B.Sc., CHEMISTRY

SYLLABUS

Programme Code: 3USCHE

2024-2025

SENGAMALA THAYAAR EDUCATIONAL TRUST

WOMEN'S COLLEGE (AUTONOMOUS)

(Affiliated to Bharathidasan University, Tiruchirappalli)
(Accredited by NAAC)
SUNDARAKKOTTAI, MANNARGUDI–614016.
TAMILNADU, INDIA.

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B.Sc., CHEMISTRY

CHOICE BASED CREDIT SYSTEM– LEARNING OUTCOMES BASED CURRICULUM FRAME WORK (CBCS–LOCF)

(For the candidates admitted in the academic year 2024–2025)

CHOICE BASED CREDIT SYSTEM

The credit-based semester system provides flexibility in designing curriculum and assigning credits based on the course content and hours of teaching. The choice-based credit system provides a 'cafeteria' type approach in which the students can take courses of their choice, learn at their own pace, undergo additional courses and acquire more than the required credits, and adopt an interdisciplinary approach to learning. Our college has moved to CBCS and implemented the grading system.

OUTCOME-BASED EDUCATION (OBE)

LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (LOCF)

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that higher education qualifications are awarded on the basis of demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and academic standards expected of graduates of a programme of study. Learning outcomes specify what graduates completing a particular programme of study are expected to know, understand and be able to do at the end of their programme of study. The expected learning outcomes are used as reference points that would help to formulate graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes which in turn will help in curriculum planning and development, and in the design, delivery and review of academic programmes. They provide general guidance for articulating the essential learnings associated with programmes of study and courses with in a programme, maintain national standards and international comparability of learning outcomes and academic standards to ensure global competitiveness, and to facilitate student/graduate mobility and provide higher education institutions an important point of reference for designing teaching-learning strategies, assessing student learning levels, and periodic review of programmes and academic standards. Some important aspects of the Outcome Base Education Course: is defined as a theory, practical or theory cum practical subject studied in a semester.

Course Outcomes (COs): are statements that describe significant and essential learning that learners have achieved, and can reliably demonstrate at the end of a course. Generally, three or more course outcomes may be specified for each course based on its weightage.

Programme: is defined as the specialization or discipline of a degree.

Programme Outcomes (POs): Programme outcomes are narrower statements that describe what students are expected to be able to do by the time of graduation.

POs are expected to be aligned closely with Graduate Attributes.

Programme Specific Outcomes (PSOs): PSOs are what the students should be able to do at the time of graduation with reference to a specific discipline.

Some important terminologies repeatedly used in LOCF.

Core Courses (CC) A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course. These are the courses which provide basic understanding of their main discipline. In order to maintain a requisite standard certain core courses must be included in an academic program. This helps in providing a universal recognition to the said academic program.

Discipline Specific Elective Courses (DSE) Elective course may be offered by the main discipline/subject of study is referred to as Discipline Specific Elective (DSE). These courses offer the flexibility of selection of options from a pool of courses. These are considered specialized or advanced to that particular programme and provide extensive exposure in the area chosen; these are also more applied in nature.

Generic Elective Courses An elective course chosen generally from an **unrelated discipline/subject,** with an intention to seek exposure is called a Generic Elective. Generic Elective courses are designed for the students of **other disciplines**. Thus, as per the CBCS policy, the students pursuing particular disciplines would have to opt Generic Elective courses offered by other disciplines, as per the basket of courses offered by the college. The scope of the Generic Elective (GE) Courses is positively related to the diversity of disciplines in which programmes are being offered by the college.

NonMajor Elective (NME). A student shall choose at least two Non – major Elective Courses (NME) from outside his /her department. Non –Major Elective I – Those who choose Tamil in Part I can choose a non –major elective course offered by other departments. Those who do not choose Tamil in Part I must choose either a) Basic Tamil if Tamil language was not studies in school level or b) Special Tamil if Tamil language was studies up to 10^{th} & 12^{th} std.

Skill Enhancement Courses (SECs) These courses focus on developing skills or proficiencies in the student, and aim at providing hands-on training. Skill enhancement courses can be opted by the students of any other discipline, but are highly suitable for students pursuing their academic programme. These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge**.**

Field Study/Industrial Visit/Case Study: It has to be completed during the fifth semester of the degree programme. Credit for this course will be entered in the fifth semester's marks statement.

Internship: Students must complete internship during summer holidays after the fourth semester. They have to submit a report of internship training with the necessary documents and have to appear

for a viva-voce examination during fifth semester. Credit for internship will be entered in the fifth semester's mark statement.

Extra Credit Courses: In order to facilitate the students, gaining knowledge/skills by attending online courses MOOC, credits are awarded as extra credits, the extra credit are at three semesters after verifying the course completion certificates. According to the guidelines of UGC, the students are encouraged to avail this option of enriching their knowledge by enrolling themselves in the Massive Open Online Courses (MOOC) provided by various portals such as SWAYAM, NPTEL etc.

Undergraduate Programme:

Programme Pattern: The Under Graduate degree programme consists of **FIVE** vital components. They are as follows:

Part -I: Languages (Tamil / Hindi / French / Sanskrit)

Part-II: General English

Part-III: Core Course (Theory, Practical's, Generic Elective courses, Discipline Specific Elective courses, Compulsory and Optional Allied courses, Project)

Part-IV: Non-Major Elective, Foundation Course, Value Education, Environmental studies, Skill Enhancement Courses/ Soft Skills, Internship / field visit / industrial visit/ Case Study), Professional Competency Course

Part –V

Extension activity, Gender studies

EXAMINATION

Continuous Internal Assessment (CIA):

UG - Distribution of CIA Marks Passing

Minimum: 50 %

Assisgnment-3	=	30%
Test-2	=	50%
Seminar	=	10%
Attendance	=	10%

Question Paper Pattern

Part A:

Part A 1 (10X1=10 marks)

One word question/ Fill in the blanks/ /True or False/ Multiple Choice Questions

Two Questions from Each unit

Part A 2 (5X2=10 marks)

Match the following Short

Answers

One question from Each unit

Total Marks – 20

Part B: (5X5=25 marks)

Paragraph Answers

Either/ or type, One Question from each unit

Part C: (10X3=30)

Essay Type Answers
Answer 3 out of 5 Questions
One Question from each unit
Part A: K1 Level
Part B: K2, K3 and K4 Level
Part C: K5 and K6 Level

Knowledge levels for assessment of Outcomes based on Blooms Taxonomy

S. No.	Level	Parameter	Description
1	K1	Knowledge/Remembering	It is the ability to remember the previously Learned
2	K2	Comprehension/ Understanding	The learner explains ideas or concepts
3	K3	Application/Applying	The learner uses information in a new way
4	K4	Analysis/Analyzing	The learner distinguishes among different parts
5	K5	Evaluation/Evaluating	The learner justifies a stand or decision
6	K6	Synthesis /Creating	The learner creates a new product or point of View

WEIGHTAGE of K – LEVELS IN QUESTION PAPER

(Cognitive Level) K- LEVELS →	Lower Order Thinking			Higher Order Thinking			Total
	K1	K2	K3	K4	K5	K6	
END SEMESTER EXAMINATIONS (ESE)	20	25			30		**75**
Continuous Internal Assessment (CIA)	20	25			30		**75**

QUESTION PATTERN FOR END SEMESTER EXAMINATION/Continuous Internal Assessment		
PART		**MARKS**
PART –A I. (No choice, One Mark) **TWO** questions from each unit	(10x1 =10)	20
II. (No choice, Two Mark) **ONE** question from each unit	(5x2 =10)	
PART -B (Either/ or type ,5-Marks) **ONE** questions from each unit	(5x5 =25)	25
PART -C (3 out of 5) (10 Marks) **ONE** question from each unit	(3x10 =30)	30
	Total	**75**

BLUE PRINT OF QUESTION PAPER FOR END SEMESTER EXAMINATION								
DURATION: 3. 00 Hours.								**Max Mark : 75**
K- LEVELS		**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total**
PART								**Marks**
PART –A (One Mark, No choice)	(10x1 =10)	10						10
(2-Marks, No choice)	(5x2=10)	10						10
PART –B (5- Marks) (Either/or type)	(5x5=25)		5	10	10			25
PART -C (10 Marks) (3 out of 5)	(3x10=30)					20	10	30
Courses having only **K5, K6** levels, K5 level- 3 Questions, K6 level- 2 Questions **(One K6 level question is compulsory)**								
Total		**20**	**05**	**10**	**10**	**20**	**10**	**75**

EVALUATION

GRADING SYSTEM

Once the marks of the CIA and the end-semester examination for each of the courses are available, they will be added and converted as final mark. The marks thus obtained will then be graded as per the scheme provided in Table-1.

Grade Point Average (GPA) will be calculated from the first semester onwards for all semester. From the second semester onwards, the total performance within a semester and the continuous performance starting from the first semester are indicated by semester Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA) , respectively. These two are calculated by the following formulae:

$$GPA = \frac{\sum_{i=1}^{n} C_i G_i}{\sum_{I=1}^{n} C_i}$$

$$WAM\ (Weighted\ Average\ Marks) = \frac{\sum_{i=1}^{n} C_i M_i}{\sum_{I=1}^{n} C_i}$$

Where,

C_i is the Credit earned for the Course i

G_i is the Grade Point obtained by the student for the Course i

M_i is the marks obtained for the course i and

n is the number of Courses **Passed** in that semester.

CGPA: Average GPA of all the Courses starting from the first semester to the current semester.

CLASSIFICATION OF FINAL RESULTS:

1. For each of the first three parts, there shall be separate classification on the basis of CGPA, as indicated in Table-2.
2. For the purpose of declaring a candidate to have qualified for the Degree of Bachelor of Arts/Science/Commerce/Management as Outstanding / Excellent /Very Good /Good/Above Average/Average, the marks and the corresponding CGPA earned by the candidate in Part-III alone will be the criterion, provided the candidate has secured the prescribed passing minimum in the all the Five parts of the Programme.
3. Grade in Part –IV and Part-V shall be shown separately and it shall not be taken into account for classification.
4. A Pass in PART- V will be mandatory although the marks will not count for the calculation of the CGPA.
5. Absence from an examination shall not be taken an attempt.

Table-1: Grading of the Courses - UG

Marks Range	Grade Point	Corresponding Grade
90 and above	10	O
80 and above and below 90	9	A+
70 and above and below 80	8	A
60 and above and below 70	7	B+
50 and above and below 60	6	B
40 and above and below 50	5	C
Below 40	NA	RA

The candidate's performance in every current semester is indicated by **Semester Grade Point Average (SGPA)** and from the second semester onwards, the continuous performance including previous semester is indicated by **Cumulative Grade Point Average (CGPA).**

Table-3: Final Result

CGPA	Corresponding Grade	Classification of Final Result
9.00 and above	O	Outstanding
8.00 to 8.99	A+	Excellent
7.00 to 7.99	A	Very Good
6.00 to 6.99	B+	Good
5.00 to 5.99	B	Above Average
4.00 to 4.99	C	Average
Below 4.00	RA	Re-appearance

The candidates who have passed in the first appearance and within the prescribed duration of the UG programme are eligible. If the candidate's Grade is O/A+ with more than one attempt, the performance is fixed as "Very Good".

VISION

To empower the women students by providing excellent theoretical, practical and research skills in Chemistry to meet the global needs.

MISSION

- Providing quality education in the principles, theory and practice of Chemistry
- Making the students to cope up with the requirements of industry and service sectors
- Excelling in teaching, research, knowledge transfer and to serve the social, cultural and economic needs of the nation.

PROGRAMME OUTCOMES FOR B.Sc.,DEGREE PROGRAMME

PO No.	Programme Outcomes (Upon completion of the B.Sc. Degree Programme, the Undergraduate will be able to)
PO-1	**Disciplinary knowledge**: Demonstrate comprehensive knowledge and understanding of one or more disciplines that form a part of an undergraduate program of study in Bachelor of science.
PO-2	**Critical thinking, Problem Solving and Reflective thinking:** think critically about the issues and identify, critically analyze and solve problems from the disciplines of concern using appropriate tools and techniques and the knowledge, skills and attitudes acquired and extrapolate the same to real life situations; show critical sensibility to life experiences, with self-awareness and reflexivity of both self and society.
PO-3	**Analytical & Scientific Reasoning:** evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyze and synthesize data from a variety of sources; draw valid conclusions and support them with evidence and examples and addressing opposing viewpoints; critically evaluate ideas, evidence, and experiences from an open minded and reasoned perspective.
PO-4	**Research-related Skills:** develop a sense of capability for relevant/appropriate inquiry and asking questions, synthesize, articulate and report results and to recognize and predict cause and effect relationships, define problems, formulate and establish hypothesis, analyze and interpret and draw conclusions from data, execute and report the results of an experiment or investigation.
PO-5	**Digital literacy and Effective Communication:** use ICT in a variety of learning situations and speak, read, write and listen clearly in person and through electronic media in English and in one or more Indian languages, and make meaning of the world by connecting people, ideas ,books, media and technology; efficiently communicate thoughts and ideas in a clear and concise manner.
PO-6	**Individual and Team Work:** effectively accomplish tasks individually as well as work effectively and respectfully as member or leader with diverse teams, facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interest so for a common cause and work efficiently as a member of a team.
PO-7	**Multicultural Competence and Social Interaction:** understand the values and beliefs of multiple cultures, global perspectives, engage and interact respectfully with diverse groups andelicit views of others, mediate disagreements and help reach conclusions in group settings.
PO-8	**Awareness of Ethical issues, Human values and Gender Issues:** embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work and understand the value of relationship between self and the community and aware of the various issues concerning Women and society.
PO-9	**Awareness of Environment and Sustainability:** understand the impacts of technology and Business practices in societal and environmental contexts, and sustainable development.
PO-10	**Self-directed and Lifelong learning:** acquire knowledge and skills, including learning "how to learn", that are necessary for participating in learning activities throughout life and to engage in independent and life-long learning in the broadest context of socio-Technological changes.

