GIET MAIN CAMPUS AUTONOMOUS GUNUPUR – 765022

RM19002021

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

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

M.TECH 2ND SEMESTER (AR 18) REGULAR 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) Define compressibility factor.
b) Explain through a suitable example the difference the first and second law efficiencies.
c) What is mean free path?
d) What do you mean by fugacity?
e) Explain the concept of Helm Holtz function.
f) Define thermodynamic probability in relation to entropy.
g) What do you mean by equipartition of energy?
h) Write down the Maxwell equations.
i) Write a general relation for Joule-Thompson coefficient.
j) Prove that C_p of an ideal gas is a function of temperature only.

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

Answer any five questions from the following.

Q2. 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. he turbine output
iii. the maximum possible turbine output, and
iv. Irreversibility.

Q3. 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]

Q4. 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]

Q.5.a) A certain gas has C_P=1.968 and C_V=1.507 Kj/kg K. find its molecular weight and the gas constant. [5]

A constant volume chamber of 0.3m^3 capacity contains 2 kg of this gas at 5^{0}C. heat is transferred to the gas until the temperature is 100^{0}C. Find the work done, the heat transferred, changes in the internal energy, enthalpy and entropy. [5]

b) From T – ds equation derive Cp – Cv = tVβ2/ K.

Q.6.a)Derive the equation $(\delta Cp/\delta p)T = - T (\delta 2V/\delta T2)$ [5]

b) Briefly explain Fermi Dirac and Bose Einstein statics [5]

Q.7.a) Write down about Maxwell Boltzmann distribution for different kind of molecular speed. [5]

b) Derive the Clausius Clapeyron equation [5]

Q.8. Write short notes on

a) Nernst Law [5]
b) Principle of Increase of entropy [5]

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