BIRLA INSTITUTE OF TECHNOLOGY

NEP-2020 CURRICULUM BOOK

(Effective from Academic Session: Monsoon 2024)

Bachelor of Technology

DEPARTMENT OF _____

INSTITUTE VISION

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INSTITUTE MISSION

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DEPARTMENT VISION

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DEPARTMENT MISSION

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PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

1. **Basic Knowledge**
   Students will learn the basic concepts of chemistry like bonding, reactions, spectroscopy, and electrochemistry that are needed in science and engineering.
2. **Problem-Solving Skills**
   Students will be able to handle practical chemistry challenges, understand how reactions occur in real situations, and explain the results clearly.
3. **Practical Application**
   Students will use their chemistry knowledge in industry, technology, and real-life situations, especially for sustainable development.
4. **Lifelong Learning**
   Students will develop curiosity to keep learning, do research, and stay updated with new scientific and technological changes.
5. **Professional Values**
   Students will follow safety, ethics, and environmental responsibility while working alone or in teams in academic, industrial, or research settings.

PROGRAMME OUTCOMES (POs)

PO1: Chemistry Knowledge
Apply concepts of chemistry, mathematics, and allied sciences (bonding, stereochemistry, kinetics, spectroscopy, electrochemistry) to explain and solve problems in engineering and real-life applications.

PO2: Problem Analysis
Identify, formulate, and analyze chemical reactions, mechanisms, and equilibrium processes using scientific principles and laboratory results to draw valid conclusions.

PO3: Design/Development of Solutions
Design and optimize chemical processes, experimental procedures, and material applications considering safety, cost, health, and environmental aspects.

PO4: Conduct Investigations of Complex Problems
Plan and carry out laboratory experiments in kinetics, spectroscopy, and electrochemistry; collect and analyze data systematically to obtain meaningful scientific interpretations.

PO5: Modern Tool Usage
Use modern analytical instruments (UV-Vis, IR, NMR, potentiometry, conductometry) and computational tools effectively to solve chemical and engineering problems.

PO6: The Chemist and Society
Evaluate the impact of chemistry on health, safety, environment, and sustainability, while applying chemical knowledge responsibly to societal needs.

PO7: Ethics
Demonstrate ethical behavior in handling chemicals, reporting data honestly, and following environmental and safety regulations in laboratory and industrial practices.

PO8: Individual and Team Work
Work effectively as an individual researcher as well as part of a laboratory or multidisciplinary team to solve chemistry-related problems.

PO9: Communication
Communicate effectively on chemical topics by writing lab reports, preparing project documentation, making presentations, and explaining scientific concepts clearly.

PO10: Project Management and Finance
Apply knowledge of project management and resource handling in laboratory or industrial settings, understanding cost, sustainability, and safety aspects of chemical processes.

PO11: Life-long Learning
Recognize the importance of continuous learning in chemistry and related sciences, adapting to new research, tools, and technologies throughout professional life.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1: Fundamental Knowledge in Chemistry
Students will be able to understand and apply theoretical concepts of bonding, stereochemistry, kinetics, spectroscopy, and electrochemistry to explain scientific principles and solve academic problems.

2: Analytical and Problem-Solving Skills
Students will develop the ability to analyze chemical structures, reaction mechanisms, and thermodynamic/phase equilibrium concepts to provide logical solutions in chemistry and related fields.

3: Chemistry for Society and Sustainability
Students will connect theoretical chemical knowledge with industrial, environmental, and societal contexts, promoting sustainable development and ethical responsibility.

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Mapping of Pos and PSOs with PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	3	2	2	1	2
PO2	2	3	2	1	2
PO3	2	2	3	2	2
PO4	2	2	2	3	2
PO5	1	2	3	3	2
PO6	1	2	2	2	3
PO7	0	1	1	2	3
PO8	1	2	2	2	2
PO9	2	2	2	2	2
PO10	1	1	2	2	2

PO11	3	3	3	3	2
PSO1	3	2	3	2	2
PSO2	2	3	3	3	2
PSO3	2	2	3	3	3

Grading: No correlation –0, Low correlation - 1, Moderate correlation – 2, High Correlation - 3