PROGRAMME SPECEIFIC OUTCOMES FOR B.Sc. Chemistry

PSO No.	Programme Specific Outcomes (Upon completion of the Course, the Student will be able to)
PSO-1	Acquire in-depth knowledge of the fundamental concepts in all disciplines of Chemistry.
PSO-2	Disseminate the basics of Chemistry and advanced topics and analytical Skills in Organic, Inorganic and Physical Chemistry.
PSO-3	Develop creativity in academics and research.
PSO-4	Apply digital tools to collect, analyze and interpret data and present scientific findings.
PSO-5	Gain competence to pursue higher education and career opportunities in Chemistry and allied fields
PSO-6	Exhibit leadership qualities to work individually and within a team in organizing curricular, co-curricular and extracurricular activities
PSO-7	Apply the concepts of Chemistry to solve problems in the community, entrepreneurial and research pursuits
PSO-8	Exhibit competence in educational, industrial and research pursuits that contribute towards the holistic development of self and community

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B. Sc., CHEMISTRY COURSE STRUCTURE UNDER CHOICE BASED

CREDIT SYSTEM-LEARNING OUTCOMES BASED CURRICULUM (CBCS-LOCF)

(For the candidates admitted from the academic year 2024-2025)

ELIGIBILITY: A Pass in 10+2 with Chemistry and Maths /Biology or Botany/Zoology as two of the core subjects.

Sem	Part	Nature of the Course	Course Code	Title of the course	T. In. Hrs/ Week	Ins. Hours/ Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
I	I	Language Course– I	U24LC101	Pothu Tamil-I- Tamil Ilakkiya Varalaru-I	6	5	1	-	-	3	3	25	75	100
	II	English Language Course-I	U24ELC101	General English-I	6	5	1	-	-	3	3	25	75	100
	III	Core Course-I	U24CH101	General Chemistry–I	5	4	1	-	-	5	3	25	75	100
		Core Practical-I	U24CH102P	Quantitative Inorganic Estimations and Inorganic Preparations(P)	4	-	-	4	-	4	3	25	75	100
		Allied Course-I	U24AMM101/ U24ABO101	Mathematics – I (Calculus) / Allied Botany – I	3	2	1	-	-	2	3	25	75	100
		Allied Course-II/ Allied Practical-I/	U24AMM102 U24ABO102P	Mathematics – II (Algebra and Analytical Geometry) /Allied Botany Practical	- 2	- -	- -	2	- -	- -	- -	- -	- -	- -
	IV	Non-Major Elective-I			2	2	-	-	-	2	3	25	75	100
		Foundation Course-I	U24FCCH11	Fundamentals of Chemistry	2	2	-	-	-	2	3	25	75	100
				TOTAL	**30**	**20**	**4**	**6**	**-**	**21**	-	-	-	**700**

	Part	Nature of the Course	Course Code	Title of the course	T.In. Hrs/ Week	Ins. Hours/ Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
II	1	Language Course– II	U24LC202	Pothu Tamil-II-TamilIlakkiya Varalaru-II	6	5	1	-	-	3	3	25	75	100
	II	English Language Course – II	U24ELC202	General English-II	6	5	1	-	-	3	3	25	75	100
	III	Core Course-II	U24CH203	General Chemistry–II	5	4	1	-	-	5	3	25	75	100
		Core Practical-II	U24CH204P	Qualitative Organic Analysis and Preparation of Organic Compounds(P)	4	-	-	4	-	4	3	25	75	100
		Allied Course-II/ Allied Practical-I	U24AMM102/ U24ABO102P	Mathematics-II (Algebra and Analytical Geometry)/ Allied Botany Practical	2 2	2 -	- -	2	- -	2 2	3	25	75	100
		Allied Course – II/III	U24ABO203/ U24AMM203	Allied Botany II/ Mathematics-III (Trigonometry and Fourier Series)	3	2	1	-	-	2	3	25	75	100
	IV	Non-Major Elective-II			2	2	-	-	-	2	3	25	75	100
		Skill Enhancement Course-I	U24SECH21	Cosmetics and Personal Grooming	2	2	-	-	-	2	3	25	75	100
				TOTAL	**30**	**20**	**4**	**6**	**-**	**23**	-	-	-	**800**
III	I	Language Course– III	U24LC303	Pothu Tamil-III-Tamilaga Varalarum Panpadum	6	5	1	-	-	3	3	25	75	100
	II	English Language Course – III	U24ELC303	General English-III	6	5	1	-	-	3	3	25	75	100
	III	Core Course-III	U24CH305	General Chemistry–III	4	3	1	-	-	4	3	25	75	100
		Core Practical –III	U24CH306P	Qualitative Inorganic Analysis(P)	4	-	-	4	-	4	3	25	75	100
		Allied Course-III/ IV	U24APY301	Allied Physics- I	2	1	1	-	-	2	3	25	75	100
		Allied Practical -I / II	U24APY302P	Allied Physics Practical	2	-	-	2	-	-	-	-	-	-
	IV	Skill Enhancement Course-II	U24SECH32	Entrepreneurial Skills in Chemistry	2	-	-	2	-	2	3	25	75	100
		Skill Enhancement Course—III	U24SECH33	Pesticide Chemistry	2	2	-	-	-	2	3	25	75	100
	V	Special Course	24UGSC	Health and Wellness	2	-	-	2	-	1	-	-	-	-
				TOTAL	**30**	**16**	**4**	**10**	**-**	**21**	-	-		**700**

Sem	Part	Nature of theCourse	Course Code	Title of the course	T.In. Hrs/ Week	Ins. Hours/Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
IV	I	Language Course–IV	U24LC404	Pothu Tamil-IV-Tamilum Ariviyalum	6	5	1	-	-	3	3	25	75	100
	II	English Language Course– IV	U24ELC404	General English-IV	6	5	1	-	-	3	3	25	75	100
	III	Core Course –IV	U24CH407	General Chemistry–IV	5	4	1	-	-	5	3	25	75	100
		Core Practical- IV	U24CH408P	Gravimetric Analysis (P)	4	-	-	4	-	4	3	25	75	100
		Allied Practical-I/ II	U24APY302P	Allied Physics Practical	2	-	-	2	-	2	3	25	75	100
		Allied Course -IV/V	U24APY403	Allied Physics –II	3	2	1	-	-	2	3	25	75	100
	I V	Skill Enhancement Course –IV	U24SECH44	Instrumental Methods of Chemical Analysis	2	2	-	-	-	2	3	25	75	100
		Skill Enhancement Course –V	U24SECH45	Forensic Science	2	2	-	-	-	2	3	25	75	100
				TOTAL	**30**	**20**	**4**	**6**	**-**	**23**	-	-	-	**800**
V	III	Core Course –V	U24CH509	Organic Chemistry-I	5	4	1	-	-	5	3	25	75	100
		Core Course –VI	U24CH510	Inorganic Chemistry	5	4	1	-	-	4	3	25	75	100
		Core Course-VII	U24CH511	Physical Chemistry–I	6	5	1	-	-	5	3	25	75	100
		Core Practical- V	U24CH512P	Physical Chemistry Practical	4	-	-	4	-	4	3	25	75	100
		Elective Course-I	U24CHE51A/ U24CHE51B/ U24CHE51C	Nanoscience and Nanotechnology /Biochemistry / Organometallic Chemistry	4	3	1	-	-	3	3	25	75	100
		Elective Course -II	U24CHE52A/ U24CHE52B/ U24CHE52C	Nuclear, Industrial Chemistry & Metallic State / Solid State Chemistry / Pharmaceutical Chemistry	4	3	1		-	3	3	25	75	100
	IV	Environmental Studies	24UGCES	Environmental Studies	2	2	-		-	2	3	25	75	100
		Internship/ Industrialvisit/ Field visit	U24CHI51	Internship/ Industrial visit/ Field visit	-	-	-		-	2	-	-	-	-
				TOTAL	**30**	**21**	**5**	**4**	**-**	**28**		**-**	**-**	**700**

Sem	Part	Nature of the Course	Course Code	Title of the course	T.In. Hrs/ Week	Ins. Hours/ Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
VI	III	Core Course-VIII	U24CH613	Organic Chemistry – II	6	5	1	-	-	4	3	25	75	100
		Core Course—IX	U24CH614	Physical Chemistry –II	6	5	1	-	-	4	3	25	75	100
		Core Project- X	U24CHPW	Group Project with viva voce /Research Topics	**5**	1	**-**	4	**-**	5	3	25	75	100
		Elective Course-III	U24CHE63A/ U24CHE63B U24CHE63C	Fundamentals of Spectroscopy/ Industrial Chemistry **/** Supramolecular Chemistry	4	3	1	-	-	3	3	25	75	100
	-	Elective Course-IV	U24CHE64A/ U24CHE64B/ U24CHE64C	Polymer Chemistry/ Green Chemistry**/** Textile Chemistry	4	3	1	-	-	3	3	25	75	100
	IV	Value Education	24UGVED	Value Education	2	2	-	-	-	2	3	25	75	100
		Professional Competency Course	U24PCCH61	Chemistry for Competitive Examinations	2	2	-	-	-	2	3	25	75	100
	V	Gender Studies	24UGGS	Gender Studies	1	1	-	-	-	1	3	25	75	100
		Extension activity		Extension activity	-	-	-	-	-	1	-	-	-	-
			TOTAL		**30**	**22**	**4**	**4**	**-**	**25**	-	-	-	**800**
			Grand Total		**180**	**121**	**25**	**34**	**-**	**141**	-	-	-	**4500**
Extra Credit			Value added Courses (At least one per year)			**-**	**-**	**-**	**-**	**2**	-	-	-	**-**

L-Lecture **T- Tutorial** **P-Practical** **S-Seminar**

Credit Distribution for UG PROGRAMME: CHEMISTRY

S. No	Part	Subject	No. of Courses	Total Credits
1	I	Language Course	4	12
2	II	English Language Course	4	12
3	III	Core Course	9	41
4		Core Practical	5	20
5		Core Project	1	05
6		Allied Course- Mathematics/ Botany	5/4	10/8
7		Allied Practical- Mathematics/ Botany	1/2	02/04
8		Elective Course	4	12
9	IV	Non-Major Elective	2	04
10		Foundation Course – FC	1	02
12		Skill Enhancement Course	5	10
13		Internship/ Industrial visit/ Field visit	1	02
14		Environmental Studies	1	02
15		Value Education	1	02
16		Professional Competency Course	1	02
17	V	Gender Studies	1	01
18		Extension Activity	1	01
19		Special Course-Health and Wellness	1	01
		Total	**48**	**141**

Note:

		CIA	ESE
1	Theory	25	75
2	Practical	25	75

3 Separate passing minimum is prescribed for Internal and External marks

FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for University Examinations shall be 40% out of 75 marks [i.e. 30marks]

FOR PRACTICAL

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for University Examinations shall be 40% out of 75 marks

[i.e.30Marks]

NON -MAJOR ELECTIVE (NME) OFFERED BYTHE DEPARTMENT

Semester	Part	Course	Course code	Title of the Course
I	IV	NME– I	U24NMECH11	Drugs and Cosmetics
II	IV	NME– II	U24NMECH22	Hydro Chemistry

SEMESTER-V

Semester: V-CC-V: Organic Chemistry-I

Ins. Hrs. /Week: 5 **Course Credit: 5** **Course Code: U24CH509**

UNIT I: STEREOCHEMISTRY (15 Hours)

Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans, syn-anti isomerism, E/Z notations.

Optical Isomerism: Optical activity, specific rotation, asymmetry, enantiomers, distereoisomers, meso structures - molecules with one and two chiral centres, racemisation- methods of racemisation; resolution- methods of resolution. C.I.P rules. R and S notations for one and two chirality (stereogenic) centres. Molecules with number of asymmetric carbon atoms – allenes and biphenyls. Conformational analysis of ethane and butane.

UNIT II: CHEMISTRY OF NITROGEN COMPOUNDS – I (15 Hours)

Nitroalkanes

Nomenclature, isomerism, preparation from alkyl halides, halo acids, alkanes; physical properties; reactions – reduction, halogenations, Grignard reagent, Pseudo acid character. Nitro - aci nitro tautomerism.

Aromatic nitro compounds

Nomenclature, preparation – nitration, from diazonium salts, physical properties; reactions - reduction of nitrobenzene in different medium, Electrophilic substitution reactions, TNT

Amines: Aliphatic amines

Nomenclature, isomerism, preparation – Hofmanns' degradation reaction, Gabriel's phthalimide synthesis, Curtius Schmidt rearrangement Physical properties, reactions – alkylation, acylation, carbylamines reaction, Mannich reaction, oxidation, basicity of amines.

