M-303 Thermal Engineering - 1

Blue Print of a Model Question Paper

S. No	Chapter Name	Periods Allocated	Weightage Allocated	Question Wise Distribution of Weightage			Question Wise Distribution of Marks		
				R	U	Ap	R	U	Ap
1	Fundamentals of Thermodynamics	14	21	01	01	1 ½	03	03	15
2	Laws of Perfect Gases	14	21	01	01	1 ½	03	03	15
3	Thermodynamic Processes on Gases	19	26	01	01	2	03	03	20
4	Air Standard Cycles	14	21	01	01	1 ½	03	03	15
5	Fuels and Combustion	14	21	01	01	1 ½	03	03	15
TOTAL		**75**	**110**	**05**	**05**	**08**	**15**	**15**	**80**

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

Unit Test – 1

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	**Fundamentals of Thermodynamics** , Laws of Perfect gases, Thermodynamic Processes on Gases	R,U	4	CO1 - CO3
2	**Fundamentals of Thermodynamics**	U	3	CO1
3	**Fundamentals of Thermodynamics**	U	3	CO1
4	Laws of Perfect Gases	U	3	CO2
5	Thermodynamic processes on gases	U	3	CO3
Part - B (24 marks)				
6	**Fundamentals of Thermodynamics**	Ap	8	CO1
7	Laws of Perfect Gases	Ap	8	CO2
8	Thermodynamic Processes on Gases	Ap	8	CO3

Unit Test – 2

Q.No	Question from the Chapter	Bloom's category	Marks allocated	CO addressed
Part - A (16 marks)				
1	Thermodynamic Processes on Gases, Air Standard Cycles, Fuels and Combustion	R,U	4	CO3-CO5
2	Thermodynamic Processes on Gases	U	3	CO3
3	Air Standard Cycles	U	3	CO4
4	Air Standard Cycles	U	3	CO4
5	Fuels and Combustion	U	3	CO5
Part - B (24 marks)				
6	Thermodynamic Processes on Gases	Ap	8	CO3
7	Air Standard Cycles	Ap	8	CO4
8	Fuels and Combustion	Ap	8	CO5

R-Remembering; U-Understanding; Ap-Applying; An- Analylising

BOARD DIPLOMA EXAMINATION
D.M.E – Third Semester
Unit Test - 1
THERMAL ENGINEERING – 1

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Write the formulas for displacement work and flow work.
   (b) In the throttling process the entropy remains constant. (True/False)
   (c) The Universal gas constant value is _________ kJ/kg mole-K.
   (d) What is the characteristic of Isochoric process?
2. What are the intensive properties? Give two examples.
3. In a piston cylinder arrangement air expands from a volume of 0.003 m^3 to 0.024 m^3 at a constant pressure of 690 kN/m^2. The amount of heat rejected through cylinder walls is 6 kJ. Determine the change of internal energy.
4. 0.24 kg of gas at a pressure of 110 kPa and a temperature of 330 K occupies a volume 0.21 m^3. Calculate the value of gas constant and molecular weight of the gas.
5. Represent Isothermal process on p-V and T-s diagrams.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. In a steady flow system, a fluid flows at the rate of 4 kg/s. It enters at a velocity of 300 m/s and has enthalpy of 2330 kJ/kg at inlet. It leaves the system at a velocity of 150 m/s and its enthalpy at outlet is 1656 kJ/kg. During

its passage through the system fluid has a loss of heat transfer by 30 kJ/kg to the surroundings. Determine the power of the system in kW. Neglect any change in the potential energy.

(OR)

Apply the steady flow energy equation and find the heat transfer in the boiler and the exit velocity in the nozzle.

7. 2 kg of an ideal gas is heated from 25^0C to 105^0C. Assuming R = 0.265 kJ/ kg-K and γ = 1.18 for the gas, find (a) specific heats (b) change in internal energy and (c) change in enthalpy.

(OR)

An ideal gas is expanded from 400 kN/m^2 and 0.04 m^3 to 120 kN/m^2 and 0.1 m^3. The temperature fell down during the process was observed as 150^0C. If the values of C_P and C_V are 1.025 kJ/kg K and 0.726 kJ/kg K respectively. Find (a) the change in internal energy (b) the mass of the gas.

8. Represent isobaric process on p-V and T-s diagrams and Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for a isobaric process.

(OR)

Represent isentropic process on p-V and T-s diagrams and Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for an Isentropic process.

BOARD DIPLOMA EXAMINATION

Unit Test – 2

D.M.E – Third Semester

THERMAL ENGINEERING – 1

Time : 90 Minutes Total Marks: **40**

PART – A

Instructions: *1st Question having 4 one mark questions, and remaining 4Questions carry 3 marks each*

1. (a) Write an expression for change entropy for constant pressure process.
   (b) Carnot cycle consists of two adiabatic and two isothermal processes. (True/False)
   (c) In the diesel cycle the heat is added at constant ____________ process.
   (d) Write the formulae for HCV of a fuel.
2. If 0.05 kg of gas is heated from 25^0 C to 150^0 C, what is the change of entropy, if the process is carried out at constant volume? Assume C_V = 0.9 kJ/ kg K.
3. A gas engine working on Otto cycle has a cylinder diameter if 180 mm and a stroke of 320 mm; the clearance volume is 0.0022 m^3. Find the air standard efficiency assuming γ = 1.4.
4. Show the Carnot cycle on p-V diagram and T-s diagram.
5. Write the advantages of liquid fuels over solid and gaseous fuels.

