No. of Printed Pages : 4

BIME-023

DIPLOMA VIEP MECHANICAL ENGINEERING (DMEVI)

00890

Term-End Examination

June, 2013

BIME-023 : ENGINEERING THERMODYNAMICS

Time : 2 hours *Maximum Marks : 70*

Note : *Attempt* **any five.** *Question No - 1 is* ***compulsory*** *use of steam tables and Mollier chart is* ***allowed.***

1. Fill in the blanks : **2x7=14**

(a) _____ and _____ are path functions while pressure and volume are print functions.

(b) Zeroth law is the basis for _____ measurement.

(c) The relation for displacement work

$$W = \frac{P_1V_1 - P_2V_2}{1-n}$$ is valid for _____ process.

(d) The first law of thermodynamics refers to the law of conservation of _____ .

(e) "No heat engine can operate by exchanging heat from a single reservoir". This statement of second law is given by _____ .

(f) A system undergoes change of state via a process whereupon $\oint \frac{\delta Q}{T} = 0$ and $\Delta S > 0$. The process is called _____ .

(g) The critical temperature of steam is _____ °C.

2. (a) Explain the concept of displacement work and derive the relation for same. 7

(b) A gas (volume = 0.014 m^3) expands poly tropically from a pressure of 2.07 MPa to 207 kPa. The polytropic exponent is n = 1.35. Determine the work done by the gas during expansion. 7

3. (a) What is PMM1 ? Why it is impossible ? 7

(b) A gas is compressed (neglecting friction) from an initial state of 0.3m^3 and 0.105 MPa to a final state of 0.15m^3 and 0.105 MPa, the pressure remains constant during the process. There is a transfer of 37.6 kJ of heat from the gas during the process. Calculate the change in Internal energy of the gas. 7

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

(b) A refrigerator maintains a temperature of −15°C. inside the cabinet. The outside air temperature is 30°C. If the heat leaks inside the refrigerator at the continuous rate of 1.75 kJ/sec. What is the least power necessary to pump this heat out continuously ? 7

5. (a) State and prove Clausius theorem. 7

(b) Show that entropy is a property of the system. 7

6. (a) What is available energy and unavailable energy ? Explain with suitable examples. 7

(b) What do you understand by exergy and anergy ? Determine the exergy of 100 m^3 of complete vacuum. 7

7. (a) Show the carnot cycle on P − V and T − S diagram and derive a relation to calculate its thermal efficiency. 7

(b) Dry saturated steam is throttled from 25 bar to a pressure of 5 bar and is then allowed to expand adiabatically to 1 bar. Use the mollier diagram to find : 7

(i) Dryness fraction of steam in the final state.

(ii) Temperature of the steam in the final state.

8. Attempt *any four* parts. Write short notes on : **3½x4=14**

(a) Alternative fuels and their importance

(b) Proximate and ultimate analysis of fuel.

(c) Ideal gas and gas laws

(d) Concept of continuum

(e) Rankine cycle and its efficiency

(f) COP of refrigerator and heat pump.