UNIT III: CHEMISTRY OF NITROGEN COMPOUNDS – II (15 Hours)

Aromatic amines – Nomenclature, preparation – from nitro compounds, Hofmann's method; Schmidt reaction, properties - basic nature, ortho effect; reactions – alkylation, acylation, carbylamines reaction, reaction with nitrous acid, aldehydes, oxidation, Electrophilic substitution reactions, diazotization and coupling reactions; sulphanilic acid - zwitter ion formation. Diazomethane, Benzene diazonium chloride - preparations and synthetic applications.

Dyes -Theory of colour and constitution; classification based on structure and application; preparation – Martius yellow, aniline yellow, methyl orange, alizarin, indigo, malachite green. Industry oriented content, Dyes Industry, Food colour and additives.

UNIT IV: HETEROCYCLIC COMPOUNDS -I (15 Hours)

Nomenclature and classification. General characteristics - aromatic character and reactivity. Five-membered heterocyclic compounds, Pyrrole – preparation - from succinimide, Paal Knorr synthesis; reactions – reduction, basic character, acidic character, electrophilic substitution reactions, ring opening.

Furan – preparation from mucic acid and pentosan; reactions –hydrogenation, reaction with oxygen, Diels Alder reactions, formation of thiophene and pyrrole; Electrophilic substitution reaction. Thiophene synthesis - from acetylene; reactions –reduction; oxidation; electrophilic substitution reactions.

UNIT V: HETEROCYCLIC COMPOUNDS -II (15 Hours)

Pyridine – synthesis - from acetylene, Physical properties; reactions - basic character, oxidation, reduction, electrophilic substitution reactions; nucleophilic substitution- uses Condensed ring systems.

Quinoline – preparation - Skraup synthesis and Friedlander's synthesis; reactions – basic nature, reduction, oxidation; electrophilic substitutions; nucleophilic substitutions – Chichibabin reaction.

Isoquinoline – preparation by the Bischler – Napieralski reaction, reduction, oxidation; electrophilic substitution.

Total Lecture Hours- 75

COURSE OUTCOMES

The students should be able to

1. Assign RS notations to chirals and EZ notations to olefins and explain conformations of ethane and butane.
2. Explain preparation and properties of aromatic and aliphatic nitro compounds and amines.
3. Explain colour and constitution of dyes and food additives.
4. Discuss preparation and properties of five membered heterocycles like pyrrole, furan and thiophene.
5. Discuss preparation and properties of six membered heterocycles like pyridine, quinoline and isoquinoline.

TEXT BOOK(S)

1. Jain, M. K., & Sharma, S. C. (2009). Modern organic chemistry (4th reprint). Vishal Publishing.
2. Mukherji, S. M., & Singh, S. P. (2009). Reaction mechanism in organic chemistry (3rd ed.). Macmillan India Ltd.
3. Bahl, A., & Bahl, B. S. (2012). Advanced organic chemistry (Multi colour ed.). S. Chand & Company Pvt. Ltd.
4. Soni, P. L., & Chawla, H. M. (2007). Text book of organic chemistry (29th ed.). Sultan Chand & Sons.
6. Pillai, C. N. (2025). Text book of organic chemistry. Universities Press (India) Private Ltd.

REFERENCE BOOK(S)

1. Morrison, R. T., & Boyd, R. N. (2012). Organic chemistry (6th ed.). Pearson Education.

2. Solomons, T. W. G. (2012). Organic chemistry (11th ed.). John Wiley & Sons.

3. Carey, F. A. (2009). Organic chemistry (7th ed.). Tata McGraw-Hill Education Pvt. Ltd.

4. Finar, I. L. (2024). Organic chemistry (6th ed., Vols. 1-2). Wesley Longman Ltd.

5. Kumar, S. (2026). *Heterocyclic Compounds in Organic Chemistry*. Taylor & Francis Ltd.

E-RESOURCES

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. Virtual Textbook of Organic Chemistry
5. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/heterocy.htm

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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: V-CC-VI: Inorganic Chemistry

Ins. Hrs. /Week: 5 **Course Credit: 4** **Course Code: U24CH510**

UNIT I : CO-ORDINATION CHEMISTRY – I **(15 Hours)**

IUPAC Nomenclature of coordination compounds, Isomerism in coordination compounds. Werner's coordination theory – effective atomic number –interpretation of geometry and magnetic properties by Pauling's theory – geometry of co-ordination compounds with co-ordination number 4 &6 Chelates – types of ligands forming chelates – stability of chelates, applications of chelates in qualitative and quantitative analysis– application of DMG and oxine in gravimetric analysis –estimation of hardness of water using EDTA, metal ion indicators.- Role of metal chelates in living systems – haemoglobin and chlorophyll.

UNIT II : CO-ORDINATION CHEMISTRY – II **(15 Hours)**

Crystal field theory –Crystal field splitting of energy levels in octahedral and tetrahedral complexes, Crystal field stabilization energy (CFSE), spectrochemical series - calculation of CFSE in octahedral and tetrahedral complexes - factors influencing the magnitude of crystal field splitting, crystal field effect on ionic radii, lattice energies, heats of ligation with water as a ligand (heat of hydration), interpretation of magnetic properties, spectra of $[Ti(H_2O)6]^{3+}$ - Jahn – Teller effect. Stability of complexes in aqueous solution, stability constants- factors affecting the stability of a complex ion, thermodynamic and kinetic stability (elementary idea). Comparison of VBT and CFT.

UNIT III : ORGANOMETALLIC COMPOUNDS **(15 Hours)**

Metal Carbonyls Mono and polynuclear carbonyls, General methods of preparation of carbonyls – general properties of binary carbonyls – bonding in carbonyls – structure and bonding in carbonyls of Ni, Fe, Cr, Co, Mn, Ru and Os. EAN rule as applied to metal carbonyls. Ferrocene-Methods of preparation, physical and chemical properties.

UNIT IV: INNER TRANSITION ELEMENTS (LANTHANOIDS AND ACTINOIDS) **(15 Hours)**

General characteristics of f-block elements - Comparative account of lanthanoids and actinoids - Occurrence, Oxidation states, Magnetic properties, Colour and spectra - Lanthanoids and Actinoids, Separation by ion-Exchange and Solvent extraction methods - Lanthanoids contraction- Chemistry of thorium and Uranium-Occurrence, Ores, Extraction, properties and uses - Preparation, Properties and uses of ceric ammonium sulphate, thorium

dioxide and uranyl acetate.

UNIT V : REACTIONS AND CATALYSIS BY ORGANOMETALLICS (15 Hours)

Organometallic reactions – ligand association and dissociation – oxidative addition and reductive elimination – insertion reactions. Reactions of coordinated ligands in organometallics – hydrogenation, hydroformylation, epoxidation, metathesis. Polymerization of olefins, olefin oxidation (Wacker process) and carbonylation of methanol.

Total Lecture Hours- 75

COURSE OUTCOMES

The students should be able to

1. Explain isomerism, Werner's Theory and stability of chelate complexes
2. Discuss crystal field theory, magnetic properties and spectral properties of complexes.
3. Explain preparation and properties of metal carbonyls
4. Give a comparative account of the characteristics of lanthanoids and actinoids
5. Explain properties and uses of inorganic polymers of silicon, sulphur, boron and phosphorous.

TEXT BOOK(S)

1. Madan, R. L., & Mangla, B. (2026). Chemistry for B.Sc. Students: Coordination Chemistry, Chemistry of d- and f-block Elements, Inorganic Reaction Mechanism and Electron Transfer Reactions. S. Chand Publishing.
2. Prakash, S., Tuli, G. D., Basu, S. K., & Madan, R. D. (2009). Advanced inorganic chemistry (18th ed.). S. Chand & Co.
3. Lee, J. D. (1991). Concise inorganic chemistry (4th ed.). ELBS William Heinemann.
4. Malik, W. V., Tuli, G. D., & Madan, R. D. (2000). Selected topics in inorganic chemistry. S. Chand and Company Ltd.
5. De, A. K. (1992). Text book of inorganic chemistry (7th ed.). Wiley Eastern Ltd.

REFERENCE BOOK(S)

1. Guha, S. (2025). Wiley's J.D. Lee Concise Inorganic Chemistry for JEE (Main & Advanced), 5th ed., 2026. Wiley India.
2. Gopalan, R. (2009). Inorganic chemistry for undergraduates (1st ed.). University Press (India) Private Limited.
3. Sivasankar, B. (2013). Inorganic chemistry (1st ed.). Pearson.
4. Sharp, A. G. (1992). Inorganic chemistry (3rd ed.). Addison-Wesley.
5. Atkins, P., Overton, T., Rourke, J., & Weller, M. (2014). Inorganic chemistry (6th ed.). Oxford University Press.
6. Mamta Kharkwal & S. B. Tyagi (2024) College Inorganic Chemistry Himalaya Publishing House 25 edition

E-RESOURCES

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. https://byjus.com/chemistry/inner-transition-elements
5. www.ndli.ac.in

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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: V-CC-VII - Physical Chemistry–I

Ins. Hrs. /Week: 6 **Course Credit: 5** **Course Code: U24CH511**

UNIT I : THERMODYNAMICS – III **(18 Hours)**

Free energy and work functions - Need for free energy functions, Gibbs free energy, Helmholtz free energy - their variation with temperature, pressure and volume, criteria for spontaneity; Gibbs-Helmholtz equation – derivations and applications; Maxwell relationships, thermodynamic equations of state; Thermodynamics of mixing of ideal gases, Ellingham Diagram-application.

Partial molar properties – chemical potential, Gibbs Duhem equation, variation of chemical potential with temperature and pressure, chemical potential of a system of ideal gases, Gibbs-Duhem- Margules equation.

UNIT II : CHEMICAL KINETICS **(18 Hours)**

Rate of reaction - Average and instantaneous rates, factors influencing rate of reaction - molecularity of a reaction - rate equation - order of reaction. order and molecularity of simple and complex reactions, Rate laws - Rate constants – derivation of rate constants and characteristics for zero, first order, second and third order (equal initial concentration) Derivation of time for half change with examples. Methods of determination of order of Volumetry, manometry and polarimetry.

Effect of temperature on reaction rate – temperature coefficient - concept of activation energy - Arrhenius equation. Theories of reaction rates – Collision theory – derivation of rate constant of bimolecular gaseous reaction – Failure of collision theory. Lindemann's theory of unimolecular reaction. Theory of absolute reaction rates – Derivation of rate constant for a bimolecular reaction – significance of entropy and free energy of activation. Comparison of collision theory and ARRT.

Complex reactions – reversible and parallel reactions (no derivation and only examples) kinetics of consecutive reactions – steady state approximation.

UNIT III: ADSORPTION AND CATALYSTS **(18 Hours)**

Adsorption – Chemical and physical adsorption and their general characteristics- distinction between them Different types of isotherms – Freundlich and Langmuir. Adsorption isotherms and their limitations – BET theory, kinetics of enzyme catalysed reaction – Michaelis- Menten and Briggs- Haldene equation – Lineweaver- Burk plot – inhibition – reversible – competitive, noncompetitive and uncompetitive (no derivation of rate equations)

Catalysis – general characteristics of catalytic reactions, auto catalysis, promoters, negative

catalysis, poisoning of a catalyst – theories of homogenous and heterogeneous catalysis – Kinetics of Acid – base and enzyme catalysis. Heterogenous catalysis.

UNIT IV : COLLOIDS AND SURFACE CHEMISTRY (18 Hours)

Colloids: Types of Colloids, Characteristics Colloids (Lyophilic and Lyophobic sols),Preparation of Sols- Dispersion methods, aggregation methods, Properties of Sols-Optical properties, Electrical properties - Electrical double layer, Electro Kinetic properties-Electro-osmosis, Electrophoresis, Coagulation or precipitation, Stability of sols, associated colloids, Emulsions, Gels-preparation of Gels, Applications of colloids Macromolecules: Molecular weight of Macromolecules-Number average molecular weight-average molecular weight, Determination of Molecular weight of molecules.

UNIT V : PHOTOCHEMISTRY (18 Hours)

Laws of photo chemistry – Lambert – Beer, Grotthus – Draper and Stark – Einstein. Quantum efficiency. Photochemical reactions – ratelaw – Kinetics of H_2-Cl_2, H_2-Br_2 and H_2-I_2 reactions, comparison between thermal and photochemical reactions.

Fluorescence – applications including fluorimetry – sensitised fluorescence, phosphorescence – applications - chemiluminescence and photosensitisation – examples Chemistry of Vision – 11 cis retinal – vitamin A as a precursor - colour perception of vision.

Total Lecture Hours: 90

COURSE OUTCOMES

The students should be able to

1. Explain Gibbs and Helmholtz free energy functions, partial molar quantities and Ellinghams.
2. Apply the concepts of chemical kinetics to predict the rate of the reaction and order of the reaction, demonstrate the effect of temperature on reaction rate, and the significance of free energy and entropy of activation.
3. Compare chemical and physical adsorption, Freundlich and Langmuir adsorption isotherms, and differentiate between homogenous and heterogeneous catalysis.
4. Demonstrate the types and characteristics of colloids, preparation of sols and emulsions, and determine the molecular weights of macromolecules.
5. Utilize the concepts of photochemistry in fluorescence, phosphorescence, chemiluminescence and color perception of vision.