Program Course Structure

Birla Institute of Technology, Mesra, Ranchi **Course Structure for B.Tech. (Electronics and Communication Engineering)** **Based on NEP-2020, CBCS and OBE, Effective from 2024-2025**								
Sr. No.	**Semester of Study (Recommended)**	**Category of Course**	**Course Code**	**Subjects**	**Mode of Delivery & Credits** *L-Lecture; T-Tutorial; P-Practical*			**Total Credits**
					L (*Periods/ Week*)	**T** (*Periods/ Week*)	**P** (*Periods/ Week*)	
	FIRST	**THEORY**						
I.1		FS	MA24101	Mathematics - I	3	1	0	4
I.2			CH24101	Chemistry	3	1	0	4
		GE	EC24101	Basic Electronics	2	1	0	3
I.4			ME24101	Basics of Mechanical Engineering	2	1	0	3
I.5		FS	CE24101	Environmental Sciences	2	0	0	2
		LABORATORIES						
I.6		FS	CH24102	Chemistry Lab	0	0	2	1
I.7		GE	EC24102	Basic Electronics Lab	0	0	2	1
I.8			ME24102	Engineering Graphics	0	0	4	2
I.9			PE24102	Workshop Practice	0	0	2	1
I.10		MC	MC24 101/ 102 /103/ 104/105	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA) /Entrepreneurship	0	0	2	1
TOTAL (Theory + Labs)								**22**
	SECOND	THEORY						
II.1		FS	MA24103	Mathematics - II	3	1	0	4
II.2			PH24101	Physics	3	1	0	4
			BE24101	Biological Sciences for Engineers	2	0	0	2
II.4		GE	CS24101	Programming for Problem Solving	3	1	0	4

