P P SAVANI UNIVERSITY

Third Semester of B. Tech. Examination

December 2021

SEME2011 Engineering Thermodynamics

10.12.2021, Friday | Time: 09:00 a.m. To 11:00 a.m. | Maximum Marks: 60

Instructions:

1. The question paper comprises of two sections.
2. Section I and II must be attempted in separate answer sheets.
3. Make suitable assumptions and draw neat figures wherever required.
4. Use of scientific calculator and Steam Table is allowed.

SECTION – I

Q - 1 **Answer the Following. (Any Five)** **[05]**

(i) Heat and Work are
a)Point functions b) System Properties
c) Path functions d) Intensive Properties

(ii) Entropy change depends on
a)heat transfer b)mass transfer
c)change of temperature d)change of pressure and volume

(iii) According to first law of thermodynamics furnishes the relationship between
a)heat and work b) heat, work and properties of the system
c) various properties of the system d)various thermodynamics processes

(iv) Diesel cycle consists of..... Processes
a)two constant volume and two isentropic
b)two constant pressure and two isentropic
c)two constant volume and two isothermal
d)one constant pressure, one constant volume and two isentropic

(v) If the temperature of source is increased, the efficiency of the Carnot engine
a) decrease b) increase c) does not change d) depends on other factors.

(vi) A perpetual motion machine of first kind is impossible according to
a)zeroth law of thermodynamics
b) first law of thermodynamics
c) second law of thermodynamics
d) none of above

(vii) Third law of thermodynamic defines
a)internal energy b) absolute zero entropy c) heat d) work

Q – 2 (a) Define the term "Thermodynamic system". Discuss the type of thermodynamic system by giving suitable example of it. **[05]**

Q – 2 (b) A reversible heat engine operates within the higher and lower temperature limit of 1400 K and 400 K resp. The entire output from this engine is utilized to operate a heat pump. The pump works on reverse Carnot cycle, extracts heat from a reservoir at 300 K and delivers it to the reservoir at 400 K. If 100 kJ/s of net heat supplied to the reservoir at 400 K, calculate the heat supplied by the reservoir at 1400 K. **[05]**

OR

Q – 2 (a) State and prove Carnot's Theorem. **[05]**

Q – 2 (b) A domestic food freezer maintains a temperature of -15°C.The ambient air temperature is 30°C.If heat leaks into the freezer at the continuous rate of 1.75 KJ/s what is the least power necessary to pump this heat out continuously? **[05]**

Q – 3 (a) What do you mean Steady flow process? Write the Steady Flow Energy Equation(SFEE) for the open system and obtain the expression of ; [05]
1) Velocity of fluid at exit of "Nozzle".

Q – 3 (b) State and explain Gibbs-Dalton law. [05]

OR

Q – 3 (a) Justify the statement: "Entropy of an Isolated system either increase or remain constant during process between equilibrium states." [05]

Q – 3 (b) 1 kg of ice at -5oC is exposed to the atmosphere which is at 20oC.The ice melts and comes into thermal equilibrium with the atmosphere. Determine the change in entropy of the Universe. Take Cp (solid ice)=2.1 kJ/kg K, Cp (liquid water)=4.187 kJ/kg K ,latent heat of water 335 kJ/kg [05]

Q – 4 **Attempt any one.** [05]

(i) Application of Gouy Stodola Theorem in Heat Transfer through a Finite Temperature Difference.

(ii) Explain concept of available Energy, unavailable Energy and lost work.

SECTION – II

Q - 1 **Answer the Following.** [06]

(i) Define partial pressure.

(ii) Rankine cycle comprises of

a. Two isentropic processes and two constant volume processes
b. Two isentropic processes and two constant pressure processes
c. Two isothermal processes and two constant pressure processes
d. None of the above

(iii) The air standard Otto Cycle comprises of

a. Two constant pressure processes and two constant volume processes
b. Two constant pressure processes and two constant entropy processes
c. Two constant volume processes and two constant entropy processes
d. None of the above

(iv) What do you mean by Air Standard Efficiency?

(v) Define Refrigeration.

(vi) What are the four basic components of steam power plant?

Q - 2 (a) Explain vapour carnot cycle with P – v and T – s diagram. Also derive the equation of efficiency. [06]

Q - 2 (b) In constant volume otto cycle, the pressure at the end of the compression is 15 times that of start. The temperature at the beginning of the compression is 38 °C and maximum cycle temperature is 1950 °C. Determine [06]

1. Compression Ratio
2. Thermal Efficiency
3. Work Done

OR

Q - 2 (a) Prove that the efficiency of Otto Cycle is depends on Compression ratio only. [06]

Q - 2 (b) A Rankine Cycle operates between pressure of 80 bar and 0.1 bar. The maximum cycle temperature is 600 °C. Calculate work done and thermal efficiency of the cycle. **[06]**

P (bar)	T (°C)	V_f	V_g	h_f (KJ/kg)	h_g (KJ/kg)	S_f (KJ/kg K)	S_g (KJ/kg K)
0.1	45.84	0.0010103	14.83	191.9	2584.2	0.6488	8.1494
80	295.1	0.001395	0.0235	1317	2757.5	3.2073	5.7424

Q - 3 (a) Explain Dalton 's Law of Partial pressure and Gibbs – Dalton 's law in brief. **[06]**

Q - 3 (b) Compare Otto, Diesel and Dual cycle for **[06]**

1. Same Compression ratio and heat rejection
2. Same maximum temperature and pressure of the cycle & heat rejection

OR

Q - 3 (a) Explain Brayton Cycle with P – v and T – s diagram. Also derive the expression for efficiency. **[06]**

Q - 3 (b) Explain air refrigeration cycle with necessary sketches. **[06]**

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