TEXT BOOK(S)

1. Puri, B. R., & Sharma, L. R. (2021). Principles of physical chemistry (48th ed.). Shoban Lal Nagin Chand and Co.
2. Atkins, P., de Paula, J., & Keeler, J. (2018). Physical chemistry (11th ed.). Oxford University Press.
3. Bahl, A., Bahl, B. S., & Tuli, G. D. (2019). Essentials of physical chemistry (28th ed.). S. Chand & Co.
4. Dogra, S. K., & Dogra, S. (1996). Physical chemistry through problems (4th ed.). New Age International.
5. Rajaram, J., & Kuriacose, J. C. (1986). Thermodynamics. Shoban Lal Nagin Chand and Co.
6. Peter Atkins Concepts in Physical Chemistry ,2nd Edition, 2024, Royal Society of Chemistry
7. Atkins, P., & de Paula, J. (2026). *Atkins' Physical Chemistry*. Oxford University Press.

REFERENCE BOOK(S)

1. Rajaram, J., & Kuriacose, J. C. (2013). Chemical thermodynamics (1st ed.). Pearson.
2. Laidler, K. J. (2003). Chemical kinetics (3rd ed.). Pearson.
3. Atkins, P. W., & de Paula, J. (2002). Physical chemistry (7th ed.). Oxford University Press.
4. Kapoor, K. L. (2009). A textbook of physical chemistry (3rd ed.). Macmillan India Ltd.
5. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2001). Principles of physical chemistry (41st ed.). Shobanlal Nagin Chand and Co.
6. Textbook of physical chemistry. (2023). Sultan Chand & Sons. (Author not specified)
7. Çengel, Y. A., & Boles, M. A. (2026). Thermodynamics: An Engineering Approach. McGraw-Hill Higher Education.

E- RESOURCES

1. https://nptel.ac.in
2. https://swayam.gov.in
3. www.epgpathshala.nic.in
4. https://chemistlibrary.files.wordpress.com/2015/02/principals-of-colloid-and-surface-chem.pdf
5. https://tech.chemistrydocs.com/Books/Physical/Fundamentals-of-Photochemistry-by-K-K-Rohatgi-Mukherjee.pdf

Semester: V-CP-V: Physical Chemistry Practical

Ins. Hrs. /Week: 4 **Course Credit: 4** **Course Code: U24CH512P**

UNIT I : PHASE DIAGRAMS

1. Simple eutectic - determination of eutectic temperature and composition of naphthalene-diphenyl amine or naphthalene-diphenyl system.
2. Determination of transition temperature of a salt hydrate.
3. Determination of upper critical solution temperature of phenol –water system
4. Effect of an electrolyte on miscibility temperature of phenol – water system
5. Determination of concentration of sodium chloride using phenol-sodium chloride system

UNIT II : DISTRIBUTION LAW

6. Determination of the distribution coefficient of iodine between carbon tetrachloride and water.
7. Determination of equilibrium constant of the reaction

$$I_2 + I \rightarrow I_3$$

8. Determination of concentration of the given potassium iodide solution using the above equilibrium constant.

UNIT III : Electrochemistry

9. Conductometric titration of hydrochloric acid against sodiumhydroxide.
10. Potentiometric titration of ferrous ion against potassium dichromate using quinhydronde Electrode.

COURSE OUTCOMES

1. Describe the principles and methodology for the practical work.
2. Explain the procedure, data and methodology for the practical work
3. Apply the principles of phase rule and electrochemistry for carrying out the practicalwork
4. Demonstrate laboratory skills for safe handling of the equipment and chemicals

TEXT BOOK(S)

1. Sindhu, P. S. (2005). *Practicals in Physical Chemistry*. New Delhi: Macmillan India.
2. Khosla, B. D., Garg, V. C., & Gulati, A. (2011). *Senior Practical Physical Chemistry*. New Delhi: R. Chand.
3. Gupta, R. (2017). *Practical Physical Chemistry* (1st ed.). New Delhi: New Age International.
4. Wadhawa, G. C., Patel, H. N., Jain, K. P., Yamgar, R. S., Turakhia, S. P., Puniyani, S. R., & Shaikh, S. F. (2024). *Post Graduate Practical Chemistry (MSc I)* (8th ed.). Mumbai: Himalaya Publishing House.
5. Atkins, P., & de Paula, J. (2026). *Physical Chemistry*. Oxford University Press.

REFERENCE BOOK(S)

1. Daniels, F., & Alberty, R. A. (2026). *Physical Chemistry*. Wiley Eastern Ltd.
2. Levine, I. N. (2026). *Physical Chemistry*. McGraw-Hill Education.
3. Barrow, G. M. (2026). *Physical Chemistry*. Tata McGraw-Hill Publishing Company Ltd.
4. Moore, W. J. (2026). *Physical Chemistry*. Orient Longman Pvt. Ltd.

E-RESOURCES

1. https://www.vlab.co.in/broad-area-chemical-sciences
2. https://www.nptel/chemistrylaboratorycourses.
3. https://www.chem libre texts.
4. https://www.virtual labs.
5. https://www.mit open course ware chemistrylabs.

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DEPARTMENT OF CHEMISTRY
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Semester: V-EC-1A : Nanoscience and Nanotechnology

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE51A**

UNIT I : INTRODUCTION TO NANOSCIENCE (12 Hours)

Definition of terms – nanoscience, nanoparticles, clusters, quantum dots, nanostructures and nanocomposites. Electron behaviour in free space, bulk material and nanomaterials.Synthesis and stabilization of nanomaterials Top down approach (physical methods), mechanical dispersion – ball milling, methods based on evaporation of a precursor-inert gas condensation, ion sputtering, spray pyrolysis, aerosol synthesis-nanolithography. Bottom–up approach (chemical methods) - solvothermal synthesis, photochemical method, gamma radiolysis, sonochemical synthesis, electro deposition, sol-gel method, nanomaterials via chemical routes- solvents reducing agents, capping agents-stabilization of nanoparticles -electrostatic and steric, stabilization, common stabilizers, nanoparticle growth in solution, templated growth, Langmuir – Blodgett (L-B) method, reverse micelles-emulsion method.

Unit II: PROPERTIES OF MATERIALS ON A NANOSCALE (12 Hours)

Optical properties of metal and semiconductor nanomaterials- surface Plasmon resonance (SPR), surface enhanced Raman spectra (SERS), quantum confinement effect, tuning of optical spectrum. Magnetic properties - Fe_3O_4 particle, supra magnetic properties, electronic properties, Chemical properties- chemical process on the surface of nanoparticles, catalysis, mechanical properties.

UNIT III : TECHNIQUES EMPLOYED FOR CHARACTERIZATION OF NANOMATERIALS (12 Hours)

Spectrocopy – UV-visible, Photoelectron spectroscopy – Electron microscopy – Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Scanning probe microscopy (SPM) – Atomic Force Microscopy (AFM), Scanning Tunneling Microscopy (STM), Optical microscopy – confocal microscopy, X-ray diffraction (XRD) [Principle and Block diagram only.

UNIT IV : SPECIAL NANOMATERIALS (12 Hours)

Carbon Nano Structures Carbon nanotubes: Introduction - types - zigzag, armchair, helical, synthesis by CVD, Functionalization of Carbon Nanotubes, Reactivity of Carbon Nanotubes, Field emission, Fuel Cells, Display devices . Other Important Carbon based materials: Preparation and Characterization Fullerene, Graphene, properties, DLC and

nanodiamonds and Applications Semiconductor nanoparticles: Quantum dots, synthesis – chemical synthesis using clusters, properties, porous silicon – electrochemical etching, aerogel – types – silica aerogel, resorcinol formaldehyde (RF) aerogels, zeolites – applications. Self Assembled Nanomaterials: Self Assembled Monolayers (SAMS) – inorganic, organic molecules.

UNIT V : APPLICATION OF NANOMATERIALS (12 Hours)

Biomedical Applications- drug, drug delivery, biolabelling, artificial implants, cancer treatment. Sensors – Natural nanoscale sensors, chemical sensors, biosensors, electronic noses. Optics & Electronics – Nanomaterials in the next generation computer technology, high definition TV, flat panel displays, quantum dot laser, single electron transistors [SET]. Nanotechnology in agriculture – Fertilizer and pesticides nanomaterials for water purification, nanomaterials in food and packaging materials, fabric industry. Impacts of Nanotechnology – human & environmental safety risks.

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. Explain the general concepts and physical phenomena of relevance within the field of nanoscience.
2. Describe the properties, synthesis, characteristics of nanomaterials, special nanomaterials and applications.
3. Examine the structure, properties, applicability and characterization of nanomaterials.
4. Analyze various synthesis procedures, characterizations and uses of carbon nanotubes,fullerene and grapheme.
5. Discuss applications of nanomaterials of sensors and in optics and electronics.

TEXT BOOK(S)

1. Kulkarni, S. K.(2006) Nanotechnology: Principles and practices. Capital Publishing Co.
2. Pradeep, T. (2007). Nano: The essentials, understanding nanoscience and nanotechnology. Tata McGraw-Hill Publishing Company Limited.
3. Shah, M. A., & Ahmad, T. (2010). Principles of nanoscience and nanotechnology. Narosa Publishing House.
4. Murthy, B. S., Shankar, P., Raj, B., & James, M. (2012). Textbook of nanoscience and nanotechnology. Universities Press, India Ltd.
5. Singh, S. P. (2024). Fundamentals of nanoscience and nanotechnology. Narosa Publishing House.
6. Poole, C. P., & Owens, F. J. (2026). *Introduction to Nanotechnology*. Wiley India Pvt. Ltd.

REFERENCE BOOK(S)

1. Sharma, P. K. (2008). Understanding nanotechnology. Vista International Publishing House.
2. Poole, C. P., Jr., & Owens, F. J. (2003). Introduction to nanotechnology. John Wiley & Sons.
3. Viswanathan, B. (2009). Nano materials. Narosa Publishing House.
4. Katta, N. R. (2023). Essentials of nanoscience & nanotechnology. Prowess Publishing.
5. Edelstein, A. S., & Cammarata, R. C. (2026). *Nanomaterials: Synthesis, Properties and Applications*. CRC Press.
6. Bhushan, B. (2026). *Springer Handbook of Nanotechnology*. Springer.

E- RESOURCES

1) http://www.nanotechnology.com/docs/wtd015798.pdf
2) http://nccr.iitm.ac.in/Nanomaterials.pdf
3) https://sci-hub.se/downloads/2019-02-12/37/titus2019.pdf
4) https://www.worldscientific.com/doi/10.1142/9789814340571_0006?srsltid=AfmBOopeO772QjUs0H3GR9DNbRRIUbrcFEg9Nj_dxP9jHP3kF7QcQm69
5) https://www.rcet.org.in/uploads/academics/rohini_28930289576.pdf

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Semester: V- EC IB : Biochemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE51B**

UNIT I : LOGIC OF LIVING ORGANISMS (12 Hours)

Relationship of Biochemistry and Medicine Blood - Composition of Blood, Blood Coagulation – Mechanism. Hemophilia and Sickle Cell Anaemia Maintenance of pH of Blood – Bicarbonate Buffer, Acidosis, Alkalosis.

UNIT II : PEPTIDES AND PROTEINS (12 Hours)

Amino acids – nomenclature, classification – essential and Non- essential; Synthesis - Gabriel Phthalimide, Strecker; properties – zwitter ion and isoelectric point, electrophoresis and reactions.

Peptides – peptide bond – nomenclature – synthesis of simple peptides – solution and solid phase. Determination of structure of peptides, N- terminal analysis – Sanger's & Edmann method; C terminal analysis - Enzymic method.

Proteins – classification based on composition, functions and structure; properties and reactions – colloidal nature, coagulation, hydrolysis, oxidation, denaturation, renaturation; colour tests for proteins; structure of proteins – primary, secondary, tertiary and quaternary. Metabolism of Amino acids – general aspects of metabolism (a brief outline); urea cycle.

UNIT III : ENZYMES AND VITAMINS (12 Hours)

Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP, FMN, FAD, pyridoxal phosphate, CoA, folic acid, biotin, cyanocobalamin.

UNIT IV :AMINO ACIDS (12 Hours)

Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions RNA –types– structure - functions; biosynthesis of proteins **Hormones** Adrenalin and thyroxine — chemistry, structure and functions (Nostructure elucidation).

UNIT V: LIPIDS (12 Hours)

Occurrence, biological significance of fats, classification of lipids **Simple lipids** – Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats.

Compound lipids – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol – occurrence, structure, test, physiological activity. Metabolism of lipids: β-oxidation of fatty acids.

