Madanapalle Institute of Technology & Science (MITS)

Deemed to be University

Department of Chemistry

The following members are nominated as Board of Studies Members during the Academic Year (2025-26)

S. No	Key Positions	Name	
1.	Dean of School or Head of the Department – Chairperson	Head of the Department	**Dr. Renjith Bhaskaran**
2.	**Two External Experts** to be co-opted for their specialised knowledge with Affiliation Details	Academic Expert	**Dr. Debapratim Das** Professor, Department of Chemistry, IIT Guwahati, Assam, India. Email: ddas@iitg.ac.in Phone: +91 8011001612
		Industry Expert	**Dr. Aditi Agarwal** Principal Consultant – Agrochemical / Life sciences Infosys, Noida, India. Email: aditiagbansal@gmail.com Phone: +91 9910214685
3.	All Professors of the School or Department	Professors	-
4.	**Two Associate Professors** of the School or Department, by rotation;	Associate Professors	1. **Dr. K. Chandra Mohan** 2. **Dr. Gajanan Kunde**
5.	**Two Assistant Professors** of the School or Department, by rotation;	Assistant Professors	1. **Dr. Amaladass P.** 2. **Dr. Rahul Pal**

Dr. Renjith Bhaskaran
Head-Department of Chemistry
MITS (Deemed to be University)

Head of the Department
Chemistry
Madanapalle Institute of Technology & Science
MADANAPALLE - 517 325

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DEPARTMENT OF CHEMISTRY

Minutes of the Meeting

BoS Meeting- 28th August 2025

Chairman: Dr. Renjith Bhaskaran, Assistant Professor & Head, Department of Chemistry, MITS.

The board of studies meeting for the Department of Chemistry was held virtually through MS teams on 28th August 2025. All the external committee members were present in the meeting.

Agenda

Discussion on the syllabus for the following courses under R25 curriculum.

1) **SMART Chemistry** (B. Tech I Year I & II Semester, for CSE and allied branches)
2) **Chemistry for Electronics** (B. Tech I Year I & II Semester, for ECE branch)
3) **Engineering Chemistry** (B. Tech I Year I & II Semester, for EEE, Civil & ME branches)
4) **Chemistry Laboratory** (B. Tech I Year I & II Semester, for CSE & allied branches)
5) **Applied Chemistry Laboratory** (B. Tech I Year I & II Semester, for ECE branch)
6) **Engineering Chemistry Laboratory** (B. Tech I Year I & II Semester, for Civil, Mechanical & EEE branches)

External Members:

1. Dr. Debapratim Das, Professor, Department of Chemistry, IIT Guwahati
2. Dr. Aditi Agarwal, Principal Consultant- Agrochemical/Life Sciences, Infosys

Internal Members:

1. Dr. Renjith Bhaskaran, Assistant Professor (HOD, Department of Chemistry)
2. Dr. Gajanan Kunde, Associate Professor
3. Dr. K. Chandra Mohan, Associate Professor
4. Dr. P. Amaladass, Assistant Professor
5. Dr. Rahul Pal, Assistant Professor
6. Dr. Abhijit Bijanu, Assistant Professor

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DEPARTMENT OF CHEMISTRY

B.Tech. – Credit Course	**L**	**T**	**P**	**C**
Total Hours: 45	**3**	**0**	**0**	**3**

25BACHETC03-SMART CHEMISTRY

The following changes are made to the **SMART Chemistry** syllabus based on the suggestions from BoS members.

- The program's course code is **25BACHETC03,** and it includes a total of **45 lecture hours**.
- Incorporated the outcomes of the specified course.

CO1: Explain the fundamental postulates of quantum mechanics and the significance of the wave function

CO2: Explain the basic concepts of group theory, symmetry operations, and point groups
CO3: Explain Boolean logic, basic logic gates, and the transition from silicon to molecular electronics
CO4: Explain the structure and functions of biomolecules and their roles in biological computing systems
CO5: Explain the concepts, properties, and applications of semiconductors, superconductors, conducting polymers, and memristors

Unit I

- No modifications.

Unit II

- It was advised by Prof. Das sir to replace Unit II (Materials for Computing) with Unit V (Group Theory & Spectroscopy)

Unit III

- No modifications.

Unit IV

- The topic **"Applications in Genetic AI and neuromorphic computing"** is suggested to be removed and replaced by "Application of Genes, codons, DNA computing, protein computing, biohybrid robots-Xenobots, Belousov–Zhabotinsky (BZ) reaction" by Prof. Das.

- The topic **"Future of Molecular Computing: AI/ML-driven design of molecular circuits, hybrid silicon-molecular architectures "** was added to Unit IV as suggested by Dr. Aditi Agarwal.

Unit V

- The topic **"AI in Bio-computing: ML for genome analysis, protein folding (AlphaFold)"** was added to Unit V as suggested by Dr. Aditi Agarwal.

