D17001039

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

Total Number of Pages : 03 **B.TECH**

B.TECH 1ST SEMESTER REGULAR EXAMINATIONS, DECEMBER 2017
BASIC OF THERMODYNAMICS
Subject Code:BBSES1032
Time: 3 Hours
Max Marks : 100
The figures in the right hand margin indicate marks.

PART-A

(10X1 = 10 MARKS)

Answer all questions.

a. Thermodynamic properties are ……. functions.
b. Universe is an example of ……. System.
c. The value of dryness fraction is …… for saturated liquid.
d. Process in which no heat transfer take place is known as …… process.
e. _____ is a device which increases the velocity or KE of a fluid at the expense of its pressure drop.
f. The throttling process is an _____ process.
g. The thermal energy reservoir from which heat is transferred to the system operating in a heat engine cycle is called as _____.
h. Condenser works effectively in …….. Season.
i. For irreversible heat engine, η_{max} is…….. than η_{th}
j. When iron is heated the colour changes from grey to white. It is satisfied by _____ law of heat radiation.

PART-B

(15 x 2 = 30 MARKS)

Answer any fifteen questions from the following.

1. Define zeroth law of thermodynamics.
2. Explain PMM-2.
3. Define intensive and extensive properties with two examples from each..
4. Explain Newton's law of cooling.
5. What do you mean by free expansion?
6. What is principle of entropy increase?
7. Why Carnot cycle is not practically possible?
8. Define throttling process.
9. A piston cylinder contains air at 600 kPa, 290 K and a volume of 0.01m^3. A constant pressure process gives 54 kJ of work out. Find the final volume of the air.
10. A small steam whistle (perfectly insulated and no shaft work) causes an enthalpy drop of 0.8 kJ/kg from inlet to outlet. If the kinetic energy of the steam at entry is negligible, what is the velocity of steam at outlet?
11. What is COP? Write COP of heat pump.
12. Define pressure and write the different units of pressure.
13. The change in temperature of a liquid is 20^oC. Convert it to Kelvin scale and Fahrenheit scale.

14. State Fourier's law of conduction.
15. The temperature of 3 kg of air is increased by 50^0C. There is 500 KJ of heat is supplied to air. Find the magnitude and direction of work done.
16. What are the limitations of 1st law of thermodynamics?
17. Show the Carnot's cycle on a T-S and p-v chart.
18. Prove $C_p - C_v = R$
19. Find out internal energy, enthalpy, entropy of 5 kg steam at 10 bar and 500^0C.
20. 3 kg of water whose temperature increases from 303 K to 70^oC in a constant volume process. Find the change in internal energy and heat transfer.

PART-C

(6 x 5 = 30 MARKS)

Section-i **Answer any Six questions**

1. Derive the expression of heat transfer for a polytropic process with relation to polytropic work.
2. An investigator designed a temperature scale (X) on two fixed points as 60^oN and 300^oN. What will be the value of temperature 375 K and 85^oF in new scale (X).
3. Determine the work done for the **fig: 1**

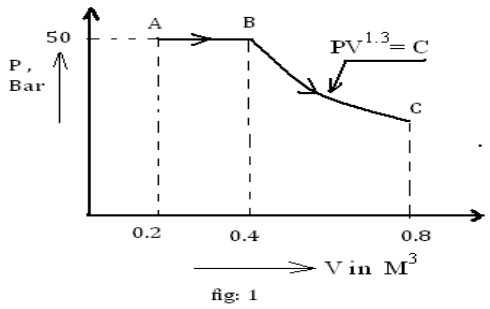

fig: 1

4. If a gas of volume 6000$cm^3$and at a pressure of 100kPa is compressed quasistatically according to $pV^{1.2}$= constant until the volume becomes 2000cm^3, determine the final pressure and work transfer.
5. Calculate the pressures for the following when the barometer reads 760 mm of Hg-
   i) 12 cm of water gauge ii) 250 mm of Hg vacuum
6. 8 kg of air undergoes a reversible adiabatic process from 2 bar, 40^0C to 10 bar. Find a) work transfer b) change in internal energy and c) heat transfer in the process.
7. What is pure substance? 10 kg of steam expanded from 8 bar and 400^0C to 0.2 bar in a reversible adiabatic process, find out the dryness fraction, enthalpy of the final steam?
8. Describe the working principle of 4-stroke petrol engine with neat sketch.

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. a. Steam expands isentropically in a nozzle from 1 MPa, 255°C to 10 kPa. The steam flow rate is 1 kg/s. Find the velocity of steam at the exit from the nozzle, and the exit area of the nozzle. Neglect the velocity of steam at the inlet to the nozzle.

   b. A mass of gas is compressed in a quasi-static process from 80 kPa, 0.1 m^3 to 0.4MPa, 0.03 m^3. Assuming that the pressure and volume are related by PV^n = constant, find the work done by the gas system.

3. What do you mean by heat engine? Classify engine with examples. Describe steam power plant with a neat sketch.

4. Write the Kelvin Planck and Clausisus statement.

   Two reversible heat engines A and B are arranged in series. Engine A rejects heat directly to engine B. Engine A receives 200 kJ at a temperature of 421^{o}C from hot source while Engine B is in communication with a cold sink at a temperature of 5^{o}C. If the work output of A is twice of B. Find-

   i) Intermediate temperature between A and B.

   ii) Efficiency of both engines.

   iii) Heat rejected to sink.

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