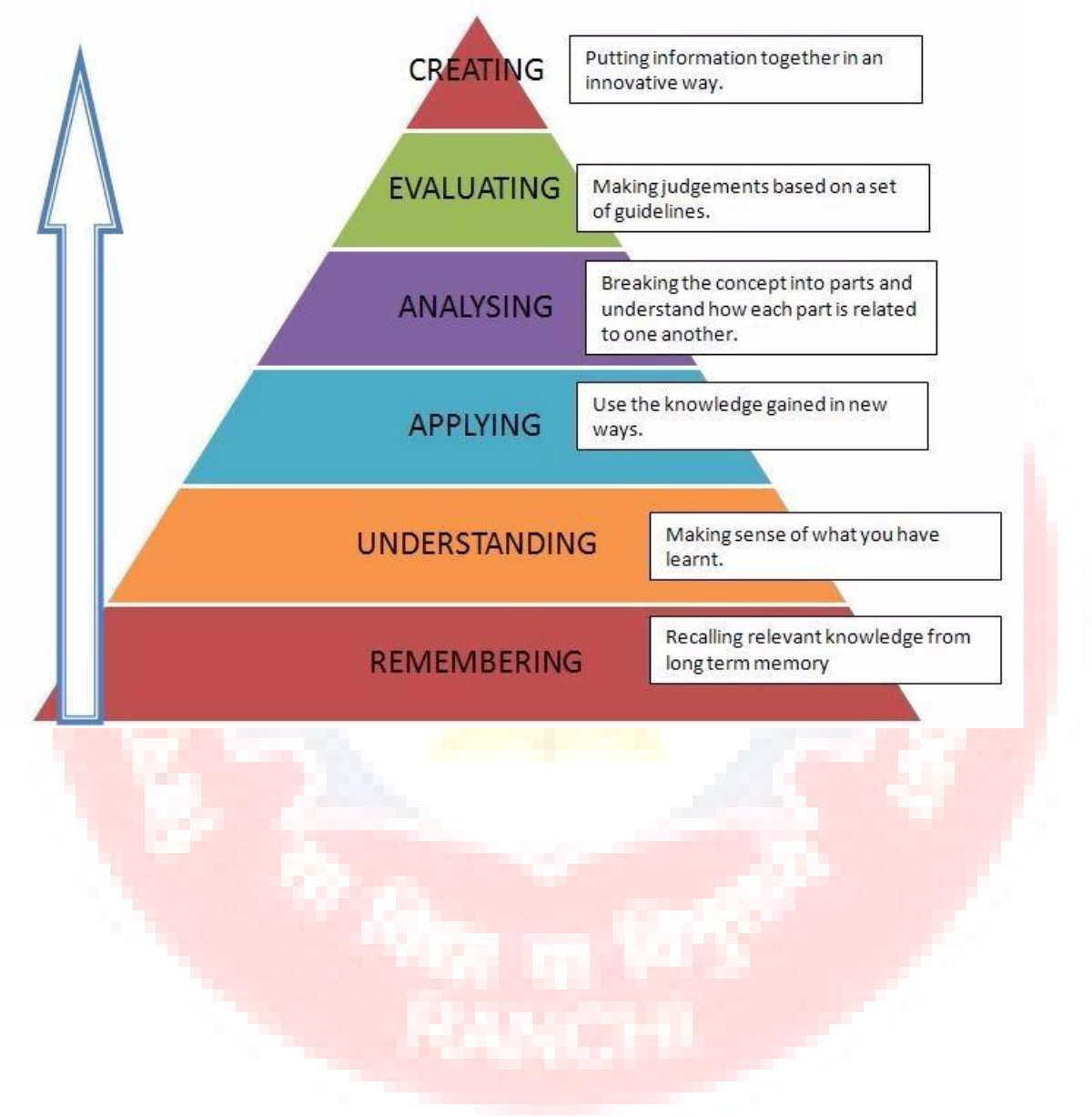
II.5			EE24101	Basics of Electrical Engineering	2	1	0	3
		LABORATORIES						
II.6		FS	PH24102	Physics Lab	0	0	2	1
II.7		GE	CS24102	Programming for problem Solving Lab.	0	0	2	1
II.8			EE24102	Electrical Engineering Lab.	0	0	2	1
I.9		HSS	HS24131	Communication Skill - I	0	0	3	1.5
I.10		MC	MC24 106 /107/108/109/110	Choice of : NCC/NSS/ PT & Games/ Creative Arts (CA) /Entrepreneurship	0	0	2	1
TOTAL (Theory + Labs)								**22.5**
GRAND TOTAL FOR FIRST YEAR								**44.5**
Vocational Courses for Exit after 1st Year								
Vocational Course I: Course Code. Course Name					**1**	**0**	**4**	**3**
Vocational Course II: Course Code. Course Name					**1**	**0**	**4**	**3**
	THIRD	THEORY						
III.1		PC	EC24201	Electronic Devices	3	1	0	4
III.2			EC24203	Digital System Design	3	0	0	3
III.3			EC24205	Network Theory	3	1	0	4
III.4			EC24207	Signals and Systems	3	0	0	3
III.5			EC24209	Probability and Random Processes	3	0	0	3
III.6		HSS	MT24131	UHV-II: Understanding Harmony	3	0	0	3
		LABORATORIES						
III.7		PC	EC24202	Electronic Devices Lab	0	0	2	1
III.8		PC	EC24204	Digital System Design Lab	0	0	2	1
III.9		MC	MC24 201/202/ 203/204 / 205	Choice of: NCC/NSS/ PT & Games/ Creative Arts (CA) / Entrepreneurship	0	0	2	1
	TOTAL (Theory + Labs)							**23**
	FOURTH	THEORY						
IV.1		PC	EC24251	Analog Circuits	3	1	0	4
IV.2			EC24253	Analog Communication	3	1	0	4
IV.3			EC24255	Computer Architecture	3	0	0	3
IV.4			EC24257	VLSI Design	3	1	0	4
IV.5		PE	XX24XXX / MO24201	Open Elective - I / MOOC - I	3	0	0	3
IV.6			HS24211	Indian Knowledge System	2	0	0	0
		LABORATORIES						
IV.8		PC	EC24252	Analog Circuits Lab	0	0	2	1
IV.9		PC	EC24258	VLSI Design Lab	0	0	2	1
IV.11		MC	MC24 206/ 207/208 / 209/ 210	Choice of: NCC/NSS/ PT & Games/ Creative Arts (CA) / Entrepreneurship	0	0	2	1
TOTAL (Theory + Labs)								**21**
GRAND TOTAL FOR SECOND YEAR								**44**
Vocational Course III: Course Code. Course Name					**1**	**0**	**4**	**3**
Vocational Course IV: Course Code. Course Name					**1**	**0**	**4**	**3**

