Code No: I2102/R16

M. Tech. I Semester Regular/Supplementary Examinations, Jan/Feb-2018

ADVANCED THERMODYNAMICS

Thermal Engineering (21)

Time: 3 Hours **Max. Marks: 60**

Answer any FIVE Questions
All Questions Carry Equal Marks

1. a Derive the general energy equation for a transient flow process. Explain control volume technique used in transient flow process.
   b Three identical finite bodies of constant heat capacity are at temperatures 300 K, 300 K and 100 K. If no work or heat is supplied from outside, what is the highest temperature to which any one of these bodies can be raised by the operation of heat engines or refrigerators?

2. a Derive the first and second Tds equations. Also derive the expression for difference in specific heat capacities Cp and Cv. What does the expression signify?
   b Discuss about Entropy, availability and unavailability.

3. a 0.5 kg of air is compressed reversibly and adiabatically from 80 kPa, 60^0C to 0.4 mPa, and then expanded at constant pressure to the original volume. Sketch these processes on p – v and T – s planes. Compute the heat transfer and work transfer for the whole path. Take characteristics gas constant of dry air R = 0.287 kJ/kgK.
   b Derive Vander Waal's equation and Clausius Clapeyro equation.

4. a Derive the expression to evaluate entropy of perfect gas mixtures.
   b Atmospheric air at 1.0132 bar has a dbt of 32^0C and wbt of 26^0C. Compute i) partial pressure of water vapour, ii) specific humidity, iii) dew point temperature, iv) relative humidity, v) degree of saturation, vi) density of air in the mixture, vii)density of vapour in the mixture,viii) enthalpy of the mixture.

5. a Discuss enthalpy of formation and entropy of formation.
   b A gasoline engine delivers 150 KW. The fuel is $C_8H_{18}$and enters the engine at 25^0C. 150% theoretical air is used and it enters at 45^0C. The products of combustion leave the engine at 750K, and the heat transfer from the engine is 205 kW. Determine the fuel consumption per hour, if complete combustion is achieved.

6. a Explain the working of simple vapour compression refrigeration cycle and derive the expression for its COP.
   b Discuss Onsage reciprocity relation
   c Discuss heat flux and entropy production.

7. a Explain the working of Magneto hydrodynamic generator. Discuss its advantages and limitations.
   b Discuss about thermo ionic and thermo electric power generation

8. Discuss the following
   i) Gibbs phase rule ii)Photovoltaic cells iii)Corollaries of first and second laws of thermodynamics.

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