PART – B

Instructions: *Part B consists of **3** Units. Answer any one full question from each unit. Each question carries 8 marks and may have sub questions.*

6. One kg of air at a pressure of 10 bar and a temperature of 373 K undergoes a reversible process which may be represented by $pV^{1.1}$ = constant. The final pressure is 2 bar. Assume R =0.287 kJ/kg K and γ = 1.4, find (a) final volume (b) final temperature and (c) increase in entropy.

(OR)

Represent polytropic process on p-V and T-s diagrams and Write the mathematical expressions for change in internal energy, work transfer, heat transfer, change in enthalpy and change in entropy for a polytropic process.

7. Derive an expression for air standard efficiency of an Otto cycle. State the air standard assumptions.

(OR)

An engine operating on the ideal Otto cycle has a bore of 0.1 m a stroke of 0.127 m and compression ratio 7. At the beginning of compression stroke the cylinder contains air at 288.6 K and 100 kPa, if the maximum cycle temperature 1923 K. Determine (a) The pressure, volume and temperature at main points (b) The air standard efficiency and (c) Heat supplied and heat rejected per kg of air.

8. Explain the working of Bomb calorimeter with a line diagram and write an expression to find the Higher Calorific Value.

(OR)

Describe the working of Orsat apparatus for the analysis of dry flue gases to with a line diagram .

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BOARD DIPLOMA EXAMINATION
D.M.E. – III SEMESTER EXAMINATION
THERMAL ENGINEERING – 1

Time : 3 Hours Total Marks: **80**

PART – A

10 X 3 = 30

Instructions: *Part A consists of **10** questions. Answer **all** questions and each question carries **three** marks.*

1. State the Kelvin-Plank statement of the second law of thermodynamics and explain with a line diagram.
2. Pressure behind the piston remains constant at 700 kPa while the volume increases from $0.003m^3$ to $0.024m^3$. Determine the work transfer across the boundaries.
3. Define Charles's law and write the equation for Charles's law between two states.
4. State Avagadro's law and calculate the molar volume at NTP conditions.
5. 2 kg of gas occupying 0.7 m^3 had an initial temperature of 15^0C. It was then heated at constant volume until its temperature becomes 135^0C. How much heat was transferred to the gas?
6. Represent a constant pressure process on p-V and T-s diagrams.
7. Write three assumptions made in the analysis of air standard cycles.
8. Plot the Carnot cycle on Pressure-Volume diagram, Temperature-Entropy diagram and name the thermodynamic processes.
9. Define (a) LCV (b) HCV related to fuels.
10. Write the steps involved in conversion of gravitational analysis into volumetric analysis of a fuels.

PART – B

5 X 10 = 50

Instructions: *Answer any five questions. Each question carries 10 marks.*

11. A) In a steady flow system, a fluid flows at the rate of 4kg/s. It enters at a velocity of 300m/s and has enthalpy of 2330 kJ/kg at inlet. It leaves the system at a velocity of 150m/s and its enthalpy at outlet is 1656 kJ/kg. During its passage through the system through the system fluid has a loss of heat transfer by 30 kJ/kg to the surroundings. Determine the power of the system in kW. Neglect any change in the potential energy.
12. 2·5 kg of an idea gas is expanded from a pressure of 700 kPa and volume 1·5 m^3 to a pressure of 140 kPa and volume of 4·5 m^3. The change is internal energy is 500 kJ. Specific heat at constant volume for the gas is 0·719 kJ/kgK. Determine (a) gas constant and (b) initial and final temperatures.

13. (a) A quantity of gas is contained in a frictionless piston – cylinder system. The pressure is given by

$$P= (8 – 4V)$$

Where p is in bar and V is in m^3. The gas expands from initial volume of 0.06 m^3 to 0.3 m^3 and there is a heat transfer of 105 kJ to the gas. Calculate the change of internal energy.

(b) An ideal gas is expanded from initial state of 900 kN/m^2 and 0·12 m^3 to final state of 100 kN/m^2 and 0·48 m^3. The temperature change during this process was observed as 160°C. The values of C_p and C_v are 1·025 kJ/kg K and 0·735 kJ/kg K respectively. Find (a) mass of the gas and *(b)* the change in internal energy of the gas.

14. A quantity of gas has an initial pressure, volume and temperature 140 KN/m^2, 0.4 m^3 and 25^0C respectively. It is compressed to a pressure of 1.4MN/m^2 according to the law $PV^{1.25}$ = constant. Determine: (a) Work transfer to the gas; (b) Heat transfer from the gas; (c) Change in entropyTake C_p = 1.041 kJ/kg K and C_v = 0.743 kJ/kg K

15. 2 kg of air at 10 bar and 327^0 C expands adiabatically to a pressure of 1 bar. Determine (a) Final volume (b) Final temperature (c) Work energy transferred during the process (d) Change in internal energy and (e) Change in enthalpy. For air C_p = 1.005 kJ/kg K and R = 0.287 kJ/kg K

16. In an ideal Otto cycle the air at the beginning of isentropic compression is 1 bar and 15^0 C. The ratio of compression is 8. The heat added is 1008 kJ/kg during constant volume process.
Take $\gamma = 1.4$; C_v = 0.714 kJ/kg K
Determine (a) Maximum temperature in the cycle
(b) The air standard efficiency
(c) The work done per kg of air
(d) The heat rejected per kg of air

17. The volumetric analysis of a producer gas is as follows: Hydrogen – 20.2%, Methane – 2.8%, Carbon monoxide – 22.2%, carbon dioxide – 7.7% and Nitrogen – 47.1%. Estimate the volume of air required.

18. (a) Explain the thermodynamic processes of a Diesel Cycle with the help of p-V diagram.
(b) Explain the working of Junkers gas calorimeter with a line diagram and write an expression to find the Higher Calorific Value.