



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

215

UNDERGRADUATE (UG) PROGRAMME OUTCOMES (POs)

Undergraduate (B.A., B.Sc., B.Com., B.C.A., B.B.A., etc.,) is a 3 year degree programme with 6 semesters consisting the following Programme Outcomes (POs) under various criteria including critical thinking, problem solving, effective communication, societal/ citizenship/ ethical credibility, sustainable growth and employable abilities.

PO 1	Critical Thinking: Intellectual exploration of knowledge towards actions in clear and rational manner by understanding the logical connections between ideas and decisions.
PO 2	Problem Solving: Understanding the task/ problem followed by planning and narrow execution strategy that effectively provides the solution.
PO 3	Effective Communication: Knowledge dissemination by oral and verbal mechanisms to the various components of our society.
PO 4	Societal/ Citizenship/ Ethical Credibility: Realization of various value systems/ moral dimensions and demonstrate the empathetic social concern as well as equity in all the decisions, executions and actions.
PO 5	Environmental Concern and Sustainable Growth: Understanding the emerging environmental challenges and provide the possible contribution in sustainable development that integrates environment, economy and employment.
PO 6	Skill Development and Employable Abilities: Adequate training in relevant skill sector and creating employable abilities among the under graduates.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

On completion of **B.Sc. Chemistry Programme**, the students are expected to

PSO 1	get a firm foundation in the fundamentals and applications of chemical and scientific theories including environmental and biological aspects in chemistry.
PSO 2	make use of experiments by demonstration with the help of analytical instruments and analyze the outcomes.
PSO 3	develop skills in problem solving, critical thinking and analytical reasoning as applied to chemistry related problems.
PSO 4	find the solution for the ethical, historic, philosophical, economical and environmental dimensions of problems and issues facing chemists.
PSO 5	pursue post graduate program in higher educational institutions and also to get suitable employment opportunities in industries and academic institutions.



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216

B.SC CHEMISTRY COURSE STRUCTURE SEMESTER – I

S. No.	Sub. Code	Subject Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UACT11	Part – I: Tamil – கவிதையும் சிறுகதையும்	6	3	25	75	100	3
	21UACH11	Hindi – Hindi – I						
	21UACS11	Sanskrit – Sanskrit – I						
2.	21UACE11	Part – II: English – English For Enrichment – I	6	3	25	75	100	3
3.	21UCYC11	Part – III: Core – 1 T: General Chemistry – I	4	3	25	75	100	4
4.	21UCYC12	Part – III: Core – 2 T: General Chemistry – II	4	3	25	75	100	4
5.	21UCYCP1	Part – III: Core – 3 P: Volumetric Analysis *	2	–	–	–	–	–
6.	21UMSA11/ 21UBYA11	Part – III: Anc.1 – 1 T: Mathematics / Botany *	6 / 4	3	25	75	100	5 / 4
7.	21UBYAP1	Part – III: Anc.1: Botany Practical *	2	–	–	–	–	–
8.	21UACVE1	Part – IV: Value Education	2	3	25	75	100	2
		TOTAL	30				600	21

*Practical examination conducted at the end of the even semester

SEMESTER – II

S. No.	Sub. Code	Subject Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UACT21	Part – I: Tamil – செய்யுளும் புதினமும்	6	3	25	75	100	3
	21UACH21	Hindi – Hindi – II						
	21UACS21	Sanskrit – Sanskrit – II						
2.	21UACE21	Part – II: English – English For Enrichment – II	6	3	25	75	100	3
3.	21UCYC21	Part – III : Core – 4 T: Inorganic Chemistry – I	4	3	25	75	100	4
4.	21UCYC22	Part – III : Core – 5 T: Physical Chemistry – I	4	3	25	75	100	4
5.	21UCYCP1	Part – III: Core – 3 P: Volumetric Analysis	2	3	40	60	100	2
6.	21UMSA21/ 21UBYA21	Part – III :Anc.1 – 2 T: Mathematics / Botany	6 / 4	3	25	75	100	5/4
7.	21UBYAP1	Part – III :Anc. 1 : Botany Practical	2	3	40	60	100	2
8.	21UACES1	Part – IV : Environmental Studies	2	3	25	75	100	2
		TOTAL	30				800	25



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217

SEMESTER – III

S. No	Subject Code	Subject Title	Hrs./ Week	Exam (Hrs.)	CA	SE	Total	Credits
1.	21UACT31	Part – I: Tamil – காப்பியமும் நாடகமும்	6	3	25	75	100	3
	21UACH31	Hindi – Hindi – III						
	21UACS31	Sanskrit – Sanskrit – III						
2.	21UACE31	Part – II: English – English for Enrichment – III	6	3	25	75	100	3
3.	21UCYC31	Part – III: Core – 6: Organic Chemistry – I	5	3	25	75	100	5
4.	21UCYCP2	Part – III: Core – 7: Practical: Inorganic Qualitative Analysis*	3	–	–	–	–	–
5.	21UPSA31	Part – III: Allied 2 – 1 T: Properties of Matter, Thermal Physics, and Optics	4	3	25	75	100	4
6.	21UPSAP2	Part – III: Allied 2 – 2 P: Allied Practical – II*	2	–	–	–	–	–
7.	21UCYS31	Part – IV: SBS – 1: Laboratory Techniques	2	3	25	75	100	2
8.	21UCYN31	Part – IV: NME– 1 : Chemistry For Human Welfare – I	2	3	25	75	100	2
		TOTAL	30				600	19

* Practical examination conducted at the end of the even semester

SEMESTER – IV

S. No.	Sub. Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UACT41	Part – I: Tamil – சங்க இலக்கியமும் அற இலக்கியமும்	6	3	25	75	100	3
	21UACH41	Hindi – Hindi – IV						
	21UACS41	Sanskrit – Sanskrit – IV						
2.	21UACE41	Part – II: English – English for Enrichment – IV	6	3	25	75	100	3
3.	21UCYC41	Part – III: Core – 8: Inorganic Chemistry – II	5	3	25	75	100	5
4.	21UCYCP2	Part – III: Core – 7: Practical: Inorganic Qualitative Analysis	3	3	40	60	100	2
5.	21UPSA41/ 21UPSA21	Part – III: Allied 2 – 3 T: Electricity, Electronics, Atomic And Nuclear Physics	4	3	25	75	100	4
6.	21UPSAP2	Part – III: Allied 2 – 2 P: Allied Practical – II	2	3	40	60	100	2
7.	21UCYS41	Part – IV: SBS – 2: Dairy Chemistry	2	3	25	75	100	2
8.	21UCYN41	Part – IV: NME – 2: Chemistry For Human Welfare – II	2	3	25	75	100	2
9.		Part – V: Extension Activities	–	–	–	–	100	1
		TOTAL	30				900	24



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218

SEMESTER – V

S. No.	Subject Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UCYC51	Part – III: Core – 9: Organic Chemistry – II	5	3	25	75	100	5
2.	21UCYC52	Part – III: Core – 10: Physical Chemistry – II	5	3	25	75	100	5
3.	21UCYCP3	Part – III: Core – 11: Practical: Physical Chemistry Experiments	5	6	40	60	100	5
4.	21UCYCP4	Part – III: Core – 12: Practical: Organic Estimation and Organic Preparation	3	3	40	60	100	2
5.	Part – III: Elective – 1:		4	3	25	75	100	4
	21UCYE51	Coordination Chemistry, Bio– Inorganic Chemistry and Organometallic Compounds						
	21UCYE52	Chemistry of Materials						
	21UCYE53	Forensic Chemistry						
6.	Part – III: Elective – 2:		4	3	25	75	100	4
	21UCYE54	Analytical Chemistry and Computer Applications in Chemistry						
	21UCYE55	Medicinal Chemistry						
	21UCYE56	Polymer Chemistry						
7.	21UCYS51	Part – IV: SBS – 3: Applied Organic Spectroscopy	2	3	25	75	100	2
8.	21UCYS52	Part – IV: SBS – 4: Applied Chemistry	2	3	25	75	100	2
9.	21USSY51	Soft Skills (Self–Study)	–	–	–	–	100	–
		TOTAL	30				900	29

*One elective course to be chosen from THREE courses



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B.Sc. CHEMISTRY – SYLLABUS

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219

SEMESTER – VI

S. No.	Subject Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UCYC61	Part – III: Core – 13: Organic Chemistry – III	6	3	25	75	100	5
2.	21UCYC62	Part – III: Core – 14: Physical Chemistry – III	6	3	25	75	100	5
3.	21UCYCP5	Part – III: Core – 15: Practical: Gravimetric Estimation and Inorganic Complex Preparation	6	6	40	60	100	5
4.	21UCYCP6	Part – III: Core – 16: Practical: Organic Analysis	3	3	40	60	100	2
5.	Part – III: Elective – 3:		5	3	25	75	100	5
	21UCYE61	Chemistry of Biomolecules						
	21UCYE62	Battery and Fuel Cells						
	21UCYE63	Food Chemistry						
6.	21UCYS61	Part – IV: SBS – 5: Pharmaceutical and Clinical Chemistry	2	3	25	75	100	2
7.	21UCYS62	Part – IV: SBS – 6: Green chemistry and Nanochemistry	2	3	25	75	100	2
8.	21UGKY61	General Knowledge (Self – Study)	–	–	–	–	100	–
		TOTAL	30				800	26

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220

COURSE STRUCTURE – V SEMESTER

S. No.	Subject Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1	21UCYC51	Part – III: Core – 9: Organic Chemistry – II	5	3	25	75	100	5
2	21UCYC52	Part – III: Core – 10: Physical Chemistry – II	5	3	25	75	100	5
3	21UCYCP3	Part – III: Core – 11: Practical: Physical Chemistry Experiments	5	6	40	60	100	5
4	21UCYCP4	Part – III: Core – 12: Practical: Organic Estimation and Organic Preparation	3	3	40	60	100	2
5	Part – III: Elective – 1:		4	3	25	75	100	4
	21UCYE51	Coordination Chemistry, Bio– Inorganic Chemistry and Organometallic Compounds						
	21UCYE52	Chemistry of Materials						
	21UCYE53	Forensic Chemistry						
6	Part – III: Elective – 2:		4	3	25	75	100	4
	21UCYE54	Analytical Chemistry and Computer Applications in Chemistry						
	21UCYE55	Medicinal Chemistry						
	21UCYE56	Polymer Chemistry						
7	21UCYS51	Part – IV: SBS – 3: Applied Organic Spectroscopy	2	3	25	75	100	2
8	21UCYS52	Part – IV: SBS – 4: Applied Chemistry	2	3	25	75	100	2
9	21USSY51	Soft Skills (Self–Study)	–	–	–	–	100	–
TOTAL			30				900	29

*One elective course to be chosen from THREE courses

CA – Class Assessment (Internal)

SE – Summative Examination

SBS – Skill Based Subject

T – Theory

P – Practical



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221

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYC51	ORGANIC CHEMISTRY – II	CORE – 9	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course imparts detailed knowledge in aliphatic carbonyl compounds, aromatic carbonyl compounds. It also helps to know the synthesis and characteristics of organo acids and understand about stereo chemistry, symmetry elements optical activity and geometrical isomerism of organic molecules.

COURSE OBJECTIVES:

- ❖ To know the methods of synthesis of aliphatic aldehydes and ketones, mechanism of nucleophilic addition, oxidation and reduction reactions
- ❖ To learn the general behavior of organic reactions with mechanism of aromatic carbonyl compounds
- ❖ To understand the general preparation and properties of aliphatic and aromatic carboxylic acids.
- ❖ To analyse the preparation and properties of substituted carboxylic acids, aromatic sulphonic acids and dicarboxylic acids.
- ❖ To get hold of the knowledge of stereochemistry of carbon compounds.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	explain the preparation and mechanism of aliphatic aldehydes & ketones.	Upto K3
CO 2	spell the chemistry of aromatic aldehydes and ketones.	Upto K3
CO 3	explain the preparation and chemical properties of aliphatic and aromatic carboxylic acids.	Upto K3
CO 4	comprehend the preparation and properties of substituted carboxylic acids, aromatic sulphonic acids and dicarboxylic acids	Upto K3
CO 5	identify the stereo chemical aspects of organic molecules	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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222

ORGANIC CHEMISTRY – II

UNIT – I: Aliphatic Carbonyl Compounds (15 hrs)

a) Preparation by oxidation, hydrolysis, reduction reactions and from 1,3-dithianes & organometallics (magnesium, cadmium and lithium) – reactivity of carbonyl group and acidity of α -hydrogens – nucleophilic addition reactions (HCN, Grignard Reagent, ammonia and its derivatives) – condensation reactions (aldol, Cannizzaro, Mannich and Tischenko) with their mechanisms – oxidation (including haloform reaction) – reduction reactions (MPV, Clemmensen, Wolf-Kishner, catalytic and metal hydrides) and polymerisation reactions – Distinguishing reactions between aldehydes and ketones

b) Preparation, properties and uses of crotonaldehyde, glyoxal and acetone.