Following Text books & reference books were included

Text Books:
Quantum Chemistry – Ira N. Levine, 8th Ed., Pearson Education, 2020.
Nanostructures and Nanomaterials: Synthesis, Properties and Applications – Guozhong Cao & Ying Wang, 2nd Ed., World Scientific, 2011. *Group Theory and Chemistry* – David M. Bishop, Dover Publications, 1993.
Reference Books:
Molecular Electronics: An Introduction to Theory and Experiment – Juan Carlos Cuevas & Elke Scheer, 2nd Ed., World Scientific, 2017.
Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies – Dario Floreano & Claudio Mattiussi, MIT Press, 2008.
Principles of Instrumental Analysis – Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, 7th Ed., Cengage Learning, 2018.
Mode of Evaluation Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I/II Semester

25BACHETC03 SMART CHEMISTRY

L	T	P	C
3	0	0	3

Pre Requisites: Intermediate Chemistry

Course Description:

SMART Chemistry explores the intersection of modern chemistry, materials science, and computation. The course covers quantum chemistry, group theory, spectroscopy, nanomaterials, molecular logic gates, and bio-inspired computing, emphasizing their applications in molecular electronics and AI-driven chemical systems. Students gain a foundational understanding of advanced chemical principles and futuristic computing paradigms.

Course Objectives:

1. **To develop** an understanding of the principles of quantum chemistry, materials science, group theory, and spectroscopy relevant to computing and molecular technologies.
2. **To enable** students to apply concepts of materials for computing, molecular logic gates, and bio-inspired systems to solve problems in next-generation computing and electronics.
3. **To cultivate** analytical skills for interpreting chemical, spectroscopic, and computational data, and relating them to emerging scientific and technological applications.

UNIT I	QUANTUM CHEMISTRY	9 hours

Fundamentals of Quantum mechanics:- Wave-particle duality, Uncertainty principle, Postulates of quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homo-diatomic molecules – energy level diagrams of N_2, and O_2, calculation of bond order, π-molecular orbitals of butadiene.

UNIT II	GROUP THEORY & SPECTROSCOPY	9 hours

Introduction to group theory, definitions of group, subgroup, Class, Properties of a group, Symmetry elements and symmetry operations, Symmetry point groups, Matrix representation of groups, C_{2v} & C_{2h} point groups. Integration with Quantum Chemistry: Symmetry-informed AI models for molecular structure prediction.

Introduction to spectroscopy, UV-Visible spectroscopy – electronic transitions in MOs, Beer-Lambert's Law - Instrumentation – Applications.

UNIT III	MATERIALS FOR COMPUTING	9 hours

Semiconductors – Introduction, basic concept, role of doping agents, applications

Super conductors-Introduction, basic concept, applications.

Conducting polymers – Introduction, mechanism of conduction & applications

Memristors: Concept, working principle, and applications

Nano materials: Introduction, classification, properties and applications (including computing) of Fullerenes, carbon nano tubes and Graphene.

UNIT IV	MOLECULAR LOGIC GATES	9 hours

Introduction to Boolean logic, Basic logic gates: AND, OR, NOT, Truth tables and binary language, Transition from silicon to molecules: molecular electronics (VS) molecular logic, Simple chemical input–output systems (e.g., pH, metal ions), Fluorescent and colorimetric logic gates.

Basic examples: (AND gate using acid–base, OR gate using metal ions, NOT gate using quenching), Applications of Molecular Logic, Future of Molecular computing (Limitations and challenges of

molecular logic, Comparison with traditional electronics.
Future of Molecular Computing: AI/ML-driven design of molecular circuits, hybrid silicon architectures.

UNIT V	BIO-INSPIRED COMPUTING	

Introduction to biomolecules, structure & functions of carbohydrates, amino acids, protein, DNA, RNA, neurons, synapses, neuro-muscular junctions (NMJ).
Genes, codons, DNA computing, protein computing, biohybrid robots-Xenobots, Belousov–Zhabotinsky (BZ) reaction and applications.
Introduction to post-CMOS computing, Link to brain-inspired AI (neuromorphic computing)
AI in Bio-computing: ML for genome analysis, protein folding (AlphaFold).

Course Outcomes:

At the end of the course, the students would be able to
CO1: Explain the fundamental postulates of quantum mechanics and the significance of function
CO2: Explain the concepts, properties, and applications of semiconductors, superc conducting polymers, and memristors. Analyze semiconductors, superconductors, memristors, and nanomaterials for computing, with emphasis on AI-enabled materials discov
CO3: Explain Boolean logic, basic logic gates, and the transition from silicon to molecular el
CO4: Explain the structure and functions of biomolecules and their roles in biological systems
CO5: Explain the basic concepts of group theory, symmetry operations, and point groups, i AI/ML approaches for chemical and spectroscopic data interpretation.

