Question Bank of Basic Thermodynamics

Section –A (2 marks)

1. Define thermodynamic system?
2. Define the terms: State, path, process and cycle.
3. Define quasi-static process?
4. Differentiate between: Temperature, heat and work.
5. Define: Internal energy, external energy and zeroth law of thermodynamics.
6. Describe the working of Carnot cycle.
7. Give various statements of second law of thermodynamics.
8. Define: Brake power, indicated power, thermal efficiency of an engine.
9. What is compression ratio?
10. Discuss whether Quantity Pdv represents system Property or not?
11. Distinguish between Closed, Open and isolated System with suitable examples.
12. Which law is essential for the temperature measurement brief it?
13. With the help of suitable example, write about first law of thermodynamics.
14. Write about enthalpy and specific heat.
15. Is it Possible that $W \neq 0$ Even if $dv = 0$? If so give an example and explain?
16. Explain the Quasi static process.
17. What are the conditions for reversibility?
18. What is a steady flow process and what are the assumptions for it.
19. Define specific heats for a gas and give their relations.
20. Calculate work done when the volume changes from $5m^3$ to $10m^3$ in a non-flow process in which pressure is given by. P=(5V-5) bar.
21. Explain the corollaries of Ist law of thermodynamics.
22. Explain thermal reservoir and its types?
23. Explain Kelvin Planck and Clausius statement?

24. Write down the assumptions and impartibility of Carnot cycle?

25. Entropy is important term in Thermodynamics explain it.

26. Write in brief about the Third law of thermodynamics.

27. With the help of suitable example, write about High grade and low grade energy.

28. A heat engine receiving heat at the rate of 2250KJ/min and develops 10KW power. Find out its thermal efficiency.

29. What are the heat engines? How these are classified.

30. Explain the terms. 1. Compression ratio 2.Pressure Ratio 3.Cut-off Ratio 4.Mean Effective Pressure.

Section –B (8 marks)

Q1. Differentiate between:

a. Closed system and open system.

b. Macroscopic and microscopic approach

c. Extensive and intensive properties.

Q2. What is reversible and irreversible process, explain both with examples.

Q3. Explain the corollaries of first law.

Q4. Define and explain the concept of enthalpy. Why does enthalpy of an ideal gas depends on temperature?

Q5. Distinguish between different poly-tropic processes, draw common (p-v) diagram.

Q6. Derive an expression for the $pv^{\gamma} = C$ for adiabatic process

Q7. What is isochoric process? Show it on P-V diagram and explain various property changes.

Q8. State the Carnot theorem for heat engine, refrigerator and heat pump.

Q9. Prove that the efficiency of a reversible engine is maximum.

Q10. Show by inequality of clausius that no heat pump cycle working between two reservoirs can receive less work per unit of heat received than a reversible cycle.

Q11. Find out the expression for change of entropy for a reversible Poly-tropic process?

Q12. What is heat pump, refrigerator and Heat engine. Also explain their working differences.

Q13. Explain reversed heat engine Carnot cycle with (p-v) diagram.

Q14. What is physical concept of entropy?

Q15. Derive equation for change of entropy during constant volume process, constant pressure process, isothermal process, adiabatic process and poly-tropic process.

Q16. Explain low grade and high grade energies.

Q17. Differentiate between:

a. Four storke and two stroke engine (Petrol and Diesel)

b. Two stroke Petrol engine and two stroke diesel engine

Q18. Explain the working principle of Air standard cycle with the help of (p-v) and (T-S) diagrams.

Q19. Explain the working principle of diesel cycle with the help of (p-v) and (T-s) diagrams.

Q20. Explain the working of dual cycle with valid charts.

Q21. Find out the expression for air standard efficiency for otto cycle.

Q22. Derive expression for efficiency of dual cycle.

Q23. Explain any two Boiler Mounting & Accessories.