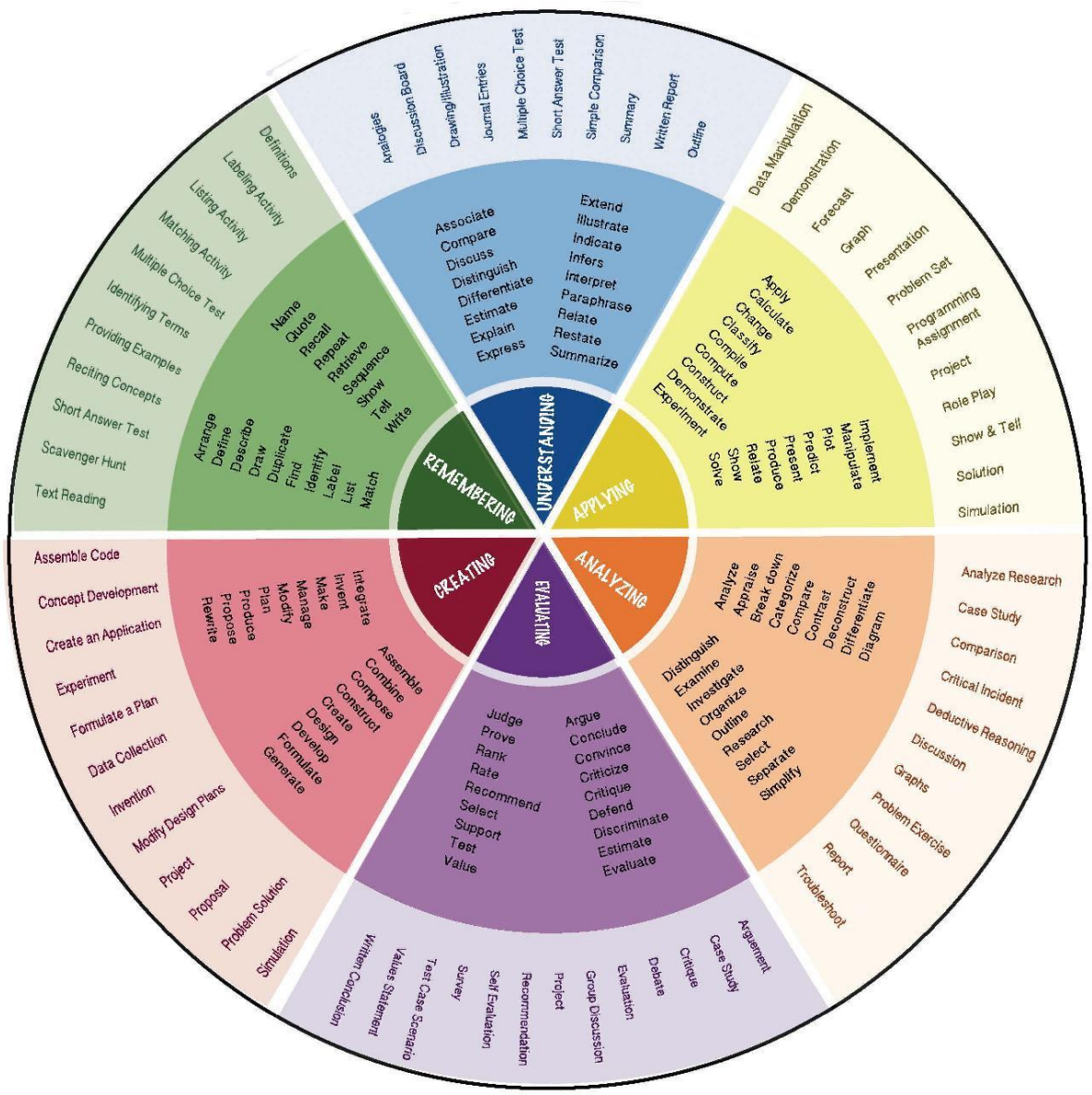
	FIFTH	THEORY						
V.1		PC	EC24301	Electromagnetic Fields and Waves	3	1	0	4
V.2		PC	EC24303	Digital Communication	3	0	0	3
V.3		PC	EC24305	Microprocessors	3	0	0	3
V.4		PC	EC24307	Data Communication and Computer Networking	3	1	0	4
V.5		PE	EC24XXX	Program Elective-I (PE-I)	3	0	0	3
		OE	XX24XXX /MO24301	Open Elective - II / MOOC - II	3	0	0	3
		LABORATORIES						
V.7		PC	EC24304	Communication System Lab	0	0	2	1
V.8		PC	EC24306	Microprocessors Lab	0	0	2	1
V.9		PC	EC24300	Project - I				2
TOTAL (Theory + Labs)								**24**
	SIXTH	THEORY						
VI.1		PC	EC24351	Digital Signal Processing	3	1	0	4
VI.2		PC	EC24353	Control Systems	3	1	0	4
VI.3		PC	EC24355	Embedded Systems	3	0	0	3
VI.4		PE	EC24XXX	Program Elective-II (PE-II)	3	0	0	3
VI.5		OE	XX24XXX / MO24303	Open Elective - III / MOOC - III	3	0	0	3
		HSS	MT24204	Constitution of India	2	0	0	0
		LABORATORIES						
VI.6		PC	EC24352	Digital Signal Processing Lab	0	0	2	1
VI.7		PC	EC24356	Embedded Systems Lab	0	0	2	1
		PE	EC243XXX	Program Elective-II Lab	0	0	2	1
		PC	EC24350	Project - II				2
VI.8		HSS	HS24133	Communication Skill - II	0	0	3	1.5
TOTAL (Theory + Labs)								**23.5**
GRAND TOTAL FOR THIRD YEAR								**47.5**
	SEVENTH	THEORY						
VII.1		PC	EC24401	Microwave Theory and Techniques	3	1	0	4
VII.2		PE	EC24XXX	Program Elective-III (PE-III)	3	0	0	3
VII.3		PE	EC24XXX	Program Elective-IV (PE-IV)	3	0	0	3
		PE	EC24XXX	Program Elective-V (PE-V)	3	0	0	3
		OE	XX24XXX / MO24401	Open Elective - IV / MOOC - IV	3	0	0	3
		LABORATORIES						
VII.6		PC	EC24402	Microwave Lab	0	0	2	1
VII.7		MC	MC24400	Summer Training (Minimum Four Weeks / 160 Hrs)				4
VII.8		PC	EC24400	Project - III				3
TOTAL (Theory + Labs)								**24**

