


VIT

 Vellore Institute of Technology
(An ISO 9001:2015 Certified Institution)
Final Assessment Test – November 2025

 Course: **BACHY105 - Applied Chemistry**

 Class NBR(s): 6525 / 6529 / 6533 / 6537 / 6541 / 6545 /
 6549 / 6553 / 6557 / 6561 / 6565 / 6569 / 6573 / 6575 /
 6579

 Slot: **G1+TG1**

 Time: **Three Hours**

 Max. Marks: **100**

- KEEPING MOBILE PHONE/ANY ELECTRONIC GADGETS, EVEN IN 'OFF' POSITION IS TREATED AS EXAM MALPRACTICE
- DON'T WRITE ANYTHING ON THE QUESTION PAPER

COs	CO Statements
CO1	Apply the concepts of thermodynamics and kinetics.
CO2	Use chemical concepts for the advancement of materials in electrical, magnetic, and energy domains.
CO3	Demonstrate UV Visible spectroscopic and X- ray diffraction techniques.
CO4	Discuss molecular orbitals and its energies through computational chemistry.

BL – Blooms Taxonomy Level (1 – Remember, 2 – Understand, 3 – Apply, 4 – Analyse, 5 – Evaluate, 6 – Create)

 Answer ALL Questions

(10 X 10 = 100 Marks)

- Based on the four different stages of the reversible heat engine, substantiate that the maximum efficiency of any heat engine is limited by the temperatures of its hot and cold reservoirs. CO1 BL3
- Utilizing a photosensitive organic dye, construct a renewable energy device. Discuss its advantages and disadvantages in practical applications. CO1 BL3
- Discuss the unique characteristics and five applications of the compound $\text{YBa}_2\text{Cu}_3\text{O}_7$. CO2 BL3
- Explain the working principle of the UV-Visible spectroscopy technique using the Beer-Lambert Law. How are the various electronic transitions in UV-Visible spectroscopy is crucial in identifying organic compounds? CO3 BL3
- a) List out the merits of computational chemistry in comparison to conventional chemistry? CO4 BL2
 b) Illustrate on the molecular orbital treatment of the diatomic molecules is bond formation using the time-independent Schrödinger equation.
- Provide a neat diagram illustrating the various components of the X-ray diffraction (XRD) instrument, and explain its working principle based on Bragg's equation. Estimate the crystallite size of the given nanomaterial using p-XRD data: Peak position $2\theta = 25.61^\circ$, FWHM of sample = 0.85° , $k = 0.9$ and $\lambda = 1.5406 \text{ \AA}$. CO3 BL3
- Distinguish between diamagnetic, paramagnetic, and ferromagnetic materials. Write any five applications of magnetic materials. CO2 BL3
- a) One mole of Nitrogen gas contained in a cylinder at 300K is allowed to expand irreversibly and isothermally against an external pressure of 5 atm from a volume of 5.0 dm^3 to 7.0 dm^3 . Calculate W, ΔU and ΔH . CO1 BL3
 b) The half-life of a homogeneous gaseous reaction $\text{SO}_2\text{Cl}_2 \longrightarrow \text{SO}_2 + \text{Cl}_2$, which obeys first-order kinetics, is 8 minutes. How long will it take for the concentration of SO_2Cl_2 to be reduced to 1% of the initial value.

- 9.a) With a neat diagram, explain how the ceramic materials in a device produce electricity. Despite the high operating temperature, reason out the advantages of using this energy device.

.CO1 BL3

[OR]

- 9.b) Describe the function of a Lithium-ion battery with a neat diagram and list out the advantages and disadvantages associated with this energy device.
- 10.a) Using a schematic diagram, explain the mechanical method commonly employed in preparing nanomaterials and discuss on the limitations associated with this approach.

CO2 BL3

[OR]

- 10.b) Discuss in detail the various steps involved in the synthesis of nano silica through sol-gel method.

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