Text Books:

1.	*Quantum Chemistry* – Ira N. Levine, 8th Ed., Pearson Education, 2020.
2.	*Nanostructures and Nanomaterials: Synthesis, Properties and Applications* – Guozhong Ying Wang, 2nd Ed., World Scientific, 2011. *Group Theory and Chemistry* – David M. Bishop, Dover Publications, 1993.
3.	*Artificial Intelligence in Chemistry: Machine Learning and Deep Learning in Chemical Materials Science* – Edited by Hugh Cartwright, Royal Society of Chemistry, 2020.
4	*Symmetry and Spectroscopy: An Introduction to Vibrational and Electronic Spectroscopy Daniel C. Harris & Michael D. Bertolucci, Illustrated Reprint (Dover Publications), Nov 1989.*
5	*Recent Developments in Biologically Inspired Computing* – L. N. de Castro & F. J. Von Idea Group Publishing, 2004.
6	*Molecular Logic-based Computation* – A. Prasanna de Silva, Royal Society of Chemistry

Reference Books:

1.	Molecular Electronics: An Introduction to Theory and Experiment – Juan Carlos Cuevas & Elke 2nd Ed., World Scientific, 2017.
2.	Bio-Inspired Artificial Intelligence: Theories, Methods, and Technologies – Dario Floreano & Cl Mattiussi, MIT Press, 2008.
3.	Principles of Instrumental Analysis – Douglas A. Skoog, F. James Holler, and Stanley R. Crouch, Cengage Learning, 2018.

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination

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DEPARTMENT OF CHEMISTRY

B.Tech. – Credit Course

L	T	P	C
3	0	0	3

Total hours: 45

25BACHETC02 – Chemistry for Electronics

The minutes regarding the syllabus of course, **Chemistry for Electronics** as suggested by the BoS members is listed below:

- The program's course code is **25BACHETC02,** and it includes a total of **45 lecture hours**.
- Incorporated the outcomes of the specified course.

CO1: Explain the fundamental postulates of quantum mechanics and the significance of wave functions

CO2: Explain the synthesis, properties, and applications of nanomaterials, superconductors, conducting polymers, and related functional materials

CO3: Apply the Nernst equation and electrochemical concepts to solve numerical problems and compare and contrast the working principles and cell reactions of different electrochemical energy devices such as batteries, fuel cells, and supercapacitors

CO4: Explain the principles of photovoltaic conversion and semiconductor band structures

CO5: Explain the principles of green chemistry and identify hazardous substances in e-waste

Unit I

- No modifications

Unit II

- No modifications

Unit III

- No modifications

Unit IV

- No modifications

Unit V

- No modifications

Following Text books & reference books were included

Text Books:

1. Engineering Chemistry Jain and Jain Dhanpat Rai, Publishing company, 17th Edition/2015
2. Engineering Chemistry RV Gadag and A, Nityananda Shetty, Wiley 3rd edition /2019
3. Engineering Chemistry, Wiley Editorial, Wiley 2nd Edition/2013

Reference Books:

1. Textbook of Nanoscience and Nanotechnology, B S Murty;P Shankar;Baldev Raj;B B Rath;James Murday, University Press-IIM
2. *Encyclopedia of Electrochemical Power Sources* — Edited by Garche et al. Elsevier, 2nd Edition 2024
3. Electronic Waste: Recycling and Reprocessing for a Sustainable Future, Maria E. Holuszko, Amit Kumar, Denise C. R. Espinosa, Wiley-VCH, 1st Edition 2022

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I/II Semester

25BACHETC02 CHEMISTRY FOR ELECTRONICS

		L	T	P	C
		3	0	0	3

Pre Requisites: Intermediate Level

Course Description:

This course introduces the fundamentals of quantum chemistry, functional and energy-harvesting materials, electrochemistry, and green chemistry concepts. It explores the synthesis, properties, and applications of nanomaterials, conducting polymers, and smart electronic devices, alongside sustainable practices in e-waste management and green electronics. Students will gain a holistic understanding of modern materials and energy technologies with practical and environmental relevance.

Course Objectives:

- **To develop** an understanding of the fundamental principles of quantum chemistry, electrochemistry, functional materials, energy harvesting, and green chemistry relevant to modern scientific and technological applications.
- **To enable** students to apply theoretical concepts to analyze, interpret, and solve problems related to molecular structures, material properties, energy conversion, and sustainable practices.
- **To cultivate** awareness of emerging materials, technologies, and eco-friendly practices in electronics, fostering the ability to propose solutions for energy and environmental challenges.

