

Day : Friday  
Date : 27/10/2017

Time : 03.00 PM TO 06.00 PM  
Max. Marks : 60.

**W-2017-0556**

**N.B.:**

- 1) All questions are **COMPULSORY**.
- 2) Figures to the **RIGHT** indicate full marks.
- 3) Draw neat labeled diagrams **WHEREVER** necessary.
- 4) Use of electronic calculator/ log table is **ALLOWED**

**Q.1 A) Attempt all the followings: (06)**

- a) In high pressure condition, the real gases conform more closely with
  - i) van der Waals equation
  - ii) ideal gas equation
  - iii) both i and ii
  - iv) none of the above
- b) Carnot cycle contains two reversible adiabatic process and
  - i) two reversible isentropic processes
  - ii) two reversible isobaric processes
  - iii) two reversible isochoric processes
  - iv) two reversible isothermal processes
- c) In which condition can real gas obey closely the ideal gas equation?
  - i) pressure is very small and temperature is very high
  - ii) pressure is very high and temperature is very low
  - iii) both pressure and temperature are very high
  - iv) both pressure and temperature are very low
- d) The total energy of the universe
  - i) is always increasing
  - ii) is always decreasing
  - iii) either increases or decreases
  - iv) is always constant
- e) In a Carnot cycle, the working medium receives heat at a ..... temperature.
  - i) lower
  - ii) higher
  - iii) constant
  - iv) d)none of the mentioned
- f) Which of the following statements best describes the Second Law of Thermodynamics?
  - i) The internal energy of the universe is constant.
  - ii) Energy can be neither created nor destroyed.
  - iii) When an isolated system undergoes a spontaneous change, the entropy of the system will increase or remains constant.
  - iv) At absolute zero, the entropy of a perfect crystal is considered to be zero.

**B) Attempt all of the followings: (06)**

- a) Define critical temperature and critical pressure of the gas
- b) Explain the terms **i)** Closed system **ii)** open system
- c) What is meant by a reversible change? State its example.
- d) State the principle of the heat engine
- e) A Carnot's heat engine absorbs heat 200 calories from source at 400 <sup>0</sup>K and reject heat 100 calories to the sink. What is the temperature of the sink?
- f) What is the entropy? State its units.

**P.T.O.**

**Q.2** Attempt any **THREE** of the following: (12)

- a) Determine the Van der Waal's constant **a** and **b** for helium gas if the critical temperature and critical pressure of helium are  $-268^{\circ}\text{C}$  and  $2.3 \times 10^5 \text{ N/m}^2$  respectively. ( $R=8.3 \times 10^3 \text{ J/kmol } ^{\circ}\text{K}$ ).
- b) Derive an expression for the work done during an adiabatic process.
- c) Explain what you understand by the 'temperature entropy' diagram.
- d) Draw block diagram of Diesel engine and explain its working.

**Q.3** Attempt any **FOUR** of the following: (12)

- a) What are the defects of the Van der Waal's equation?
- b) Explain in short isothermal process and the adiabatic process with one example of each.
- c) Show that adiabatic curve is steeper than isothermal curve.
- d) State any three points which can differentiate Diesel engine from Otto engine.
- e) Calculate the change in entropy when 8 gm of ice at  $0^{\circ}\text{C}$  is converted into water at the same temperature. (Latent heat of ice = 80 cal/g).

**Q.4** Attempt any **TWO** of the following: (12)

- a) Derive Van der Waal's equation of state for the real gases.
- b) Derive an expression for the work done during an isothermal process.
- c) Draw block diagram of Carnot's heat engine and explain its parts.

**Q.5** Attempt any **TWO** of the following: (12)

- a) One the basis of Van der Waals equation, obtain an expression for the Boyle temperature of a gas. Hence obtain the relation between the Boyle temperature and critical temperature.
- b) What is the principle of refrigerator? Give the schematic representation of refrigerator.
- c) Deduce expression for the change in entropy of a substance when it is heated.

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