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**GANDHI INSTITUTE OF ENGINEERING AND TECHNOLOGY UNIVERSITY, ODISHA, GUNUPUR  
(GIET UNIVERSITY)**



Ph.D. (First Semester-Winter) Examinations, June - 2025  
**23WPPECY1021 - Instrumental Methods of Chemical Analysis**  
(Chemistry)

Time: 3 hrs

Maximum: 70 Marks

**The figures in the right hand margin indicate marks.**

**Answer ANY FIVE Questions.****(14 x 5 = 70 Marks)    Marks**

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| 1.a. Explain the working principle of Mass Spectroscopy and structural determination of organic compounds.                               | 7  |
| b. Write notes on chemical shift.  | 7  |
| 2. Explain the working principle AAS and instrumentation of AES with analytical applications, advantages and disadvantages.              | 14 |
| 3.a. Describe the principle, instrumentation, and applications of Transmission Electron Microscopy (TEM).                                | 7  |
| b. Compare and contrast X-ray Absorption Spectroscopy (XAS) and X-ray Diffraction (XRD).   | 7  |
| 4. Describe the principle, instrumentation, and applications of Polarography, including the use of the Dropping Mercury Electrode (DME). | 14 |
| 5.a. Discuss the principle, instrumentation, and applications of Electronic Spectroscopy.  | 7  |
| b. Describe the process of fragmentation in mass spectrometry and its significance.  | 7  |
| 6.a. Describe the characteristic vibrational frequencies of common functional groups in IR spectroscopy.                                 | 7  |
| b. Discuss the Ilkovic equation in Polarography and its significance in determining the diffusion coefficient of electroactive species.  | 7  |
| 7. Explain the working principle and instrumentation of <sup>13</sup> C-NMR, principles, rules and applications.                         | 14 |
| 8.a. Discuss the principle, instrumentation, and applications of Differential Scanning Calorimetry (DSC).                                | 7  |
| b. Explain the principle, instrumentation, and applications of Cyclic Voltammetry.   | 7  |

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