UNIT I QUANTUM CHEMISTRY — 9 hours

Fundamentals of Quantum mechanics, Postulates of Quantum mechanics, Schrodinger Wave equation, significance of Ψ and Ψ^2, particle in one dimensional box, molecular orbital theory – bonding in homonuclear diatomic molecules – energy level diagrams of N_2, and O_2, π-molecular orbitals of butadiene and calculation of bond order. Electronic excitations-Beer-Lambert law

UNIT II FUNCTIONAL MATERIALS — 9 hours

Nano materials: Introduction, classification, Synthesis – precipitation method,
properties and applications of Fullerenes, carbon nano tubes and Graphene, Quantum Dots.
Super conductors-Introduction, basic concept, applications.
Conducting polymers – polyacetylene, polyaniline, – mechanism of conduction and applications.
Concepts of MEMS, dielectric and ferroelectric materials, OLED

UNIT III ELECTROCHEMISTRY AND APPLICATIONS — 9 hours

Electrochemical cell, Nernst equation, numerical problems, potentiometry- potentiometric titrations (redox titrations), concept of conductivity, conductivity cell, conductometric titrations (acid-base titrations).
Primary cells – Zinc-air battery, Secondary cells –lithium-ion batteries- working of the batteries including cell reactions; Fuel cells, hydrogen-oxygen fuel cell– working of the cells.
Supercapacitors: Introduction, Basic Concept-Classification – Applications.
Electrochemical sensors – potentiometric sensors with examples, amperometric sensors with examples, piezoelectric sensors.

UNIT IV ENERGY HARVESTING MATERIALS — 9 hours

Basic principles of photovoltaic (PV) conversion
Atomic structure of silicon; energy bands in semiconductors; n-type and p-type materials; formation of p-n junctions.

Classification based on materials and manufacturing (single crystalline silicon, polycrystalline silicon, amorphous silicon, thin films, organic perovskite),
Advancements in fabrication, efficiency improvement, and Self-healing polymers (SHP) smart coating (thin films)

UNIT V	GREEN CHEMISTRY & E-WASTE MANAGEMENT	9 hours

Fundamentals of Green Chemistry : Definition and scope, Importance of sustainability in electronics. Introduction to E-waste, Hazardous substances in E-waste. E-toxic components in computer, Disposal of e-waste (Incineration, Landfilling, Recycling).
Materials in Green Electronics : Lead-free solders and halogen-free flame retardants (SAC alloys, Sn-Cu, Sn-Bi), Nanomaterials for sustainable device fabrication. Application, advantages and challenges of green electronics.
E-waste Management: Introduction (ill effects of e-waste management, global losses, environmental importance), sources, types, effects of e-waste on environment and human health, methods of disposal (Classification), advantages of recycling. Extraction of copper and gold from e-waste (Principle, process, taking PCB as an example)

Course Outcomes:

At the end of the course, the students will be able to:
CO1: Explain the fundamental postulates of quantum mechanics and the significance of wave functions
CO2: Explain the synthesis, properties, and applications of nanomaterials, superconductors, conducting polymers, and related functional materials
CO3: Apply the Nernst equation and electrochemical concepts to solve numerical problems and compare and contrast the working principles and cell reactions of different electrochemical energy devices such as batteries, fuel cells, and supercapacitors
CO4:. Explain the principles of photovoltaic conversion and semiconductor band structures
CO5: Explain the principles of green chemistry and identify hazardous substances in e-waste

Text Books:

1. Engineering Chemistry Jain and Jain Dhanpat Rai, Publishing company, 17th Edition/2015
2. Engineering Chemistry RV Gadag and A, Nityananda Shetty, Wiley 3rd edition /2019
3. Engineering Chemistry, Wiley Editorial, Wiley 2nd Edition/2013

Reference Books:

1. Textbook of Nanoscience and Nanotechnology, B S Murty;P Shankar;Baldev Raj;B B Rath;James Murday, University Press-IIM
2. Encyclopedia of Electrochemical Power Sources — Edited by Garche et al. Elsevier, 2nd Edition 2024
3. Electronic Waste: Recycling and Reprocessing for a Sustainable Future, Maria E. Holuszko, Amit Kumar, Denise C. R. Espinosa, Wiley-VCH, 1st Edition 2022

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

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DEPARTMENT OF CHEMISTRY

B.Tech. – Credit Course
Total Hours: 45

L	T	P	C
3	0	0	3

25BACHETC01 ENGINEERING CHEMISTRY

The minutes regarding the syllabus of course, **Engineering Chemistry** as suggested by the BoS members is listed below:

- The program's course code is **25BACHETC01,** and it includes a total of **45 lecture hours**.
- Incorporated the outcomes of the specified course.

CO1: Explain the estimation of impurities present in water like hardness, alkalinity and softening of impure water.

CO2: Explain the working principles of batteries & demonstrate the corrosion prevention methods and factors affecting corrosion

CO3: Explain the preparation, properties, and applications of thermoplastics, thermosetting, elastomers, conducting polymers & explain calorific values, octane number, refining of petroleum and cracking of oils.

CO4: Explain the setting and hardening of cement, properties of composites and lubricants.

CO5: Summarize the properties & applications of super conductors and nanomaterials.

Unit I

- No modifications

Unit II

- No modifications

Unit III

- No modifications

Unit IV

- No modifications

Unit V

- No modifications

DEPARTMENT OF CHEMISTRY

Following Text books & reference books were included

1. Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2. Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxfordversity Press, 2010.
3. G V Subba Reddy, K N Jayaveera, C Ramachandraiah, Engineering Chemistry, McGrawl;First Edition, 2019.