VIII.1	EIGHTH	PC	EC24450/ EC24490	Project-IV / Industry Internship				6
VIII.2			EC24498	Comprehensive Viva				2
	TOTAL (Theory + Labs)							**8**
GRAND TOTAL FOR FOURTH YEAR								**32**
GRAND TOTAL FOR B.TECH.								**168**

BLOOM'S TAXONOMY FOR CURRICULUM DESIGN AND ASSESSMENT:

Preamble
The design of curriculum and assessment is based on Bloom's Taxonomy. A comprehensive guideline for using Bloom's Taxonomy is given below for reference.





Bloom's Taxonomy is used to formulate questions. It facilitates the formulation of action verbs in connection with the various tiers of thinking to achieve a balance between basic retrieval and more complex abilities. Questions at the Remember level, e.g., may use verbs to define or list, questions at the Understand level may use verbs to explain or summarize, at the Apply level use or demonstrate, at the Analyze level differentiate or compare, at the Evaluate level justify or critique, and then at the Create level design or formulate.

COURSE INFORMATION SHEET

Course Code: CH24101
Course Title:Chemistry
Pre-requisite(s): Intermediate level Chemistry
Co- requisite(s):XXXXXXXXX
Credits: 4 L: 3 T: 1 P: 0
Class schedule per week: 4
Class: B.Tech.
Semester / Level: I
Branch: All
Name of Teacher:

COURSE OBJECTIVES

This course envisions to impart to students:

1.	To create concept of chemical bonding in coordination chemistry
2.	To understand the basics of stereochemistry, aromaticity and reaction mechanism of organic molecules
3.	To understand the reaction dynamics and to know different types of catalysis
4.	To apprehend the basic principles and the application of vibrational, electronic and NMR spectroscopy
5.	To develop knowledge on the physical state and electrochemistry of molecules

COURSE OUTCOMES (COs) (3 COs to 6 COs depending upon the course)

After the completion of this course, students will be able to:

CO1	Able to explain the bonding in a coordination complex
CO2	Able to explain the 3D structure, aromaticity and stereochemistry of organic molecules
CO3	Able to predict the rate, molecularity and mechanism of a simple as well as catalytic reaction
CO4	Able to explain the UV-vis, IR and NMR spectra of unknown molecules
CO5	Able to interpret the phase diagram of simple one and two component heterogeneous systems in equilibrium and the electrochemical behavior of the molecules

