Code No: 153BZ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, April/May - 2023
THERMODYNAMICS
(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 75**

Note: i) Question paper consists of Part A, Part B.
ii) Part A is compulsory, which carries 25 marks. In Part A, Answer all questions.
iii) In Part B, Answer any one question from each unit. Each question carries 10 marks and may have a, b as sub questions.

JNTUH Used papers 2023

PART – A

(25 Marks)

1.a)	Summarize the characteristics of boundary.	[2]
b)	What is meant by intensive properties of system? Give some examples.	[3]
c)	Tell the significance of third law of thermodynamics.	[2]
d)	Illustrate the functions of heat pump.	[3]
e)	List the advantages of mollier chart.	[2]
f)	Summarize the characteristics of pure substances.	[3]
g)	What is meant by real gas?	[2]
h)	Explain the importance of compressibility chart.	[3]
i)	List out the advantages of dual cycle.	[2]
j)	Explain the importance of Brayton cycle.	[3]

PART – B

(50 Marks)

2.a) Distinguish the (i) Reversible process and Irreversible process (ii) Heat and work.
b) Examine the characteristics of quasi static process and thermodynamic equilibrium of the system. [5+5]

OR

3.a) Discuss the concepts of continuum and energy in state and energy in transition.
b) In a two part process with an expansion from 0.1 to 0.2 m^3 at a constant pressure of 150 kPa is followed by an expansion from 0.2 to 0.4 m^3 with a linearly rising of pressure from 150 kPa ending at 300 KPa. By showing the process on P-V diagram calculate the boundary work. [5+5]

4.a) Establish an equation for first law of thermodynamics applied to a closed system operating in a cycle with the help of Joule's experiment.
b) A Closed system of mass 2 kg undergoes a process in which there is heat transfer of 25 kJ from the system to the surroundings. The amount of work done on the system is 100 kJ. The specific internal energy decreased by 15 kJ/kg and the elevation of the system increased by 1000 m. The acceleration due to gravity is 9.6 m/s^2. Determine the change in kinetic energy of the system. [5+5]

OR

5.a) Deduce the expression for the thermal efficiency of the hat engine.

b) Conclude "All reversible engines have same thermal efficiency working under the same temperature limits". [5+5]

6.a) Explain p-V-T surface with a neat sketch.

b) Water at 40^0 C is continuously sprayed into a pipe line carrying 5 tonnes of steam at 5 bar, 30^0C per hour. At a section downstream where the pressure is 3 bar, the quality is to be 95%. Find the rate of spray in kg/h. [5+5]

OR

7.a) Draw and explain the T-v diagram for the formation of compressed liquid water to superheated steam.

b) Enumerate the importance of free expansion process with some examples. [5+5]

8. Deduce the expression of Vander Waals equation of state for the real gases and also state the assumptions in its derivation. [10]

OR

9. An insulated rigid tank is divided into two compartments by a partition. One compartment contains 7 kg of oxygen gas at 40^0 C and 100 kPa, and the other compartment contains 4 kg of nitrogen gas at 20^0 C and 150 kPa. Now the partition is removed, and the two gases are allowed to mix. Determine a) the mixture temperature b) the mixture pressure after equilibrium has been established. [10]

10.a) With a neat sketch, explain the working of Brayton cycle and derive the expression for thermal efficiency.

b) List out the assumptions in the air standard cycles for derivation of thermal efficiency. [5+5]

OR

11. At the beginning of compression in an air standard Otto cycle engine cylinder the temperature is 37^0C, the pressure is 1 bar and volume is 0.000707 m^3. At the end of compression the pressure is 10 bar. The heat supplied to the cycle is 1.5 kJ. Calculate (a) Compression ratio (b) the net work per cycle (c) the mean effective Pressure. [10]

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Code No: 153BZ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B. Tech II Year I Semester Examinations, August/September - 2022
THERMODYNAMICS
(Mechanical Engineering)

Time: 3 Hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1.a) Differentiate between exact and inexact differential and explain with suitable example.
b) A mass of 1.5 kg of air is compressed in a quasi-static process from 0.1 MPa to a final pressure 0.7 MPa by following the law $pv^{1.75}$ = constant. The initial density of air is 1.16 kg/m^3. Find the final density, work done by the piston during compression and heat transfer. [7+8]

2.a) What are the reference points to be considered for the absolute scale for the temperature measurement? Explain.
b) The properties of a certain fluid are related as follows. u = 196 + 0.178t & pv = 0.287(t+273) Where u is specific internal energy (kJ/kg), t is in ^{0}C, p is pressure (kN/m^2) and v specific volume (m^3/kg). For this fluid calculate C_v, C_p and R value. [7+8]