UNIT – II: Aromatic Carbonyl Compounds (15 hrs)

a) Preparation from carboxylic acids, Grignard Reagent, nitrile (Stephen reaction) and electrophilic substitutions of aromatic hydrocarbons (Gattermann, Gattermann-Koch, Reimer-Tiemann, Friedel-Crafts and Houben – Hoesch reactions) – reactivity of carbonyl group and its comparison with aliphatic counterparts – nucleophilic addition reactions – condensation reactions (Cannizzaro, Claisen-Schmidt, Perkin, Benzoin, Knoevenagel and Stobbe) with their mechanisms – electrophilic substitution reactions – oxidation and reduction reactions.

b) Preparation, properties and uses of cinnamaldehyde, vanillin and acetophenone.

UNIT – III: Organo Acids – I (15 hrs)

a) **Aliphatic carboxylic acids:** Preparation by oxidation, hydrolysis, carboxylation and haloform reactions – acidic character – effect of substituents on acidic strength – chemical properties: reaction involving acidic hydrogen (reactions with bases, diazomethane), replacement of –OH groups (formation of acid halides, amides, esters, acid anhydrides and ketone), reactions involving –COOH group (formation of alcohol, alkane and carbonyl compounds) and HVZ reaction.

b) **Aromatic carboxylic acids:** Preparation by oxidation, hydrolysis, carboxylation and haloform reactions – acidic character – effect of substituents on acidic strength – chemical properties: reactions involving acidic hydrogen of –COOH, reactions involving –OH group (formation of acid chlorides, amides, esters & acid anhydrides), reactions involving –COOH group (Hunsdiecker reaction), reduction and electrophilic substitution reactions.

UNIT – IV: Organo Acids – II (15 hrs)

a) **Substituted Carboxylic acids:** Preparation and properties of chloroacetic acid, lactic acid and pyruvic acid – distinction between among various halo acids, hydroxy acids and keto acids – preparation, properties and uses of salicylic acid.

b) **Aromatic Sulphonic acids:** Preparation and properties of benzene sulphonic acid – comparison of acidity with carboxylic acid – electrophilic and nucleophilic substitution reactions – preparation and properties of benzene sulphonyl chloride and sulphanilic acid – preparation and uses of saccharin and chloramine-T.

c) **Dicarboxylic acids :** Preparation and properties of aliphatic saturated dicarboxylic acids (upto glutaric acid) – preparation and properties of maleic acid and fumaric acid – preparation and properties of phthalic acid.



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223

UNIT – V: Stereochemistry

(15 hrs)

a) Optical isomerism: Concept of chirality – chirality in organic molecules– enantiomers and diastereomers – distinguishing between them – optical activity – definition and its determination – dissymmetry – relative specification of configuration D and L notation – absolute configuration: R and S notation – racemisation – resolution : methods – asymmetric synthesis – Walden inversion – a brief study about the stereochemistry of allenes, spirans and biphenyl systems.

b) Geometrical isomerism: Condition for existence – *cis* & *trans* system and *syn* & *anti* system – determination of configuration present in maleic acid and fumaric acid, aldioximes and ketoximes – E and Z nomenclature.

TEXT BOOKS:

1. *Modern Organic Chemistry* by M. K. Jain and S. C. Sharma –Vishal Publishing Co. 4th Edn. (2014)
2. *Organic Chemistry* by Bhupinder Mehta and Manju Mehta – Eastern Economy Edition,(2010)

REFERENCE BOOKS:

1. *Organic Chemistry* by I.L. Finar (Vol. I & Vol.II) – Pearson Education Ltd. (2012)
2. *Stereochemistry of Organic Compounds* by Eliel etal – Wiley India , reprint (2008)
3. *Advanced Organic Chemistry* by Arun Bahl and B.S. Bahl, S. Chand Publishing Co. Ltd.,(2017)
4. *Organic Chemistry* by Morrison Boyd Pearson Education Ltd. Seventh Edition (2010)

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=oui5g4ycd6M>
2. https://www.youtube.com/watch?v=2K_rn3YQglY&list=PLi6oabjl6coxYqpjAGd55GYguyTINjsHp&index=11
3. <https://www.youtube.com/watch?v=sTaI7Hir1CE>
4. <https://www.youtube.com/watch?v=QjPoY0cCneM>
5. https://www.youtube.com/watch?v=qiKJqdJK_t8

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	3	3
CO2	3	2	2	1	3
CO3	3	2	2	1	3
CO4	2	1	2	3	3
CO5	2	1	1	2	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. V. SATHIYENDIRAN



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224

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYC52	PHYSICAL CHEMISTRY – II	CORE – 10	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

To acquire the knowledge of analyzing various aspects of solid systems through phase rule and distribution law and to have a thorough knowledge of energetic and kinetics of reactions by detailed study of laws of thermodynamics and chemical kinetics.

COURSE OBJECTIVES:

- ❖ To give the knowledge about the phase rule and phase diagram and distribution law.
- ❖ To study about the first law of thermodynamics and its applications
- ❖ To acquire the knowledge about the principle of heat engines and their efficiency, entropy, free energy and chemical potential.
- ❖ To know about the applications of thermodynamics to various chemical equilibria and colligative properties, a study about Nernst heat theorem and its applications
- ❖ To understand the kinetics and the theories of reaction rate.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	characterize the chemical state of a system and predicting equilibrium relations of the phases.	Upto K3
CO 2	understand the flow of energy in chemical processes.	Upto K3
CO 3	know the concept of heat engine, a study about the relations towards entropy, free energy changes and chemical potential.	Upto K3
CO 4	calculate the concentration of reactants for maximizing products, determine the molecular weight of chemical substances using colligative properties.	Upto K3
CO 5	gain knowledge about kinetics and its theories and can solve the problems related to kinetics	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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225

PHYSICAL CHEMISTRY – II

UNIT – I: Phase Rule & Distribution Law (15 hrs)

- a) **Phase rule:** Definition of the terms phase, component and degrees of freedom – conditions for equilibria between phases – derivation of Gibb's phase rule – eutectic point, congruent melting point and incongruent melting point .
One component system: H_2O , Sulphur and CO_2 systems – reduced phase rule – two component system: Lead – Silver, Potassium iodide – Water, Zinc – Magnesium and Sodium sulphate – Water systems.
- b) **Distribution law:** Statement – thermodynamic derivation – conditions – limitations – solvent extraction – applications.

UNIT – II: Thermodynamics – I (15 hrs)

- a) Introduction – energy and its units – work and heat – thermodynamic systems – properties of systems – state function and path function – thermodynamic processes – internal energy.
- b) **First Law :** Statement – mathematical formulation – enthalpy – heat capacity at constant pressure and at constant volume – C_p , C_v relationship – work done in isothermal reversible expansion and compression of an ideal gas – calculation of ΔE , ΔH , q and w for isothermal and adiabatic expansion of an ideal gas – reversible adiabatic expansion (P , V and T relationships) – Joule – Thomson effect for an ideal gas – comparison between isothermal and adiabatic expansions – Joule–Thomson co-efficient in ideal and real gases – inversion temperature and significance.
- c) **Thermochemistry:** Definition: heat of combustion, heat of formation, heat of neutralization and heat of solution – variation of enthalpies with temperature – Kirchoff's equation – Hess's law of heat summation – statement and applications

UNIT – III: Thermodynamics – II (15 hrs)

- a) **Second Law of Thermodynamics:** Different ways of stating II law of thermodynamics – conversion of heat into work – Carnot's cycle – Carnot's theorem – thermodynamic efficiency – entropy – definition – concept of entropy – entropy changes in reversible and irreversible processes – entropy change for an ideal gas – physical significance of entropy.
- b) Free energy function – Gibb's free energy – Helmholtz free energy – variation of free energy change with temperature and pressure – Gibb's –Helmholtz equation and its applications – Clapeyron–Clausius equation and its applications – Maxwell's relationships.
- c) **Chemical Potential:** Definition – significance – Gibb's–Duhem equation – variation of chemical potential with temperature and pressure.

UNIT – IV: Thermodynamics – III and Colligative Properties (15 hrs)

- a) Application of thermodynamics to various types of equilibria – law of mass action – relation between K_p and K_c – equilibrium constant and free energy changes – Van't Hoff reaction isotherm – Van't Hoff reaction isochore.
- b) Nernst heat theorem and its applications – Third law of thermodynamics – statement – determination of absolute entropy – Zeroth law of thermodynamics – significance.
- c) Colligative properties – Raoult's law – vapour pressure lowering, osmotic pressure (definition only) – depression of freezing point – elevation of boiling point – thermodynamic derivation.



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226

UNIT – V: Chemical Kinetics

(15 hrs)

Introduction – rate of reaction – rate law and rate constant – order and molecularity–distinguishing between them – first order reactions – examples – rate equation – derivation – half life period – second order reactions – examples – rate equations – derivation – half life period – zero order and third order reactions – examples – rate equations (no derivation required) – determination of order of a reaction.

Influence of temperature on the rate of reaction – Arrhenius rate equation and its significance – theory of reaction rates – Bimolecular collision theory – Unimolecular reactions – Lindemann's hypothesis – Absolute Reaction Rate Theory – kinetics of fast reactions – flow methods for fast reactions – stopped flow method.

TEXT BOOKS:

1. *Principles of Physical Chemistry* by B.R. Puri, L.R. Sharma and S. Pathania – Vishal Publishing Co. (2022)
2. *Essentials of Physical Chemistry* by B.S. Bahl, Arun Bahl and G.T. Tuli – S.Chand and Co. Ltd., (2016)

REFERENCE BOOKS:

1. *A Textbook of Physical Chemistry* by S.Glasstone – Macmillan (India) Ltd. (2009)
2. *Advanced Physical Chemistry* by D.A.Bajpai– S.Chand and Co.Ltd., 3rd Edn. 39th edition (2014).
3. *Chemical Kinetics* by K. J. Laidler, Pearson Edition 3rd edition (2008).

DIGITAL TOOLS:

1. [https://chem.libretexts.org/Bookshelves/General_Chemistry/Book%3A_Chem1_\(Lower\)/11%3A_Chemical_Equilibrium/11.06%3A_Phase_Distribution_Equilibria](https://chem.libretexts.org/Bookshelves/General_Chemistry/Book%3A_Chem1_(Lower)/11%3A_Chemical_Equilibrium/11.06%3A_Phase_Distribution_Equilibria)
2. <https://www.thoughtco.com/thermodynamic-process-2699424>
3. <https://www.youtube.com/watch?v=ELR1Hx4qymo>
4. <https://www.doubtnut.com/question-answer-chemistry/describe-the-absolute-entropy-and-third-law-of-thermodynamics-642660512>
5. <https://byjus.com/jee/chemical-kinetics/>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	3	3
CO2	3	2	2	1	3
CO3	3	2	2	1	3
CO4	2	1	2	3	3
CO5	2	1	1	2	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Prof. K. VASUKI



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(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

227

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYCP3	PHYSICAL CHEMISTRY EXPERIMENTS	CORE – 11 PRACTICAL	–	5	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

- ❖ This practical paper makes use of the concepts of thermodynamics, equilibria, kinetics and electrochemistry.
- ❖ This course helps the students to get trained in safe handling of chemicals, apparatus and instruments.
- ❖ The laboratory ambience gained through this course can cultivate the required skill for a position in an industry/company/factory/research laboratory.
- ❖ The paper aims at improving analytical skills and it is reflected in terms of the agreement between graphical and experimental data.
- ❖ The course shapes the students' frame of mind towards the scientific interpretation of data and helps to improve their efficiency for societal developments

COURSE OBJECTIVES:

- ❖ To apply the concepts of phase rule for the construction of phase diagrams of simple eutectic systems.
- ❖ To utilize potentiometric and conductometric methods for quantitative estimations.
- ❖ To evaluate the rate constant of pseudo first order and second order reactions.
- ❖ To determine the critical solution temperature (CST) and study the effect of impurities in the phenol–water system.
- ❖ To scientifically verify the agreement between experimental and graphical data.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO	recall the principles of various physical chemistry experiments. To systematically perform the procedure relating to electrical and non-electrical experiments. To calculate and process the measured values obtained from the experiments.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

228

PHYSICAL CHEMISTRY EXPERIMENTS

1. Determination of molecular weight by
 - a) Rast's macro method
 - b) Transition temperature method.
2. Phase Diagram involving a) simple eutectic. b) compound formation.
3. Heat of solution by solubility method.
4. Determination of strength of the given KI by Equilibrium constant method.
5. Conductometric titration– Strong Acid vs Strong Base.
6. Potentiometric Redox titrations: a) FeSO_4 vs KMnO_4 . b) FeSO_4 vs. $\text{K}_2\text{Cr}_2\text{O}_7$.
7. Colorimetric estimations of a) Nickel b) Iron c) Chromium
8. Preparation of various Buffer mixtures and comparing their pH values with theoretical values using pH meter.
9. pH titrations – a) Strong Acid vs Strong Base b) Weak Acid vs Strong Base.
10. Determination of rate constant for the acid catalyzed hydrolysis of ester.
11. Determination of rate constant of sucrose by Polarimetry.
12. Determination of CST on Phenol–water system & effect on impurity on CST– strength of NaCl.

