

GUJARAT TECHNOLOGICAL UNIVERSITY**BE - SEMESTER-III • EXAMINATION – WINTER • 2014****Subject Code: 2130405****Date: 18-12-2014****Subject Name: Thermodynamics****Time: 02.30 pm - 05.00 pm****Total Marks: 70****Instructions:**

1. Attempt all questions.
2. Make suitable assumptions wherever necessary.
3. Figures to the right indicate full marks.

- Q.1** Explain PVT behavior of pure substances with PT diagram and PV diagram in detail. Also, include phase rule and definition of gas, vapor and liquid in your description. **14**
- Q.2 (a)** Derive equation for constants “a” and “b” of Vander Waals equation of state in terms of critical constants of substances. **07**
- (b)** Define Entropy and irreversibility. Discuss their relationships. **07**
- OR**
- (b)** Give various statement of the second law of thermodynamics. **07**
- Q.3 (a)** Define and discuss the First law of Thermodynamics in its various form. What are its limitations? **07**
- (b)** Write a note on virial equation of states for gases. **07**
- OR**
- (a)** What is cubic equation of state? State application of it. Also, mention some cubic equation of state. **07**
- (b)** Discuss the Carnot refrigerator. **07**
- Q.4 (a)** With neat sketch explain the Vapor compression cycle. **07**
- (b)** Explain system and surroundings. Also discuss the scope of thermodynamics. **07**
- OR**
- Q.4 (a)** Write a note on Standard heat of reaction, Standard heat of formation, Standard heat of combustion. **07**
- (b)** What is steady flow process? Explain mass balance and energy balance in open system. **07**
- Q.5 (a)** Write four Maxwell’s equation and drive the equation for enthalpy and entropy as functions of temperature and pressure. **07**
- (b)** Define Hess law and using Hess’s law, calculate the heat of formation of methane gas from the following heat of combustion data **07**

- a) $\text{CH}_4(\text{g}) + 2\text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}) + 2\text{H}_2\text{O}(\text{l}); \quad \Delta H_{298} = -890.94 \text{ KJ}$
 b) $\text{C}(\text{s}) + \text{O}_2(\text{g}) \rightarrow \text{CO}_2(\text{g}); \quad \Delta H_{298} = -393.78 \text{ KJ}$
 c) $\text{H}_2(\text{g}) + \frac{1}{2}\text{O}_2(\text{g}) \rightarrow \text{H}_2\text{O}(\text{l}); \quad \Delta H_{298} = -286.03 \text{ KJ}$

OR

Q.5 (a) Write a short note on Thermodynamic diagram and discuss in brief P-H diagram. **07**

(b) Describe Zeroth law and write its application. **07**