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. Explain molecular logic of living organisms, composition of blood and blood coagulation
2. Explain synthesis and properties of amino acids, determination of structure of peptides and proteins
3. Explain factors influencing enzyme activity and vitamins as coenzymes
4. Explain RNA and DNA structure and functions
5. Explain biological significance of simple and compound lipids

TEXT BOOK(S)

1. Bahl, B. S., & Bahl, A. (2003). Advanced organic chemistry (3rd ed.). S. Chand.
2. Jain, M. K., & Sharma, S. C. (2017). Modern organic chemistry. Vishal Publications.
3. Shanmugam, A. (1999). Fundamentals of biochemistry for medical students (6th ed.). (Published by the author).
4. Veerakumari, L. (2004). Biochemistry (1st ed.). MJP Publications.
5. Jain, J. L. (1983). Fundamentals of biochemistry (2nd ed.). S. Chand.
6. Voet, D., Voet, J. G., & Pratt, C. W. (2024). Fundamentals of biochemistry (6th ed.). John Wiley & Sons.
7. Lehninger, A. L., Nelson, D. L., & Cox, M. M. (2026). *Principles of Biochemistry*. W.H. Freeman and Company.

REFERENCE BOOK(S)

1. Conn, E. E., & Stumpf, P. K. (2002). Outline of biochemistry (5th ed.). Wiley Eastern.
2. West, E. S., Todd, W. R., Mason, H. S., & Van Bruggen, J. T. (1970). Textbook of biochemistry (4th ed.). Macmillan.
3. Lehninger, A. L. (1993). Principles of biochemistry (2nd ed.). CBS Publisher.
4. Rastogi, S. C. (2003). Biochemistry (2nd ed.). Tata McGraw-Hill.
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3) https://swayam.gov.in/courses/4384-biochemistry Biochemistry
4) https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry
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SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
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(For the Candidates admitted in the academic year 2024 – 2025)
DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: V-EC-IC : Organometallic Chemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE51C**

UNIT I: Introduction (12 Hours)
Compounds with transition metal to carbon bonds: classification of ligands, nomenclature, eighteen electron rule; transition metal carbonyls: range of compounds and structure, bonding, vibrational spectra, preparation, reactions; transition metal organometallics: square planar complexes, metal alkyls, metal alkylidenes, metalalkylidynes and metal arenes.

UNIT II: Complexes of Unsaturated Molecules (12 Hours)
Synthesis, structure, bonding and reactivity of transitional metal complexes with alkenes, cyclopentadienyl (Metallocenes), Benzenoid, π-allyl, and enylsystems. Complexes with cyclic π donors: Cyclopentadiene, benzene, cycloheptatriene and cyclooctatetraene complexes.

UNIT III :Catalytic Processes (12 Hours)
Hydrosilation reaction, hydride elimination, abstraction, cyclooligomerisation, olefin isomerisation, ethylene dimerization using RhCl3catalyst.FischerTropsch process, water gas shift reaction. Oxidation of Aldehydes, Cyclohexanol, Cyclohexanone, p-Xylene.

UNIT IV : Properties and Reactions of Organometallic Compounds (12 Hours)
Complex formation, reactions with active oxygen compounds, reactions with halogen, reactions with alkyl halides, acid halides, reactions with oxygen, carbonyls and others. Metal carbonyls, isocyanides and acetylides: Preparation, structure, reactions of metal carbonyls with alkyl halides, reactions of metal carbonyls with metal alkyls, cyanides and isocyanides complexes, acetalynide complex adduct formation. Complexes: 2, 3,4,5,6 and 7 electron donor carbametallic compounds ,aromaticity of cyclopentadienyls.

UNIT V : Applications of Organometallic Compounds (12 Hours)
Introduction, organometallics in medicine, organometallic compounds in agriculture and horticulture, organometallics in Industry and environmental aspects of organometallic compounds.

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. To study in depth the properties of organometallic compounds
2. To gain knowledge in various catalytic processes of organometallic compounds

3. To understand the various reactions of organometallic compounds
4. To identify the applications of organometallic compounds.
5. To study application of organic metallic compounds.

TEXT BOOK(S)

1. Mehrotra, R. C., & Singh, A. (2000). Organometallic chemistry: A unified approach. Wiley Eastern.
2. Rochow, E. G. (1964). Organometallic chemistry. Reinhold.
3. Zeiss, H. (1960). Organometallic chemistry. Reinhold.
4. Cotton, F. A., & Wilkinson, G. (1988). Advanced inorganic chemistry (5th ed.). John Wiley and Sons.
5. Coates, G. E., Green, M. L. H., Powell, P., & Wade, K. (1968). Principles of organometallic chemistry. Methuen. (Republished by Chapman & Hall in 1971).
6. Patmore, N. J., & Elliott, P. I. P. (Eds.). (2024). Organometallic chemistry: Volume 45. Royal Society of Chemistry.
7. *Huheey, J. E., Keiter, E. A., & Keiter, R. L. (2026).* Inorganic Chemistry: Principles of Structure and Reactivity. *Pearson Education.*

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2. Powell, P. (1991). Principles of organometallic chemistry (2nd ed.). ELBS.
3. Lippard, S. J. (1983). Progress in inorganic chemistry (Vol. 30). John Wiley & Sons.
4. Kumar, I. (1900). Organometallic compounds. Pragati Prakashan. (Note: The publication date seems suspiciously early; please verify the date.)
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6. Ansari, A., & Kumar, V. (Eds.). (2024). Recent advances in organometallic chemistry: Synthetic, mechanistic, and medicinal perspectives. Elsevier.
7. *Crabtree, R. H. (2026).* The Organometallic Chemistry of the Transition Metals. *Wiley.*

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3. http:/swayam.gov.in
4. https://www.slideshare.net/slideshow/applications-of-organometallic-compounds
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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: V- EC II A: Nuclear, Industrial Chemistry & Metallic State

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course code: U24CHE52A**

UNIT- I: NUCLEAR CHEMISTRY I (12 Hours)

Introduction, nuclear structure – composition of the nucleus, subatomic particles, nuclear forces, nuclear stability – mass defect and binding energy, whole number rule and packing fraction, n-p ratio, odd even rules – liquid drop and shell models, isobars, isotones and isomers. Isotopes – detection, physical and chemical methods of separation, isotopic constitution of elements-Radioactivity – introduction – radioactive emanations- characteristics of α, β and gamma rays,

UNIT –II: NUCLEAR CHEMISTRY II (12 Hours)

Detection and measurement of radioactivity- Wilson cloud chamber, Geiger- Muller Counter. Particle accelerators – Linear accelerator and cyclotron. Artificial Radioactivity – nuclear transformation – classification of nuclear reactions, fission – atom bomb, fusion – hydrogen bomb, stellar energy – nuclear reactor – atomic power projects in india. Applications of radioisotopes as trackers in reaction mechanism, medicine, agriculture, industry and carbon dating, Hazards of radiations.

UNIT –III: METALLIC STATE (12 Hours)

Metallic bond-Packing of atoms in metal (BCC, CCP, HCP) electron gas, Pauling and band theories, Structure of alloys, substitutional and interstitial solid solutions, Hume – Ruthery ratios, crystal defects – stoichiometric and non- stoichiometric defects. Semiconductors – intrinsic and extrinsic – n-type and p-type composition, properties, structure and uses in electronic industry.

UNIT- IV: INORGANIC POLYMERS (12 Hours)

Inorganic polymers – coordination polymers , metal alkalis, phosphonitrilic polymers. Silicates – Classification in to discrete anions – one, two and three dimensional structures with typical examples. Composition, properties and uses of beryl, asbestos, talc, mica, feldspar and zeolite.

UNIT –V: INDUSTRIAL CHEMISTRY (12 Hours)

Gaseous fuels -Natural gas, gobar gas, water gas, semi water gas, producer gas and LPG composition, manufacture and its applications. Safety matches - Introduction, raw materials and manufacturing methods. Paints and varnishes : Definitions, types and compositions. Glass: Composition, manufacture, types and uses. Cement: manufacture, Wet and Dry processes, composition and setting of cement.

Total Lectures Hours- 60

COURSE OUTCOMES

The students should be able to

1. Learn the fundamentals of nuclear chemistry.
2. Understand the nuclear reactions and its applications.
3. Understand the concepts of metallic bonds and its applications.
4. Learn the structure and properties of inorganic polymers.
5. Learn the applications of fertilizers, paints, glass and cements.

TEXT BOOK(S)

1. Gopalan R, Subramaniyan PS. Rengarajan K. 1991. Elements of Analytical Chemistry, Sultan Chand & sons, 2nd edition,
2. Gowarikar VR, Viswnathan NV. Jayadevm . 2019. Polymer Science, Third edition, New Age International Publishers.
3. Kent JA, 2002. Reigels Handbook of Industrial Chemistry, 9th edition, Reigels publications
4. Madhan, RD. 1987. Text Book of Modern Inorganic Chemistry, 2nd edition, S.Chand & Company Ltd.,
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6. Sharma, B. K. (2023). *Industrial chemistry PART 1 & 2*. Krishna Prakashan.
7. Arnikar, H. J. (2026). *Essentials of Nuclear Chemistry*. New Age International Publishers.

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2. Glasstone, S. (1967). Source book on atomic energy. East-West Press.
3. Heaton, C. A. (No date specified). An introduction to industrial chemistry. Springer Science & Business Media.
4. Mehrotra, R. C. (2007). Organometallic chemistry. New Age International.
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6. Pfennig, B. W. (2024). Principles of inorganic chemistry (2nd ed.). Wiley.
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4. https://goldbook.iupac.org/terms/view/it07515
5. https://www.internetchemistry.com/chemistry/industrial-chemistry.php

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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: V-EC-II B: Solid State Chemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE52B**

UNIT I: CRYSTAL STRUCTURE AND CRYSTAL ENGINEERING OF ORGANIC SOLIDS

(12 Hours)

Types of close packing – hcp and ccp – packing efficiency – SC, BCC, and FCC, radius ratio rule – applications – polyhedral description of solids – structure types: Na_2O, Cs_2O, rutile, perovskite (ABO_3), ReO_3, K_2NiF_4, spinels and antispinels. Hydrogen bonded supramolecular patterns involving water / carboxyl / halide motifs – concepts of different types of synthons based on non-covalent interactions – principles of crystal engineering and non-covalent synthesis – polymorphism and pseudopolymorphism – supramolecular isomorphism, polymorphism and crystal engineering of pharmaceutical phases.

UNIT II: METALLO ORGANIC FRAMEWORKS (12 Hours)

M.O.Fs (Metallo Organic Frameworks) – organometallic systems – combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. Design of nanoporous solids. Interligand hydrogen bonds in metal complexes – implications for drug design – crystal engineering of NLO and OLED materials.

UNIT III: PREPARATIVE METHODS IN SOLID STATE CHEMISTRY (12 Hours)

Experimental procedure, coprecipitation as a precursor to solid state reaction, other precursor methods, kinetics of solid state reactions – crystallizations of solutions, melts, glasses and gels, solutions and gels: zeolite synthesis – precipitation from solution or melt: flux method, epitaxial growth of thin layers, verneuil flame fusion method. Graphite intercalation compounds, transition metal dichalcogenide and other intercalation compounds, ion exchange reaction, synthesis of new metastable phases by 'Chimie Douce'. Electrochemical reduction methods – preparation of thin films, chemical and electrochemical methods, physical methods – growth of single crystals,

Czochralski method, Bridgman-Stockbarger methods – zone melting. Vapour phase transport, hydrothermal methods, comparison of different methods – high pressure and hydrothermal methods and dry high pressure methods.

UNIT IV: MAGNETIC MATERIALS AND OPTICAL PROPERTIES (12 Hours)

Selected examples of magnetic materials and their properties – metals and alloys, transition metal oxides, spinels, garnets, ilmenite and perovskites. Magnetoplumbites – applications – structure/property relations – transformer, information storage, magnetic bubble memory devices, permanent magnets. Luminescence, Lasers and phosphors – definitions and general comments, configurational coordinate model, some phosphor materials, anti-Stokes phosphors –lasers – the ruby laser, Neodymium lasers

UNIT V: ORGANIC SOLID STATE CHEMISTRY (12 Hours)

Topochemical control of solid state organic reactions – intramolecular reactions – conformational effects – intermolecular reactions – molecular packing effects – photodimerization of 2-ethoxycinnamic acid (α form, β form, γ form) – photopolymerization of 2,5-distyrylpyrazine – photopolymerizations of diacetylenes. Asymmetric syntheses – dimerization of anthracene – control of molecular packing arrangements. Organic reactions within inorganic host structures – electrically conductive organic solids – organic metals, conjugated systems, doped polyacetylene, polyparaphenylene, polypyrrole – organic charge transfer complexes – new superconductors

Total Lecture Hours: 60

COURSE OUTCOMES

The student should able to

1. Identify crystal structures of few inorganic solids.
2. Study the chemistry of crystallization and vapour phase transport.
3. Explain the applications of magnetic materials.
4. Understand the chemistry of organic solids.
5. Design the molecular rods, triangles, ladders, networks

TEXT BOOK(S)

1. Lee, J. D. (2011). Concise inorganic chemistry (5th ed.). Blackwell Science.
2. Shriver, D. F., & Atkins, P. W. (2021). Inorganic chemistry (3rd ed.). W. H. Freeman and Co.
3. Puri, B. R., Sharma, L. R., & Kalia, K. C. (2019). Principles of inorganic chemistry. Shoban Lal Nagin Chand and Co.