Distribution of Marks	Internal – 40 Marks	External – 60 Marks
<u>External Examination</u>		
Viva voce	– 10 marks	
Record Notebook	– 10 marks	
For completion of the experiment	– 20 marks	
Graph	– 5 marks	
Tabulation & Calculation	– 5 marks	
Result	– 10 marks	
Total	60 marks	



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

229

TEXT BOOKS:

1. *Basic principles of Practical Chemistry* by R. Veeraswamy, V. Venkateswaran and A. R. Kulandaivelu, 2nd edition, Sultan Chand & Sons. (2015)
2. *Chemistry Practical Book* by Jeyavathana Samuel, 1st edition, Kalos Offset Division, Chennai (2000)
3. *Physical Chemistry Experiments for Undergraduate Students* by Dr. R. Rajalakshmi, 1st edition, Notion Press India, (2020)
4. *Experiments in Physical Chemistry* by Dr. Ashok Kumar, Acharya 1st edition, AkiNik Publications (2018)
5. *Adv. Physical Chemistry Experiments* by Gurtu J.N., Amit Gurtu, 1st edition, Pragati Prakashan (2011)

REFERENCE BOOKS:

1. *Textbook of Physical Chemistry – The Experimental Aspects in Physical Chemistry* by Kapoor K L. Volume–7, 1st edition, McGraw–Hill India (2019)
2. *Senior Practical Physical Chemistry* by Khosla, B. D.; Garg, V. C. & Gulati, A., 18th edition, R. Chand & Co.: New Delhi. (2018)
3. *Practical Physical Chemistry* by B. Viswanathan; P.S. Raghavan, 2nd edition, Viva Books (2005)
4. *Experimental Physical Chemistry* by Athawale, V. D. & Mathur, P., 1st edition, New, Age International: New Delhi. (2001)
5. *Experiments in Physical Chemistry* by David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, 5th edition, McGraw–Hill Book Company (1989)

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=tOGdZFDU2eU>
2. <https://www.youtube.com/watch?v=-GS6uoFf3qQ>
3. <https://www.youtube.com/watch?v=gd1YQr-74sw>
4. <https://www.youtube.com/watch?v=y-7t-GdRTKA>
5. <https://www.youtube.com/watch?v=KeIyTqEHMEY>
6. <https://www.youtube.com/watch?v=68-maBUjYLc>
7. <https://www.youtube.com/watch?v=TdljF0whwMQ>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO	3	3	3	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. V. SATHIYENDIRAN



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

230

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYCP4	ORGANIC ESTIMATION AND ORGANIC PREPARATION	CORE – 12 PRACTICAL	–	3	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course trains the students to prepare the solutions of different concentrations and to estimate quantitatively by different techniques.

COURSE OBJECTIVES:

- ❖ To practice the preparative method and quantitative estimation of organic substances.
- ❖ To impart the basic knowledge of the preparation of organic compounds.
- ❖ To learn the methods of different preparation of organic compounds.
- ❖ To handle the glassware and apparatus for conduct experiments in organic chemistry
- ❖ To perform common laboratory techniques precipitation

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO	understand the principles behind the estimations of phenol, aniline & glycine iodometrically. To interpret a suitable method for the preparation of organic compounds.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

231

ORGANIC ESTIMATION AND ORGANIC PREPARATION

I. ORGANIC ESTIMATION

1. Estimation of phenol.
2. Estimation of aniline.
3. Estimation of glycine.

II. ORGANIC PREPARATION

1. Preparation of p-bromo acetanilide from acetanilide (bromination)
2. Preparation of benzoic acid from benzamide.(hydrolysis)
3. Preparation of m-dinitrobenzene from nitrobenzene.(nitration)
4. Preparation of benzoic acid from benzaldehyde.(oxidation)
5. Preparation of benzoic acid from ethylbenzoate.(hydrolysis)

Distribution of Marks	Internal – 40 Marks	External – 60 Marks
<u>External Examination</u>	<u>(Choice of choosing any one category of the above two)</u>	
Record Note book – 10 marks	Organic Estimation – 50 marks Procedure – 10 marks Estimation – 40	
Organic Preparation – 50 marks		
Procedure – 10 marks		
marks		
Crude sample – 30 marks		< 2% Error – 40 marks
Recrystallisation – 10 marks		2–3% Error – 30 marks
		3–4% Error – 20 marks
		4–5% Error – 15 marks
		> 5% Error – 10 marks

TEXT BOOKS:

1. *Practical Chemistry (Part III)* by Sundaram, Krishnan, Raghavan, S. Viswanathan Co. Pvt.ltd., (1996)
2. *Organic Chemistry–Lab Manual* by N.S. Gnanapragasam, G. Ramamurthy, S. Viswanathan Co. Pvt. New edn. (2013)
3. *College Practical Chemistry* by V.K. Ahluwalia, University press, 1st edn. (2005)

REFERENCE BOOKS:

1. *Vogel's Textbook of Practical Organic Chemistry* by B.A. Furniss, A.J. Hanna Ford, P.W.G. Smith, A.R. TatChell, ELBS/Longman England, 5th edn. (1989)
2. *Vogel's Textbook of Quantitative Chemical Analysis*, G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denny, Longman Scientific & Technical, 5th edn. (1989)

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=C1tG69O0fXc> (phenol)
2. <https://www.youtube.com/watch?v=sqIhKvAO9j4> (aniline)
3. https://www.youtube.com/watch?v=WLv8r_zBdVA (Glycine)
4. <https://www.youtube.com/watch?v=iW0UjRdOHN8> (preparation)
5. https://www.youtube.com/watch?v=_GKfdRfoPnY (nitration)

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO	3	3	3	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. N. P. KRISHNAN



SOURASHTRA COLLEGE, MADURAI – 625004

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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

232

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE51	COORDINATION CHEMISTRY, BIO-INORGANIC CHEMISTRY AND ORGANOMETALLIC COMPOUNDS	ELECTIVE – 1	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

To get the information of mono and poly dentate ligand are coordinate with transition metal ions. To study about the isomerism, geometry and hybridization of complexes. To learn the bio-comfortable metal ions and metal complexes in living system. To have an idea about the organometallic compounds.

COURSE OBJECTIVES:

- ❖ To learn about the basic nomenclature of complex and isomerism
- ❖ To gain information about the geometry and hybridization of complex.
- ❖ To study the importance of metal ion in biological system.
- ❖ To discuss the structure and function of metalloporphyrins and metalloenzymes.
- ❖ To deal with the industrial catalyst of organometallic compounds.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	gain the importance of basic idea of coordination chemistry	Upto K3
CO 2	understand the properties of metal complexes	Upto K3
CO 3	realize the significance of bioinorganic chemistry	Upto K3
CO 4	know the function of hemoglobin, myoglobin and chlorophyll	Upto K3
CO 5	understand the preparation and properties of organometallic compounds.	Upto K3

K1- KNOWLEDGE (REMEMBERING), K2-UNDERSTANDING, K3-APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

233

COORDINATION CHEMISTRY, BIO– INORGANIC CHEMISTRY AND ORGANOMETALLIC COMPOUNDS

UNIT – I: Coordination Chemistry –I

(12 hrs)

Double salts and coordination compounds – terminology: coordination sphere, coordination number, ligand and its types – nomenclature of coordination compounds – Werner's coordination theory: postulates and experimental evidence. Chelates: classification and application of the formation of chelated complexes in analytical chemistry.

UNIT – II: Coordination Chemistry –II

(12 hrs)

Isomerism: structural isomerism and stereo isomerism ($[Ma_2b_2]$, $[Mabcd]$, $[M(AB)_2]$, $[Ma_4b_2]$, $[Ma_3b_3]$, $[Ma_2b_2c_2]$, $[M(AB)_3]$) – Preparation of complexes, stability constant – thermodynamic and kinetic stability – factors affecting the stability of metal complexes – Experimental determination of composition of complexes by Job's method. Sidgwick's concept: EAN rule, calculation and its applications

UNIT – III: Coordination Chemistry –III

(12 hrs)

Valence Bond Theory: assumptions and illustration to 4– and 6– coordination ions ($[Ni(NH_3)_4]^{2+}$, $[Cu(CN)_4]^{2-}$, $[Co(NH_3)_6]^{2+}$, $[Fe(CN)_6]^{3-}$, $[FeF_6]^{3-}$) – hybridization, magnetic properties and geometry – limitations – Crystal Field Theory: salient features – orbital splitting as applied to octahedral, tetrahedral and square planar complexes – CFSE and its calculation – spectrochemical series– magnetic moments and color of transition metal complexes.

UNIT – IV: Bioinorganic Chemistry

(12 hrs)

Essential and trace elements: Introduction and their classification – Metalloporphyrins: definition – hemoglobin and myoglobin – structure and function – cooperative and non-cooperative binding – Bohr effect – CO poisoning of Hb – chlorophyll–structure and its functions – metalloenzymes.

Role of Na^+ and K^+ ions in biological system – Na–K pump– role of calcium in biology – rickets – osteoporosis – hypercalcemia and hypocalcemia – comparison of biochemistry of Ca^{2+} and Mg^{2+} .

UNIT – V: Organometallic Compounds

(12 hrs)

Introduction – general preparation and properties of organometallic compounds– preparation, properties and uses of organometallic compounds such as alkali metal, beryllium, magnesium and olefine. Metallocenes: ferrocene –preparation and properties– metal carbonyls – preparation and properties of $Ni(CO)_4$, $Fe(CO)_5$



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

234

TEXT BOOKS:

1. *Principles of Inorganic Chemistry* by B.R. Puri, L.R. Sharma and K.C. Kalia – Milestone Publishers, 48th Edn. (2019).
2. *Modern Inorganic Chemistry* by R. D. Madan and Satya Prakash – S. Chand and Co, 3rd Edn. (2014).
3. *Bioinorganic Chemistry* by K. Hussain Reddy, New age international, (2007).

REFERENCE BOOKS:

1. *Inorganic Chemistry* by J. E. Huheey et. al. – Pearson Education Pvt. Ltd., 4th Edn. (2004).
2. *Advanced Inorganic Chemistry (Volume-II)* by Satya Prakash, G. D. Tuli, S.K. Basu and R. D. Madan – S. Chand and Co, 4th Edn. (2020).
3. *Bioinorganic Chemistry* by Asim K. Das, Books and allied Ltd, (1999).
4. *Concise Coordination Chemistry* by R. Gopalan et al. – Vikas publishing house Pvt. Ltd. Revised Edn. (2012).

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=TF3r9JT83Ss>
2. <https://www.youtube.com/watch?v=XIvB-G57AiI>
3. <https://www.youtube.com/watch?v=8IT21wKoXyQ>
<https://www.youtube.com/watch?v=s0dJHwBVFcI>
4. [https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Book%3A_Inorganic_Chemistry_\(Saito\)/08%3A_Reaction_and_Physical_Properties/8.02%3A_Bioinorganic_chemistry](https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Book%3A_Inorganic_Chemistry_(Saito)/08%3A_Reaction_and_Physical_Properties/8.02%3A_Bioinorganic_chemistry)
5. [https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Organometallic_Chemistry_\(Evans\)](https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Organometallic_Chemistry_(Evans))

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	2	3
CO2	1	2	2	2	3
CO3	2	2	2	3	3
CO4	2	2	3	3	3
CO5	1	1	2	2	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Dr. M. RAJASEKARAN



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

235

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE52	CHEMISTRY OF MATERIALS	ELECTIVE – 1	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course trains the students to understand the structure of solids and their properties.

COURSE OBJECTIVES:

To learn the structure, preparative methods with characterisation, properties viz., electrical, optical and magnetic of solids and to have a bird's eye view on special materials.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	gain the knowledge about solid matters	Upto K3
CO 2	learn the preparative and characterized technique for solid materials	Upto K3
CO 3	understand the knowledge about electrical and optical properties.	Upto K3
CO 4	acquire the idea about the magnetic properties.	Upto K3
CO 5	study about the special materials.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

236

CHEMISTRY OF MATERIALS

UNIT – I: Structures of solids

(12 hrs)

Introduction to solids – crystalline and amorphous. Unit cell, Bravais lattices and X-ray structure determination (NaCl and KCl only) – powder and single crystal– methods and applications– identification of the cubic lattice and indexing of the X-ray diffraction lines. Radius ratio rules – coordination number. Packing arrangement –different structure types in solids – rock salt, zinc blende, wurtzite, fluorite and antiferrofluorite, spinel and inverse–spinel and perovskite structures.

UNIT – II: Preparative methods and characterization

(12 hrs)

Solid state reactions – ceramic method, sol–gel, hydrothermal, high pressure, zone refining, CVD, Czochralski and Bridgman and Stockbarger methods. Physical methods – thermogravimetric and differential thermal analysis and scanning electron microscopy (only introduction and application).

UNIT – III: Electrical and optical properties

(12 hrs)

Defects in solid state – point defects – Frenkel and Schottky defects and non–stoichiometric defects. Conductors – variation of conductivity with temperature – solar energy conversion, organic semiconductors. Piezoelectric, pyro–electric and ferroelectrics (introduction and application). Photoluminescence.