SYLLABUS

MODULE	(NO. OF LECTURE HOURS)
Module – I: Bonding in Coordination Complex Introduction to Chemical Bonding, Werner's Theory, Bonding in coordination complexes, Crystal Field Theory, Octahedral, Tetrahedral and Square planar complexes, CFSE, Jahn Teller theorem, Spectral, electronic and magnetic properties of coordination complexes.	8
Module – II: Organic Structure and Reactivity Aromaticity, Geometrical isomerism: cis–trans, E/Z, and syn-anti isomerism; Optical isomerism & Chirality; Wedge, Fischer, Newmann and Sawhorse projection formulae and interconversions; D/L, R/S nomenclature system; Conformational studies of n-butane. Addition, Elimination, Substitution and Rearrangement reaction.	8
Module – III: Kinetics and Catalysis Kinetics of Chain, Parallel/Competing/Side, Consecutive reactions; Fast reactions; Outline of Catalysis, Acid-base catalysis, Enzyme catalysis (Michaelis-Menten equation), Important catalysts in industrial processes: Hydrogenation using Wilkinsons catalyst, Phase transfer catalyst.	8
Module – IV: Spectroscopic Techniques Absorption Spectroscopy, Lambert-Beers law, Principles and applications of UV-Visible spectroscopy, Principles and applications of Vibrational spectroscopy; Introduction of NMR spectroscopy.	8
Module – V: Phase and Chemical equilibrium Phase rule: terms involved, Phase diagram of one component (Water) & two component (Pb/Ag) system & their applications; Gibbs Free energy, Van't Hoff equation and Chemical Equilibrium; Nernst Equation, Standard electrode potential, EMF measurement and its application, Batteries and Fuel Cells.	8

TEXTBOOKS:

1. Huheey, J. E., Inorganic Chemistry: Principles of Structure and Reactivity, 4 th edition, Pearson.
2. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Seventh Edition, Pearson
3. Atkins, P. W. & Paula, J. Physical Chemistry, 10th Ed., Oxford University Press, 2014.

REFERENCE BOOKS:

1. Lee, J. D. Concise Inorganic Chemistry ELBS, 1991.
2. Mortimer, R. G. Physical Chemistry 3rd Ed., Elsevier (2009).
3. William Kemp, Organic Spectroscopy, 3 rd Ed., 2008 Macmillan.

GAPS IN THE SYLLABUS (TO MEET INDUSTRY/PROFESSION REQUIREMENTS)

Limited exposure to computational tools, industrial case studies, and skill-based training needed for industry readiness.

POS MET THROUGH GAPS IN THE SYLLABUS

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN

POS MET THROUGH TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

DIRECT ASSESSMENT

Assessment Tool	% Contribution during CO Assessment
Mid Sem Examination	25
End Sem Examination	50
Quiz	10
Assignment	10
Teacher's assessment	05

Continuous Internal Assessment	% Distribution
Mid Sem Examination	50
Quiz and assignment	40
Teacher's assessment	**10**

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	Y	Y	Y	Y	
Semester End Examination	Y	Y	Y	Y	Y

INDIRECT ASSESSMENT

1. Student Feedback onCourse Outcome

COURSE DELIVERY METHODS

CD1	Lectures by use of boards/LCD projectors/OHP projectors
CD2	Tutorials/Assignments
CD3	Self- learning such as use of NPTEL materials and internets
CD4	Seminars
CD5	Laboratory experiments/teaching aids
CD6	Industrial/guest lectures
CD7	Industrial visits/in-plant training

MAPPING BETWEEN COURSE OUTCOMES AND POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	1	1	0	0	0	0	1	0	2			
CO2	3	3	2	1	0	0	0	0	1	0	2			
CO3	3	3	3	2	1	1	0	0	1	0	3			
CO4	3	2	1	3	3	0	0	0	2	0	2			
CO5	3	3	2	2	1	2	0	0	1	0	3			

Grading: No correlation – 0, Low correlation - 1, Moderate correlation – 2, High Correlation - 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3

CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3
CO5	CD1, CD2, CD3

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEO1 – Strong Foundation
Develop a solid base in chemistry, mathematics, and engineering fundamentals, enabling the understanding and solution of scientific and engineering problems effectively.