Reference Books:

1. H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2. D.J. Shaw, Introduction to Colloids and Surface Chemistry,

   Butterworth-Heineman, 1992.
3. Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

B. Tech I Year I/II Semester

25BACHETC01 ENGINEERING CHEMISTRY

		L	T	P	C
		3	0	0	3
Pre Requisites:	**Intermediate Level**				

Course Description:

This course introduces essential concepts of chemistry relevant to civil and mechanical engineering, including water treatment, electrochemistry, corrosion, polymers, fuels, modern engineering materials, and nanomaterials. Students will learn the principles, properties, and applications of these materials and processes in engineering practice, emphasizing practical solutions for industrial and environmental challenges.

Course Objectives:

- To familiarize engineering chemistry and its applications
- To impart the concept of soft and hard waters, softening methods of hard water
- To train the students on the principles and applications of electrochemistry, polymers, nanomaterials, and cement

UNIT I	**WATER TECHNOLOGY**	**9 hours**

Specifications for drinking water as per BIS and WHO standards
Impurities present in water:- Types of hardness, units of hardness, disadvantages of hardness of water, Estimation of hardness of water by EDTA Method, Alkalinity, Estimation of dissolved Oxygen
Boiler troubles –Priming, foaming, scale and sludge, Caustic embrittlement,
Industrial water treatment:– Ion-exchange processes, desalination of brackish water by reverse osmosis (RO), electrodialysis.

UNIT II	**ELECTROCHEMISTRY AND CORROSION**	**9 hours**

Electrodes –electrochemical cell, Nernst equation, cell potential calculations.
Super capacitors – Classifications & applications
Batteries- classification, Primary cells – Zinc-air battery, Secondary cells – lithium-ion batteries- working principles including cell reactions; Fuel Cells-Basic Concepts, the principle and working of hydrogen-oxygen Fuel cell.
Corrosion: Introduction to corrosion, differential aeration cell corrosion, galvanic corrosion, Factors affecting the corrosion, cathodic and anodic protection, electroplating (Nickel and Copper) and electroless deposition. Surface Coating on thin films.

UNIT III	**POLYMERS AND FUEL CHEMISTRY**	**9 hours**

Introduction to polymers, types of polymerizations, Thermoplastics and Thermo-setting plastics-: Preparation, properties and applications of Teflon, PVC, Nylon 6,6 and Bakelite. Elastomers – Preparation, properties and applications of Buna S, Buna N.
Biodegradable polymers – PLA & PGA

Fuels: Types of fuels, calorific value of fuels, numerical problems based on calorific value; Analysis of coal (Proximate and Ultimate analysis), Liquid Fuels, refining of petroleum, Octane and Cetane number- alternative fuels- biodiesel.

UNIT IV	**MODERN ENGINEERING MATERIALS**	**9 hours**

Composites- Definition, Constituents, Classification- Particle, Fibre and Structural reinforced composites, properties and Engineering applications

bricants- Classification, Functions of lubricants, Mechanism, Properties of lubricating oils– Viscosity, scosity Index, Flash point, Fire point, Cloud point, saponification number.
ilding materials- Portland Cement, constituents, Setting and Hardening of cement (with chemical ctions).

NIT V	NANOMATERIALS AND SUPERCONDUCTORS	9 hours

nomaterials: Introduction, classification (Material based), properties (Electrical, catalytic, magnetic, echanical, super conducting, optical) and applications of Nano materials (nano particles, nano tubes, no wires, nano composites, dendrimers); synthesis of Nanomaterials – Sol-gel process and ecipitation method.
per Conductors: Introduction, basic concept (BCS Theory), Classification Properties and plications.

ourse Outcomes:

t the end of the course, the students will be able to:
O1: Explain the estimation of impurities present in water like hardness, alkalinity and softening of npure water.
O2: Explain the working principles of batteries & demonstrate the corrosion prevention methods and actors affecting corrosion
O3: Explain the preparation, properties, and applications of thermoplastics, thermosetting, elastomers, onducting polymers & explain calorific values, octane number, refining of petroleum and cracking of ils.
O4: Explain the setting and hardening of cement, properties of composites and lubricants.
O5: Summarize the properties & applications of super conductors and nanomaterials.

Text Books:

1.	Jain and Jain, Engineering Chemistry, 16/e, DhanpatRai, 2013.
2.	Peter Atkins, Julio de Paula and James Keeler, Atkins' Physical Chemistry, 10/e,Oxford University Press, 2010.
3.	G V Subba Reddy, K N Jayaveera, C Ramachandraiah, Engineering Chemistry, McGraw-Hill;First Edition, 2019.