UNIT – IV: Magnetic properties

(12 hrs)

Magnetic properties – classification – diamagnetic, paramagnetic, antiferromagnetic, ferro and ferri magnetic — magnetic susceptibility. Variation with temperature – Curie–Weiss law, Curie temperature and Neel temperature. Permanent and temporary magnets.

UNIT – V: Special materials

(12 hrs)

Superconductivity – introduction, Meissner effect – mention of Bardeen, Cooper and Schrieffer theory and Cooper pairs – examples of superconducting oxides, Chevrel phases – applications of superconducting materials. Ionic conductors – sodium– β alumina, sodium–sulphur battery. Intercalation – layered compounds – graphitic compounds. Special applications of solid state materials. High energy battery, lithium cells.

TEXT BOOKS:

1. *Solid State Chemistry* by M. G. Arora, Anmol Publications, New Delhi, (2001)
2. *Materials Science* by P. K. Palanisamy, Scitech Publications, Chennai, (2003)

REFERENCE BOOKS:

1. *Solid State Chemistry and its Applications* by A. R. West, John–Wiley and sons, (1987)
2. *Fundamentals of Crystal Chemistry* by T R N Kutty and J A K Tareen, Universities press Limited, (2001)
3. *Solid State Chemistry–An Introduction* by Lesley Smart and Elaine Moore, Chapman Hall, London, (1992)

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=LmLYwREkj7Y>
2. <https://www.youtube.com/watch?v=5vwHFP9LIIM>
3. <https://www.youtube.com/watch?v=ksUhHx44GQ0>
4. <https://www.youtube.com/watch?v=NyN9uPLxXJw>
5. <https://www.youtube.com/watch?v=D-9M3GWoBrw>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	1	3	3
CO2	2	2	2	1	3
CO3	1	2	2	3	3
CO4	2	2	3	3	3
CO5	1	1	2	2	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Dr. V. SATHIYENDIRAN



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

237

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE53	FORENSIC CHEMISTRY	ELECTIVE – 1	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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COURSE DESCRIPTION:

This course imparts detailed knowledge in forensic science.

COURSE OBJECTIVES:

- ❖ To acquire knowledge about the concept of chemistry as related to forensic science.
- ❖ To understand the use of chemicals in criminal investigation.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	learn the collection of samples and preservation of evidences.	Upto K3
CO 2	understand the examination and identification of drugs	Upto K3
CO 3	gain the knowledge of finger print and forensic serology.	Upto K3
CO 4	identify the types of crime detection	Upto K3
CO 5	find the forgery in various fields.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

238

FORENSIC CHEMISTRY

UNIT – I: Collection and Preservation of Evidences (12 hrs)

Introduction– historical development of forensic science; types of physical evidence– importance of physical evidence– collection and preservation of physical evidence– identification of physical evidence– Forensic characteristics of glass and soil – Forensic examination of hair, fibre and paints.

UNIT – II: Examination and Identification of Drugs, Alcohol and Poisons (12 hrs)

Drug abuse– effects of marijuana and LSD– Alcohol–effect of the amount of alcohol consumed–analysis of alcohol by breathalyzer – Poisons– types and classification of poison – diagnosis of poisons in the living and the dead– clinical symptoms– identification of phenol, chloral, HCN, alkaloids and arsenic poisons.

UNIT – III: Finger Print and Forensic Serology (12 hrs)

Finger prints– principles– detection and preservation of developed finger prints– Forensic Serology–blood types–characterization of blood strains– preservation of blood evidence – Analysis of seminal stains.

UNIT – IV: Crime Detection (12 hrs)

Document and voice examination–hand writing comparison– collection of hand writing exemplars– typewriting comparisons– voice examination–sound spectrograph– Human bombs– possible explosives (gelatin sticks and RDX) – metal detector devices

UNIT – V: Forgery and Counterfeiting (12 hrs)

Detecting forgery in bank cheques/drafts and educational records like mark sheet, certificate using UV light. Alloy analysis using AAS to detect counterfeit coins – Checking silver line water mark in currency notes – Detecting of gold purity in 22 carat ornaments and detecting gold plated jewels.

TEXT BOOKS:

1. *Forensic Sciences* by James T.H., Stanley Thornes Ltd, New York, (2005)
2. *Textbook of Forensic Chemistry* by S. A. Iqbal (2011)

REFERENCE BOOKS:

1. *Criminalistics– A Introduction to Forensic Science* by Richard Saferstein 8th Edition, Prentice Hall, U.K., (2000)
2. *Introduction to Forensic Chemistry* by Elkins & Kelly M (2019)

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=TF3r9JT83Ss>
2. <https://www.youtube.com/watch?v=XIvB-G57AiI>
3. <https://www.youtube.com/watch?v=hlndGPRUDfM>
4. <https://www.youtube.com/watch?v=aWIAW1K4Abs>
5. <https://www.thecriminallawteam.ca/counterfeiting-forgery/>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	3	3	3
CO2	2	3	2	2	3
CO3	3	3	3	3	3
CO4	2	3	3	3	3
CO5	2	3	3	3	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Dr. N. P. KRISHNAN



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

239

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE54	ANALYTICAL CHEMISTRY AND COMPUTER APPLICATIONS IN CHEMISTRY	ELECTIVE – 2	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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COURSE DESCRIPTION:

To acquire the knowledge of data and their analysis with different formats, to study the theory and handling operations of various analytical instruments and to have an idea about C language and its applications in Chemistry.

COURSE OBJECTIVES:

- ❖ To learn about the prediction and analysis of data
- ❖ To gain information about the estimation of various ions
- ❖ To provide the principles of gravimetric analysis, methods and characteristic features of precipitation techniques.
- ❖ To study the analytical techniques and their applications in chemistry
- ❖ To get knowledge about basic C language and its applications in chemistry

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	interpret the data and errors in chemistry.	Upto K3
CO 2	understand the applications of colorimetric techniques.	Upto K3
CO 3	get the knowledge of precipitation and purification using gravimetric techniques.	Upto K3
CO 4	understand the role of polarimetric techniques and radioactive tracers.	Upto K3
CO 5	demonstrate the steps involved in 'C' program and 'C' programs in Chemistry using C language.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

240

ANALYTICAL CHEMISTRY AND COMPUTER APPLICATIONS IN CHEMISTRY

UNIT – I: Data Analysis (12 hrs)

Analysis of experimental results: Graphical method – curve fitting – method of least squares – problems involving straight line graphs.

Error analysis: significant figures – Errors & its classification – methods used for minimisation of errors – precision & accuracy – distinguishing between them – confidence limits: Q-test, F-test & t-test.

UNIT – II: Colorimetry (12 hrs)

Colorimetry: Principle – Beer – Lambert law – methods of colour comparison – standard series method – colorimetric titration – Duboscq colorimeter – photoelectric colorimeter – spectrophotometers – criteria for satisfactory colorimetric estimations – Estimation of Iron, Nickel and Chromium.

UNIT – III: Gravimetric analysis (12 hrs)

Principle – methods to obtaining the precipitate – conditions for precipitation – types of precipitants: inorganic and organic precipitants – sequestering agents – theories of precipitation – co precipitation – post precipitation – digestion – precipitation from homogeneous medium – filtration – washing – drying.

UNIT – IV: Polarimetry & Radiometry (12 hrs)

a) Polarimetry: Theory – instrumentation – Optical Rotatory Dispersion – plain curves & cotton effect curves – applications of optical rotation method in the determination of rate constant: acid – catalyzed, mutarotation of glucose – inversion of cane sugar.

b) Radiometry: Radioactive tracer– tracer technique–applications of tracer technique: structure investigation–radiocarbon dating–activation analysis–advantages of activation analysis – radiometric analysis – isotopic dilution analysis.

UNIT – V: C-Programming in Chemistry (12 hrs)

C language : Introduction – Basics of 'C' program – steps involved in 'C' program – operators and header files – control statements– C programs in Chemistry : Half-life period calculation, normality, molality and molarity calculations, calculation of RMS velocity, pH calculation from H^+ concentration and finding acidic, basic or neutral nature.



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

241

TEXT BOOKS:

1. *Elements of Analytical Chemistry* by R. Gopalan, P. S. Subramanian, & K. Rangarajan – Sultan Chand & Sons – reprint of 6th Edition (2017)
2. *Computers in Chemistry* by K. V. Raman, Tata McGraw–Hill Publishing company Ltd. (2005)

REFERENCE BOOKS:

1. *Analytical Chemistry* by Gurdeep R. Chatwal – Himalaya Publishing House, 1st Edn (2015)
2. *Analytical Chemistry* by Gary D. Christian, Purnendu K. Dasgupta & Kevin A. Schug – Wiley 6th Edn (2020)
3. *Computers for Chemists* by Pundir and Bansal – Pragati Prakashan Publishers (2007)

DIGITAL TOOLS:

1. <https://study.com/academy/lesson/accuracy-vs-precision-in-chemistry-definitions-comparisons.html>
2. <https://www.youtube.com/watch?v=2MW-qc1ABss>
3. <https://www.youtube.com/watch?v=1mhcLO8LLoI>
4. <https://www.youtube.com/watch?v=YtX3SuHqKOs>
5. <https://www.youtube.com/watch?v=nvsJ6Hs4b3c>
6. <https://www.youtube.com/ZRARhYLPKE>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	3	1	2
CO2	3	2	2	1	3
CO3	3	3	2	1	3
CO4	2	2	2	1	3
CO5	3	1	2	1	2

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Dr. T. S. MANIKANDAN



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

242

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE55	MEDICINAL CHEMISTRY	ELECTIVE – 2	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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COURSE DESCRIPTION:

This course enables the students to gain knowledge on fundamentals of Medicinal Chemistry

COURSE OBJECTIVES:

- ❖ To acquire basic knowledge in the field of Medicinal Chemistry.
- ❖ To understand the drugs for various diseases and their mode of action.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	tell the theory of pharmacokinetics model	Upto K3
CO 2	summarize the theory of drug design and discovery	Upto K3
CO 3	explain the relationship between physical parameters and drug activity	Upto K3
CO 4	study the psycho active and cardio vascular drug	Upto K3
CO 5	apply the synthetic methodologies of various types of drugs	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

243

MEDICINAL CHEMISTRY

UNIT – I: Absorption, Distribution, Metabolism, and Excretion (12 hrs)

a) ADME Properties –The pharmacokinetics phase – Adsorption–Distribution, Metabolism – Elimination. Bioavailability of drug, pharmacokinetics models, Intravascular and Extravascular administration. The use of pharmacokinetics in Drug design.

b) Pharmacodynamics–Stereo electronic structure.

UNIT – II: Drug Discovery by Design (12 hrs)

a) Stereo chemistry and Drug Design– Structurally rigid Groups –procaine, Acetyl choline. Conformation Syn and Anti Acetyl choline, Phenyl ethanoate methiodides. Configuration Variations in the biological activities of stereo isomers

b) Structural–Activity–Relationship (SAR)

Changing the size and shape. Changing the degree of unsaturation. Introduction or removal of ring system. Introduction of new substituents–methyl group, Halogens, hydroxyl groups, Basic groups, carboxylic and sulphonic acid groups. Changing the existing substituents of lead isosteres, bioisosteres.

UNIT – III: QSAR & Combinatorial Chemistry (12 hrs)

a) Quantitative structural Activity Relationship (QSAR)

Partition parameters partition coefficients (p), Lipophilic substituents constant s (π) Electronic parameters The Hammett constants Steric parameters The Taft Steric Parameters (E_s), Molar refractivity(MR) , Hansch analysis craig plots, The toplss decision tree. Compute–aided drug design Modelling Drug Recept or Interaction.

b) Combinatorial Chemistry

Basic concepts The design of combinatorial syntheses. The general technique used in Combinatorial synthesis i)Solid support method parallel synthesis–Fur ka's mix and splt Techniques sequential chemical tagging methods Still's binary code Tag system computerized tagging. ii)Combinatorial synthesis in solution iii) Screening and deconvolution

UNIT – IV: (12 hrs)

a) Antineoplastic Agents:

Introduction, cancer chemotherapy, special problems, role of alkylating agents and anti-metabolites in treatment of cancer.

b) Psychoactive drugs–The chemotherapy of Mind:

Introduction, neurotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, neurochemistry of mental diseases

c) Cardiovascular Drugs and Local Anti infective Drugs:

Introduction, Cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output.

UNIT – V: Synthesis of Drugs (12 hrs)

a) Synthesis of Antineoplastic agents

Mechlorethamine, Cyclophosphamide uracil , mustards and 6 – mercaptopurine

b) Synthesis of cardio vascular drugs

Amyl nitrate, sorbitrate, Verapamil.

c) Synthesis of Psychoactive drugs

Synthesis of Diazepam, Chlorazepam, oxazepam, Alprazolam, Phenyltocin or Diphenyl hydantoin, Barbitol , Phenobarbital .