Section –C (8 marks)

Q1. Define Kelvin-Planck and Clausius statements of second law. Show equivalence between the two.

Q2. Find out the expression for air standard efficiency of a diesel cycle. Also prove that for the same ratio and heat supplied a diesel cycle is less efficient as compared to otto cycle?

Q3. Explain the regeneration, inter-cooling and reheating of gas turbine

Q4. Explain the working of four stroke petrol engines.

Q5. Explain the Air-Standard Cycles i.e. Dual Cycle

Q6. A system contains 0.15 m^3 of a gas at a pressure of 3.8 bar and 423 K. It is expanded adiabatically till the pressure falls to 1 bar. The gas is then heated at a constant pressure till its enthalpy increases by 70 KJ. Determine the total work done. Take C_P =1 kJ/kg K and C_V=0.714 kJ/kg K

Q7. A certain quantity of air has a volume of 0.028 m^3 at a pressure of 1.25 bar and 25°C. It is compressed to volume of 0.0042 m^3 according to the law $PV^{1.3}$= constant. Find the final temperature and work done during the compression. Also determine the reduction in pressure at a constant volume required to bring the air back to its original temperature.

Q8. With the help of suitable diagram explain in Detail the Carnot Cycle; also derive its efficiency formula.

Q9. A centrifugal pump delivers 2750 kg of water per minute from initial pressure of 0.8 bar absolute to a final pressure of 2.8 bar absolute. The suction pipe is 2m below and the delivery is 5 m above the center of pump. If the suction and delivery pipes are of 15 cm and 10 cm diameter respectively, make calculations for the power required to run the pump.

Q10. During a non-flow frictional less compression process, the volume changes from 0.12 m^3 to 0.04 m^3 and system rejects 40 kJ of heat. Determine the change in internal energy, heat loss and enthalpy if pressure varies with volume as P= (4.5 V+2), Where P is in bar and V is in m^3. And internal energy is given by equation U= 40-PV.

Q11. In a vessel 20 kg of air is heated in a reversible, non-flow isochoric process so that pressure of air is increased two times that of initial value. The Initial temp. is 20°C. Determine (a) Final temperature (b) Change in internal energy (c) change in Enthalpy(d) Heat Transfer Cv= 0.718 kJ/Kg K, R=0.287 kJ/Kg K.

Q12. Air at 1.02 bar and 22°C temperature is initially occupying a cylinder volume of 0.015 m^3 is compressed reversibly and adiabatically by piston to pressure of 6.8 bar. Calculate (a) Final Temp. (b) Final Volume (c) Work Done; Take $\boldsymbol{\gamma}$ = 1.4.

Q13. Calculate the loss of air standard efficiency of the diesel cycle if the cut-off is delayed from5% to 8%.The compression ratio is 12. Assume γ = 1.4 of air

Q14. Three Carnot engines E1, E2, E3 work in series between the temperature limits of 1000 K and 300 K. The amounts of work produced by the engine are in ratio of 5:4:3. Determine the intermediate temperature.

Q15. A single cylinder, 4 stroke oil engine works on dual cycle. The inlet condition of the air is 1 bar and 300K.The compression ratio of the cycle is 15 and maximum pressure limit is 55 bar. Heat supplied at constant volume is twice that at constant pressure. Find out 1) Cut off ratio 2) Thermal efficiency of cycle. Take C_P=1KJ/Kg K C_V=0.72KJ/Kg K and γ = 1.4

Q16. 0.20 m^3 of air at 1 bar and 333 K is compressed to 0.05 m^3 according to the law $pv^{1.3}$= constant. Heat is then added at constant volume until the pressure is 10 bars. Calculate the change in entropy in each process undergone. Assume γ = 1.4 and R = 287 J/Kg K.

Q17. Calculate the loss of air standard efficiency of the diesel cycle if the cut-off is delayed from5% to 8%.The compression ratio is 12. Assume γ = 1.4 of air