Reference Books:

1.	H.F.W. Taylor, Cement Chemistry, 2/e, Thomas Telford Publications, 1997.
2.	D.J. Shaw, Introduction to Colloids and Surface Chemistry, Butterworth-Heineman, 1992.
3.	Textbook of Polymer Science, Fred W. Billmayer Jr, 3rd Edition

Mode of Evaluation: Assignments, Mid Term Tests and End Semester Examination.

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DEPARTMENT OF CHEMISTRY

Chemistry Laboratory Experiments for CSE and allied branches

B. Tech I Year I & II Semester

25BACHELC03 CHEMISTRY LABORATORY
(For CSE & allied branches)

The minutes regarding the syllabus of course, **Chemistry Laboratory** as suggested by the BoS members is listed below:

- The program's course code is **25BACHELC03,** and it includes a total of **30 hours.**
- Incorporated the outcomes of the specified course.

CO1: Apply volumetric, colorimetric, conductometric, and spectroscopic techniques to determine physicochemical properties and composition of chemical systems.
CO2: Demonstrate the principles of molecular logic gates and their applications in bio-inspired computing through chemical and spectroscopic experiments.
CO3: Design and synthesize nanomaterials, conducting polymers, and biodegradable polymers, highlighting sustainable and green chemistry approaches.
CO4: Analyze kinetic parameters and quantitative data using modern computational tools such as regression models and molecular modelling software.
CO5: Integrate experimental chemistry with interdisciplinary applications in materials science, biopolymers, and biomolecular identification for real-world problem solving.

Following suggestions were given by BOS committee members

- Any one of the experiments can be chosen to perform between experiment no. 4 and 13.
- Similarly, any one of the experiments can be chosen to perform between experiment no. 2 and 3.
- Between experiment no. 15 and 16, anyone can be chosen for performing in the laboratory.

Following reference books were added to the syllabus

Reference Books:

1. Vogel's Textbook of Quantitative Chemical Analysis – J. Mendham, R.C. Denney, J.D. Barnes & M.J.K. Thomas, 6th Ed., Pearson Education, 2000.
2. Instrumental Methods of Chemical Analysis – B.K. Sharma, 23rd Ed., Goel Publishing House, 2007.
3. Molecular and Supramolecular Information Processing: From Molecular Switches to Logic Systems – Evgeny Katz (Ed.), Wiley-VCH, 2012.

B. Tech I Year I/II Semester

25BACHELC03 CHEMISTRY LABORATORY

		L	T	P	C
		0	0	2	1
Pre Requisites:	**NIL**				

Course Description:

This laboratory course provides practical training in classical volumetric and instrumental analytical techniques, alongside modern experimental approaches including nanomaterials synthesis, conducting and biodegradable polymers, spectroscopy, and molecular logic gates. Emphasis is placed on sustainable methodologies, quantitative data analysis, and applications of bio-inspired computing in chemical systems.

Course Objectives:

- To verify the fundamental concepts with experiments

List of Experiments:

From the following 17 experiments, students are required to perform any 10 using volumetric and/or instrumental methods of analysis. Wherever applicable, modeling software may also be used.

1. Preparation of a nanomaterial.
2. Demonstration of a two-input molecular AND logic gate based on two chemical inputs using spectroscopy
3. Demonstration of a three-input molecular AND logic gate based on three chemical inputs using spectroscopy
4. Determination of λ_{max} for molecules using UV-VISIBLE spectroscopy
5. Synthesis of polyaniline conducting polymer
6. Demonstration of a two-input molecular OR logic gate based on two chemical inputs
7. Estimation of ferrous ion by colorimetry
8. Demonstration of a two-input molecular AND logic gate based on two chemical inputs using titrimetry
9. Green synthesis of PVA/Starch biopolymer (biodegradable materials for sustainable tech)
10. Synthesis of PVA biopolymer
11. Estimation of Ascorbic acid
12. Demonstration of a two-input molecular NOT logic gate based on two chemical inputs
13. Verification of Beer-Lambert's Law
14. Determine reaction order and rate constant using MS-excel regression model
15. Conductometric titration of strong acid vs strong base
16. Conductometric titration of weak acid vs strong base
17. Determination of amino-acid sequence and ID of a protein from a DNA/protein input.

Course Outcomes:

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DEPARTMENT OF CHEMISTRY

Chemistry Laboratory Experiments for CE and ME branches

B. Tech I Year I & II Semester

25BACHELC01 ENGINEERING CHEMISTRY LABORATORY
(For CE,ME & EEE branches)

- The program's course code is **25BACHELC01,** and it includes a total of **30 hours**.
- Incorporated the outcomes of the specified course.

CO1: Demonstrate the ability to synthesize and characterize nanomaterials, conducting polymers, and biopolymers.

CO2: Accurately determine water quality parameters, including hardness, alkalinity, and dissolved oxygen, using standard laboratory methods.

CO3: Construct and analyze electrochemical cells, perform potentiometric and conductometric titrations, and evaluate redox potentials.

CO4: Apply analytical techniques for the quantitative estimation of industrially relevant materials such as cement, coal, and oils.

