

**SEMESTER S1/S2**  
**CHEMISTRY FOR INFORMATION SCIENCE AND ELECTRICAL**  
**SCIENCE**

**(Common to Group A & B)**

<b>Course Code</b>	<b>GXCYT122</b>	<b>CIE Marks</b>	40
<b>Teaching Hours/Week (L: T:P: R)</b>	3:0:2:0	<b>ESE Marks</b>	60
<b>Credits</b>	4	<b>Exam Hours</b>	2 Hrs. 30 Min.
<b>Prerequisites (if any)</b>	None	<b>Course Type</b>	Theory + Lab

**Course Objectives:**

1. To equip students with a comprehensive understanding of chemistry concepts that are relevant to engineering applications.
2. To familiarize students with applied topics such as spectroscopy, electrochemistry, and instrumental methods.
3. To raise awareness among students about environmental issues, including climate change, pollution, and waste management, and their impact on the quality of life.

**SYLLABUS**

<b>Module No.</b>	<b>Syllabus Description</b>	<b>Contact Hours</b>
<b>1</b>	<p><b>Electrochemistry and Corrosion Science (9 Hours)</b></p> <p><b>Electrochemical Cell-</b> Electrode potential- Nernst equation for single electrode and cell (Numerical problems)- Reference electrodes – SHE &amp; Calomel electrode –Construction and Working - Electrochemical series - Applications – Glass Electrode &amp; pH Measurement-Conductivity-Measurement using Digital conductivity meter. Li-ion battery &amp; H<sub>2</sub>-O<sub>2</sub> fuel cell (acid electrolyte only) construction and working.</p> <p><b>Corrosion</b> –Electrochemical corrosion mechanism (acidic &amp; alkaline</p>	<b>9</b>

	medium) - Galvanic series - Corrosion control methods - Cathodic Protection - Sacrificial anodic protection and impressed current cathodic protection – Electroplating of copper - Electroless plating of copper.	
2	<p><b>Materials for Electronic Applications (9 Hrs)</b></p> <p><b>Nanomaterials</b> - Classification based on Dimension &amp; Materials- Synthesis – Sol gel &amp; Chemical Reduction - Applications of nanomaterials – Carbon Nanotubes, Fullerenes, Graphene &amp; Carbon Quantum Dots – structure, properties &amp; application.</p> <p><b>Polymers</b> - Fire Retardant Polymers- Halogenated &amp; Non-halogenated polymers (Examples only)- Conducting Polymers-Classification- Polyaniline &amp; Polypyrrole-synthesis, properties and applications.</p> <p><b>Organic electronic materials and devices</b>- construction, working and applications of Organic Light Emitting Diode (OLED) &amp; Dye-Sensitized Solar Cells (DSSC)</p> <p>Materials used in Quantum computing Technology, Super capacitors, Spintronics</p>	9
3	<p><b>Molecular Spectroscopy and Analytical Techniques (9 Hours)</b></p> <p><b>Spectroscopy</b>-Types of spectra- Molecular energy levels - Beer Lambert’s law – Numerical problems - Electronic Spectroscopy – Principle, Types of electronic transitions –Role of conjugation in absorption maxima- Instrumentation-Applications – Vibrational spectroscopy – Principle- Number of vibrational modes - Vibrational modes of CO<sub>2</sub> and H<sub>2</sub>O – Applications</p> <p><b>Thermal Analysis:</b> Dielectric Thermal Analysis (DETA) of Polymers- Working and Application.</p> <p><b>Electron Microscopic Techniques:</b> SEM - Principle, instrumentation and Applications.</p>	9
4	<p><b>Environmental Chemistry (9Hrs)</b></p> <p><b>Water characteristics</b> - Hardness - Types of hardness- Temporary and Permanent - Disadvantages of hard water -Degree of hardness (Numericals) Water softening methods-Ion exchange process- Principle, procedure and advantages. Reverse osmosis – principle, process and advantages. – Water</p>	9

<p>disinfection methods – chlorination-Break point chlorination, ozone and UV irradiation. Dissolved oxygen (DO), BOD and COD- Definition &amp; Significance.</p> <p><b>Waste Management:</b> Sewage water treatment- Primary, Secondary and Tertiary - Flow diagram -Trickling filter and UASB process. E Waste, Methods of disposal – recycle, recovery and reuse. Chemistry of climate change- Greenhouse Gases- Ozone Depletion-Sustainable Development- an introduction to Sustainable Development Goals.</p>	
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**Self-Study Topics (NOT TO BE INCLUDED FOR END SEMESTER EXAMINATION):**

Construction, working and applications of Lead acid battery, Nickel cadmium battery and Nickel metal hybrid battery.