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

244

TEXTBOOKS:

1. *Introduction to Medical Chemistry* by Gringuage, Wiley–VCH, (2004)
2. *Text Book of Organic Medicinal & Pharmaceutical Chemistry* by Wilson and Gisvold's, Ed., Robert F. Dorge, (2003)
3. *An Introduction to Drug Design* by S.S. Pandeya and J. R. Dimmock, New Age International, (2006)

REFERENCE BOOKS:

1. *Strategies for Organic Drug Synthesis & Design* by D. Lednicher, John Wiley & Sons, 2nd edition (2008).
2. *Medicinal Chemistry: An introduction* by Gareth Thomas, John Wiley & Sons, (2004)
3. *Medicinal chemistry Lectures on Drug design and Synthetic Drugs* by M.L. Gangwal Student Publishing House, (2007)

DIGITAL TOOLS:

1. <https://www.xenotech.com/nonclinical-studies/adme/>
2. <https://www.youtube.com/watch?v=3Gl0gAcW8rw>
3. <https://www.youtube.com/watch?v=dOi8KwcecoM>
4. <https://www.youtube.com/watch?v=DKB4DtOasv0>
5. <https://humanbiology.pressbooks.tru.ca/chapter/10-8-psychoactive-drugs/>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	2	3
CO2	3	2	2	2	3
CO3	3	1	2	2	3
CO4	3	2	1	2	3
CO5	3	1	2	2	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNERS: Dr. N. P. KRISHNAN



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

245

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE56	POLYMER CHEMISTRY	ELECTIVE – 2	4	–	4

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course will focus on importance of polymers and its applications

COURSE OBJECTIVES:

In this course the students are exposed to various polymer studies and the techniques that are used in their preparation and properties.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	understand polymerization – forms of polymers – co-polymerization.	Upto K3
CO 2	gain knowledge the types of polymers – addition	Upto K3
CO 3	gain knowledge the types of polymers– condensation	Upto K3
CO 4	understand the properties of co-polymerization	Upto K3
CO 5	learn about the applications of polymers	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

246

POLYMER CHEMISTRY

UNIT – I: Introduction (12 Hrs)

Historical Introduction – Natural and Synthetic polymer – Polymerization – Forms of polymers – Co-polymerization.

UNIT – II: Condensation polymerization (12 Hrs)

Introduction – Types of condensation polymer – kinetic of linear condensation polymerization – Some linear condensation polymers – Three – dimensional polymers – Inorganic polymers – Ring opening polymerization.

UNIT – III: Addition polymerization (12 Hrs)

Introduction – Addition polymerization – Inhibition and retardation – Various polymerization techniques – Ionic addition polymerization – Coordination polymerization – Some addition polymers – Ion exchange resin – Condensation polymerization versus addition polymerization.

UNIT – IV: Co-polymerization (12 Hrs)

Introduction, Co-polymerization composition equation – block and graft co-polymers – Polymer blends – Step co-polymerization – Some important co-polymer.

UNIT – V: Applications of Polymers (12 Hrs)

Elastomeric materials – introduction – structure property relationships in polymers, natural rubber, raw rubber – vulcanization of rubber – synthetic rubber buna rubber – buna rubber S(Sbr, Grs)rubber, neoprene rubber (Gr-M), Thiokol, poly butanes and butyl rubbers.

Fiber-forming polymers – rayon's proteins nylons-polyesters-vinyls – spinning – Fabrication of polymers – moulding of thermosetting resins, moulding of thermoplastics, extrusion moulding, casting of films – calendaring – Naturally occurring polymer

TEXT BOOKS:

1. *Industrial Chemistry* by B. K. Sharma, Goel Publishing House (2008)
2. *Text book of Polymer Chemistry* by Dr. M.S. Bhatnagar, S. Chand and Co Ltd., First edition (2004)

REFERENCE BOOKS:

1. *Fundamental Concepts of Applied Chemistry* by Jeyashree Ghosh, S. Chand & Co. Ltd.(2008)
2. *Polymer Chemistry* by P.V.Anil Kumar, Vishal Publishing Co., first edition (2021)
3. *Polymer Science* by V.R. Gowarikar, N.V. Viswanathan & Jayadev Sreedhar, New age International Publishers, 4th edition (2021)

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=newNCml5DN0>
2. <https://www.youtube.com/watch?v=-d14DmSBuAQ>
3. <https://www.toppr.com/ask/question/explain-addition-polymerization-with-an-example/>
4. <https://www.doubtut.com/question-answer-chemistry/what-is-copolymerization-explain-with-examples-639457806>
4. <https://study.com/learn/lesson/what-are-polymers-properties-applications-examples.html>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	1	2	3
CO2	3	1	1	2	3
CO3	2	1	1	2	3
CO4	3	1	2	2	3
CO5	3	1	2	2	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. M. RAJASEKARAN



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(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

247

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYS51	APPLIED ORGANIC SPECTROSCOPY	SBS – 3	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

- ❖ Spectroscopy deals with the interaction of electromagnetic radiation with atoms and molecules. It also talks about quantization of energy, relative population of energy levels, transition probability, etc.
- ❖ The aim of the course is also to highlight the significance of principles, absorption laws, Woodward–Fieser rule for structural elucidations.
- ❖ The principles behind the transitions and instrumentation techniques in various branches of spectroscopy will be dealt with.
- ❖ This course will focus on interpretation of spectra and application of these tools to address questions of structures.

COURSE OBJECTIVES:

- ❖ To understand the importance of quantization of energy, relative population of energy levels, transition probability, etc.,
- ❖ To learn the significance of absorption laws and the influence of chromophores and auxochromes.
- ❖ To infer their importance in the structural elucidation of molecules in IR spectroscopy.
- ❖ To make use of the analysis of various IR spectra and to predict the structures of organic compounds.
- ❖ To get knowledge about the analysis of organic molecules using NMR Spectroscopy

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	recognize the significance of the principles, laws, approximations, etc., to understand the transitions in atoms and molecules.	Upto K3
CO 2	learn the significance of absorption laws and the influence of UV visible to organic molecules	Upto K3
CO 3	compare the spectral pattern and evaluate the parameters essential for structural determinations.	Upto K3
CO 4	analyze scientifically the various spectra and identify the appropriate structure of chemical compounds.	Upto K3
CO 5	understand the various aspects in NMR spectroscopy	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

248

APPLIED ORGANIC SPECTROSCOPY

UNIT – I: Electromagnetic spectrum (6 hrs)

Wavelength, wave number, frequency, energy units – problems – absorption spectroscopy – molecular absorption of energy in various regions of the electromagnetic spectrum.

UNIT – II: UV–Visible Spectroscopy (6 hrs)

Introduction – types of electronic transitions – bathochromic, hypochromic, hyperchromic and hypsochromic shifts – applications of UV–visible to organic molecules – Woodward–Fieser rule for conjugated diene and α , β unsaturated carbonyl compounds.

UNIT – III: IR Spectroscopy (6 hrs)

Introduction – principles – theory of molecular vibrations – number of fundamental vibrations – selection rules – finger print region – factors influencing vibrational frequencies – coupled vibrations and fermi resonance – electronic effects – instrumentation – sampling techniques. (solids, liquids, gases and solutions)

UNIT – IV: Applications of IR Spectroscopy (6 hrs)

Analysis of the following IR spectra:

- Alcohols and phenols – Ethanol, phenol and benzyl alcohol.
- Aldehydes and ketones – Benzaldehyde and ethyl methyl ketone.
- Amines – Propyl amine, dimethyl amine and toluidine.
- Nitro compound – Nitro benzene.

UNIT – V: NMR spectroscopy (6 hrs)

Principle – instrumentation – solvents and reference chemicals – number of signals – chemical shift : definition and factors affecting chemical shift –shielding, deshielding, resonance and anisotropy effects – proton counting – splitting of signals – spin–spin coupling and coupling constant – Interpretation of PMR spectra of the following molecules : n– propanol, p–anisidine, benzaldehyde and ethylacetate

TEXT BOOKS:

- Fundamentals of Molecular Spectroscopy* by Banwell, C. N, 4th edition, McGraw–Hill Education, (2017)
- Elementary Organic Spectroscopy – Principles and Chemical Applications*, by Sharma, Y. R., Chand S. publications, 5th edition (2013)
- Spectroscopy of Organic Compounds* by Kalsi, P. S., 8th edition, New Age International Publishers, (2020)



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

249

REFERENCE BOOKS:

1. *Introduction to Spectroscopy* by Pavia, D. L. Lampman, G. M. Kriz, G. A. Vyvyan, J. R. 5th edition, Cengage Learning. (2009)
2. *Spectroscopic Identification of Organic Compounds* by Silverstein, R. M. Webster, F. X. Kiemle, D. J. Bryce, D. L., 8th edition, Wiley and Sons, (2014)
3. *Introduction to Magnetic Resonance Spectroscopy* by Sathyanarayana, D. N., 3rd edition, Tech Press., (2020)

DIGITAL TOOLS:

1. https://science.nasa.gov/ems/01_intro
2. <https://byjus.com/chemistry/uv-vis-spectroscopy/>
3. https://www.youtube.com/watch?v=WTmj_9VT5oE
4. <https://www.bruker.com/en/products-and-solutions/infrared-and-raman/ft-ir-routine-spectrometer/guide-to-applications-of-ir-spectroscopy.html>
5. <https://www.khanacademy.org/science/organic-chemistry/spectroscopy-jay/proton-nmr/v/introduction-to-proton-nmr>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	3	2	3
CO2	3	3	2	2	3
CO3	3	3	3	2	3
CO4	3	3	2	2	3
CO5	3	3	2	2	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. N. P. KRISHNAN



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B.Sc. CHEMISTRY – SYLLABUS

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250

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYS52	APPLIED CHEMISTRY	SBS – 4	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	V	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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COURSE DESCRIPTION:

To acquire the knowledge of data and their analysis with different formats, to study the theory and handling operations of various analytical instruments and to have an idea about computer software and their utilization in Chemistry.

COURSE OBJECTIVES:

- ❖ To study about the agrochemicals
- ❖ To get a knowledge of match industries, pyrotechniques and explosives
- ❖ To understand the various industries such as silicate, paints and pigments
- ❖ To know the chemistry of polymers and their application in various fields.

COURSE OUTCOMES (COs):

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

No.	Course outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	understand the role of fertilizers, pesticides and insecticide	Upto K3
CO 2	get the knowledge of Match Industry, Pyrotechnology & Explosives	Upto K3
CO 3	relate the cement, silicate and zeolites	Upto K3
CO 4	understand the concepts of manufacture of paints and pigments	Upto K3
CO 5	construct the basic concepts of rubber and designing new type of polymer products.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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251

APPLIED CHEMISTRY

UNIT – I: Agrochemicals

(6 hrs)

Fertilizers: Role of macro nutrients in plant growth – requisites of a good fertilizer – manufacture and uses of urea, superphosphate of lime, muriate of potash and –NPK fertilizers – adverse effects of fertilizer on the environment.

Pesticides: Definition– classification – safety measures to handle pesticide.

Insecticides: Manufacture and uses of Bordeaux mixture, calcium arsenates, sodium fluoride, malathion, parathion and carbaryl

UNIT – II: Match Industry, Pyrotechny & Explosives

(6 hrs)

Match Industry: classification – match head and striking surface – manufacture of safety matches –chemistry of lighting of match stick.

Pyrotechny: Composition of fireworks – coloured smokes – coloured matches.

Explosives: Classification – preparation and uses of gun powder, smokeless powder, TNT, picric acid, GTN and dynamite

UNIT – III: Silicate Industry

(6 hrs)

Cement – portland cement – manufacture – glass: raw materials – manufacture – ceramics: classification – manufacture

UNIT – IV: Paints and Pigments

(6 hrs)

Paints: Composition– manufacture – characteristics of good paint

Pigments: Classification – elementary study of zinc white, lithophone, ultramarines, carbon black, red lead and chrome green – lacquers – varnishes and their types.

UNIT – V: Polymers

(6 hrs)

Rubber: Natural and synthetic rubbers – composition of natural rubber– neoprene –SBR

Synthetic polymers: Preparation and uses of polyethylene, PVC, Teflon, Nylon 6,6, Bakelite– Urea formaldehyde resin and dacron.

