NATIONAL INSTITUTE OF TECHNOLOGY KARNATAKA, SURATHKAL
DEPARTMENT OF CHEMISTRY

COURSE CONTENT AND EVALUATION PLAN

1) **Course Code**: CY100N 2) **Course Title**: Engineering Chemistry 3) **L-T-P**: 3-0-2(4) 4) **Credit**: 04 5) **Pre-requisite**: Nil 6) **Course category**: BSC 7) **Teaching Department**: Chemistry 8) **Course for**: I/II Semester B. Tech.

9) Objectives of the course:

a. To learn fundamentals and applications of UV-Vis and FTIR spectroscopic techniques and microscopy in materials chemistry.
b. Understand the principles of green chemistry and apply them in the synthesis of organic compounds.
c. To get comprehensive knowledge on the fundamentals of electrochemistry, electroplating, and electroless plating.
d. To learn the fundamentals of the corrosion process and its control by different methods.
e. To grasp the knowledge of basic of polymer chemistry and advanced polymers.
f. To know the fundamentals of nanomaterials and their applications in various disciplines.
g. To understand the principles of volumetric analysis in chemistry
h. To know the principles of Instrumental methods of analysis, such as colorimetry and conductometry, and their handling.

10) Skill development of the student expected from the course:

a. Interpret UV-Vis and IR spectra by identifying chromophores, auxochromes, functional group frequencies, and fundamental vibrational modes, and explain the basic concepts of microscopic techniques for materials characterization.
b. Apply the principles of green chemistry to eliminate/minimize waste production, improve the environmental sustainability of the chemical processes, and evaluate the sustainability of chemical processes using parameters like atom economy and E-factor.
c. Understand electrochemical principles and apply them to processes such as metal electroplating and the preparation of integrated circuit boards.
d. Identify different types of corrosion and design strategies for corrosion control.
e. Classify polymers based on structural features and properties, understand the polymer synthesis techniques, molecular weight determinations, and explain the structure-property relationships.
f. Explain the unusual properties of nanoparticles & nanomaterials (e.g., nanocarbon, ZnO, TiO_2), understand the synthetic techniques for nanomaterials, and various applications.
g. Gain experience in the safe handling of chemicals, glassware, and analytical instruments.
h. Training in the design of scientific experiments, observation, data collection, reasoning, and reporting of results.
i. Gain experience in weighing by precision balance, volume measurements, quantitative transfer of chemicals, and calibration of analytical instruments.

11) Course coverage: Lecture Schedule- **36 periods**

Sl. No	***Main Topics***	***Blow-up syllabus***	***Lecture Periods***
1	Spectroscopy	Introduction to Spectroscopy: Electromagnetic Spectrum and Energy; Absorption and Emission spectra; UV-Vis Spectroscopy; Chromophore and Auxochrome, Beer-Lambert's law, Fluorescence and Phosphorescence; Infra-Red Spectroscopy: Modes of vibrations; Vibration frequency of chemical bonds; Characteristic	09

		vibration frequencies of some of the common bonds; Introduction to Microscopic Techniques. Atomic absorption spectroscopy (**Assignment**).	
2	Electrochemistry and Electroplating	Introduction to single electrode potential, electrochemical series, calomel electrode, glass electrode, polarization, decomposition potential, overvoltage; lead-storage batteries, introduction to fuel cells; electroplating theory: factors affecting the nature of deposit, electroplating of copper; concept of multilayer coating and its applications; electroless plating of copper- PCB preparation.	08
3	Corrosion and its control	Theory of electrochemical corrosion, factors affecting corrosion rate, brief account of different forms of corrosion: General, galvanic (galvanic series), differential aeration, pitting and stress corrosion, cathodic protection; anodic protection.	04
4	Nano-materials	Introduction to nanomaterials, general properties: comparison with bulk materials, size effects. General methods of preparation: CVD, pulsed laser deposition, sol-gel, and hydrothermal. Nanocarbon: types, preparation, properties and application. ZnO and TiO_2 nanostructures: preparation, properties and applications.	04
5	Green Chemistry	Introduction to green chemistry, 12 principles of green chemistry, atom economy and E-factor.	02
6	Polymers	Basic definitions, classification of polymers based on mechanism, thermal properties and tacticity; copolymerization – alternate, random, block and graft; mechanism of addition polymerization (free radical, cationic and anionic), coordination polymerization and condensation polymerization; molecular weights of polymers, number average, weight average, methods of polymerization – bulk, solution, suspension, and emulsion polymerization; glass transition temperature, factors affecting Tg; effect of polymer structure on properties; Conducting polymers (**Assignment**).	09

Lab Experiments: (02 hours)

Volumetric Titration:

1. Estimation of the total hardness of water by complexometric titration with EDTA.
2. Estimation of the percentage of manganese dioxide in the given sample of pyrolusite by redox titration with oxalic acid solution.
3. Estimation of the percentage of nitrogen in a given ammonium fertilizer by acid-base titration with sodium hydroxide solution.