CO5: Implement green chemistry principles in laboratory experiments, including biopolymer synthesis and environmentally friendly deposition techniques.

Following suggestions were given by BOS committee members:

- Any ten out of sixteen experiments listed can be chosen to perform for regular laboratory.

Following reference books were added to the syllabus

1. Vogel's Textbook of Quantitative Chemical Analysis – J. Mendham, R.C. Denney, J.D. Barnes & M.J.K. Thomas, 6th Ed., Pearson Education, 2000.
2. Instrumental Methods of Chemical Analysis – B.K. Sharma, 23rd Ed., Goel Publishing House, 2007.
3. S. Choudhury, *Experiments in Nanomaterials, Electrochemistry and Green Chemistry*, Wiley, 2nd Edition, 2013.

B. Tech I Year I/II Semester

25BACHELC01 ENGINEERING CHEMISTRY LABORATORY

		L	T	P	C
		0	0	2	1
Pre Requisites:	NIL				

Course Description:

This laboratory course provides practical exposure to essential techniques in modern materials, water chemistry, electrochemistry, polymers, and green chemistry. Students will gain hands-on experience in synthesizing nanomaterials and biopolymers, analyzing water and industrial samples, performing electrochemical measurements, and applying analytical methods for real-world engineering applications.

Course Objectives:

1. **To develop** experimental skills in the synthesis and characterization of nanomaterials, conducting polymers, and biopolymers.
2. **To train** students in analytical techniques for water quality assessment, industrial material analysis, and electrochemical measurements.
3. **To promote** environmentally sustainable laboratory practices, including green synthesis and safe handling of chemical materials.

From the following 18 experiments, students are required to perform any 10 using volumetric and/or instrumental methods of analysis. Wherever applicable, modeling software may also be used.

List of Experiments:

1. Preparation of a nanomaterial by precipitation method
2. Determination of Hardness of a groundwater sample
3. Synthesis of polyaniline conducting polymer
4. Estimation of alkalinity of water sample
5. Construction of a Galvanic cell and determination of cell emf & free energy
6. Conductometric titration of strong acid vs strong base
7. Conductometric titration of weak acid vs strong base
8. Electroless deposition of copper from copper sulphate solution
9. Estimation of Dissolved Oxygen by Winkler's method
10. Determination of strength of an acid in Pb-Acid battery
11. Estimation of Calcium in Portland Cement
12. Determination of molecular weight of a polymer by using Ostwald's viscometer
13. Determination of percentage moisture content in a coal sample
14. Estimation of iron in cement by colorimetry
15. Green synthesis of PVA/Starch biopolymer
16. Synthesis of PVA biopolymer
17. Potentiometry - determination of redox potentials and emfs
18. Determination of Saponification value of an oil sample

Course Outcomes:
CO1: Demonstrate the ability to synthesize and characterize nanomaterials, conducting polymers, and biopolymers.
CO2: Accurately determine water quality parameters, including hardness, alkalinity, and dissolved oxygen, using standard laboratory methods.
CO3: Construct and analyze electrochemical cells, perform potentiometric and conductometric titrations, and evaluate redox potentials.
CO4: Apply analytical techniques for the quantitative estimation of industrially relevant materials such as cement, coal, and oils.
CO5: Implement green chemistry principles in laboratory experiments, including biopolymer synthesis and environmentally friendly deposition techniques.

Reference Books:	
.	Vogel's Textbook of Quantitative Chemical Analysis – J. Mendham, R.C. Denney, J.D. Barnes & M.J.K. Thomas, 6th Ed., Pearson Education, 2000.
.	Instrumental Methods of Chemical Analysis – B.K. Sharma, 23rd Ed., Goel Publishing House, 2007.
.	S. Choudhury, *Experiments in Nanomaterials, Electrochemistry and Green Chemistry*, Wiley, 2nd Edition, 2013.
Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination	

MADANAPALLE INSTITUTE OF TECHNOLOGY & SCIENCE
(DEEMED TO BE UNIVERSITY)
Declared under section 3 of UGC Act, 1956 by Govt. of India - MoE

DEPARTMENT OF CHEMISTRY

Chemistry Laboratory Experiments for ECE

B. Tech I Year I & II Semester

25BACHELC02 APPLIED CHEMISTRY LABORATORY
(For ECE branch)

- The program's course code is **25BACHELC02,** and it includes a total of **30 hours**.
- Incorporated the outcomes of the specified course.

CO1: Demonstrate the ability to synthesize and characterize nanomaterials, conducting polymers, and ferroelectric/perovskite materials.

CO2: Analyze electrochemical cells, measure conductivity, and determine redox potentials with precision.

CO3: Apply spectrophotometric and colorimetric methods for the quantitative estimation of ions and reaction kinetics.

CO4: Evaluate photocatalytic and electrocatalytic properties of materials for energy and environmental applications.

CO5: Implement green chemistry principles in laboratory experiments, including biopolymer synthesis and metal recovery from e-waste.