4. Lehn, J. M. (2000). Transition metals in supramolecular chemistry (Vol. 5). John Wiley and Sons.
5. Rao, C. N. R. (2001). [Article title missing]. Current Science, Royal Society of Chemistry, UK. (More details needed for accurate citation)
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2. Lehn, J. M. (2011). Supramolecular chemistry. VCH.
3. Desiraju, G. R. (2013). Crystal engineering: The design of organic solids. Elsevier.
4. Desiraju, G. R., & Steiner, T. (2002). The weak hydrogen bond in structural chemistry and biology. Oxford University Press.
5. Jeffrey, G. A. (1997). Introduction to hydrogen bonding. Oxford University Press.
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E-RESOURCES

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3. https://www.researchgate.net
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5. engineering/research/electrical- magnetic-optical-properties
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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: V-EC-II C: Pharmaceutical Chemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE52C**

UNIT I : INTRODUCTION **(12 Hours)**

Important terminologies – drug , pharmacognosy, pharmacy, pharmacology, pharmacodynamics, pharmacokinetics, clinical pharmacology, pharmacotherapeutics, chemotherapy, toxicology, pharmacophore, antimetabolites, mutation, bacteria, virus, fungi, actinomycetes, vaccines, pharmacopeia, posology and therapeutic index.

Sources of drugs – dosage forms – bio availability – routes of administration – absorption, distribution and elimination of drugs – drug metabolism –prescription terms.

Unit II : INDIAN MEDICINAL PLANTS **(12 Hours)**

Some important Indian medicinal plants – tulsi, neem, kizhanelli, mango, semparuthi, adadodai, turmeric and thoothuvalai – uses.

Common diseases and their treatment

Causes, prevention and treatment of the following diseases:
Insect borne diseases– malaria, filariasis, plague;Air borne diseases– diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis; Water borne diseases – cholera, typhoid , dysentery.
Digestive system – jaundice; Respiratory system – asthma; Nervous system – epilepsy.

Antibiotics

Definition – classification – structure and therapeutic uses of chloramphenicol, penicillins , structure activity relationship of chloramphenicol ; therapeutic uses of ampicillin, streptomycin, erythromycin, tetracycline, rifamycin.

UNIT III : ENZYMES AND VITAMINS **(12 Hours)**

Nomenclature and classification, characteristics, factors influencing enzyme activity – mechanism of enzyme action – Lock and key hypothesis, Koshland's induced fit model. Proenzymes, antienzymes, coenzymes and isoenzymes; allosteric enzyme regulation. Vitamins as coenzymes – functions of TPP, lipoic acid, NAD, NADP,FMN,FAD, pyridoxal phosphate, CoA, folic acid,biotin, cyanocobalamin.

UNIT IV : AMINO ACIDS **(12Hours)**

Components of nucleic acids - nitrogenous bases and pentose sugars, structure of nucleosides and nucleotides, DNA- structure & functions; RNA –types– structure - functions; biosynthesis of proteins **Hormones** Adrenalin and thyroxine — chemistry, structure and functions (No structure elucidation).

UNIT V: LIPIDS **(12Hours)**

Occurrence, biological significance of fats, classification of lipids.

Simple lipids – Oils and fats, chemical composition, properties, reactions – hydrolysis, hydrogenation, trans-esterification, saponification, rancidity; analysis of oils and fats – saponification number, iodine number, acid value, R.M. value. Distinction between animal and vegetable fats. **Compound lipids** – Lipoproteins - VLDL, LDL, HDL, chylomicrons – biological significance. Cholesterol – occurrence, structure, test, physiological activity. Metabolism of lipids: β-oxidation of fatty acids.

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. Explain molecular logic of living organisms, composition of blood and blood coagulation.
2. Explain synthesis and properties of amino acids, determination of structure of peptides and proteins.
3. Explain factors influencing enzyme activity and vitamins as coenzymes.
4. Explain RNA and DNA structure and functions.
5. Explain biological significance of simple and compound lipids.

TEXT BOOK(S)

1. Bahl, B. S., & Bahl, A. (2003). Advanced organic chemistry (3rd ed.). S. Chand.
2. Jain, M. K., & Sharma, S. C. (2017). Modern organic chemistry. Vishal Publications.
3. Shanmugam, A. (1999). Fundamentals of biochemistry for medical students (6th ed.). (Published by the author).
4. Veerakumari, L. (2004). Biochemistry (1st ed.). MJP Publications.
5. Jain, J. L. (1983). Fundamentals of biochemistry (2nd ed.). S. Chand.
6. Nagrady, T. (2020). Medicinal chemistry: A molecular and biochemical approach. Elsevier.
7. Ashutosh Kar. (2026). *Medicinal Chemistry*. New Age International Publishers.

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6. West, E. S., Todd, W. R., Mason, H. S., & Van Bruggen, J. T. (1970). Textbook of biochemistry (4th ed.). Macmillan.
7. Lehninger, A. L. (1993). Principles of biochemistry (2nd ed.). CBS Publisher.
8. Rastogi, S. C. (2003). Biochemistry (2nd ed.). Tata McGraw-Hill.
9. Chatterjea, M. N., & Shinde, R. (2002). Textbook of medical biochemistry (5th ed.). Jaypee Brothers.
6. Ashutosh Kar. (2026). *Medicinal Chemistry*. New Age International Publishers.

E- RESOURCES

1) http://library.med.utah.edu/NetBiochem/nucacids.html
2)http://users.rcn.com/jkimball.ma.ultranet/BiologyPages/E/EnzymeKine tics.html
3)https://swayam.gov.in/courses/4384-biochemistry Biochemistry
4)https://onlinecourses.nptel.ac.in/noc19_cy07/preview Experimental Biochemistry
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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: V : Environmental Studies

Ins. Hrs. /Week: 2 **Course Credit: 2** **Course Code: 24UGCES**

Unit: 1 The Multidisciplinary nature of environmental studies
Definition, scope and importance. **(2 lectures)**
Need for public awareness

Unit: 2 Natural Resources: (**2 lectures**)
Renewable and non-renewable resources:
Natural resources and associated problems.

a) Forest resources: use and over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.

b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water, dams benefits and problems.

c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.

d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.

e) Energy resources: Growing energy needs, renewable and non renewable energy sources, use of alternate energy sources. Case studies.

f) Land resources: Land as a resources, land degradation, man induced Landslides, soil erosion and desertification.

Role of an individual in conservation of natural resources.
Equitable use of resources for sustainable lifestyles.

(8 lectures)

Unit: 3 **Ecosystems**

Concept of an ecosystem.
Structure and function of an ecosystem.
Producers, consumers and decomposers
Energy flow in the ecosystem
Ecological succession.

Food chains, food webs and ecological pyramids
Introduction, types, characteristic features, structure and function of the following ecosystem:-

a. Forest ecosystem
b. Grassland ecosystem
c. Desert ecosystem
d. Aquatic ecosystems, (ponds, streams, lakes, rivers, oceans, estuaries)

(6 lectures)

Unit: 4 Biodiversity and its conservation

Introduction – Definition : Genetic, species and ecosystem diversity
Biogeographical classification of India
Value of biodiversity : consumptive use, productive use, social, ethical, aesthetic and option values
Biodiversity at global, National and local levels India as a mega-diversity nation
Hot-spots of biodiversity
Threats to biodiversity : habitat loss, poaching of wildlife, man-wildlife conflicts.
Endangered and endemic species of India
Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.
Biological Diversity Act 2002/ BD Rules, 2004

(8 lectures)

Unit: 5 Environmental Pollution

Definition
Causes, effects and control measures of :

a. Air Pollution
b. Water Pollution
c. Soil Pollution
d. Marine Pollution
e. Noise pollution
f. Thermal Pollution
g. Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes.
Role of an individual in prevention of pollution
Pollution case studies
Disaster management: floods, earthquake, cyclone and landslides.
Ill-Effects of Fireworks: Firework and Celebrations, Health Hazards, Types of Fire, Firework and Safety

(8 lectures)

Unit: 6 Social Issues and the Environment

From Unsustainable to Sustainable development.

Urban problems related to energy.
Water conservation, rain water harvesting, watershed management.
Resettlement and rehabilitation of people; its problems and concerns.
Case studies
Environmental ethics: Issues and possible solutions.
Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
Wasteland reclamation.
Consumerism and waste products.
Environment Protection Act.
Air (Prevention and Control of Pollution) Act.
Water (Prevention and Control of Pollution) Act.
Wildlife Protection Act.
Forest Conservation Act.
Issues involved in enforcement of environmental legislation
Public awareness.

(7 lectures)

Unit: 7 Human Population and the Environment

Population growth, variation among nations.
Population explosion – Family Welfare Programmes
Environment and human health
Human Rights - Value Education
HIV/ AIDS - Women and Child Welfare
Role of Information Technology in Environment and human health
Case studies.

Unit: 8 Field Work

Visit to a local area to document environmental assets-river / forest/ grassland/ hill / mountain

COURSE OUTCOMES

1. Understand the environmental importance including interactions across local to global scales.
2. The learners to update and analyze environmental relationships and interactions of environmental components
3. The student to gain knowledge on importance of natural resources in a systematic way.
4. The course content is introduce the concept of renewable and non-renewable energy resources and its scenario in India and at global level
5. The students will know the relationship between biodiversity and ecosystem functions, direct and indirect values of biodiversity resources and their bioprospecting opportunities.
6. The learners can gain awareness related on environmental pollution, causes and pollution control with case studies.
7. Student to obtain the environmental ethics and gain knowledge about the sustainable development.

8. Learners should realize the environmental legislation and policies of national and international regime and know the regulations applicable to industries and other organizations with significant Environmental aspects

REFERENCE BOOK(S)

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2. Bharucha Erach, The Biodiversity of India, Mapin Publishing Pvt ltd, Ahamedabad – 380013, India, E-mail: mapin@icenet.net(R)
3. Brunner R.C. 1989, Hazardous Waste Incineration, McGraw Hill Inc 480 p
4. Clark R.S. Marine Pollution, Clanderson Press Oxford (TB)
5. Cunningham, W.P.Cooper, T.H.Gorhani E & Hepworth, M.T. 2001.
6. De A.K. Environmental Chemistry, Wiley Eastern Ltd
7. Down to Earth, Centre for Science and Environment (R)
8. Gleick, H.P. 1993. Water in crisis, Pacific Institute for Studies in Dev., Environment & Security. Stockholm Env. Institute Oxford University, Press 473p.
9. Hawkins, R.E. Encyclopedia of India Natural History, Bombay Natural History Society, Bombay (R)
10. Heywood, V.H & Watson, R.T. 1995. Global Biodiversity Assessment. Cambridge University Press 1140 p.
11. Jadhav, H & Bhosale, V.M. 1995. Environmental Protection and Laws Himalaya Pub. House, Delhi 284 p.
12. Mckinney, M.L. & Schoch R.M. 1996. Environmental Science systems & Solutions, Web enhanced edition 639 p.
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15. Odum, E.P. 1971 Fundamentals of Ecology. W.B. Saunders Co. USA. 574 p
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18. Survey of the Environment, The Hindu (M).
19. Townsend C. Harper, J and Michael Begon, Essentials of Ecology, Blackwell science (TB)
20. Trivedi R.K. Handbook of Environmental Laws, Rules, Guidelines, Compliances and Standards, Vol. I and II, Enviro Media (R).
21. Trivedi R.K. and P.K. Goel, Introduction to air pollution, Techno-Science Publications (TB).
22. Wagner K.D. 2024 Environmental Management. W.B. Saunders Co. Philadelphia USA

    499 p (M) Magazine (R) Reference (TB) Textbook
23. Cunningham, W. P., & Cunningham, M. A. (2026). *Principles of Environmental Science*.

    McGraw-Hill Education.
24. http://nbaindia.org/uploaded/Biodiversityindia/Legal/33%20Biological%20Diversity%20

SEMESTER-VI

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(For the Candidates admitted in the academic year 2024 – 2025)
DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: VI - CC VIII : Organic Chemistry – II

Ins. Hrs. /Week: 6 **Course Credit: 4** **Course Code: U24CH613**

UNIT I : ALKALOIDS (18 Hours)

Classification, isolation, general properties- Hofmann Exhaustive Methylation; Structure elucidation – Coniine, piperine, nicotine.

Terpenes: Classification, Isoprene rule, isolation and structural elucidation of Citral, alpha terpineol, Menthol, Geraniol and Camphor.

UNIT II: CARBOHYDRATES (18 Hours)

Definition and Classification of Carbohydrates with examples. Relative configuration of sugars. Determination of configuration (Fischer's Proof). Definition of enantiomers, diastereomers, epimers and anomers with suitable examples.

Monosaccharides– configuration – D and L hexoses – aldohexoses and ketohexoses. Glucose, Fructose – Occurrence, preparation, properties, reactions, structural elucidation, uses.

Interconversions of sugar series – ascending, descending, aldose to ketose and ketose to aldose.

Disaccharides – sucrose, lactose, maltose - preparation, properties and uses (no structural elucidation).

Polysaccharides – Source, constituents and biological importance of homopolysaccharides-starch and cellulose, heteropolysaccharides – hyaluronic acid, heparin.

UNIT III :MOLECULAR REARRANGEMENTS (18 Hours)

Molecular Rearrangement: Type of rearrangements, Mechanism for Benzidine, Favorskii, Clasien, Fries, Hofmann, Curtius, Schmidt and Beckmann, Pinacol-pinacolone rearrangement.

