Name: **Enrolment No:**	

UPES

End Semester Examination, December 2023

Course: Advance analytical chemistry **Semester : V**

Program: Int. B.Sc. M.Sc. Chemistry **Time : 03 hrs.**

Course Code: CHEM3034 **Max. Marks: 100**

Instructions: a) Answer the following questions. Mention properly the question number for each of your answers.
b) Schematic representations are highly encouraged during answering the questions

SECTION A
(5Qx4M=20Marks)

S. No.		Marks	CO
Q 1	Describe the Ilkovic equation.	**4**	**CO1**
Q 2	Differentiate cyclic voltammetry and polarography.	**4**	**CO1**
Q 3	Differentiate XPS and EDX.	**4**	**CO2**
Q 4	Multiple choice question A. DMA is particularly useful for studying: a. Crystal structure b. Mechanical properties as a function of temperature or frequency c. Surface tension d. Electrochemical reactions B. During a TGA experiment, a sample with an initial mass of 10 grams undergoes decomposition. The mass decreases by 20% during the process. If the final mass is denoted as Mf, what is the final mass of the sample? a. 8 grams b. 7 grams c. 6 grams d. 5 grams C. In Scanning Electron Microscopy (SEM), the images are formed by detecting signals resulting from the interaction of the electron beam with the sample. Which signal is commonly used to generate high-resolution images with detailed surface morphology? a. Backscattered electrons (BSE) b. Secondary electrons (SE) c. Auger electrons d. X-ray fluorescence (XRF)	**1 X 4**	**CO2**

	D. In DSC, the area under a peak in the heat flow vs. temperature curve is related to: a. Thermal conductivity b. Heat capacity c. Thermal diffusivity d. Coefficient of thermal expansion		
Q 5	A compound containing carbon (C), hydrogen (H), nitrogen (N), and sulfur (S) is analyzed using Elemental Analysis (CHNS). The mass percentages of each element in the compound are found to be: Carbon: 40% Hydrogen: 6.7% Nitrogen: 10% Sulfur: 3.3% Calculate the empirical formula of the compound.	**4**	**CO3**
SECTION B (4Qx10M= 40 Marks)			
Q 6	Explain the significance of electrochemical cells in various applications such as sensors and energy harvesters. **OR** Briefly describe chemiresistive sensors and their applications (with proper examples). Differentiate chemiresistive sensors with electrochemical sensors.	**5+5**	**CO1**
Q 7	Discuss the role of electron transfer, ion movement, and redox reactions in electrochemical processes.	**10**	**CO1**
Q 8	Describe the principles of DSC. How does DSC provide insights into the thermal properties, purity, and composition of materials?	**3 +7**	**CO1**
Q 9	Describe the significance of measuring rheology. A fluid with a dynamic viscosity (η) of 0.01 Pa·s experiences a shear stress (τ) of 5 Pa. Calculate the shear rate (γ) at which the fluid is sheared.	**5 + 5**	**CO2**
SECTION-C (2Qx20M=40 Marks)			
Q 10	Elaborate on the role of electrochemistry in energy storage technologies, including batteries and supercapacitors. Discuss the challenges and potential future developments in electrochemical energy storage. **OR** Describe the working principle of a chemiresistive sensor and its response to changes in the environment. Provide insight for plausible applications of chemiresistive sensors for health care and environmental monitoring.	**10+10**	**CO1**
Q 11	Discuss the key applications of TMA in materials characterization, including the determination of coefficients of thermal expansion, softening temperatures, and deformation behavior. Discuss the diverse	**10+10**	**CO2**

	range of applications of DMA in materials characterization, including the study of viscoelastic behavior, storage and loss moduli, and glass transition temperatures.		