GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

BD17001016

Registration No: | | | | | | | | | | |

Total Number of Pages : 02 B.TECH

AR-17

B.TECH 1ST SEMESTER EXAMINATIONS(BACK), NOV/DEC 2019

BBSES1032- BASICS OF THERMODYNAMICS

Time: 3 Hours Max Marks : 100

The figures in the right hand margin indicate marks.

PART-A (10X1 = 10 MARKS)

Answer all questions.

a) A wall which permits the flow of heat is a _____wall.
b) When the polytropic exponent 'n' tends to infinite, the polytropic process becomes _____ Process.
c) The entropy of an _____ system can never decrease.
d) As per sign convention, work done by the system is _____.
e) Concept of Temperature is related to _____ law of Thermodynamics.
f) Temperature at Triple point of water is …….
g) In a constant volume process, internal energy change is equal to ……..
h) Any point lying on the saturated vapor line would be said to have a dryness fraction of _____.
i) In an isothermal process, _____ remains constant.
j) The amount of heat required to change a saturated liquid to saturated vapor is called as _____ heat.

PART-B (15 x 2 = 30 MARKS)

Answer any fifteen questions from the following.

1. Define COP of refrigerator and heat pump.
2. Differentiate open and closed system.
3. Prove that for an isochoric process, change in heat transfer is equal to change in internal energy.
4. Sate first law of thermodynamics.
5. A container of capacity 1.5 m^3 contains air at 4 bar pressure and 50^0C temperature. Determine the mass of the air in the container.
6. What are the four basic components of a steam power plant?
7. What do you mean by thermodynamic equilibrium?
8. Define entropy principle.
9. What do you mean by dryness fraction?
10. Define intensive and extensive property with examples.
11. Define specific heat and its types.
12. Define enthalpy & internal energy.
13. Define pressure and write the different units of pressure.
14. The change in temperature of a liquid is 20^oC. Convert it to Kelvin scale and Fahrenheit scale.
15. What is thermodynamic equilibrium?
16. What are the different modes of heat transfer? Give examples.
17. Write 1st law of thermodynamics.
18. What do you mean by free expansion?
19. Find out internal energy, enthalpy, entropy of 5 kg steam at 10 bar and 500^0C.
20. What do you meant Quasi-static Process?

1.

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PART-C (6 x 5 = 30 MARKS)

Section-i Answer any Six questions

1. Write short note on different modes of heat transfer.
2. Show that energy is a property of system.
3. What is carnot cycle? What are the four processes which constitute the cycle? Explain with T-S and P-V diagram.
4. A carnot heat engine operating between 1000K and 400K used to drive a reversible heat pump which is working between 500K and 300K.Find the heat rejected by both the devices, if heat absorbed by the engine is 140kJ.What is the heat extracted by the heat pump?
5. Write short note on Refrigerator
6. A heat engine is used to drive a heat pump. The heat transfers from the heat engine and from the heat pump are used to heat water circulating through the radiators of building. The efficiency of heat engine is 27percent and COP of heat pump is 4. Evaluate the ratio of heat transfer to the circulating water to heat transfer to the heat engine.
7. G. Explain Free Expansion work.
8. H. A blower handles 1 kg/sec of air at 20^{o}C and consumes a power of 15 kW. The inlet and outlet velocities of air are 100 m/sec and 150 m/sec respectively. Find the exit temperature assuming the adiabatic conditions. Take C_p for air=1.005 kJ/kg .

Section-ii Answer any Two questions (2 x 15 = 30 MARKS)

1. For an adiabatic process: derive Work done,$w = \frac{P_1V_1 - P_2V_2}{\gamma - 1}$. Air initially at 75 kPa pressure, 1000 K temperature and occupying a volume of 0.12 m^3 is compressed isothermally until the volume is halved and subsequently it undergoes further compression at constant pressure till the volume is halved again. Sketch the processes on p-V diagram and calculate the work done.

   (7+8)
2. Derive the steady flow energy equation. Air at a pressure of 295 kPa and a temperature of 58°C flows steadily into the turbine with a velocity of 45 m/s. The air leaves the turbine at a pressure of 115 kPa, a temperature of 2°C, and a velocity of 150 m/s. The shaft work delivered by the turbine is 54 kJ/kg of air. Neglecting changes in elevation, determine the magnitude and direction of the heat transfer per unit mass of air flowing. For air, take C_p = 1.005 kJ/kg K and the enthalpy h = C_p t. (7+8)
3. Prove that C_p-C_v=R.

   A vessel of volume 0.04m^3 contains a mixture of saturated water and saturated steam at a temperature of 250^{o}C. The mass of the liquid present is 9 kg. Find the pressure, mass of mixture, specific volume, enthalpy, entropy and internal energy.

   (1+2+12)
4. (a) Two reversible heat engines are arranged in series in such a way that the heat rejected by the first engine is absorbed by the second engine. The first engine receives 400kJ of heat from a reservoir at 600^{0}C, while the second engine rejects heat to a reservoir having temperature 0^{0}C. If the work output of the first engine is 2.5 times that of the second. Determine (i) efficiency of both engines, (ii) heat rejected by the second engine, (iii) intermediate temperature.

   (12)

   (b)What is entropy? Write down clausius inequality. (3)

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