R18 Regulation *Subject code: 2P3CB*

TKR COLLEGE OF ENGINEERING AND TECHNOLOGY

(Autonomous, Accredited by NAAC with 'A' Grade)

B.Tech III Semester Supplementary Examinations, March/April 2023

THERMODYNAMICS

(Mechanical Engineering)

Maximum Marks: 70 Date:29.03.2023 Duration: 3 hours

Note: 1.This question paper contains two parts A and B.
2. Part A is compulsory which carries 20 marks. Answer all questions in Part A.
3. Part B consists of 5 Units. Answer any one full question from each unit which carries 10M.
4. Each question carries 10 marks and may have a, b, c, d as sub questions.

Part-A

All the following questions carry equal marks (10x2M=20 Marks)

1 What is Quasi static process?
2 What do you understand by macroscopic and microscopic viewpoints?
3 State the limitations of first law of thermodynamics.
4 State the causes of irreversibility.
5 Define Pure Substance and what do you understand by a saturation stage?
6 Draw the phase equilibrium diagram for a pure substance on H-s plot with relevant constant property line.
7 State Dalton's law of partial pressures.
8 Write a note on volumetric and gravimetric analysis.
9 State the Processes in Otto cycle and represent on P-V and T-S diagrams.
10 Draw the PV and TS diagrams of dual combustion cycle.

Part-B

Answer All the following questions. (5X10M=50Marks)

11 A. Differentiate between the system, surroundings and boundary. Explain in detail. 5 M

B. Two thermometers one centigrade and other Fahrenheit are immersed in a fluid, after the thermometers reached equilibrium with the fluid, it is noted that both the thermometers indicate the same numerical values. Find that the identical numerical values shown by the thermometers? Determine the corresponding temperature of the fluid, express in degrees Kelvin and degrees Rankine. 5 M

OR

12 A fluid contain in a horizontal cylinder with a frictionless leak proof piston is continuously agitated by a stirrer passing through the cylinder cover. The diameter of the cylinder is 50 cm and the piston is held against the fluid due to atmospheric pressure equal to 100 kPa. The stirrer turns 8000 revolutions with an average torque of 1.5Nm. If the piston slowly moves outwards by 60 cm. Determine the network transfer to the system? 10M

13 A reversible heat engine is supplied with heat from two constant temperature sources at 900K and 600 K and rejects heat to a constant temperature at 300K to sink. The engine develops work equivalent to 91kJ/s and rejects heat at the rate of 56kJ/sec. Estimate (i) heat supplied by each source (ii) Thermal efficiency of engine. 10M

OR

14 A. Three Carnot engine are arranged in series. The first engine takes 4000kJ of heat from a source at 2000K and delivers 1800kJ of work. The second and third engines deliver 1200kJ and 500kJ of work respectively. Compare the exhaust temperature of second and third Carnot engines? 5M

B. Discuss about Clausius Inequality in detail. 5M

15 Explain throttling and free expansion process in detail. 10M

OR

16 A. A pressure cooker holding 2 kg of steam at 5 bar and 90% dry is being cooled slowly. What quantity of heat has to be extracted so as to reduce the steam quality down to 60%? Also calculate the pressure and temperature of the steam that remains in the pressure cooker after the heat rejection. 5M

B. Write short notes on "Mollier diagram". Why do isobars on the Mollier diagram diverge from one another? 5M

17 Discuss why does the enthalpy of air-vapour mixture remains constant during an adiabatic saturation process? 10M

OR

18 A. Explain the Avogadro's laws of additive volumes. 5M

B. A gas mixture contains 1 Kg of O2 and 3 Kg of N2. The pressure and temperature of the mixture are 1 bar and 27^0 C. 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. 5M

19 Explain the working of Atkinson Cycle. 10M

OR

20 An engine works on a diesel cycle with an Inlet pressure and temperature of 1 bar and 17^0C. The pressure at the end of the adiabatic compression is 35 bar. The ratio of expansion, i.e. after constant pressure heat addition is 5. Calculate the heat addition, heat rejection and efficiency of the cycle. Assume r=1.4, Cp=1.005 kJ/kgk, Cv=0.717 kJ/kgk 10M

Note: Allow the steam tables