**Course Assessment Method**  
(CIE: 40 marks, ESE: 60 marks)

**Continuous Internal Evaluation Marks (CIE):**

Attendance	Continuous Assessment	Internal Examination-1 (Written)	Internal Examination-2 (Written)	Internal Examination-3 (Lab Examination)	Total
5	10	10	10	5	40

**End Semester Examination Marks (ESE)**

*In Part A, all questions need to be answered and in Part B, each student can choose any one full question out of two questions*

Part A	Part B	Total
<ul style="list-style-type: none"> <li>• 2 Questions from each module.</li> <li>• Total of 8 Questions, each carrying 3 marks</li> </ul> <p>(8x3 =24marks)</p>	<ul style="list-style-type: none"> <li>• Each question carries 9 marks.</li> <li>• Two questions will be given from each module, out of which 1 question should be answered.</li> <li>• Each question can have a maximum of 3 sub divisions.</li> </ul> <p>(4x9 = 36 marks)</p>	<b>60</b>

**Course Outcomes (COs)**

At the end of the course students should be able to:

Course Outcome		Bloom's Knowledge Level (KL)
<b>CO1</b>	Explain the Basic Concepts of Electrochemistry and Corrosion to explore the possible applications in various engineering fields	K2
<b>CO2</b>	Describe the use of various engineering materials in different industries	K2
<b>CO3</b>	Apply appropriate analytical techniques for the synthesis and characterization of various engineering materials.	K3
<b>CO4</b>	Outline various water treatment and waste management methods	K2

Note: K1- Remember, K2- Understand, K3- Apply, K4- Analyse, K5- Evaluate, K6- Create

**CO-PO Mapping Table:**

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
<b>CO1</b>	3	2										2
<b>CO2</b>	3	3										2
<b>CO3</b>	3	3										2
<b>CO4</b>	3	3				2	3					2

**Text Books**

Sl. No	Title of the Book	Name of the Author/s	Name of the Publisher	Edition and Year
1	Engineering Chemistry	B. L. Tembe, Kamaluddin, M. S. Krishnan	NPTEL Web-book	2018
2	Physical Chemistry	P. W. Atkins	Oxford University Press	International Edition- 2018
3	Instrumental Methods of Analysis	H. H. Willard, L. L. Merritt	CBS Publishers	7th Edition- 2005
4	Engineering Chemistry	Jain & Jain	Dhanpath Rai Publishing Company	17 <sup>th</sup> Edition - 2015

<b>Reference Books</b>				
<b>Sl. No</b>	<b>Title of the Book</b>	<b>Name of the Author/s</b>	<b>Name of the Publisher</b>	<b>Edition and Year</b>
1	Fundamentals of Molecular Spectroscopy	C. N. Banwell	McGraw-Hill	4 <sup>th</sup> edn., 1995
2	Principles of Physical Chemistry	B. R. Puri, L. R. Sharma, M. S. Pathania	Vishal Publishing Co	47th Edition, 2017
3	Introduction to Spectroscopy	Donald L. Pavia	Cengage Learning India Pvt. Ltd	2015
4	Polymer Chemistry: An Introduction	Raymond B. Seymour, Charles E. Carraher	Marcel Dekker Inc	4th Revised Edition, 1996
5	The Chemistry of Nanomaterials: Synthesis, Properties and Applications	Prof. Dr. C. N. R. Rao, Prof. Dr. h.c. mult. Achim Müller, Prof. Dr. A. K. Cheetham	Wiley-VCH Verlag GmbH & Co. KGaA	2014
6	Organic Electronics Materials and Devices	Shuichiro Ogawa	Springer Tokyo	2024
7	Principles and Applications of Thermal Analysis	Gabbot, P	Oxford: Blackwell Publishing	2008