Following suggestions were given by BOS committee members

- Any ten out of eighteen experiments listed can be chosen to perform for regular laboratory.

Following reference books were added to the syllabus

Reference Books:

Vogel's Textbook of Quantitative Chemical Analysis – J. Mendham, R.C. Denney, J.D. Barnes & M.J.K. Thomas, 6th Ed., Pearson Education, 2000.

Instrumental Methods of Chemical Analysis – B.K. Sharma, 23rd Ed., Goel Publishing House, 2007.

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Mode of Evaluation: Continuous Internal Evaluation and End Semester Examination

B. Tech I Year I/II Semester

25BACHELC02 APPLIED CHEMISTRY LABORATORY

		L	T	P	C
		0	0	2	1
Pre Requisites:	NIL				

Course Description:

This laboratory course provides hands-on experience in modern materials, electrochemistry, and green chemistry techniques. Students will synthesize and characterize nanomaterials, conducting and ferroelectric polymers, study electrochemical and photochemical processes, and apply analytical methods to real-world problems including e-waste and energy devices.

Course Objectives:

- **To develop** practical skills in the synthesis and characterization of nanomaterials, conducting polymers, and ferroelectric/photovoltaic materials.
- **To familiarize** students with electrochemical and spectrophotometric techniques for quantitative and qualitative analysis.
- **To promote** sustainable laboratory practices, including green chemistry approaches and recovery of metals from e-waste.

From the following 16 experiments, students are required to perform any 10 using volumetric and/or instrumental methods of analysis. Wherever applicable, modeling software may also be used.

List of Experiments:

1. Preparation of a nanomaterial
2. Determination of Cell constant and Conductance of solutions
3. Potentiometry - determination of redox potentials and emfs
4. Photocatalytic dye-degradation using nanomaterial
5. Synthesis of polyaniline conducting polymer
6. Construction of a Galvanic cell for determination of cell emf and free energy
7. Estimation of ferrous ion by colorimetry
8. Conductometric titration of strong acid vs strong base
9. Conductometric titration of weak acid vs strong base
10. Determination of strength of acid in Pb-acid battery
11. Verification of Beer-Lambert's Law
12. Synthesis of ferroelectric $BiFeO_3$ (BFO) by coprecipitation method
13. Preparation of perovskite material for solar cell application
14. Determination of reaction order and rate constant using MS-excel regression model
15. Colorimetric estimation of cupric ion from e-waste
16. Green synthesis of PVA/starch biopolymer

Course Outcomes:

CO1: Demonstrate the ability to synthesize and characterize nanomaterials, conducting polymers, and ferroelectric/perovskite materials.
CO2: Analyze electrochemical cells, measure conductivity, and determine redox potentials with precision.
CO3: Apply spectrophotometric and colorimetric methods for the quantitative estimation of ions and reaction kinetics.
CO4: Evaluate photocatalytic and electrocatalytic properties of materials for energy and environmental applications.
CO5: Implement green chemistry principles in laboratory experiments, including biopolymer synthesis and metal recovery from e-waste.

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DEPARTMENT OF CHEMISTRY

Signature of Members

Chairman:

1) Dr. Renjith Bhaskaran, Assistant Professor and Head

External Members:

1. Dr. Debapratim Das, Professor, Department of Chemistry, IIT Guwahati Approved through email
2. Dr. Aditi Agarwal, Principal Consultant- Agrochemical/Life Sciences, Infosys Approved through email

Internal Members:

1. Dr. Renjith Bhaskaran, Assistant Professor
2. Dr. Gajanan Kunde, Associate Professor
3. Dr. K. Chandra Mohan, Associate Professor
4. Dr. P. Amaladass, Assistant Professor
5. Dr. Rahul Pal, Assistant Professor
6. Dr. Abhijit Bijanu, Assistant Professor

Outlook

Re: Request for Approval – Minutes of Meeting & Finalized R25 Syllabi

From Aditi Agarwal <aditiagbansal@gmail.com>
Date Tue 02-Sep-25 9:08 AM
To HoD-Chemistry Department <chemistryhod@mits.ac.in>

Dear Sir,

I approve the minutes of the meeting and the finalized syllabus.
Thank you for providing the opportunity.

Best wishes.
Aditi Agarwal, Ph.D.
9910214685
aditiagbansal@gmail.com

On Mon, Sep 1, 2025 at 10:37 AM HoD-Chemistry Department <chemistryh
Dear Madam,

I kindly request your approval for the Minutes of Meeting and the finali
herewith. Your approval email will be considered as your signature for

Best regards,

Dr. Renjith Bhaskaran,
Assistant Professor & Head
Department of Chemistry,
Madanapalle Institute of Technology & Science,
Madanapalle, Andhra Pradesh – 517325.
Mobile: +91 9160020737
https://mits.ac.in/facultyprofile/377
लोकाः समस्ताः सुखिनो भवन्तु॥

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