GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

SM19002017

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

Total Number of Pages : 1 **M.TECH**

M.TECH 2ND SEMESTER (AR 17) SUPPLEMENTARY EXAMINATIONS, APRIL/MAY 2019

ADVANCED ENGINEERING THERMODYNAMICS

Branch: TE, Subject Code:MTEPC2010

Time: 3 Hours **Max Marks : 70**

PART-A **(10 X 2=20 MARKS)**

1. Answer the following questions.

a) Write down the Maxwell's Equations.
b) What do you mean by equi-partition of energy?
c) Explain through a suitable example the difference between the first and second law efficiencies.
d) What do you mean by compressibility factor and what is the value of it for ideal gas?
e) A refrigerator removes 1.5 kJ from the cold space using 1 kJ work input. How much energy goes into the kitchen, and what is its coefficient of performance?
f) Define fugacity.
g) Explain the concept of principle of increase of entropy.
h) Explain the concept of Helm Holtz free energy.
i) Define adiabatic flame temperature.
j) Difference between exergy and energy.

PART-B **(5 X 10=50 MARKS)**

Answer any five questions from the following.

2. A steam turbine has steam flowing at steady rate of 5kg/s entering at 5 MPa and 500^{O}C and leaving at 0.2 MPa and 140^{O}C. During flow through turbine a heat loss of 600kJ/s occurs to the environment at 1 atm and 25^{O}C. Determine [10]
   i) the availability of steam at inlet to turbine, ii) the turbine output iii)the maximum possible turbine output, and iv) Irreversibility.
3. a) Write down about Maxwell-Boltzmann distribution of different kind of molecular speeds. [3]
   b) Determine the Fugacity of pure water for the following case. Assume Fugacity coefficient 0.74 a) Saturated Vapour at 100^{O}C b) Saturated liquid at 100^{O}C c) Compressed liquid at 100^{O}C and 200bar d) Superheated vapour at 100^{O}C and 0.5 bar e) Saturated Vapour at 350^{O}C. f) Super cooled vapour at 90 OC, 1bar. Assume ideal gas as vapour. [7]
4. a) Is it possible to perform an irreversible process with a closed system yet having entropy change nil? [4]
   b) Enclosed in a perfectly insulated and smooth piston-cylinder assembly is a 20 kg mass of air. And it is then allowed to expand adiabatically from 500 kPa, 353K till its volume is doubled and temperature becomes equal to 278 K- the temperature of the surroundings. Determine the a) maximum work availability b) change in availability due to this expansion process c) irreversibility. [6]
5. a) From T – ds equation derive Cp – Cv = tVβ2 / K. [5]
   b) Give the expression for first and second T – ds equation. [5]
6. a) Derive the equation (δCp/δp)T = - T (δ2V/δT2) [5]
   b) Briefly explain Fermi Dirac and Bose Einstein statics [5]
7. a) Please show, By the help of Partition functions and their properties $Z = Z\,lZ\,ll$ Where Z is the partition function for the total system $Z\ l$ & $Z\ ll$ are the partition function of weakly non interacting parts [6]
   b) Using Maxwell relation, Prove $Cp > C_v$ [4]
8. Write Short notes on
   a) Entropy maximum Vs. Energy minimum principle [5]
   b) Gibbs Free Energy Vs. Helmholtz Free Energy principle [5]

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