

Seat No.: \_\_\_\_\_

Enrolment No. \_\_\_\_\_

## GUJARAT TECHNOLOGICAL UNIVERSITY

### BE - SEMESTER– III (New) EXAMINATION – WINTER 2019

**Subject Code: 3130405**
**Date: 28/11/2019**
**Subject Name: Concepts of Thermodynamics and Bioenergetics**
**Time: 02:30 PM TO 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**
- |     |  |    |
|-----|--|----|
| (a) | Define intensive and extensive properties.   | 03 |
| (b) | Write about the common forms of the statements of the second law of thermodynamics.  | 04 |
| (c) | What is thermodynamics? Mention its scopes and limitations. State the applications of thermodynamics in biotechnology field. | 07 |

- Q.2**
- |     |  |    |
|-----|--|----|
| (a) | What is 'Equations of state'? Enlist some of them.                                     | 03 |
| (b) | Discuss system and surrounding.  | 04 |
| (c) | Explain PVT behavior of a pure substance with the help of PT and PV diagram in detail. | 07 |

**OR**

- |     |   |    |
|-----|---|----|
| (c) | Discuss the cubic equations of state and derive expressions of constants 'a' and 'b' of Vanderwall's EOS in terms of critical properties of substances. | 07 |
|-----|---|----|
- Q.3**
- |     |  |    |
|-----|--|----|
| (a) | Write first law of thermodynamics in brief.  | 03 |
| (b) | Classify the catabolism and anabolism based on carbon source, and energy supply.   | 04 |
| (c) | An instrument is to measure the acceleration of gravity on Mars is constructed of a spring from which there is suspended mass of 0.40 kg. At a place on earth where the local acceleration of gravity is $9.81 \text{ m/s}^2$ , the spring extends 1.08 cm. When the instrument package is landed on Mars, it radios the information that the spring is extended 0.40 cm. What is the Martian acceleration of gravity? | 07 |

**OR**

- Q.3**
- |     |   |    |
|-----|---|----|
| (a) | Discuss concept of Entropy.   | 03 |
| (b) | Briefly explain the free energy changes and its manipulations for metabolism. | 04 |
| (c) | Discuss Concept of vapor liquid equilibrium for pure component.               | 07 |
- Q.4**
- |     |  |    |
|-----|--|----|
| (a) | What is Partial molar properties?  | 03 |
| (b) | State the criteria for phase equilibrium.  | 04 |
| (c) | Derive the equation which relates the fundamental properties relation for homogeneous phase of constant composition. | 07 |

**OR**

- Q.4**
- |     |  |    |
|-----|--|----|
| (a) | What is the Phase Rule?  | 03 |
| (b) | Narrate the concept of ideal and non ideal solution.   | 04 |
| (c) | Explain the term 'temperature'. Mention different units of temperature and relations among various temperature scales with diagrams. | 07 |
- Q.5**
- |     |   |    |
|-----|---|----|
| (a) | What are the terminal electron acceptor in degradative and synthesis process? | 03 |
| (b) | Define respiration. Explain it with example.                                  | 04 |
| (c) | Compare catabolism and anabolism.   | 07 |

**OR**

- Q.5**
- |     |   |    |
|-----|---|----|
| (a) | Discuss the motifs of metabolic pathway.                            | 03 |
| (b) | Exemplify the concept of metabolism with its classical subdivision. | 04 |
| (c) | Explain in detail the regulation of metabolic pathways.             | 07 |