3.a) Explain the corollaries of first law of thermodynamics and discuss their important applications.
b) The air speed of a jet engine in flight is 550 m/s when the ambient air temperature is 10^0 C. The temperature at the outlet of nozzle is 600^0 C and the corresponding enthalpy values for air and gas are respectively 50 kJ/kg and 1050 kJ/kg respectively. The fuel air ratio is 0.0190 and the calorific value of the fuel is 44.5 MJ/kg. Assume the heat loss from the engine is 25 kJ/kg of air. Calculate the velocity of the exhaust jet. [7+8]

4.a) A heat engine is used to drive a heat pump. The heat transfers from the heat engine and from the heat pump are used to heat the water circulating through the radiators of a building. The efficiency of heat engine is 27% and COP of the heat pump is 4. Evaluate the ratio of the heat transfer to the circulating water to the heat transfer to the heat engine.
b) State and explain the significance of third law of thermodynamics and discuss its practical applications. [5+10]

5.a) Draw P-V-T surface for pure substance water and discuss the salient features to understand Critical point and triple point.
b) Moist air enters an adiabatic saturator at 30^0C and leaves 20^0C, which is the adiabatic saturation temperature. The pressure remains constant at 100 kPa. Determine the relative humidity and the humidity ratio of the inlet mixture. [8+7]

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6.a) Explain the importance of throttling process and derive the equation for Joules Kelvin coefficient.

b) One kg of steam initially at 1.1 MPa expands in a cylinder follows the law $pv^{1.13} = C$. The pressure at the end of the expansion is 0.1 MPa. Determine the final volume, final dryness fraction, the work done, the change in internal energy and heat transfer. [7+8]

7.a) How to make use of Vander Waal's equation for the estimation of properties of real gases? Explain.

b) Derive the equation for the estimation of COP for Bell Coleman cycle and explain the working principle. [8+7]

8.a) Compare and contrast Otto, Diesel and dual cycle for the same compression ratio and explain the salient points.

b) The volume ratios of compression and expansion for a diesel engine are 15.3 and 7.5 respectively. The pressure and temperature at the beginning of the compression are 1 bar and 27 ^{0}C. Assuming an ideal engine, determine the mean effective pressure, ratio of maximum pressure to mean effective pressure and cycle efficiency. [7+8]

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JNTUH Used paper Aug-2022

Code No: 153BZ **R18**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
B.Tech II Year I Semester Examinations, October - 2020
THERMODYNAMICS
(Mechanical Engineering)

Time: 2 hours **Max. Marks: 75**

Answer any five questions
All questions carry equal marks
- - -

1. A mass of 8 kg gas is expands in a flexible container so that the p-v relationship is in the form of $pv^{1.2}$=const. the initial pressure is 1000 kPa and the initial volume is 1 m^3. The final pressure is 5 kPa. If the specific internal energy of the gas is decreases by 40 kJ/kg, find the heat transfer in magnitude and direction. [15]

2. A room for four persons has two fans, each consuming 0.18 kW power, and three 100 W lamps. Ventilation air at the rate of 80 kg/h enters with an enthalpy of 84 kJ/kg and leaves with an enthalpy of 59 kJ/kg. If each person puts out heat at the rate of 630 kJ/h, determine the rate at which heat is to be removed by a room cooler, so that a steady state is maintained in the room. [15]

3.a) Prove that energy is a property.
b) Apply steady flow energy equation for nozzle, compressor and condenser. [7+8]

4.a) Derive the Maxwell's relations.
b) Sketch the thermodynamic mnemonic diagram and explain its use to obtain Gibbs equations and Maxwell relations. [7+8]

5. A steam pressure of holding capacity 4 m^3 contains a mixture of saturated water and saturated steam at 250^0C. The mass of the liquid present is 1 ton. Determine (a) Quality; (b) Specific Volume; (c) Specific Enthalpy; (d) Specific Entropy and (e) Specific Internal Energy of steam. [15]

6. Explain in detail about throttling and free expansion processes with a neat sketch and also mention their applications. [15]

7.a) State Avagadro's Hypothesis.
b) State and explain Dalton's law partial pressure and prove the statement mathematically. [7+8]

8. How does the vapour compression refrigeration system work? Explain with suitable diagrams. [15]

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Model Question paper

Q.P Code: ME2105PC Hall Ticket No.