TEXT BOOKS:

1. *Industrial Chemistry* by B. K. Sharma, Goel Publishing House (2014)
2. *Applied Chemistry* by K. Bhagavathi Sundari, MJP publishers (2019)
3. *Text book on Inorganic Chemistry* by P. L. Soni and M. Katyal 20th Edn., Sultan Chand & Sons (2013)

REFERENCE BOOKS:

1. *Fundamental concepts of Applied Chemistry* by Jeyashree Ghosh, S. Chand & Co. Ltd.(2008)
2. *Principles of Inorganic Chemistry* by Puri, Sharma and Kalia, milestone Publisher & Distributor, (2008)
3. *Advanced Organic Chemistry* by Arun Bahl and B.S.Bahl, S.Chand Publishing Co., Ltd., (2017)

DIGITAL TOOLS:

1. <https://youtu.be/TOEusBA6G04>,
2. <https://youtu.be/2MW-qc1ABssl>
3. <https://youtu.be/uMsHBG-HQYA>,
4. <https://youtu.be/ZRARhYLPKE>
5. <https://youtu.be/2gDjpM3NY>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	1	2	2	3
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CO5	3	2	2	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level
COURSE DESIGNER: Dr. T. S. MANIKANDAN



SOURASHTRA COLLEGE, MADURAI – 625004

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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

252

SEMESTER – VI

S. No.	Subject Code	Subject Title	Hrs. / Week	Exam (Hrs.)	CA	SE	Total Marks	Credits
1.	21UCYC61	Part – III: Core – 13: Organic Chemistry – III	6	3	25	75	100	5
2.	21UCYC62	Part – III: Core – 14: Physical Chemistry – III	6	3	25	75	100	5
3.	21UCYCP5	Part – III: Core – 15: Practical: Gravimetric Estimation and Inorganic Complex Preparation	6	6	40	60	100	5
4.	21UCYCP6	Part – III: Core – 16: Practical: Organic Analysis	3	3	40	60	100	2
5.	Part – III: Elective – 3:		5	3	25	75	100	5
	21UCYE61	Chemistry of Biomolecules						
	21UCYE62	Battery and Fuel Cells						
	21UCYE63	Food Chemistry						
6.	21UCYS61	Part – IV: SBS – 5: Pharmaceutical and Clinical Chemistry	2	3	25	75	100	2
7.	21UCYS62	Part – IV: SBS – 6: Green chemistry and Nanochemistry	2	3	25	75	100	2
8.	21UGKY61	General Knowledge (Self-Study)	–	–	–	–	100	–
		TOTAL	30				800	26

*One elective course to be chosen from THREE courses

CA – Class Assessment (Internal)

SE – Summative Examination

SBS – Skill Based Subject

T – Theory

P – Practical



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(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

253

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYC61	ORGANIC CHEMISTRY – III	CORE – 13	6	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This course imparts detailed knowledge in nitrogen containing compounds, polynuclear hydrocarbons and heterocyclic compounds. It also helps to know the synthesis organometallic & active methylene compounds and to understand the mechanism of molecular rearrangements and synthetic importance of reagents.

COURSE OBJECTIVES:

- ❖ To know the preparation and properties of aliphatic and aromatic nature of nitrogen containing compounds.
- ❖ To analyze the preparation and properties of polynuclear hydrocarbons.
- ❖ To study about the basic concepts, preparation and properties of chemistry of heterocyclic compounds.
- ❖ To predict the synthetic applications of organometallic & active methylene compounds.
- ❖ To get hold of the knowledge of molecular rearrangements and synthetic importance of reagents

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	explain the preparation, properties of aliphatic and aromatic nature of nitrogen containing compounds.	Upto K3
CO 2	discuss the preparation and properties of polynuclear hydrocarbons.	Upto K3
CO 3	spell the chemistry of heterocyclic compounds	Upto K3
CO 4	comprehend the preparation and synthetic applications of organometallic & active methylene compounds	Upto K3
CO 5	analyse the mechanism of rearrangement reactions and synthetic importance of reagents	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

254

ORGANIC CHEMISTRY – III

UNIT – I: Nitrogen Containing Compounds

(18 hrs)

a) Aliphatic nature:

- (i) Preparation and properties of nitroethane and ethyl nitrite, ethylcyanide and ethyl isocyanide – distinguishing between them.
- (ii) Amines: Preparation of 1°, 2° and 3° amines by reductive amination, Hofmann degradation, Curtius, Leuckart, Gabriel – Phthalimide and Hofmann elimination methods – basicity of amines – chemical properties.
- (iii) Diazomethane : preparation and synthetic applications.

b) Aromatic nature:

- (i) Nitrobenzene : preparation – properties viz., reduction, electrophilic and Nucleophilic substitution reactions
- (ii) Preparation of 1°, 2° and 3° amines – properties of primary amine (aniline) – basic character of amines with the influence of substituents on N atom and in the ring.
- (iii) Benzene diazonium chloride: preparation and synthetic applications.

UNIT – II: Polynuclear Hydrocarbons

(18 hrs)

- a) **Isolated systems:** Preparation and properties of biphenyl, diphenylmethane and triphenylmethane including the study of dyes viz., Malachite green, Pararosaniline, Rosaniline and crystal violet.
- b) **Fused systems:** Isolation, synthesis, properties and structure of naphthalene and anthracene – preparation and properties of derivatives of naphthalene derivatives viz., naphthols, naphthylamines and naphthaquinones including the study of the dyes (Naphthol yellow S, Naphthol green Y, Maritius Yellow, Orange II, congo red and alizarin)

UNIT – III: Heterocyclic Compounds

(18 hrs)

a) Monocyclic systems: Nomenclature.

- (i) Pyrrole, Furan and Thiophene: preparation and properties viz., electrophilic substitution, acidic and basic characters, oxidation and reduction.
- (ii) Pyridine: preparation and its properties viz., basic character, electrophilic substitution, nucleophilic substitution, reduction and oxidation reactions.
- (iii) Comparative study of preparation of pyrazole, thiazole and oxazole – the study of their basic character.

- b) **Condensed systems:** Preparation, and properties of indole, quinoline and isoquinoline – preparation of purine and pyrimidine – importance of heterocyclic compounds in medicine and biochemistry.



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

255

UNIT – IV: Organometallic & Active Methylene Compounds (18 hrs)

- Organometallic compounds** : Preparation and synthetic applications of Grignard reagent, Frankland reagent, Gilman reagent and organo lithium compounds.
- Active methylene compounds** : Preparation and synthetic applications of malonic ester and acetoacetic ester

UNIT – V: Molecular Rearrangements and Reagents of Synthetic importance (18hrs)

- Molecular rearrangements**: Definition and its types – detailed study of the following mechanisms of the rearrangements – Pinacol–pinacolone, Hofmann, Claisen Fries, Beckmann, Baeyer–Villiger, Benzil – Benzilic acid and Wagner–Meerwin.
- Reagents of synthetic Importance**
Preparation and applications of aluminium isopropoxide, lead tetraacetate, N–bromosuccinimide, osmium tetroxide and Raney nickel

TEXT BOOKS:

- Modern Organic Chemistry* by M. K. Jain and S. C. Sharma – Vishal Publishing co. 4th Edn. (2014).
- A Text book of Organic Chemistry* by K.S. Tewari and N. K. Vishnoi – Vikas Publishing House pvt. Ltd. 3rd Edn. (2006).
- Text Book of Organic Chemistry* by P.L.Soni and H. M Chawla – Sultan Chand & sons 29th Edn. (2012).

REFERENCE BOOKS:

- Organic Chemistry* by I.L.Finar (Vol. I & Vol.II) – Pearson Education Ltd. 6th Edn. (2012).
- Advanced Organic Chemistry: Reactions, Mechanisms and Structure* by Jerry March – Wiley India, 7th Edn.(2015)
- Advanced Organic Chemistry* by Arun Bahl and B.S. Bahl, S. Chand Publishing Co. Ltd.,(2017)
- Organic Chemistry* by Morrison Boyd Pearson Education Ltd. 7th Edn. (2010)

DIGITAL TOOLS:

- <https://www.youtube.com/watch?v=K6TuQSGdhmk>
- <https://www.youtube.com/watch?v=vxPgyR75D6M>
- https://www.youtube.com/watch?v=zyRRHfH9_Zg
- <https://www.youtube.com/watch?v=JgmzmehMiWM>
- <https://byjus.com/chemistry/organic-rearrangement-reaction/>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	1	3
CO2	3	1	3	2	3
CO3	3	1	2	2	3
CO4	3	1	3	1	3
CO5	3	1	2	2	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Dr. V. SATHIYENDIRAN



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

256

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYC62	PHYSICAL CHEMISTRY –III	CORE – 14	6	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

To learn the preliminary idea about group theory and quantum mechanics and to get exposed to the principles and applications of electrochemistry and photochemistry, theoretical aspects of molecular spectroscopy.

COURSE OBJECTIVES:

- ❖ To acquire the knowledge in quantum mechanics and symmetry of molecules.
- ❖ To know the principle of ion movements in solutions.
- ❖ To gain the knowledge of electrochemical cells and their applications.
- ❖ To study about the photo influence of chemical reactions.
- ❖ To understand the basic concept in electromagnetic spectrum.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	relate electronic structure, symmetry of molecules to their physical properties and reaction mechanism.	Upto K3
CO 2	understand the behaviour of ions in solutions through various theories.	Upto K3
CO 3	apply the electrochemical cells in chemical analysis	Upto K3
CO 4	understand the photochemical transformations that occur through photochemical processes.	Upto K3
CO 5	know the concepts in various electromagnetic spectrum and apply them in structural analysis.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

257

PHYSICAL CHEMISTRY – III

UNIT – I: QUANTUM MECHANICS & GROUP THEORY (18 hrs)

a) **Quantum mechanics:** Limitations of classical mechanics – Schrodinger wave equation – derivation – Eigen values and Eigen functions – significance of wave function and probability – particle in a one dimensional box and its derivation.

b) **Group Theory:** symmetry elements and its types – symmetry operations and the products of symmetry operations – Groups – properties and its types – group multiplication table – C_{2v} and C_{3v} – classes and sub groups. Point groups: explanation and classification – study of the following with examples: C_{2v} , C_{3v} , D_{2h} , and D_{6h} .

UNIT – II: ELECTROCHEMISTRY – I (18 hrs)

Electrolytic conductance–Faraday's laws of electrolysis – specific conductance – equivalent conductance – molar conductance – variation of equivalent conductance with dilution – Electrolytes and its types – Arrhenius theory of ionization – postulates – limitations – degree of dissociation – factor influencing degree of dissociation – Ostwald's dilution law – theory of strong electrolytes – Debye–Huckel–Onsager theory – Transport number – determination of transport number by Moving boundary method. Kohlrausch's law of ionic mobilities and its applications –conductometric titrations: neutralization and precipitation.

UNIT – III: ELECTROCHEMISTRY – II (18 hrs)

Comparison of electrolytic cells and electro chemical cells – Galvanic Cells – sign conventions, representation of a cell – single electrode potential – thermodynamics of reversible electrodes and cells – standard electrode potentials – electrochemical series – emf of galvanic cells – standard cell– reference electrode – The Nernst equation and electrode potential calculations – concentration cells – types of concentration cells – determination of emf for electrode and electrolyte concentration cells – liquid junction potential – applications of emf measurements : determination of pH using hydrogen electrode, quinhydrone electrode, glass electrode –potentiometric titrations : acid – base, redox and precipitation.

UNIT – IV: PHOTOCHEMISTRY (18 hrs)

Introduction – comparison of thermal reactions and photochemical reactions – laws of photochemistry : Grotthus–Draper's law, Einstein law of photochemical equivalence – quantum efficiency – experimental determination of quantum efficiency – Jablonski diagram – photophysical processes: fluorescence – phosphorescence – chemiluminescence – bioluminescence – kinetics of photochemical reactions: formation of HCl, HBr and decomposition of HI – photosensitization – photo inhibitors – photochemical equilibrium.

UNIT – V: MOLECULAR SPECTROSCOPY (18 hrs)

a) Rotational spectra of diatomic molecules: rigid rotator – selection rule – determination of moment of inertia and bond length – intensities of spectral lines – effect of isotopic substitution.

b) Vibrational spectra: Hooke's law – simple harmonic oscillator – force constant – selection rule Vibrational rotational spectra: P,Q, R bands– applications of IR spectra.

c) Electronic spectra: Frank – Condon principle.

d) Raman spectra: Raman Effect – stokes and anti stokes lines, quantum theory of Raman effect – comparison between IR and Raman spectra – applications of Raman spectra.



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

258

TEXT BOOKS:

1. *Principles of Physical Chemistry* by B.R.Puri, L.R.Sharma and S.Pathania – Vishal Publishing Co. 43rd Edn. (2022).
2. *Essentials of Physical Chemistry* by B.S.Bahl, Arun Bahl and G.T.Tuli – S.Chand and Co. Ltd., reprint Edn. (2016).

REFERENCE BOOKS:

1. *A Textbook of Physical Chemistry* by S.Glasstone – Macmillan (India) Ltd. 2nd Edn. (2009).
2. *Advanced Physical Chemistry* by Gurdeep Raj – Krishna Prakashan Media (P) Ltd 39th Edn. (2014).
3. *Advanced Physical Chemistry* by D.N. Bajpai– S.Chand and Co.Ltd., 3rd Edn.(1992).

DIGITAL TOOLS:

1. https://www.youtube.com/watch?v=K0VY9_hB_WU
2. https://www.youtube.com/watch?v=BnE_MJaU8BQ
3. <https://www.youtube.com/watch?v=IV4IUsholjg>
4. <https://www.youtube.com/watch?v=cNs7CPevcYs>
5. <https://www.youtube.com/watch?v=oIQ8WEYsGW0>
6. <https://www.youtube.com/watch?v=vt3WO2rf9Qs>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	1	3
CO2	2	2	2	2	3
CO3	3	2	2	3	3
CO4	2	2	2	2	3
CO5	2	2	2	3	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Prof. K. VASUKI

**SOURASHTRA COLLEGE, MADURAI – 625004**

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B.Sc. CHEMISTRY – SYLLABUS**(Under CBCS based on OBE) (with effect from 2021 – 2022)**

259

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYCP5	GRAVIMETRIC ESTIMATION AND INORGANIC COMPLEX PREPARATION	CORE –15 PRACTICAL	–	6	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

This practical helps to improve the advanced skill of students regarding the estimation of elements and synthesis of inorganic complexes.