Instrumental Analysis:

4. Conductometric titration of a strong acid analyte using a strong base as titrant.
5. Colorimetric estimation of the percentage of copper present in the given Cu(II) solution.

Green synthesis:

6. Green organic synthesis using mechanochemistry and biorenewable catalyst.

12) **Reference books:**

1. Engineering Chemistry, R V Gadag, and A N Shetty, VAPS Knowledge Publishing, 2024
2. B. R. Puri, L. R. Sharma and Madan S. Pathania, Principles of Physical Chemistry, Vishal Publishers, 49th Ed. 2020.
3. P. C. Jain and Monika Jain, Engineering Chemistry, Dhanpat Rai Publishing, Delhi, 17th Ed. 2015.
4. Dr. E. R. Nagarajan, Wiley's Engineering Chemistry, 2nd edition, 2018.
5. C.N.R. Rao, Understanding Chemistry, Universities Press, 1999
6. Gowariker et al., Polymer Science and Technology, Prentice Hall of India Pvt. Ltd., New Delhi, 1999
7. Engineering Chemistry Lab Manual supplied by the Department of Chemistry, NITK, Surathkal.
8. Vogel's Text Book of Quantitative Chemical Analysis, Furnis et al. (ed), Pearson publication.

13) **Evaluation plan:**

Evaluation plan (weightage for each component as per the regulations) is as follows:

1. The course will be evaluated in three components: continuous evaluation, mid-semester, and end-semester test (theory & lab components).
2. The weightages for the three components are as follows:

Continuous evaluation	**: 30 Marks**
Mid-Sem Test	**: 20 Marks**
End-Sem Test	**: 50 (30 for Theory & 20 for Lab) Marks**

3. Under the continuous evaluation component,
   a) For attendance in the theory and lab components, proportional marks will be given out of **10** based on the percentage of attendance. No marks will be awarded for attendance below 75%.
   b) Two assignment topics with submission dates, one in the first half and the other in the second half of the semester, are provided in point no 4. Two (**02**) assignments are worth **10** marks in total.
   c) A lab quiz will be conducted after all six experiments are successfully completed. The weightage for the lab quiz is **10**. The question paper will be common for all, and the date will be announced later.

The mid-semester and end-semester tests will be conducted for **30** and **50** marks, respectively, as per the schedule in the academic calendar.

4. Assignment topics (hand-written):

1st topic: Atomic Absorption Spectroscopy **Submission date:** **Thursday, September 24, 2026**	**2nd topic: Conducting polymers** **Submission date:** **Thursday, November 12, 2026**

5. The end-sem test will be a comprehensive test including the entire syllabus of the course.
6. The question papers for the quiz tests, mid-sem, and end-sem tests **will not have any choices.**
7. End-sem test for the lab will have a weightage of **20 marks**
8. One experiment: Either from volumetric (only one titration), from the instrumental part, or from organic synthesis for **20 Marks**

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Scheme of Evaluation for LAB End-Sem Exam

TOTAL MARKS: 20

Marks split-up for experiments numbered 1-3:

i) **Calculations** : **2 marks**
ii) **Titre values** : **18 marks**

Error	Marks
± 0.1 mL	18
± 0.2 mL	17
± 0.3 mL	15
± 0.4 mL	12
± 0.5 mL	9
Any value	6

Marks split-up for experiments numbered (Instrumental) 4-5:

i) **Calculations** : **2 marks**
ii) **Graph** : **4 marks**
iii) **Experiment** : **14 marks**

Conductometry		Colorimetry	
Error	Marks	Error	Marks
± 0.1 mL	14	± 0.3 mg	14
+ 0.2 mL	13	+ 0.6 mg	13
± 0.3 mL	11	± 0.9 mg	11
± 0.4 mL	9	± 1.2 mg	9
± 0.5 mL	6	± 1.5 mg	6
Any value	5	Any value	5

Marks split-up for organic synthesis experiment numbered 6:

i) **Perform experiment and product isolation** : **10 mark**
ii) **Melting point** : **03 mark**
iii) **Calculation** : **03 mark**
iv) **Spectral analysis** : **04 mark**

Saikat Dutta

19/08/2026

DUGC Secretary, Chemistry
Date: 19/08/2026

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HOD, Chemistry

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