01412

DIPLOMA IN MECHANICAL ENGINEERING (DMEVI)

Term-End Examination

December, 2011

BIME-023 : ENGINEERING THERMODYNAMICS

Time : 2 hours *Maximum Marks : 70*

*Note : Attempt **any five.** First question is **compulsory.** Use of steam-table and Mollier's chart is **allowed.** Use of non-programmable scientific calculator is **allowed.***

1. Fill in the blanks :

   (a) The latent heat of vapourisation is _____ at critical point. 2

   (b) Triple point is a point where _____ exist together. 2

   (c) A four stroke petrol engine theoretically operates at _____ cycle. 2

   (d) The entropy change during a cycle is _____. 2

   (e) A temperature scale which is independent of the property of thermometric substance is defined as _____ 2

   (f) The change in the enthalpy of a system equals the heat supplied under constant _____ conditions. 2

(g) The state is the condition of a system identified by its _____. 2

2. (a) Compare Macroscopic and Microscopic viewpoints of thermodynamics. 7

(b) Name the various laws of thermodynamics and state the purpose served by each law. 7

3. (a) The pressure volume correlation for a non-flow reversible process is given by $p = (8 - 4V)$ bar, where V is in m^3. If 150 kJ of work is supplied to the system, determine the final pressure and volume of the system. Take initial volume $= 0.6\ m^3$. 7

(b) A perfect gas flows through a nozzle where it expands in a reversible adiabatic manner. The inlet conditions are 22 bar, 500°C and 38 m/sec. At exit the pressure is 2 bar. Determine the exit velocity and exit area if the flow is 4 kg/sec. Take $R = 190$ J/kgK and $\gamma = 1.35$ 7

4. (a) State and explain Kelvin-Plank and Clausius statements of the second law of thermodynamics. 7

(b) Three Carnot engines are arranged in series. The first engine takes 4000 kJ of heat from a source at 2000K and delivers 1800 kJ of work; the second and third engines deliver 1200 kJ and 500 kJ of work respectively. Make calculations for the exhaust temperatures of second and third Carnot engine. 7

5. (a) Consider a spherical balloon of 5 cm radius filled with hydrogen at 300K and atmospheric pressure. The surrounding air is at 20°C and the barometer reads 75 cm of mercury. Determine the payload that can be lifted with the aid of this balloon. 7

(b) Explain Rankine cycle with its four basic components and show them p-v and T-S diagrams. 7

6. (a) A vessel of $0.3m^3$ capacity contains 1.5 kg mixture of water and steam in equilibrium at a pressure of 5 bar. Calculate (a) the volume and mass of liquid (b) the volume and mass of vapour. 7

(b) What is meant by quality of steam ? Outline the procedure followed to determine its value by using a throttling calorimeter. 7

7. Write short notes on : **14**

(a) Types of fuels

(b) Available and unavailable energy

(c) Second Law efficiency

(d) Proximate and ultimate analysis of fuels