Code No: C2102 **R09**

JAWAHARLAL NEHRU TECHNOLOGICAL UNIVERSITY HYDERABAD
M.Tech I - Semester Examinations, March 2011
ADVANCED THERMODYNAMICS
(THERMAL ENGINEERING)

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

Answer any five questions
All questions carry equal marks

\- - -

1. a) What are different laws of thermodynamics? Explain them along with the properties developed based on these laws.
   b) A rigid insulated tank is initially evacuated is connected through a valve to a supply line that carries steam at 1 MPa and 300^0C. Now the valve is opened, and steam is allowed to flow slowly into the tank until the pressure reaches to 1 MPa, at which valve is closed. Determine final temperature of steam in tank. [12]

2. a) Explain the equation of state for real gases and suggest a suitable method for calculation of constants in the Vander Waal's equation. Describe briefly about generalized compressibility charts along with its importance.
   b) Determine the pressure of saturated steam at 40^0C if at 35^0C the pressure is 5.628 kPa, the enthalpy of vaporization is 2418.6kJ/kg and the specific volume is 25.22m^3/kg. The enthalpy of vaporization is essentially constant over this temperature range. [12]

3. a) Explain the thermodynamics of cooling tower and how to evaluate the make up water requirement.
   b) 10 m^3/min of dry air at 32^0C fixed with a stream of hydrogen at 127^0C to form a mixed stream at 47^0C and 1 bar. The mixing occurs adiabatically and at steady state. Determine (i) The mass flow rates of the dry air and hydrogen, in kg/min, (ii) Mole fractions of the dry air and hydrogen in existing mixture. [12]

4. a) Determine the adiabatic flame temperature of the diesel fuel C_{12} H_{26} with 100% excess air and also with 100% theoretical air.
   b) Describe the Vant Hoff's equilibrium box and derive its equation. [12]

5. Calculate the maximum power developed and irreversibility of a chemical reaction process of fuel C_8 H_{18} burnt with 200% theoretical air. The products of combustion leave at 1000 K and the ambient temperature is 288 K. [12]

6. a) Describe the working of combined cycle power generation with diagrams.
   b) Explain the procedure for second law analysis of power cycle. Describe the second law analysis of Rankine power cycle. [12]

7. a) Discuss the importance of Onsagar relations in evaluating the irreversibilities for coupled flows.
   b) What is fuel cell? Explain its working principle. [12]

8. Write short notes on any THREE
   a. Photovoltaic cell
   b. Vont Hoff's Equilibrium Equation
   c. Claussius Clayperon Equation
   d. Seebeck, Thompson and Peltier effects. [12]

* * * * * *