PEO2 – Problem Solving & Research
Enhance analytical and research skills through laboratory experiments such as titrations, kinetics, spectroscopy, and synthesis to arrive at innovative and sustainable solutions.

PEO3 – Professional Ethics
Practice safe laboratory methods, handle chemicals responsibly, and use modern tools and techniques ethically while considering sustainability and environmental protection.

PEO4 – Communication & Teamwork
Work both independently and collaboratively in teams, prepare clear reports, analyze data, and communicate results effectively in written and oral forms.

PEO5 – Lifelong Learning
Recognize the importance of continuous learning, adapt to new chemical technologies, and apply critical thinking to address emerging challenges in research, industry, and society.

PROGRAMME OUTCOMES (POs)

Chemistry Laboratory Experiments Mapped to Program Outcomes (POs)

PO1 – Engineering Knowledge
Apply knowledge of chemistry, mathematics, natural sciences, computing, and engineering fundamentals to solve analytical and experimental problems in gravimetric analysis, titrations, kinetics, spectroscopy, and synthesis.

PO2 – Problem Analysis
Identify, formulate, and analyze chemical and environmental problems such as water hardness, acid strength, kinetics of hydrolysis, and eutectic behavior using systematic experimental approaches.

PO3 – Design/Development of Solutions
Design and develop experimental methodologies for chemical synthesis (e.g., diazoamino benzene), separation of organic mixtures, and solution preparation, considering safety, sustainability, and efficiency.

PO4 – Conduct Investigations of Complex Problems
Plan and conduct investigations through gravimetric estimation, potentiometric/pH-metric

titrations, kinetics, and spectroscopic analysis; interpret experimental data to provide valid conclusions.

PO5 – Engineering Tool Usage
Utilize modern chemical instruments such as spectrophotometers, potentiometers, pH meters, FTIR, and NMR for analysis, while recognizing their scope and limitations.

PO6 – The Engineer and The World
Analyze the societal and environmental aspects of chemical problems, such as water quality (hardness), solvent use in organic separation, and safe disposal of chemical wastes, for sustainable practices.

PO7 – Ethics
Apply ethical principles in chemical experimentation, ensuring accurate reporting of data, responsible handling of reagents, safety compliance, and respect for human and environmental values.

PO8 – Individual and Team Work
Perform experiments independently and collaboratively in groups, developing teamwork and leadership skills in the laboratory setting.

PO9 – Communication
Document experimental procedures, record observations, prepare accurate lab reports, construct graphs, and present results effectively with clarity and scientific rigor.

PO10 – Project Management and Finance
Apply principles of resource management, time management, and cost-effectiveness in synthesis, separation, and quantitative estimations during laboratory experiments.

PO11 – Life-long Learning
Recognize the importance of continuous learning in chemistry by adapting to emerging tools, techniques, and technologies (e.g., advanced spectroscopy, green chemistry), and developing critical thinking for future research challenges.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

1. .
2. .
3. .

Mapping of Pos and PSOs with PEOs

	PEO1	PEO2	PEO3	PEO4	PEO5
PO1	3	2	1	1	2
PO2	2	3	1	1	2
PO3	2	2	3	1	1
PO4	2	3	2	1	2
PO5	2	2	2	1	2
PO6	1	2	2	1	2
PO6	1	1	3	1	1
PO7	1	1	1	3	1
PO8	1	1	1	3	1
PO9	1	1	2	2	1
PO10	1	2	1	1	3
PO11	3	2	1	1	2
PSO1					
PSO2					
PSO3					

Grading: No correlation –0, Low correlation - 1, Moderate correlation – 2, High Correlation - 3

COURSE INFORMATION SHEET

Course Code: CH24102
Course Title: Chemistry Lab
Pre-requisite(s): Intermediate level Chemistry
Co- requisite(s):
Credits: 1 L: 0 T: 0 P: 2
Class schedule per week: 2
Class: B.Tech.
Semester / Level: I
Branch: All
Name of Teacher:

COURSE OBJECTIVES

This course enables the students to:

1.	To gain an understanding of the synthesis of organic and inorganic compounds.	
2.	To interpret and analyze spectroscopic data effectively.	
3.	To develop a strong concept of potentiometric and pH-metric titrations of acids and bases.	
4.	To understand and calculate the rate constant of chemical reactions.	
5.	To acquire knowledge of determining melting points and estimating eutectic and transition temperatures.	