UNIT IV: SPECIAL REAGENTS IN ORGANIC SYNTHESIS (18 Hours)

AIBN, 9BBN, BINAP/BINOL, BOC, DABCO, DCC, DIBAL, DMAP,NBS/NCS, NMP, PCC, TBHP, TEMPO.

Organometallic compounds in Organic Synthesis

Preparation, Properties and applications: Grignard Reagents, Organo Lithium Compounds, Ziegler – Natta,Wilkinson, Metal Carbonyl, Zeiss's Salt.

UNIT V : GREEN CHEMISTRY **(18 Hours)**

Principles, chemistry behind each principle and applications in chemical synthesis. Green reaction media – green solvents, green reagents and catalysts; tools used like microwave and ultra-sound in chemical synthesis.

Total Lecture Hours: 90

COURSE OUTCOMES

The students should be able to

1. Explain isolation and properties of alkaloids and terpenes.
2. Explain preparation and reactions of mono and disachharides.
3. Classify biomolecules and natural products based on their structure, properties, reactions and uses.
4. Explain molecular rearrangements like benzidine, Hoffmann etc.,
5. Preparation and properties of organolithium compounds.

TEXT BOOK(S)

1. Jain, M. K., & Sharma, S. C. (2009). Modern organic chemistry (4th reprint). Vishal Publishing.
2. Mukherji, S. M., & Singh, S. P. (2009). Reaction mechanism in organic chemistry (3rd ed.). Macmillan India Ltd.
3. Bahl, A., & Bahl, B. S. (2012). Advanced organic chemistry (Multicolor ed.). S. Chand & Company Pvt. Ltd.
4. Soni, P. L., & Chawla, H. M. (2007). Textbook of organic chemistry (29th ed.). Sultan Chand & Sons.
5. Bandyopadhyay, C. (2020). An insight into green chemistry.
6. Jugade, R. M., & Tangde, V. M. (2025). Chemistry for (link unavailable) students semester II: Paper III & IV | Organic chemistry-2 (functional group chemistry). S Chand Publishing.
7. Morrison, R. T., & Boyd, R. N. (2026). *Organic Chemistry*. Pearson Education.

REFERENCE BOOK(S)

1. Morrison, R. T., & Boyd, R. N. (2012). Organic chemistry (6th ed.). Pearson Education.
2. Solomons, T. W. G. (2012). Organic chemistry (11th ed.). John Wiley & Sons.
3. Carey, F. A. (2009). Organic chemistry (7th ed.). Tata McGraw-Hill Education Pvt. Ltd.
4. Finar, I. L. (2006). Organic chemistry (Vol. 1 & 2, 6th ed.). Wesley Longman Ltd.
5. Joule, J. A., & Smith, G. F. (2010). Heterocyclic chemistry (5th ed.). Wiley.
6. Chouhan, M. S. (2025). Solomons, Fryhle & Snyder organic chemistry for JEE (Main & Advanced) (4th ed.). Wiley India Pvt. Ltd.
7. *Pigman, W., & Horton, D. (2026).* The Carbohydrates: Chemistry and Biochemistry. *Academic Press.*

E- RESOURCES

1. www.epgpathshala.nic.in
2. www.nptel.ac.in 3.http:/swayam.gov.in
3. Virtual Textbook of Organic Chemistry
4. https://coursecontent.indusuni.ac.in/wp-content/uploads/sites/8/2020/03/UNIT-I_Reagents-In-Organic-Synthesis-1.pdf
5. https://www.chemmethod.com/article_101213_efe849091d588418ed45c055efe18266.pdf

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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: VI : CC IX Physical Chemistry -II

Ins. Hrs. /Week: 6 **Course Credit: 4** **Course Code: U24CH614**

UNIT-I: PHASE RULE (14 Hours)

Definition of terms; derivation of phase rule ; application to one component systems – water and sulphur - super cooling, sublimation ; two component systems – solid liquid equilibria-simple eutectic (lead - silver and bismuth - cadmium), freezing mixtures (potassium iodide-water), compound formation with- congruent melting points (magnesium – zinc and ferric chloride – water system), peritectic change (sodium – potassium), solid solution (gold-silver); copper sulphate – water system.

UNIT II : CHEMICAL EQUILIBRIUM (14 Hours)

Law of mass action – thermodinamic derivation – relationship between K_p and K_c –application to the homogeneous equilibria – dissociation of PCl_5 gas, N_2O_4 gas –equilibrium constant and degree of dissociation - formation of HI, NH_3 ,and SO_3 –heterogeneous equilibrium – decomposition of solid calcium carbonate –Lechatelier principle – van't Hoff reaction isotherm – temperature dependence of equilibrium constant – van't Hoff reaction isochore – Clayperon equation – Clausius Clayperon equation and its applications.

UNIT III : BINARY LIQUID MIXTURES (16 Hours)

Ideal liquid mixtures – non ideal solutions – azeotropic mixtures – fractional distillation – partially miscible mixtures – phenol-water, triethylamine-water, nicotine-water – effect of impurities on critical solution temperature; immiscible liquids- steam distillation; Nernst distribution law – applications.

UNIT IV : ELECTRICAL CONDUCTANCE AND TRANSFERENCE (16 Hours)

Arrhenius theory of electrolytic dissociation – Ostwald's dilution law, limitations of Arrhenius theory; behavior of strong electrolytes – interionic effects – Debye Huckel theory –Onsager equation (no derivation), significance of Onsager equation, Debye Falkenhagen effect, Wien effect. Ionic mobility – Discharge of ions on electrolysis (Hittorf's theoretical device), transport number –determination –Hittorf's method, moving boundary method – factors affecting transport number – determination of ionic mobility; Kohlrausch's law- applications; molar ionic conductance and viscosity (Walden's rule); applications of conductance measurements – determination of - degree of dissociation of weak electrolyte, dissociation constant of weak acid and weak base, ionic product of water, solubility and solubility product of sparingly soluble salts - conductometric titrations – acid base titrations.

UNIT V : GALVANIC CELLS AND APPLICATIONS (22 Hours)

Galvanic cell, representation, reversible and irreversible cells, EMF and its measurement – standard cell; relationship between electrical energy and chemical energy; sign of EMF and spontaneity of a reaction, thermodynamics and EMF – calculation of ΔG, ΔH, and ΔS from EMF data; reversible electrodes, electrode potential, standard electrode potential, primary and secondary reference electrodes, Nernst equation for electrode potential and cell EMF; types of electrodes – metal/metal ion, metal amalgam/metal ion, metal, insoluble salt/anion, gas electrode, redox electrode; electrochemical series – applications of electrochemical series. Chemical cells with and without transport, concentration cells with and without transport; Applications of EMF measurements applications of EMF measurements – determination of activity coefficient of electrolytes, transport number, valency of ions, solubility product, pH using hydrogen gas electrode, quinhydrone electrode and glass electrode, potentiometric titrations – acid base titrations, redox titrations, precipitation titrations, ionic product of water and degree of hydrolysis; redox indicators - use of diphenylamine indicator in the titration of ferrous iron against dichromate.

Industrial component

Galvanic cells- lead storage, Ni-Cd, Li and Zn-air, Al-air batteries Fuel cells – H_2-O_2 cell – efficiency of fuel cells. corrosion –mechanism, types and methods of prevention.

Total Lecture Hours: 90

COURSE OUTCOMES

The students should be able to

1. Construct the phase diagram for one component and two component systems, explain the properties of freezing mixture, component with congruent melting points and solidsolutions.
2. Apply the concepts of chemical equilibrium in dissociation of PCl_5, N_2O_4 and formation of HI, NH_3, SO_3 and decomposition of calcium carbonate. Demonstrate important principles such as Le chatelier principle, van't Hoff reaction isotherm andClausius-Clayperon equation.
3. Identify an appropriate distillation method for the separation of binary liquid mixturessuch as azeotropic mixtures, partially miscible mixtures and immiscible liquids.
4. Explain the significance of Arrhenius theory, Debye-Huckel theory, Onsager equationand Kohlrausch's law in conductance.
5. Construct electrochemical cell with the help of electrochemical series and calculate cell EMF. Demonstrate the applications of EMF and significance of potentiometric titrations.

TEXT BOOK(S)

1. Puri, B. R., & Sharma, L. R. (2021). Principles of physical chemistry (48th ed.). Shoban Lal Nagin Chand and Co.
2. Atkins, P., de Paula, J., & Keeler, J. (2018). Physical chemistry (11th ed.). Oxford University Press.
3. Bahl, A., Bahl, B. S., & Tuli, G. D. (2019). Essentials of physical chemistry (28th ed.). S. Chand & Co.
4. Dogra, S. K., & Dogra, S. (1996). Physical chemistry through problems (4th ed.). New Age International.

5. Rajaram, J., & Kuriacose, J. C. (1986). Thermodynamics. Shoban Lal Nagin Chand and Co.
6. Mehta, V. (2025). Wiley's physical chemistry for JEE (Main & Advanced) (2nd ed.). Wiley India.
7. *Atkins, P., & de Paula, J. (2026).* Atkins' Physical Chemistry. *Oxford University Press.*

REFERENCE BOOK(S)

1. Kapoor, K. L. (2009). A textbook of physical chemistry (3rd ed.). Macmillan India Ltd.
2. Castellan, G. W. (1985). Physical chemistry (3rd ed.). Narosa Publishing House.
3. Atkins, P. W., & de Paula, J. (2002). Physical chemistry (7th ed.). Oxford University Press.
4. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2001). Principles of physical chemistry (41st ed.). Shobanlal Nagin Chand and Co.
5. Bajpai, D. N. (2001). Advanced physical chemistry. S. Chand & Co.
6. Tandon, O. P., & Singh, A. S. (2023). A textbook of physical chemistry (Vol. 1 & 2). (Perfect paperback edition for JEE Main & Advanced).
7. Bard, A. J., & Faulkner, L. R. (2026). *Electrochemical Methods: Fundamentals and Applications*. Wiley.

E- RESOURCES

1.https://nptel.ac.in https://swayam.gov.in
2.https://archive.nptel.ac.in/content/storage2/courses/112108150/pdf/PPT s/MTS_07_m.pdf
3. https://Thermodynamics - NPTEL
4.www.youtube.com/watch?v=f0udxGcoztE
5. Introduction to chemical equilibrium – MIT opencourse ware

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B.Sc., CHEMISTRY

Semester: VI :EC -III A: Fundamentals of Spectroscopy

Ins. Hrs. /Week: 4 **Course Credit: 2** **Course Code: U24CHE63A**

UNIT I : ELECTRICAL AND MAGNETIC PROPERTIES OF MOLECULES (12 Hours)

Dipole moment – polar and nonpolar molecules – polarisability of molecules. Application of dipole moments in the study of organic and inorganic molecules. Magnetic permeability, volume susceptibility, mass susceptibility and molar susceptibility; diamagnetism, paramagnetism – determination of magnetic susceptibility using Guoy balance, ferromagnetism, anti ferromagnetism.

Microwave spectroscopy

Rotation spectra - diatomic molecules (rigid rotator approximation) selection rules – determination of bond length, effect of isotopic substitution – instrumentation and applications

UNIT II : ULTRAVIOLET AND VISIBLE SPECTROSCOPY (12 Hours)

Electronic spectra of diatomic molecules (Born Oppenheimer approximation) - vibrational coarse structure – rotational fine structure of electronic vibration transitions – Frank Condon principle – dissociation in electronic transitions – BirgeSponer method of evaluation of dissociation energy – pre-dissociation transition - σ -σ *, π-π*, n-σ*, n-π* transitions. Applications of UV-Woodward – Fieser rules as applied to conjugated dienes and α, β - unsaturated ketones. Elementary Problems. Colorimetry - principle and applications (estimation of Fe^{3+}).

UNIT III : INFRARED SPECTROSCOPY (14 Hours)

Vibration spectra –diatomic molecules – harmonic oscillator and anharmonic oscillator; Vibration – rotation spectra – diatomic molecule as rigid rotator and anharmonic oscillator(Born Oppenheimer approximation oscillator) - selection rules, vibrations of polyatomic molecules – stretching and bending vibrations – applications – determination of force constant, moment of inertia and internuclear distance – isotopic shift – application of IR spectra to simple organic and inorganic molecules – (group frequencies).

Raman Spectroscopy

Rayleigh scattering and Raman scattering of light – Raman shift –classical theory of Raman effect – quantum theory of Raman effect – Vibrational Raman spectrum – selection rules – mutual exclusion principle – instrumentation (block diagram) – applications.

UNIT IV : NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY (10 Hours)

PMR – theory of PMR – instrumentation - number of signals – chemical shift – peak areas and proton counting – spin-spin coupling – applications. Problems related to shielding and deshielding of protons, chemical shifts of protons in hydrocarbons, and in simple monofunctional organic compounds; spin-spin splitting of neighbouring protons in vinyl and allyl systems.

UNIT V : MASS SPECTROMETRY (12 Hours)

Principle – different kinds of ionisation – instrumentation – the mass spectrum – types of ions – determination of molecular formula-fragmentation and structural elucidation – McLafferty rearrangement; Retro Diels Alder reaction - illustrations with simple organic molecules. Solving structure elucidation problems using multiple spectroscopic data (NMR, MS, IR and UV-Vis).

