18**			
4 a.	Obtain an expression for air standard efficiency of an Otto cycle.	9		C4	P1
b.	Show that intermediate pressure in the two stage air compressor with a perfect inters cooling is a geometric mean with initial and final pressure.	9		C4	P2
c.	A single acting single cylinder air compressor has a cylinder diameter of 15 cm and 20 cm stroke. Air is drawn into the cylinder at a pressure of 1.0 bar and 20°C, when is compressed to a pressure of 6 bar according to the law $PV^{1.3}$ = constant. Find the theoretical power required to drive the compressor, if the speed is 110 rpm. Also determine the weight of air compressed per minute.	9		C4	P2
	UNIT - V	**18**			
5 a.	What are the different properties required for a good refrigerant?	9		C5	P1
b.	Define and explain: i) Dry bulb temperature ii) Wet bulb temperature iii) Humidity ratio iv) Dew point temperature v) Relative humidity	9		C5	P2
c.	Explain the working principle of vapour compression refrigeration system with a neat diagram and also plot the same on P-h and T-S diagram.	9		C5	P2

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