

**DIPLOMA VIEP MECHANICAL ENGINEERING  
(DMEVI)**

**Term-End Examination**

**December, 2013**

**BIME-023 : ENGINEERING THERMODYNAMICS**

*Time : 2 hours*

*Maximum Marks : 70*

*Note : Attempt any five. First question is compulsory.  
Use of steam tables and Mollier chart is permitted.*

1. Fill in the blanks : 2x7=14
- (a) Classical thermodynamics is based on \_\_\_\_\_ approach.
  - (b) The displacement work's general expression is given as  $W_{1-2} =$  \_\_\_\_\_.
  - (c) The machine which violates the law of conservation of energy is known as \_\_\_\_\_.
  - (d) The law which states the direction of heat flow is \_\_\_\_\_ law of thermodynamics.
  - (e) Entropy of Universe always \_\_\_\_\_ (increase/decreases/constant).
  - (f) Working of Boilers are based on \_\_\_\_\_ cycle.
  - (g) Which law of thermodynamics states that "The entropy of a pure substance in thermodynamic equilibrium approaches zero ?"

2. (a) Differentiate between point function and path function with example. 7  
(b) Differentiate between thermal equilibrium and thermodynamic equilibrium. 7
3. (a) State and explain the first law of thermodynamics as applicable to cyclic process and non-cyclic process. 7  
(b) Air (1100 K and 101.32 kPa) is passing through a converging nozzle and leaves it at 300 K. Determine the velocity of air at nozzle outlet. The nozzle is laid horizontal. The inlet velocity of air can be ignored. ( $C_{p,air} = 1 \text{ kJ/kgK}$ ). 7
4. (a) Explain the concept of PMM2. Why it is impossible? 7  
(b) During a non-flow process (quasi-static), a gas is held in a cylinder piston assembly expands from 3 bar and  $0.18 \text{ m}^3/\text{kg}$  to a final volume of  $0.6 \text{ m}^3/\text{kg}$  in accordance with the law  $P = CV^{-2}$  where  $C = \text{constant}$ . Determine the work done by the gas. 7
5. (a) Energy can be conserved but not entropy. Explain. 7  
(b) Show that change in entropy of an irreversible process is always positive. 7

6. (a) Explain the working of a steam power plant by using Rankine cycle graph. Derive the efficiency of the Rankine cycle. 7
- (b) Determine the state of steam at 10 bar and 225°C using the steam table and mollier diagram. 7

**Given :**

**Steam at 10 bar :**

$$T_{\text{sat}} = 180^{\circ}\text{C}$$

$$V_f = 0.001127 \text{ m}^3/\text{kg}$$

$$V_g = 0.194 \text{ m}^3/\text{kg}$$

$$h_f = 762.6 \text{ kJ/kg}$$

$$h_{fg} = 2013.6 \text{ kJ/kg}$$

$$h_g = 2776 \text{ kJ/kg}$$

7. (a) Explain the Boyle's law, Charle's law and Gay Lusca's law of perfect gases. 7
- (b) Differentiate between exergy and anergy with suitable examples. 7
8. Write short notes on (*any four*) : 3½x4=14
- (a) Definition of combustion and thermodynamics of combustion.
- (b) Alternative fuels.
- (c) Effect of super heat and back pressure on the performance of Rankine cycle.
- (d) Statements of second law of Thermodynamics.
- (e) PdV work for constant pressure quasi static process.
- (f) Intensive and extensive properties.