BE Semester-III (MECHANICAL ENGG.) Question Bank

(Thermodynamics)

All questions carry equal marks (10 marks)

Q.1	Derive an expression for Otto cycle efficiency with usual notation
Q-2	What do you understand by Joule-Thomson coefficient? Explain
Q.3	A steam power plant uses steam as working fluid and operates at a boiler pressure of 5 MPa, dry saturated and a condenser pressure of 5 kPa. Determine the cycle efficiency for (i) Carnot cycle (ii) Rankine cycle. Also show the T-s representation for both the cycles.
Q.4	Draw the Diesel cycle on p-v and T-s diagram. Also derive expression for air standard efficiency with usual notations for the cycle.
Q.5	Explain briefly Dalton's law and Gibbs-Dalton law applied to mixture of perfect gases.
Q.6	Derive Vander Waal's equation.
Q.7	Explain in brief how calorific value is determined by calorimeter and Junkers gas calorimeter.
Q.8	Methods to improve the Rankine cycle efficiency for Vapor power cycle.
Q.9	In a Diesel cycle, air at 0.1 MPa and 300K is compressed adiabatically until the pressure rises to 5 MPa. If 700KJ/Kg of energy in form of heat is supplied at constant pressure, determine compression ratio, cut off ration, thermal efficiency and mean effective pressure.
Q.10	Draw line diagram of Brayton cycle represent on p-v diagram and derive expression for efficiency of Brayton cycle.
Q.11	With neat sketch explain construction and working of Bomb calorimeter.
Q.12	Following results were obtained when a sample of gas was tested by Junker's gas calorimeter. Volume of sampled gas : 0.08 m3 Pressure of gas supply : 52 mm of water, temperature of gas: 120 C Barometric pressure : 750 mm of Hg Weight of water heated by gas : 30 kg Temperature difference of circulated water: 150 C Steam condensate collected : 0.06 kg Determine the higher and lower calorific value per m3 of gas at temperature of 150 C and barometric pressure of 760 mm of Hg.
Q.13	State the Avogadro's law.
Q.14	In an ideal Brayton cycle, the ambient air at 1 bar - 300 K is compressed to 6 bar and the maximum cycle temperature is limited to 1200 K. if the heat supply is 120 MW, find (i) The thermal efficiency of the cycle (ii) work ratio (iii) power output and (iv) mass flow rate of air. Also show the cycle on p-v and T-s diagram.
Q.15	A mixture of hydrogen and oxygen is to be made so that the ratio of H2 and O2 is 3:1 by volume. If the pressure and temperature are 1 bar and 300 C respectively. Calculate (i) the mass of O2 required (ii) the volume of the container.
Q.16	Using Maxwell relations derive the Causius clapeyronequation.
Q.17	In an air standard diesel cycle the compression ratio is 16.At the beginning of

	isentropic compression the temperature is 15 degree and pressure is 0.1 MPa. Heat is added until the temperature at the end of constant pressure process is 148 degree. Calculate 1) cut off ratio. (2) cycle efficiency (3) M. E. P. Take, $\gamma = 1.4$, R = 287 NM/Kg K, Cv = 0.718 KJ/Kg K, CP =1.005 KJ/Kg K Assume Mass of air = 1 Kg
Q.18	Derive any two Maxwell equations.
Q.19	Draw Rankine cycle on T-S diagrams with dry and saturated steam at turbine inlet and obtain an expression for the Rankine cycle efficiency.
Q.20	What is steady flow process? Explain mass balance and energy balance in open system.
Q.21	Explain system and surroundings. Also discuss the scope of thermodynamics.
Q.22	State and discuss the Kelvin-Plank and Clausius statements of second law of thermodynamics.
Q.23	Define and discuss thermodynamics. Describe its importance in your engineering field.
Q.24	What is pure substance? Explain PVT behavior of water and pure substance other than water whose volume increases on melting.
Q.25	Write note on third law of thermodynamics.
Q.26	Define Entropy and irreversibility. Discuss their relationships
Q.27	Define ideal and non-ideal gases. How they get differ with each other in their behavior? Explain the entropy change of an ideal gas.
Q.28	Write note on reaction equilibrium.
Q.29	Define and discuss the First law of Thermodynamics.
Q.30	Explain Vapor/Liquid equilibrium (VLE). State Raoult's law and write down the two major assumptions made for it.
Q.31	Discuss the latent heat of pure substances, standard heat of reaction and standard heat of formation.
Q.32	Discuss the Carnote refrigerator.
Q.33	Define pressure. Write three different units of pressure and show their relationship amongst them. The pressure of gas in pipe line is measured with a mercury manometer having one end open to the atmosphere and one end connected to the pipe. If the difference in the height of mercury in two ends is 562mm, calculate the gas pressure. The barometer reads 761 mm Hg, the acceleration due to gravity is 9.79 m/s^2, and the density of mercury is 13640 kg/m^3.
Q.34	What is entropy? Prove that Entropy is thermodynamic property.
Q.35	Discuss thermodynamic temperature scale.
Q.36	Define and discuss Reversibility and Irreversibility. Also discuss the causes of irreversibility.
Q.37	Define Claussius inequality and prove it.
Q.38	With suitable example discuss Closed system, Open system and Isolated system.
Q.39	Write the steady flow energy equation for stead flow. Apply it to expansion valve and compressor.
Q.40	Draw Rankine cycle on P-V, T-S and h-S diagrams with dry and saturated steam at turbine inlet. Indicate areas representing heat transfer and work transfer with boiler,

	condenser and turbine.