COURSE OBJECTIVES:

- ❖ To practice the estimation of metal by gravimetric technique.
- ❖ To gain the knowledge of preparation of inorganic complexes.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO	estimate the barium, lead and calcium by gravimetric methods and prepare the coordination number 4 & 6 metal complexes.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

260

I. GRAVIMETRIC ESTIMATION

1. Estimation of Lead as lead chromate
2. Estimation of Barium as barium chromate
3. Estimation of Calcium as calcium oxalate monohydrate
4. Estimation of Nickel as Ni-DMG complex.
5. Estimation of Copper as cuprous thiocyanate.

II. INORGANIC COMPLEX PREPARATION

1. Preparation of ammonium hexachlorostannate(IV)
2. Preparation of Sodium nitroprusside.
3. Preparation of Tetraamminecopper(II) sulphate
4. Preparation of Potassium trioxalatochromate(III)
5. Preparation of Potassium trioxalatoaluminate (III).

Distribution of Marks

Internal – 40 Marks

External – 60 Marks

External Examination

Record Note book – 10 marks

Viva voce – 5 marks

Gravimetric Estimation – 30 marks

Procedure – 05 marks

Estimation – 25 marks

< 2% Error – 25 marks

2–3% Error – 20 marks

3–4% Error – 15 marks

4–5% Error – 10 marks

> 5% Error – 08 marks

Inorganic Preparation – 15 marks

Procedure – 05 marks

Crude sample – 10 marks

TEXT BOOK:

Basic Principles of Practical Chemistry by V. Venkateswaran, R. Veeraswamy and A. R. Kulandaivelu S. Chand and Co. Ltd. (2017).

REFERENCE BOOK:

Vogel's Textbook of Quantitative Inorganic Analysis 4th edition. (1978)

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=cT1rxDA13As> (Barium)
2. <https://www.youtube.com/watch?v=AquLTtaiH68> (Lead)
3. <https://www.youtube.com/watch?v=peMyqdJ57dA> (Nickel)
4. <https://www.youtube.com/watch?v=TWYu4d6-xj8>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO	3	3	3	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. M. RAJASEKARAN

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B.Sc. CHEMISTRY – SYLLABUS**(Under CBCS based on OBE) (with effect from 2021 – 2022)**

261

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYCP6	ORGANIC ANALYSIS	CORE –16 PRACTICAL	–	3	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	40	60	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

To give the organic analytical skill through identification of various functional groups.

COURSE OBJECTIVE:

- ❖ To analyze the functional group of organic compounds and preparation of solid derivative.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO	detect elements in organic substances and analyze the various functional groups and preparation of their derivatives.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

262

ORGANIC ANALYSIS

Analysis of the given organic compound containing one or two functional groups and confirmation by the preparation of a solid derivative.

Functional groups to be analysed : acids, phenols, aldehydes, ketones, esters, nitro compounds, amines (primary, secondary and tertiary), amides, anilides, aliphatic diamide, side chain and nuclear halogen compounds, aliphatic diamide containing sulphur and monosaccharides.

Distribution of Marks	Internal – 40 Marks	External – 60 Marks
<u>External Examination</u>		
Record Notebook	– 10 marks	
Preliminary reactions	– 15 marks	
Elements present	– 9 marks	
Aliphatic or aromatic	– 3 marks	
Saturated / Unsaturated	– 3 marks	
Functional group	– 15 marks	
Derivative	– 5 marks	

	60 marks	

TEXT BOOK:

Basic Principles of Practical Chemistry by V. Venkatheswaran, R. Veeraswamy and A. R. Kulandaivelu S. Chand and Co. Ltd. (2017).

REFERENCE BOOK:

Vogel's Textbook of Quantitative Inorganic Analysis 4th edition. (1978)

DIGITAL TOOLS:

- <https://www.youtube.com/watch?v=FUo428guKt0> (Lassaigne test)
- https://www.youtube.com/watch?v=n4esSHxz_J8 (Functional groups)

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO	3	3	3	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Prof. K. VASUKI



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

263

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE61	CHEMISTRY OF BIOMOLECULES	ELECTIVE – 3	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

- ❖ The course gives a detailed discussion on the occurrence and synthesis of carbohydrates.
- ❖ The course gives the knowledge of synthesis and properties of biomolecules and medicinally important alkaloids and vitamins.
- ❖ It provides the basic concepts of terpenes and lipids
- ❖ The other important aspect is to give the knowledge of structure determination of amino acids and proteins.
- ❖ This course explains the biological importance of steroids, hormones and nucleic acids

COURSE OBJECTIVES:

- ❖ To understand the nomenclature, synthesis and basic concepts of carbohydrates.
- ❖ To explain the general methods of isolation, classification and properties of alkaloids & biological role of vitamins.
- ❖ To discuss the classification, isolation, structure and extraction of terpenes and lipids.
- ❖ To explain various methods of preparations and functions of amino acids & proteins,
- ❖ To articulate the functions of steroids, hormones and nucleic acids.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	understand the basic concepts & synthesis of carbohydrates	Upto K3
CO 2	construct the structure, synthesis of alkaloids and biological role of vitamins	Upto K3
CO 3	explain the classification, isolation, structure and extraction of terpenes and lipids.	Upto K3
CO 4	integrate and assess the different methods of preparation of amino acids and gain advanced knowledge and understanding in aspect of proteins.	Upto K3
CO 5	illustrate the structure & applications of steroids, hormones & nucleic acids and their functions in the metabolism of living organisms.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

264

CHEMISTRY OF BIOMOLECULES

UNIT – I: Carbohydrates (15 hrs)

- a) Introduction – Classification
- b) **Monosaccharides:** Glucose and Fructose – preparation, properties, structure (open chain, configuration and ring structure), ascending and descending of aldose, mutarotation, epimerization and interconversion.
- c) **Disaccharides:** Sucrose – manufacture, properties, structure and uses –
Polysaccharides: properties and structure (only) of starch and cellulose – industrial applications of cellulose derivatives.

UNIT – II: Alkaloids and Vitamins (15 hrs)

- a) **Alkaloids** – Introduction, classification, occurrence, general properties – isolation general methods of structure determination by chemical methods, structural elucidation and synthesis of coniine, piperine and nicotine
- b) **Vitamins:** Introduction – classification – source, structure (only), biological role, daily requirement and deficiency manifestation of fat soluble and water-soluble vitamins.

UNIT – III: Terpenes and Lipids (15 hrs)

- a) **Terpenes** – Introduction – isoprene rule – classification – isolation – general methods of structure determination by chemical methods, structural elucidation and synthesis of citral, menthol and geraniol
- b) **Lipids:** Introduction – biological functions – classification. simple lipids : Fats and oils – composition – isolation – general properties – hydrolysis, hydrogenation, hydrogenolysis and trans-esterification – flavour changes in oils and fats – analytical characterization of fats and oils – acid value, RM value, saponification value and iodine number.

UNIT – IV: Amino Acids and Proteins (15 hrs)

- a) **Amino acids:** Introduction – Essential and non-essential amino acids –classification – synthesis by Gabriel – Phthalimide, Strecker and Erlenmeyer methods – isoelectric point – zwitter ion – general chemical properties.
- b) **Proteins:** Introduction – classification by chemical, composition and molecular shape – isolation – determination of structure – types of structures – general properties – analytical reactions – determination of protein content in foods.

UNIT – V: Steroids, Hormones and Nucleic Acids (15 hrs)

- a) **Steroids:** Introduction – biological importance – classification – occurrence, properties, structure (no elucidation), tests and physiological activity of cholesterol.
- b) **Hormones:** Introduction – chemical classification – structure (no elucidation) and biological importance of thyroid, pituitary, pancreatic and sex hormones – distinction with steroids.
- c) **Nucleic acids:** Introduction – purine and pyrimidine bases – structure of nucleosides, nucleotides and polynucleotides – difference between DNA and RNA – RNA: types and functions – DNA replication – genetic code – biosynthesis of proteins and mutation



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

265

TEXT BOOKS:

1. *Modern Organic Chemistry* by M. K.Jain and S. C. Sharma, 4th edn. Vishal publishing Co. (2014)
2. *Chemistry of Natural products Vol I & II* by Gurdeep R. Chatwal, Himalaya publishing, House Pvt. Ltd, Mumbai, (2018)
3. *Chemistry of Natural products Vol I & II* by O.P. Agarwal, Goel publishing Co, New Delhi (2001)

REFERENCE BOOKS:

1. *A Text Book of Organic Chemistry* by K.S. Tewari and N. K. Vishnoi – Vikas Publishing House Pvt. Ltd. 3rd Edn. (2006)
2. *Text Book of Organic Chemistry* by P.L. Soni and H. M Chawla – Sultan Chand & sons, 29th Edn. (2012)
3. *Organic Chemistry* by I.L.Finar (Vol. I & Vol.II) – Pearson Education Ltd. (2012)

DIGITAL TOOLS:

1. <https://microbenotes.com/category/biochemistry/>
2. <https://www.masterorganicchemistry.com/organic-1/>
3. <https://www.organic-chemistry.org/>
4. <https://www.chemistryworld.com/organic-chemistry/211.subject>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	1	3
CO2	2	2	2	2	3
CO3	3	2	2	3	3
CO4	2	2	2	2	3
CO5	2	2	2	3	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Dr. N. P. KRISHNAN



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

266

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE62	BATTERY AND FUEL CELLS	ELECTIVE – 3	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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COURSE DESCRIPTION:

The aim of this subject is to give the knowledge of electrode, electrolytic, electrochemical cell, battery and fuel cells.

COURSE OBJECTIVES:

- ❖ To impart fundamental knowledge on electrochemical energy storage systems considering the operation and design of various battery technologies.
- ❖ To make the students understand the requirement of batteries and fuel cells for automotive application
- ❖ To teach construction and working of battery
- ❖ To teach the development in battery system
- ❖ To teach the basic concepts of fuel cell and E– vehicle system.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	compare and classify the various energy storage systems	Upto K3
CO 2	analyze concepts of thermodynamics and kinetics involved in electrochemical reactions	Upto K3
CO 3	develop components and processes of various battery systems	Upto K3
CO 4	identify the recent developments in battery systems including electrode and electrolyte materials	Upto K3
CO 5	utilize fuel cells and E–vehicle system	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

267

BATTERY AND FUEL CELLS

UNIT – I: Energy demands and Energy sources (15 hrs)

World Energy consumptions–Energy in developing countries Indian Energy Sources.–
Non– conventional renewable energy resources. Potential of renewable energy sources–
Solar energy types, wind energy, wave, Tidal energy sources

UNIT – II: Introduction to Electrochemical energy storage system (15 hrs)

Introduction to battery system– Electromotive force– Reversible cells– Relation between
electrical energy and energy content of a cell–Free energy changes and electromotive
force in cell–Single Electrode potential

UNIT – III: Classification of Batteries (15 hrs)

High energy density and Power density batteries–Operational characteristics –Primary
cell– Voltaic cell, Dry cell, Alkaline cell –. Secondary batteries– Lead acid Batteries
Lithium battery–Nickel metal hydride battery Construction and its application.

UNIT – IV: Recent development in battery system (15 hrs)

Recent development of electrode materials in lithium ion batteries– Recent development
of solid electrolytes and their application to solid state batteries–Polymer solid electrolytes
for lithium ion conduction Metal air batteries (principle only) Thin Film solid state
Batteries

UNIT – V: Fuel Cells and E–vehicle system (15 hrs)

Fuel cells Basic concept and types Proton exchange membrane FC–Methanol FC–solid
oxide FC– (principle only)– Advantages and Disadvantages of fuel cell–Hydrogen
Economy– Hydrogen storage Super capacitors.

TEXT BOOKS:

1. *Textbook of Engineering Chemistry* by Jain, P.C., Jain M, A, Dhanpat Rai publications, New Delhi, 16 edition, (2015)
2. *A text book of Engineering Chemistry* by Shashi Chawla, Dhanpat Rai & Co.(pvt) Ltd, 3rd Edition, reprint (2013)
3. *Electrochemical Methods: Fundamentals and Applications* by Bard Allen J., and Larry, Faulkner.R 2nd ed. Wiley and sons (2000)

REFERENCE BOOKS:

1. *Lithium ion Batteries Fundamental and Performance* by Wakihara. M, Yamamoto. O, Published by Wiley VCH Verlag G mbH, (1999)
2. *Electrochemical Power Sources: Batteries Fuel Cell And Supercapacitors* by Skundin, M.L, Bagotski, V.S, Wiley and sons (2015)
3. *Industrial Chemistry* by Sharma. B.K. –, Goel Publishing House, New Delhi, (1994)



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

268

DIGITAL TOOLS:

1. https://en.wikipedia.org/wiki/Electric_battery
2. <https://www.britannica.com/technology/battery-electronics>
3. <https://www.batterysolutions.com/recycling-information/battery-types>
4. https://en.wikipedia.org/wiki/Fuel_cell
5. <https://americanhistory.si.edu/fuelcells/basics.html>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	1	3
CO2	3	2	1	2	3
CO3	2	2	2	1	3
CO4	2	2	1	1	3
CO5	3	2	2	2	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Dr. V. SATHIYENDIRAN



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

269

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYE63	FOOD CHEMISTRY	ELECTIVE – 3	5	–	5

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

The course briefly outlines the basic knowledge in Food and Milk Chemistry and imparts the practical knowledge in food analysis.

