



# KINGS

COLLEGE OF ENGINEERING



## DEPARTMENT OF MECHANICAL ENGINEERING

### QUESTION BANK

**Sub Code/Name: Engineering Thermodynamics**

**Year/Sem: II / III**

#### UNIT- I

##### PART – A (2 Marks)

1. Define Thermal Engg.
2. Define thermodynamic system and classify it.
3. Define open system with example.
4. Define closed system with example.
5. Define intensive and extensive properties.
6. Define zeroth law of thermodynamics.
7. Define first law of thermodynamics.
8. What is meant by open cycle?
9. What is meant by closed cycle?
10. What is meant by point and path function?

##### PART –B (16 marks)

1. one kg of gas expands at constant pressure from  $0.085 \text{ m}^3$  to  $0.13 \text{ m}^3$ . if the initial temperature of the gas is  $22.5^\circ\text{C}$ . find the final temperature, net heat transfer, change in internal energy, pressure of gas.
2. A certain quantity of gas is heated at constant pressure from  $35^\circ\text{C}$  to  $185^\circ\text{C}$ . Estimate the amount of heat transferred, ideal work done, change in internal energy, when the initial volume of the gas is  $0.6 \text{ m}^3$ .
3. Explain and derive Isothermal process
4. Explain and derive Isobaric process.
5. 2kg of gas at a pressure of 1.5 bar. Occupies a volume of  $2.5 \text{ m}^3$ . If this gas compresses isothermally to  $1/3$  times the initial volume. Find initial. Final temperature, work done, heat transfer.
6. one kg of air is compressed polytropically ( $n=1.3$ ) from 1 bar and  $27^\circ\text{C}$  to 3 bar.  
Find  
  1. work transfer
  2. Heat transfer
  3. Change in internal energy.

**UNIT-2**

**PART-A (2 marks)**

1. State second law of thermodynamics.
2. Write the clausius statement.
3. state carnot theorem
4. Define the term COP.
5. Sketch P-V and T-S diagram of camot cycle.
6. Define entropy.
7. What is meant by clausius inequality.
8. Define the term reversibility.
9. State the efficiency of camot cycle.
10. Define irreversibility.

**PART-B (16 marks)**

1. Air flows through an adiabatic compressor at 3 kg/s the inlet conditions are 2 bar and 310k and exit conditions are 20 bar and 560 k. compute the net rate of availability transfer and irreversibility.
2. Air in a closed vessel of fixed volume of  $0.15 \text{ m}^3$ , exerts pressure of 12 bar at  $250^\circ \text{C}$ , if the vessel is cooled so that the pressure falls to 3.5 bar, determine the final temperature, heat transfer and change of entropy.
3. Explain Carnot engine cycle and its efficiency.
4. Explain the term availability and unavailability.
5. A heat engine operates between a source a  $600^\circ \text{C}$  and a sink at  $60^\circ \text{C}$  Determine the least rate of heat rejection per KW net output of the engine.
- 6) 0.2 kg of air at 1.5 bar and  $27^\circ \text{C}$  is compressed to a pressure of 15 bar according to the law  $p v^{1.25} = \text{c}$ . determine work done heat flow to or from the air, increase or decrease in entropy

**UNIT- 3**

**PART-A (2 marks)**

1. Define latent heat of ice.
2. What is pure substance
3. Define dryness fraction of steam
4. Define critical point for pure substance.
5. Define triple point.
6. Define- efficiency ratio.
7. List the advantages of reheat cycle.
8. Define sensible heat factor.
9. What are the disadvantages of reheating
10. What is the function of condenser

**PART-B (16 Marks)**

1. Find the specific volume and enthalpy of steam at 9 bar when the condition of steam is a) Wet with dryness fraction 0.95 b) dry saturated c) super heated temperature of  $240^{\circ}$
2. Steam initially at 400 Kpa and 0.6 dry is heated in a rigid vessel of  $0.1\text{m}^3$  volume. The final condition is 600 Kpa. Find the amount of heat added and mass of steam.
3. Explain P-V diagram and P-V-T surface.
4. 2 kg of steam initially at 5 bar and 0.6 dry is heated at constant pressure until the temperature becomes  $350^{\circ}\text{C}$ . find the change in entropy and internal energy.
5. A steam plant working on a simple rankine cycle operated between the temperature of  $260^{\circ}\text{C}$  and  $95^{\circ}\text{C}$ . the steam is dry and saturated when it enters the turbine and expanded isentropically. Find rankine efficiency.
- 6) 2.5 kg of steam is heated at constant pressure of 250 kpa and  $100^{\circ}\text{C}$ , until temperature is  $250^{\circ}\text{C}$ . find the amount of heat added and change in entropy.  
(Use mollier chart)

**UNIT – 4**

**PART-A (2 marks)**

1. State joules law.
2. State Avogadro's law.
3. State Dalton's law of partial pressure.
4. Define vandeJWalls equation.
5. Distinguish between ideal and real gas.
6. What are Maxwell's relations.
7. Define joule-Thomson coefficient.
8. What is compressibility factor?
9. What is clapeyron equation.
10. State helmholtz function .

**PART-B (16 marks)**

1. Derive Dalton's law of partial pressure. Define Amagat's law of partial volume.
2. Derive van der Waals equation.
3. Derive Maxwell's equation
4. Derive Clausius-Clapeyron equation.
5. Derive Joule-Thomson coefficient equation.
6. A mixture of gases contains 50% nitrogen, 40% oxygen and 10% carbon dioxide by mass. 2 kg of mixture is compressed from 200 kPa and 293 K to 400 kPa polytropically which follows the  $PV^{1.25} = C$ . Determine the work done, heat transferred and change in entropy. (Take  $c_{p,N_2} = 1.04$  kJ/kg K,  $c_{p,O_2} = 0.918$  kJ/kg K,  $c_{p,CO_2} = 0.846$  kJ/kg K)

**UNIT - 5**

**PART-A (2 marks)**

1. Define psychrometry.
2. What is the difference between air conditioning and refrigeration?
3. Define dry bulb temperature.
4. Define Relative humidity.
5. Define wet bulb temperature.
6. What is meant by specific humidity?
7. Define dew point temperature.
8. Define wet bulb depression.
9. Define dew point depression.
10. State Dalton's law of partial pressure.

**PART-B (16 marks)**

1. Dry bulb and wet temperatures of 1 atmospheric air stream are  $40^{\circ}\text{C}$  and  $30^{\circ}\text{C}$  respectively. Determine

(a) Humidity (b) Relative humidity (c) Specific humidity.

2. Atmospheric air with barometric pressure of 1.013 bar has  $38^{\circ}\text{C}$  dry bulb temperature and  $28^{\circ}\text{C}$  wet bulb temperature. Determine (a) Humidity ratio (b) Relative humidity (c) dew point temperature.

3. Atmospheric air at 760 mm of Hg has  $45^{\circ}\text{C}$  DBT and  $30^{\circ}\text{C}$  WBT, using psychometric chart calculate R.H, Humidity ratio, DPT, enthalpy, specific volume of air.

4. Atmospheric air at 1 bar pressure has  $25^{\circ}\text{C}$  DBT and 75% RH using psychometric chart, calculate DBT, enthalpy, vapour pressure.

5. Explain sensible heating process, sensible cooling, and humidification process.

6. An air water vapour mixture at 0.1 Mpa,  $30^{\circ}\text{C}$ , 80% RH. Has a volume of  $50\text{ m}^3$ . Calculate the specific humidity, dew point, wet bulb temperature, mass of dry air and mass of water vapour.