Code No: RR210305 **RR**

**II B.Tech I Semester(RR) Supplementary Examinations, May/June 2010**
**THERMODYNAMICS**
**(Mechanical Engineering)**

**Time: 3 hours** **Max Marks: 80**

**Answer any FIVE Questions**
**All Questions carry equal marks**
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1. (a) Explain with a neat sketch the working principle of a constant volume gas thermometer.
   (b) Explain the concept of temperature and equality of temperature. [8+8]
2. In a vessel 10 kg of oxygen is heated in a reversible, non flow, constant volume process so that the pressure of oxygen is increased two times that of the initial value. The initial temperature is $20^oC$. Calculate
   (a) the final temperature,
   (b) the change in internal energy,
   (c) the change in enthalpy and
   (d) the heat transfer. Take R = 0.259 kj / kg K and $C_v$ = 0.652 kj / kg K for oxygen. [16]
3. Air is compressed from a pressure of 1 bar and a temperature of $21^0C$ to a pressure of 2 bar and temperature of $38^0C$. For this process determine
   (a) determine change in entropy
   (b) determine whether heat is added or removed or is it zero
   (c) Also calculate the final temperature if the process were isentropic
   (d) Sketch process for part (c) on a T-s plane [16]
4. (a) Explain : "Available energy" and "Availability" and Irreversibility.
   (b) Define Melmholtz and Gibbs free energy function. [9+7]
5. (a) What is the Free expansion process? Explain in detail why it is called a constant internal energy process.
   (b) Find the different between the work done in compressing 0.28 cubic metre of air at a pressure of 1.4bar absolute to a volume of 0.028 cubic metre when the compression is adiabatic and isothermal. [6+10]
6. (a) Define
      i. Mole fraction
      ii. Mass fraction
   (b) The volumetric analysis of a dry flue gas in a boiler trial is given in Percentage as 13% $CO_2$, 1.5% CO, 3.5% $O_2$ and 82% $N_2$. Determine the percentage gravimetric analysis. Also find the specific gas constant of the mixture. [6+10]
7. (a) Represent the Otto cycle by P-V and T-S diagram and describe the different processes with the help of above diagrams.
   (b) In an Otto cycle, the pressure limits are 100 kN/$m^2$ and 2000 kN/$m^2$. The compression ratio is 4. Calculate
      i. The thermal efficiency
      ii. Mean effective pressure. [8+8]
8. (a) Explain the important components of a simple vapour compression refrigeration system. Also discuss the functions of each component.
   (b) Discuss the effect of sub cooling on c.o.p. of the vapour compression refrigeration cycle. Would you derive large sub cooling and why? [8+8]

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