COURSE OBJECTIVES:

- ❖ To learn about the sources, functions of foods.
- ❖ To acquire the knowledge of food adulterations.
- ❖ To know about Food Spoilage and food preservation.
- ❖ To give the detailed information about vitamins.
- ❖ To understand the basic knowledge of minerals.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	explain the basic group of foods and constituents carbohydrates	Upto K3
CO 2	summarize the different types of food adulterants.	Upto K3
CO 3	illustrate the food spoilage – food preservation.	Upto K3
CO 4	construct the classification, functions and deficiencies of vitamins.	Upto K3
CO 5	understand the mineral elements in foods.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



SOURASHTRA COLLEGE, MADURAI – 625004

(An Autonomous Institution Re-accredited with 'B+' grade by NAAC)

B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

270

FOOD CHEMISTRY

UNIT – I: Food source & Constituents of foods (15 hrs)

Food: Source, functions of foods. food groups: basic five food groups.

constituents of food : carbohydrates, classification – storage of carbohydrates and its function. Proteins – classification sources and functions. fats and oils, dietary sources, uses of fat sand oils and their role in biological systems.

UNIT – II: Food Adulteration (15 hrs)

Adulterants in different foods – milk, and milk products, vegetable oils and fats spices, cereals, pulses. Contamination with toxic chemicals – pesticides and insecticides detection and prevention of food adulteration.

UNIT – III: Food Spoilage and food preservation (15 hrs)

Causes of food spoilage–food preservation – principle and methods of preservation – by using high temperature – sterilization, pasteurization and blanching. Low temperature food preservation methods.

UNIT – IV: Vitamins (15 hrs)

Classification, sources, functions and deficiencies of fat soluble vitamins – A,D,E, and K, water soluble vitamins – B₁,B₂ and B₆

UNIT – V: Minerals (15 hrs)

Mineral elements in foods, principal mineral elements – sources, functions and deficiencies of Na, K, Mg, Fe, S and P.

TEXT BOOKS:

1. *Applied Chemistry* by K Bagavathi Sundari., MJP Publishers (2019)
2. *Food Chemistry* by Lillian Hoaland Meyer,CBS Publishers and Distributors,Delhi, (1987)

REFERENCE BOOKS:

1. *Engineering Chemistry* by Jain & Monika Jain, 5th edition, Dhanpat Rai & Sons, Delhi, (1990)
2. *Elements of Industrial Chemistry* by G Mahapatra, Kalyani Publishers, New Delhi, (2001)
3. *Industrial Chemistry* by B.K Sharma, Goel Publishing House (P) Ltd., (2014)

DIGITAL TOOLS:

1. <https://www.jliedu.com/blog/constituents-food-functions/>
2. https://www.youtube.com/watch?v=l0BthUI_MMA
3. <https://byjus.com/biology/food-preservation-methods-food-poisoning/>
4. <https://www.youtube.com/watch?v=ISZLTJH5IYg>
5. <https://www.youtube.com/watch?v=i3GfrZR2DUE>

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	1	3
CO2	2	2	2	2	3
CO3	3	2	2	3	3
CO4	2	2	2	2	3
CO5	2	2	2	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level

COURSE DESIGNER: Dr. T. S. MANIKANDAN



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

271

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYS61	PHARMACEUTICAL & CLINICAL CHEMISTRY	SBS – 5	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input checked="" type="checkbox"/>
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COURSE DESCRIPTION:

To know the basic biomedical terms and to acquire the knowledge of pharmaceutical aids, anaesthetics, chemotherapeutical agents and clinical studies.

COURSE OBJECTIVES:

- ❖ To teach about the basic pharmaceutical definitions, importance & classification of drugs.
- ❖ To make the students know the chemical nature and applications of pharmaceutical aids and organic diagnostic agents.
- ❖ To give the thorough knowledge about anaesthetics.
- ❖ To know the nature, classification and uses of various therapeutic agents.
- ❖ To deal the various methods of clinical analysis.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	gain the knowledge towards pharmaceutical terminologies, drugs and their importance.	Upto K3
CO 2	know the application of chemical inorganic and organic substances in pharmaceutical field.	Upto K3
CO 3	realize the characteristic and applications of various anaesthetics.	Upto K3
CO 4	know the elementary idea about the drugs: Antipyretics, Analgesics, anti-inflammatory agents, Sulphonamide, Antimalarials and Arsenical drugs.	Upto K3
CO 5	gain the knowledge blood composition, grouping and Rh factor and its clinical analysis and acquire the knowledge about urine clinical analysis.	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

272

PHARMACEUTICAL & CLINICAL CHEMISTRY

UNIT – I: Study of drugs (6 hrs)

- a) Introduction – terminologies – micro–organisms, pharmacology, pharmacodynamics, pharmacokinetics, pharmacopoeia – importance of drugs.
- b) Classification of drugs :– biological and chemical.

UNIT – II: Pharmaceutical Aids (6 hrs)

- a) Organic pharmaceutical aids: preservatives, antioxidants, emulsifying agents, colouring, flavouring and sweetening agents, stabilizing agents, ointment bases, solvents. (explanation of the above terms and examples)
- b) Organic diagnostic agents: Drugs used for X– ray contrast media (Barium sulphate, Sodium diatrizoate injection), drugs used to test organ function (Fluorescein Sodium, Sulphobromophthalein sodium).

UNIT – III: Anaesthetics (6 hrs)

- a) Anaesthetics – definition – mode of action – classification.
- b) General anaesthetics – types – inhalation anaesthetics , intravenous anaesthetics and basal anaesthetics (two examples for each category).
- c) Local anaesthetics – types – natural and synthetic local anaesthetics (two examples for each category).

UNIT – IV: Chemotherapy (6 hrs)

- a) Antibiotics – definition – classification and uses .
- b) Antipyretics, analgesics and anti–inflammatory agents. (definition– examples– therapeutic uses)
- c) Sulphonamide: sulphanilamide, prontosil – therapeutic uses
- d) Antimalarials : quinine and chloroquine – therapeutic uses
- e) Arsenical drugs : salvarsan–606 and neosalvarsan – therapeutic uses.

UNIT – V: Clinical Chemistry (6 hrs)

- a) Blood: composition – blood grouping and Rh factor– anticoagulant drugs
- b) Analysis of blood: determination of glucose and total cholesterol in blood serum
- c) Urine: routine examination of urine – determination of glucose in urine – GTT.

TEXT BOOKS:

1. *A Text book of Pharmaceutical Chemistry* by Jayashree Ghosh, S.Chand & Co. Ltd, (2012)
2. *Pharmaceutical Chemistry* by S.Lakshmi, Sultan Chand & Sons, (2004)

REFERENCE BOOKS:

1. *Industrial Chemistry* by B.K.Sharma –Goel Publishing House, (2014)
2. *Medicinal Chemistry* by Ashutosh Kar, New Age International(P)Ltd. 5th edn. (2010)
3. *Burger's Medicinal Chemistry* by J. G. Cannon, John Wiley and Sons, Inc., 5th edn. (1995)



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B.Sc. CHEMISTRY – SYLLABUS

(Under CBCS based on OBE) (with effect from 2021 – 2022)

273

DIGITAL TOOLS:

1. <https://www.youtube.com/watch?v=490LekxEKFc>
2. <https://www.youtube.com/watch?v=GZgUQ1Bn6-o>
3. https://www.youtube.com/watch?v=9DU_q7Ue8Oc
4. <https://www.youtube.com/watch?v=wzdBDB6PzaU>
5. https://www.youtube.com/watch?v=GAMHSl_ybwk

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	1	2	2	3
CO2	3	2	2	1	3
CO3	3	2	1	2	3
CO4	3	2	2	2	3
CO5	3	3	1	1	3

3. Advanced Application

2. Intermediate Development

1. Introductory Level

COURSE DESIGNER: Prof. K. VASUKI



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B.Sc. CHEMISTRY – SYLLABUS

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274

COURSE CODE	COURSE TITLE	CATEGORY	T	P	CREDITS
21UCYS62	GREEN CHEMISTRY AND NANO CHEMISTRY	SBS – 6	2	–	2

YEAR	SEMESTER	INTERNAL	EXTERNAL	TOTAL
III	VI	25	75	100

NATURE OF COURSE	Employability <input checked="" type="checkbox"/>	Skill Oriented <input checked="" type="checkbox"/>	Entrepreneurship <input type="checkbox"/>
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COURSE DESCRIPTION:

To know the adulterants present in the consumer products and to acquire the knowledge of green chemistry and greener methods for the synthesis of well-known compounds.

COURSE OBJECTIVES:

- ❖ To learn about the basic principles of green chemistry
- ❖ To gain information about the green solvents.
- ❖ To study the importance of green synthesis.
- ❖ To discuss the introduction of nanochemistry
- ❖ To deal with the application of nanoparticles.

COURSE OUTCOMES (COs):

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

No.	Course Outcomes	Knowledge Level (According to Bloom's Taxonomy)
CO 1	gain the importance of basic idea of principle of green chemistry	Upto K3
CO 2	understand the role of green solvents	Upto K3
CO 3	realize the significance of green approach in synthesis of compounds	Upto K3
CO 4	know the basic idea of nanochemistry	Upto K3
CO 5	understand the application of nanoparticles	Upto K3

K1– KNOWLEDGE (REMEMBERING), K2–UNDERSTANDING, K3–APPLY



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275

GREEN CHEMISTRY AND NANO CHEMISTRY

UNIT – I: Green chemistry –I

(6 hrs)

Need for green chemistry – goals of green chemistry – limitations /obstacles – the progress of green chemistry – twelve principles of green chemistry – concepts of atom economy (rearrangement reactions, addition reactions, substitution reactions and elimination reactions)

UNIT – II: Green Chemistry–II

(6 hrs)

Green solvents (supercritical carbon dioxide, ionic liquids, water and organic synthesis in solid state) – mode of supplying energy to a reaction (use of microwaves and sonication) – basic concepts in designing a green synthesis (choice of starting materials, reagents, catalysts and solvents). synthesis of adipic acid

UNIT – III: Green Chemistry – III

(6 hrs)

Microwave assisted reactions in water (Hofmann elimination, hydrolysis of benzyl chloride, hydrolysis of benzamide, hydrolysis of methyl benzoate, oxidation of toluene and oxidation of alcohols) – ultrasound assisted reactions (esterification, saponification, substitution reactions) – future trends in green chemistry

UNIT – IV: Nano technology – I

(6 hrs)

Introduction of nanomaterials – properties of nanomaterials – characterization of nanomaterials – nanomaterials synthesis techniques: top–down approach – bottom–up approach.

UNIT – V: Nano technology–II

(6 hrs)

Preparation, properties and applications of CNT, gold and silver nanomaterials – applications of nanomaterials in the fields of electronics (quantum dots, sensors, optoelectronic devices), catalysts, medicine, consumer products, textiles, paints, defence and space applications.

TEXT BOOKS:

1. *Green Chemistry: A Textbook* by V. K Ahluwalia– Alpha Science International, (2012)
2. *Green Chemistry: An Introductory Text* by Mike Lancaster– Royal Society of Chemistry (2012).
3. *Introduction to Nanotechnology* by Charles P Poole and Frank J Owens – Wiley India Pvt. Limited (2007).
4. *Textbook of Nanoscience and Nanotechnology* by B.S. Murty, James Murday, P. Shankar, Baldev Raj, Springer Berlin Heidelberg (2013).

REFERENCE BOOKS:

1. *An Introduction to Green Chemistry* by V.Kumar, Vishal Publishing Co Ltd., (2015).
2. *Introduction to Green Chemistry* by Albert S. Matlack, CRC press (2022).
3. *Nano–technology* by Richard Booker & Earl Boysen, Wiley Publishing Inc. (2006)

DIGITAL TOOLS:

1. https://www.youtube.com/watch?v=vbgzfcM_P0
2. <https://www.youtube.com/watch?v=NYWWtxI7dFY>
3. <https://www.youtube.com/watch?v=Dam3cyRyGrI>
4. <https://www.youtube.com/watch?v=PNElByWIGNc>
5. https://www.youtube.com/watch?v=ebO38bbq0_4&list=PLbMVogVj5nJTdeiLvuGSB_AE8hloTAHWJ

Mapping of CO with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	2	2	2	3	3
CO2	2	2	3	3	3
CO3	2	2	2	3	3
CO4	2	2	2	3	3
CO5	2	2	2	3	3

3. Advanced Application 2. Intermediate Development 1. Introductory Level
 COURSE DESIGNER: Dr. M. RAJASEKARAN