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. Explain electrical and magnetic properties of materials and microwave spectroscopy
2. Explain theory, instrumentation and applications of Infrared and Raman spectroscopy
3. Apply selection rules to understand spectral transitions, explain Woodward – Fieser's rule for the calculation of wavelength maximum of conjugated dienes
4. Explain theory, instrumentation and applications of NMR spectroscopy
5. Explain theory, instrumentation and applications of Mass spectrometry

TEXT BOOK(S)

1. Gopalan, R., Subramaniam, P. S., & Rengarajan, K. (2003). Elements of analytical chemistry. S Chand.
2. Usharani, S. (2002). Analytical chemistry (1st ed.). Macmillan.
3. Banwell, C. N., & Mc Cash, E. M. (2017). Fundamentals of molecular spectroscopy (4th ed.). Tata McGraw Hill.
4. Dash, U. N. (2005). Analytical chemistry theory and practice (2nd ed.). Sultan Chand & Sons.
5. Sharma, B. K. (2011). Spectroscopy (22nd ed.). Goel Publishing House.
6. Bhatt, G., Bhatt, M., & Bhattacharya, S. (Eds.). (2024). Impedance spectroscopy and its application in biological detection. Springer.
7. *Banwell, C. N., & McCash, E. M. (2026).* Fundamentals of Molecular Spectroscopy. *McGraw-Hill Education.*

REFERENCE BOOK(S)

1. Srivastava, A. K., & Jain, P. C. (1997). Chemical analysis: An instrumental approach (3rd ed.). S. Chand.
2. Braun, R. D. (1987). Introduction to instrumental analysis. McGraw Hill.
3. Skoog, D. A., Crouch, S. R., Holler, F. J., & West, D. M. (2013). Fundamentals of analytical chemistry (9th ed.). Harcourt College Publishers.
4. Madan, R. L., & Tuli, G. D. (2005). Physical chemistry (2nd ed.). S. Chand.
5. Puri, B. R., Sharma, L. R., & Pathania, M. S. (2008). Principles of physical chemistry (43rd ed.). Vishal Publishing.
6. Salunkhe, A. (2025). Fundamentals of 1H NMR and 13C NMR spectroscopy. OrangeBooks Publication.
7. Silverstein, R. M., Webster, F. X., Kiemle, D. J., & Bryce, D. L. (2026). *Spectrometric Identification of Organic Compounds*. Wiley.

E- RESOURCES

1. http://vallance.chem.ox.ac.uk/pdfs/SymmetryLectureNotes2004.pdf
2. http://chemistry.rutgers.edu/undergrad/chem207/SymmetryGroupThe ory.html
3. www.epgpathshala.nic.in
4. www.nptel.ac.in
5. http:/swayam.gov.in

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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: VI : EC-III B: Industrial Chemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE63B**

UNIT I: SURVEY OF INDIAN INDUSTRIES AND MINERAL RESOURCES IN INDIA

(8 Hours)

Fuels: Classification, characteristics of fuels. Solid fuels: coal - classification; analysis of coal-proximate analysis and ultimate analysis; calorific value-determination, carbonisation of coal.

Liquid fuels: Petroleum - characteristics; Gasoline aviation petrol- knocking in internal combustion engines, antiknock agents; unleaded petrol-octane number, cetane number.

Gaseous fuel: advantages over solid and liquid fuels; water gas, producer gas, carburetted water gas -preparations - uses.

Natural gas: LPG-composition, advantages, application; gobar gas- production, composition, advantages, application. Propellants – rocket fuels (basic idea).

UNIT II : COSMETICS **(10 Hours)**

Skin care: powders, ingredients; creams and lotion-cleansing, moisturising, all purpose shaving cream, sunscreen; make up preparations. Dental care: tooth pastes – ingredients. Hair care: shampoos-types, ingredients; conditioners-types, ingredients. Perfumes: natural-plant origin-parts of the plant used, chief constituents; animal origin-amber gries, civetone and musk; synthetic-classification- esters-amylsalicylate alcohols-citronellol; terpeneols- gereniol and nerol; ketones-muskone, coumarin; aldehydes-vanilin.

Soaps and Detergents

Soaps-properties, manufacture of soap-batch process; types-transparent soap, toilet soap, powder soap and liquid soap – ingredients. Detergents-definition, properties-cleansing action; soapless detergents- anionic, cationic and non-ionic (general idea only); uses of detergents as surfactants. Biodegradability of soaps and detergents.

UNIT III : SUGAR INDUSTRY **(16 Hours)**

Manufacture from sugar cane; recovery of sugar from molasses; testing and estimation of sugar.

Food Preservation and processing

Food spoilage – causes; Food preservation - methods – high temperature, low temperature, drying, radiation; Food additives – preservatives, flavours, colours, anti-oxidants, sweetening agents; hazards of using food additives; Food standards – Agmark and Codex alimentarius.

UNIT IV : ABRASIVES **(12 Hours)**

Definition, characteristics, types-natural and synthetic; natural abrasives – diamond, corundum, emery, garnet, quartz – composition, uses; synthetic abrasives – carborundum, aluminium carbide, boron carbide, boron nitride, synthetic graphite – composition and uses.

Leather Industry

Structure and composition of skin, hide; Manufacture of leather – pre- tanning process – curing, liming, beating, pickling; methods of tanning- vegetable, chrome – one bath, two bath process; finishing.

Paper Industry

Manufacture of pulp - mechanical, chemical processes; sulphate pulp, rag pulp; manufacture of paper- beating, refining, filling, sizing, colouring, calendaring; cardboard.

UNIT V : LUBRICANTS **(14 Hours)**

Definition, classification-liquid, semi-solid, solid and synthetic; properties-viscosity index, flash point, cloud point, pour point, aniline point and drop point; greases-properties, types; cutting fluids, selection of lubricants.

Cement Industry

Cement – types, raw materials; manufacture-wet process, constituent of cement, setting of cement; properties of cement-quality, setting time, soundness, strength; mortar, concrete, RCC; curing and decay of concrete.

Intellectual Property Rights

Introduction to Intellectual Property Rights – Patents - Factors for patentability - Novelty, Non obviousness, Industrial applications - Patent offices in India: Trademark - Types of trademarks- Certification marks, logos, brand names, signatures, symbols and service marks.

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. Summarize the properties of fuels which include petroleum, water gas, natural gas and Propellents.
2. Evaluate cosmetic products, soaps, detergents.
3. Explain manufacture of sugar, food spoilages and food additives.
4. Explain properties of abrasives, manufacture of leather and paper.
5. Explain properties and manufacture of lubricants and cement, and intellectual property rights.

TEXT BOOK(S)

1. Sharma, B. K. (1998). Industrial chemistry (9th ed.). Goel Publishing House.
2. Wilkinson, J. B., & Moore, R. J. (1982). Harry's cosmeticology (7th ed.). Chemical Publishers.
3. Ramani, A. V. (2009). Food chemistry. MJP Publishers.
4. Ghosh, J. (2006). Applied chemistry. S. Chand.
5. Srilakshmi, B. (2005). Food science (4th ed.). New Age International Publication.
6. Benvenuto, M. A. (2024). Industrial chemistry. De Gruyter.
7. Dryden, C. E. (2026). *Outlines of Chemical Technology*. East-West Press.

REFERENCE BOOK(S)

1. Jain, P. C., & Jain, M. (1992). Engineering chemistry (16th ed.). Dhanpat Rai.
2. Howard, G. (1987). Principles and practice of perfumes and cosmetics. Stanley Thornes.

3. Jacob, T. (1997). Foods, drugs and cosmetics - A consumer guide. Macmillan.
4. Manay, N. S., & Shadaksharaswamy, M. (2008). Food facts and principles (3rd ed.). New Age Publication.
5. Pandey, N., & Dharni, K. (2014). Intellectual property rights. PHI Learning.
6. Haghi, R. K., & Torrens, F. (2024). Engineering technology and industrial chemistry with applications. Educational Publisher.
7. *Dryden, C. E. (2026).* Chemical Technology and Industrial Chemistry. *Butterworth-Heinemann.*

E- RESOURCES

1. http://www.sciencecases.org/irradiation/irradiation_notes.asp
2. http://discovery.kcpc.usyd.edu.au//9.5.5/
3. https://www.wipo.int/about-ip/en/
4. www.nptel.ac.in
5. http:/swayam.gov.in

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Semester: VI : EC-III C : Supramolecular Chemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code:U24CHE63C**

UNIT I: CONCEPTS OF SUPRAMOLECULAR CHEMISTRY (12 Hours)

Concepts and languages of supramolecular chemistry – various types of non-covalent interactions – hydrogen bonds, C-H···X interactions, halogen bonds – π-π interactions, non–bonded interactions – various types of molecular recognition.

UNIT II: METALLO ORGANIC FRAMEWORKS (12 Hours)

M.O.F (Metallo Organic Frameworks) – organometallic systems – combinations of different interactions to design molecular rods, triangles, ladders, networks, etc. – design of nano porous solids – inter ligand hydrogen bonds in metal complexes – implications for drug design – crystal engineering of NLO materials, OLED.

UNIT III: CO-RECEPTOR MOLECULES AND MULTIPLE RECOGNITION (12 Hours)

Di nuclear and poly nuclear metal ion cryptates – linear recognition of molecular length by ditopic co-receptors – heterotopic co-receptors – cyclophane receptors, amphiphilic receptors and large molecular cages – multiple recognition in metallo receptors – supramolecular dynamics.

UNIT IV: SUPRAMOLECULAR REACTIVITY AND CATALYSIS (12 Hours)

Catalysis by reactive macrocyclic cation receptor molecules – catalysis by reactive anion receptor molecules – catalysis with cyclophane type receptors – supramolecular metallo catalysis – co catalysis – catalysis of synthetic reactions – biomolecular and abiotic catalysis. Supramolecular chemistry in solution – cyclodextrin, micelles, dendrimers, gelators – classification and typical reactions – applications.

UNIT V: SUPRAMOLECULAR DEVICES (12 Hours)

Supramolecular devices and sensors – various types of supramolecular devices- an overview – supramolecular photochemistry – molecular and supramolecular photonic devices-light conversion and energy transfer devices– role of supramolecular chemistry in the development of nanoscience and technology.

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. Know the fundamentals of supramolecules.
2. Explain co-receptor molecules and multiple recognition.
3. Study the supramolecular reactivity and catalysis.
4. Crystal engineering of NLO materials are known.
5. Co-receptor molecules and multiple recognitions understood.

TEXT BOOK(S)

1. Steed, J. W., & Atwood, J. L. (2026). Supramolecular Chemistry. Wiley.
2. Lehn, J. M. (2026). Supramolecular Chemistry: Concepts and Perspectives. Wiley-VCH.
3. Desiraju, G. R. (2026). Supramolecular Synthons in Crystal Engineering. Springer.
4. Schneider, H. J., & Yatsimirsky, A. (2026). Principles and Methods in Supramolecular Chemistry. Wiley.

REFERENCE BOOK(S)

1. J. M. Lehn, 2010 Supramolecular Chemistry; VCH, Weinheim, Germany.
2. G. R. Desiraju, Crystal Engineering: 2014_The Design of Organic Solids; Elsevier, United States,.
3. G. R. Desiraju, and T. Steiner, 2019. The Weak Hydrogen Bond in Structural Chemistry and_ Biology; Oxford University Press, Oxford.
4. G. A Jeffrey, 2021 Introduction to Hydrogen Bonding; Oxford University Press: UK,.
5. J. M. Lehn, 1999 Transition Metals in Supramolecular Chemistry; John Wiley and Sons: New York,.
6. Shanmugaraju, S. (Ed.). (2022). Supramolecular coordination complexes: Design, synthesis, and applications. Elsevier.
7. Sauvage, J. P., & Gaspard, P. (2026). *From Non-Covalent Assemblies to Molecular Machines*. Wiley-VCH.

E- RESOURCES

1. https://www.sciencedirect.com/topics/chemistry/supramolecular-chemistry
2. https://www.newworldencyclopedia.org/entry/supramolecular_chemistry
3. http://dl.iranchembook.ir/ebook
4. https://www.researchgate.net/publication
5. https://en.wikipedia.org/wiki/Supramolecular_chemistry

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Semester: VI : EC-IV A : Polymer Chemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE64A**

UNIT I : INTRODUCTION (8 Hours)

Difference between polymer and macromolecule – classification –synthetic and natural, organic and inorganic, thermoplastic and Bulk, solution, emulsion and suspension polymerization.

UNIT II : KINETICS OF POLYMERIZATION (14 Hours)

Kinetics of condensation and addition polymerisation; ionic, free radical, copolymerisation and coordination polymerisation – reactivity ratios – block and graft copolymers.

Characterisation of polymers

Appearance, feel and hardness, density, effect of heat, solubility, combustion, tensile strength, shear, stress, impact strength, mechanical, thermo mechanical and rheological properties of polymers in viscoelastic state.

UNIT III : MOLECULAR WEIGHT AND PROPERTIES OF POLYMERS (14 Hours)

Molecular Weight of Polymers-Number Average and Weight Average, Molecular Weight Distribution, Determination of Molecular Weight polydispersity index – membrane and vapour phase osmometry, light scattering - Zimm plot, ultracentrifuge – sedimentation velocity and sedimentation equilibrium – viscometry – gel permeation chromatography.

Thermal properties of polymers – Glass Transition Temperature-State of Aggregation and State of Phase Transitions, