REG. NO.:

# VIT

Vellore Institute of Technology

**SCHOOL OF ADVANCED SCIENCES**
**CONTINUOUS ASSESSMENT TEST - II**
**FALL SEMESTER 2024-2025**

SLOT: G1+TG1

| | |
|---|---|
| **Programme Name & Branch** | **: B.Tech (All Branches)** |
| **Course Code and Course Name** | **: BCHY101L – Engineering Chemistry** |
| **Faculty Name(s)** | : Dr. Chandan Maity, Dr. Amit Kumar Tiwari, Dr. Napoleon A.A, Dr. Sumathi S, Dr. Akhila Maheswari M, Dr. Madhumitha G, Dr. Barnali Maiti, Dr. Ashok Kumar S.K, Dr. Sriraghavan K, Dr. Thenmozhi K, Dr. Asharani I.V, Dr. Sangeetha D, Dr. Shanmugam R, Dr. Tamas Kumar Panda, Dr. Manju S L |
| **Class Number(s)** | : VL2024250106756, 6760, 6763, 6767, 6776, 6780, 6781, 6790, 6792, 7040, 7041, 7131, 7239, 7241, 8576 |
| **Date of Examination** | **: 19/10/2024** |
| **Exam Duration** | **: 90 minutes** **Maximum Marks: 50** |

**General instruction(s):**

- Answer All Questions.
- Students are permitted to bring any number of textbooks, printouts of e-books (complete / chapters) and handwritten notebooks (class notes).
- M - Max mark; CO – Course Outcome; BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)
- Course Outcomes:

  *CO1: Apply the fundamental concepts in organic, inorganic and physical chemistry.*

  *CO3: Discuss energy conversion devices and protective corrosion techniques.*

| QN | Answer ALL the questions (5 x 10 = 50 Marks) | Marks | CO | BL |
|---|---|---|---|---|
| 1 | Derive appropriate equations of the maximum work an ideal gas does during reversible and irreversible isothermal expansion processes and distinguish them graphically.<br>Applying the appropriate equations, evaluate the $\Delta U$, W and $\Delta S$ values for 1 mole of an ideal gas when it undergoes an isothermal reversible expansion from a volume of 50 L to 1000 L at 25 °C. | (10) | CO1 | BL3 |
| 2 | The rate of specific reactions increases with an increase in the temperature. Show graphically how the kinetic energies of the molecules are distributed with increasing temperature and how does it help increase the rate? Write the equation that relates the rate constant and temperature and explain the terms with the underlying theory.<br>The decomposition reaction of ammonium nitrite at 50°C followed a first-order kinetics and depicted a half-life of 2 min. Evaluate the rate constant and the activation energy if its Arrhenius factor was $2.5 \times 10^{10}\ s^{-1}$. | (10) | CO1 | BL3 |

| | | | | |
|---|---|---|---|---|
| 3 | (a) Explain pictorially the appropriate heat-work flow diagram of refrigerators. State the equation to deduce the efficiency and work done by the regular heat engines. Can we arrive at a heat engine with 100% efficiency? Justify your answer.<br>(b) Explain the synthesis of an azo compound widely used as an acid-base indicator, with appropriate chemical equations. Discuss briefly the stepwise mechanisms involved in the synthetic procedure. | (5 + 5) | CO1 | BL3 |
| 4 | (a) Consider an electrochemical cell,<br>$Zn_{(s)} \mid Zn^{2+}\ (0.1\ M) \mid\mid Fe^{2+}\ (0.5\ M) \mid Fe_{(s)}$<br>The standard reduction electrode potentials of Fe and Zn are -0.4V and -0.76V, respectively. Write the cell reaction and calculate the EMF of the cell.<br>(b) Elaborate on the working principle of a widely used secondary battery that uses intercalation compounds as the cell components with a neat diagram and chemical equations. | (5 + 5) | CO3 | BL2 |
| 5 | Sketch a neat diagram depicting the working of a high-temperature fuel cell that can be employed as a secondary power-generating source alongside thermal or nuclear power reactors. Describe the cell components and chemistry involved with suitable equations in detail and list its advantages and disadvantages. | (10) | CO3 | BL2 |

**********