NARSIMHA REDDY ENGINEERINGCOLLEGE(UGC AUTONOMOUS)

II B.Tech I Semester (NR20) Regular Examination, FEB 2023

Thermodynamics(Mechanical)

Note:	• This question paper contains two parts A and B • Part A is compulsory which carries 25 marks (1st 5 sub questions are one from each unit carry 2 Marks each & Next 5 sub questions are one from each unit carry 3 Marks). Answer all questions in Part A • Part B Consists of 5 Units. Answer any one full question from each unit. Each question carries 10 Marks and may have a, b sub questions

Time :3 hours Maximum marks: 75

Part-A (25 Marks)
Answer all questions

Q.No		Questions	M	BL	CO	PO
1)	a.	Explain why the heat and work as path functions	2	L1	CO1	PO1
	b.	Explain types of thermodynamic system?	2	L1	CO1	PO1
	c.	Distinguish between change of state, path and process	2	L1	CO2	PO3
	d.	Explain Second Law of Thermodynamics	2	L1	CO2	PO3
	e.	Define dryness fraction of steam OR What is quality of steam?	2	L1	CO3	PO3
	f.	Define Dry bulb temperature and wet bulb temperature	3	L1	CO3	PO2
	g.	explain with neat sketch sling psychrometer?	3	L1	CO4	PO3
	h.	Explain in the working of cannot cycle and derive the expression for its thermal efficiency.	3	L1	CO4	PO3
	i.	What is adiabatic saturation process?	3	L1	CO5	PO3
	j.	Explain Dalton's law of partial pressure	3	L1	CO5	PO3

Part-B **50Marks**

Answer any questions

Q.No		Questions	M	BL	CO	PO
UNIT :1						
2)	a.	What is a constant volume gas thermometer? Why is it preferred to a constant pressure gas thermometer?	5	L2	CO1	PO2
	b.	Derive relation between 2 specific heats gas constant	5	L2	CO1	PO2
		O R				
3)	a.	What is Quasi static process? explain with neat sketch?	5	L3	CO1	PO2
	b.	What is the difference between the work transfer and heat transfer?	5	L2	CO1	PO2
UNIT:2						
4	a.	An air compressor handles 6.0 m3/min of air with a density of 1.26 kg/m3and a pressure of 1.013 bar, and it discharges 450 kPa with a density of 4.86 kg/m3. The change in specific internal energy across the compressor is 82 kJ/kg and heat loss by cooling is24 kJ/kg. Neglecting KE and PE, find the work in kW	5	L2	CO2	PO3
	b.	A cyclic heat engine operates between a source temperature of 800 C and A Sink temperature of 300C.What is the least rate of heat rejection per KW net output of the engine?	5	L2	CO2	PO3
		O R				
5	a.	Prove that the violation of Clausius statement leads to violation of Kelvin Plank statement.	5	L3	CO2	PO3
	b	derive an expression for MAXWELLEQUATIONS?	3	L3	CO2	PO4

	C	What are the important points of heat pump	2	L1	CO1	PO1
UNIT 3:						
6)	a.	explain the neat sketch barrel calorimeter	5	L2	CO3	PO5
	b.	explain neat sketch throttling calorimeter	5	L2	CO3	PO3
		O R				
7)	a.	One kg of ice at -50C is exposed to the atmosphere which is at 200C. Ice melts and comes into thermal equilibrium with the atmosphere. Determine the entropy increase of the universe.	5	L1	CO3	PO3
	b.	Draw psychrometric chart and show psychrometric processes in the chart	5	L1	CO3	PO4
UNIT:4						

8)	a.	Compare and contrast the Gravimetric and volumetric analysis	5	L1	CO4	PO4
	b.	Explain throttling process?	5	L4	CO4	PO4
		O R				
9)	a.	Agas mixture contains 1 Kg of O2 and 3 Kg of N2. The pressure and temperature of the mixture are 1 bar and 27degC.Determine: i Mass fraction and mole fraction of each constituent ii) Average molecular weight of mixture iii) Partial Pressure of constituents iv) Specific gas constant v) Mixture volume vi) Mixture density	5	L3	CO4	PO4
	b.	Derive gas laws of equations	5	L4	CO4	PO4
UNIT 5:						
10)	a.	Derive an expression for thermal efficiency of Otto cycle	5	L2	CO5	PO5
	b.	Explain the working of Bell- Coleman cycle	5	L4	CO5	PO5
		O R				
11)	a.	Explain the working of Diesel cycle	5	L2	CO5	PO5
	b.	Define mean effective pressure and thermal efficiency of an air standard cycle	5	L2	CO5	PO5

M – Marks **CO –** Course Outcomes **PO –** Program Outcomes

BL – Bloom's Taxonomy Levels (**L1–**Remembering, **L2–**Understanding, **L3–** Applying,**L4–**Analyzing, **L5–**Evaluating, **L6–**Creating)