COURSE OUTCOMES (COs)

After the completion of this course, students will be able to:

CO1	Able to perform the synthesis of organic and inorganic compounds.
CO2	Able to interpret and analyze spectroscopic data.
CO3	Able to carry out potentiometric and pH-metric titrations of acids and bases.
CO4	Able to determine the rate constant of chemical reactions.
CO5	Able to measure melting points and estimate eutectic and transition temperatures.

SYLLABUS (List of experiments)

1. Gravimetric estimation of Nickel using Dimethylglyoxime.

2. Determination of total Hardness of a given water Sample (Complexometric Titration).

3. Verification of Beer's Law using Fe^{3+} solution by spectrophotometer/colorimeter, and determination of the concentration of an unknown Fe^{3+} solution.

4. Preparation of Diazoamino Benzene and reporting of its melting point and yield.

5. Construction of a melting point–mass percent composition diagram for a two-component mixture and determination of its eutectic temperature.

6. Study of the kinetics of acid-catalyzed hydrolysis of ethyl acetate and evaluation of the rate constant.

7. Determination of the strength of a strong acid using potentiometric titration with a strong base.

8. Determination of the transition temperature of a given salt hydrate.

9. Separation of binary organic mixture by acid-base extraction and analysis using given FTIR and NMR spectrum.

10. Construction of a pH-titration curve for a strong acid versus a strong base

REFERENCE MATERIALS:

1. https://bitmesra.ac.in/edudepartment/content/1/140/553 (link of Lab Manual)
2. **Experimental Physical Chemistry** – B. Viswanathan, P. S. Raghavan, Narosa Publishing House (1997).
3. **Vogel's Textbook of Practical Organic Chemistry**
4. **Experiments in General Chemistry** – C. N. R. Rao, U. C. Agarwal.
5. **Experimental Organic Chemistry, Vol. 1 & 2** – P. R. Singh, D. S. Gupta, K. S. Bajpai, Tata McGraw-Hill

GAPS IN THE SYLLABUS (TO MEET INDUSTRY/PROFESSION REQUIREMENTS)

POS MET THROUGH GAPS IN THE SYLLABUS

TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN

POS MET THROUGH TOPICS BEYOND SYLLABUS/ADVANCED TOPICS/DESIGN

COURSE OUTCOME (CO) ATTAINMENT ASSESSMENT TOOLS & EVALUATION PROCEDURE

DIRECT ASSESSMENT

Assessment Tool	% Contribution during CO Assessment
Lab Journal	30
Lab quizes	20
Progressive viva	20
End Sem Examination	30

Continuous Internal Assessment	% Distribution
Lab Journal	30
Lab quiz	10
Progressive viva	20

Assessment Components	CO1	CO2	CO3	CO4	CO5
Continuous Internal Assessment	Y	Y	Y	Y	Y
Semester End Examination	Y	Y	Y	Y	Y

INDIRECT ASSESSMENT

1. Student Feedback onCourse Outcome

COURSE DELIVERY METHODS

CD1	Introductory lecture by use of boards/LCD projectors
CD2	Laboratory experiments/ teaching aid
CD3	Self- learning such as use of NPTEL materials and internets
CD4	Seminars (discussion of experimental results and error analysis).
CD5	Group discussions/problem-solving sessions (to analyze experimental data and calculations).
CD6	Industrial/guest lectures (applications of chemical analysis techniques in industry).
CD7	Industrial visits (exposure to real chemical laboratories and processes).

MAPPING BETWEEN COURSE OUTCOMES AND POs and PSOs

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	2	3	2	2	2	3	1	1	2	2			
CO2	3	2	2	3	3	2	1	1	3	2	3			
CO3	3	3	1	3	3	1	2	1	2	2	2			
CO4	3	3	1	3	2	1	1	1	1	2	3			
CO5	3	2	1	2	2	2	1	1	1	1	3			

Grading: No correlation – 0, Low correlation - 1, Moderate correlation – 2, High Correlation - 3

MAPPING BETWEEN COURSE OUTCOMES AND COURSE DELIVERY METHOD

Course Outcomes	Course Delivery Method
CO1	CD1, CD2, CD3
CO2	CD1, CD2, CD3
CO3	CD1, CD2, CD3
CO4	CD1, CD2, CD3
CO5	CD1, CD2, CD3