Hall Ticket Number:

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VASAVI COLLEGE OF ENGINEERING *(AUTONOMOUS)*, HYDERABAD

Accredited by NAAC with A++ Grade

B.E. (Mech. Engg.) II-Semester Advanced Supplementary Examinations, September-2023

Thermodynamics

Time: **3 hours** Max. Marks: **60**

*Note: Answer all questions from **Part-A** and any **FIVE** from **Part-B***

Part-A (10× 2 = 20 Marks)

Q. No.	Stem of the question	M	L	CO	PO
1.	Which law of thermodynamics forms the basis for thermometry? Explain.	2	2	1	1
2.	How do the intensive and extensive properties differ from the thermodynamic point of view? Give one example for each.	2	1	1	1
3.	What is Perpetual Motion Machine of first kind? Why is it impossible?	2	1	2	1
4.	With the help of a simple sketch, write the steady-flow energy equation for a steam nozzle used in a thermal power plant.	2	1	2	1
5.	Provide a simple sketch of a heat pump and define its coefficient of performance.	2	1	3	1
6.	State the principle of increase of entropy. What is its significance in engineering practice?	2	2	3	1
7.	It is required to transform ice at 1.01325 bar and -25°C in to steam at 200°C holding the pressure unaltered, propose as to how many sensible heat transfers and latent heat transfers would be required.	2	2	4	1
8.	Define "Critical Point" for a pure substance? What is the value of "Critical Temperature" for water?	2	1	4	1
9.	Represent "Dual cycle" on P-V and T-S planes.	2	1	5	1
10.	How does the compression ratio influence the thermal efficiency of Otto cycle?	2	2	5	1
	Part-B (5×8 = 40 Marks)				
11. a)	Distinguish between macroscopic and microscopic approaches of thermodynamics.	4	2	1	1
b)	Convert the following readings of pressure to kPa(abs), assuming that the barometer reads 760 mm Hg: (i) 1500 mm Hg (abs), (ii) 80 cm Hg gauge, (iii) 45 mm Hg vacuum and (iv) 1.2 m H_2O gauge.	4	2	1	2
12. a)	Derive steady flow energy equation.	4	2	2	1
b)	A fluid is confined in a cylinder by a spring-loaded, frictionless piston so that the pressure in the fluid is a linear function of the volume given by p =a+bV. The internal energy of the fluid is given by U=34 + 1.15 pV where U is in kJ, p in kPa, V in m^3.If the fluid changes from an initial state of 170 kPa, 0.03 m^3 to a final state of 400 kPa, 0.06 m^3, with no work other than that done on the piston, find the direction and the magnitude of the work and the heat transfers.	4	3	2	2

Contd... 2

13. a)	Give the Kelvin-Planck and Clausius statements of second law of thermodynamics. Demonstrate, together with pertinent sketches, their equivalence.	4	2	3	1
b)	A heat engine receives reversibly 420 kJ/cycle of heat from a source at 327° C and rejects heat reversibly to sink at 27° C. there are no other heat transfers. For each of the three hypothetical amounts of heat rejected, in (a), (b) and (c) below, which is reversible, which is irreversible and which is impossible. (a) 210 kJ/cycle, (b) 105 kJ/cycle, (c) 315 kJ/cycle.	4	3	3	2
14. a)	Explain with the help of p -T diagram, the solid-liquid-vapor phase transformation of water.	4	2	4	1
b)	Steam at a pressure 20 bar and 300°C is first expanded isenthalpically to 5 bar. And then it is expanded isentropically to 1 bar. Using the Mollier Diagram, find (i) the dryness fraction of steam at its final state, (ii) the net change in the specific enthalpy and (iii) the net change in the specific entropy of steam.	4	3	4	2
15. a)	Derive an expression for the efficiency of Diesel Cycle with the help of P-v and T-s diagrams.	4	3	5	1
b)	An engine working on diesel cycle has a compression ratio of 15:1 and expansion ratio of 7.5: 1. Determine its air standard efficiency.	4	3	5	2
16. a)	Explain the working principle of constant volume gas thermometer with a neat sketch.	4	1	1	1
b)	A domestic refrigerator is loaded with food and the door closed. During a certain period the machine consumes 1 kWhr of energy and the internal energy of the system drops by 5000 kJ. Find the net heat transfer for the system and the direction.	4	3	2	2
17.	Answer any ***two*** of the following:				
a)	An inventor claims to have developed an engine which produces 5 kW of power output by receiving 6 kJ of heat per second. The maximum and the minimum temperatures recorded during the experiments are 927 °C and 327 °C respectively. Does the claim deserve a patent? Explain	4	4	3	2
b)	Steam initially at 15 bar, 300°C expands reversibly and adiabatically in a steam turbine to 30°C.Determine the Ideal work output of the turbine per kg of steam	4	3	4	2
c)	Name the vapor power cycle that forms the basis for a steam power plant. Sketch the cycle on T-S and h-S planes and describe the various processes involved.	4	2	5	1

M : Marks; L: Bloom's Taxonomy Level; CO; Course Outcome; PO: Programme Outcome

i)	Blooms Taxonomy Level – 1	20%
ii)	Blooms Taxonomy Level – 2	40%
iii)	Blooms Taxonomy Level – 3 & 4	40%

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