<b>Video Links (NPTEL, SWAYAM...)</b>	
<b>Module No.</b>	<b>Link ID</b>
1	<a href="https://archive.nptel.ac.in/courses/104/106/104106137/">https://archive.nptel.ac.in/courses/104/106/104106137/</a> <a href="https://archive.nptel.ac.in/courses/113/105/113105102/">https://archive.nptel.ac.in/courses/113/105/113105102/</a> <a href="https://archive.nptel.ac.in/courses/113/104/113104082/">https://archive.nptel.ac.in/courses/113/104/113104082/</a> <a href="https://www.youtube.com/watch?v=BeSxFLvk1h0">https://www.youtube.com/watch?v=BeSxFLvk1h0</a>
2	<a href="https://archive.nptel.ac.in/courses/113/104/113104102/">https://archive.nptel.ac.in/courses/113/104/113104102/</a> <a href="https://archive.nptel.ac.in/courses/104/105/104105124/">https://archive.nptel.ac.in/courses/104/105/104105124/</a> <a href="https://archive.nptel.ac.in/courses/105/104/105104157/">https://archive.nptel.ac.in/courses/105/104/105104157/</a>

## Continuous Assessment (10 Marks)

Continuous assessment evaluations are conducted based on laboratory associated with the theory.

### Mark distribution

#### 1. Preparation and Pre-Lab Work (2 Marks)

- Pre-Lab Assignments: Assessment of pre-lab assignments or quizzes that test understanding of the upcoming experiment.
- Understanding of Theory: Evaluation based on students' preparation and understanding of the theoretical background related to the experiments.

#### 2. Conduct of Experiments (2 Marks)

- Procedure and Execution: Adherence to correct procedures, accurate execution of experiments, and following safety protocols.
- Skill Proficiency: Proficiency in handling equipment, accuracy in observations, and troubleshooting skills during the experiments.
- Teamwork: Collaboration and participation in group experiments.

#### 3. Lab Reports and Record Keeping (3 Marks)

- Quality of Reports: Clarity, completeness and accuracy of lab reports. Proper documentation of experiments, data analysis and conclusions.
- Timely Submission: Adhering to deadlines for submitting lab reports/rough record and maintaining a well-organized fair record.

#### 4. Viva Voce (3 Marks)

- Oral Examination: Ability to explain the experiment, results and underlying principles during a viva voce session.

**Final Marks Averaging:** *The final marks for preparation, conduct of experiments, viva, and record are the average of all the specified experiments in the syllabus.*

**Evaluation Pattern for Lab Examination (5 Marks)**

- 1. Procedure/Preliminary Work/Conduct of Experiments (2 Marks)**
  - Procedure Understanding and Description: Clarity in explaining the procedure and understanding each step involved.
  - Preliminary Work and Planning: Thoroughness in planning and organizing materials/equipment.
  - Setup and Execution: Proper setup and accurate execution of the experiment or programming task.
- 2. Result (2 Marks)**
  - Accuracy of Results: Precision and correctness of the obtained results.
- 3. Viva Voce (1 Marks)**
  - Proficiency in answering questions related to theoretical and practical aspects of the subject.

**List of Experiments**

\*Any 10 Experiments Mandatory

Expt. Nos.	Experiment
1	Estimation of iron in iron ore
2	Estimation of copper in brass
3	Determination of cell constant and conductance of solutions
4	Calibration of pH meter and determination of pH of a solution
5	Synthesis of polymers (a) Urea-formaldehyde resin (b) Phenol-formaldehyde resin
6	Determination of wavelength of absorption maximum and colorimetric estimation of $\text{Fe}^{3+}$ in solution
7	Determination of molar absorptivity of a compound ( $\text{KMnO}_4$ or any water-soluble food colorant)
8	Analysis of IR spectra

<b>9</b>	Identification of drugs using TLC
<b>10</b>	Estimation of total hardness of water-EDTA method
<b>11</b>	Estimation of dissolved oxygen by Winkler's method
<b>12</b>	Determination of calorific value using Bomb calorimeter
<b>13</b>	Determination of saponification value of a given vegetable oil
<b>14</b>	Determination of acid value of a given vegetable oil
<b>15</b>	Verification of Nernst equation for electrochemical cell.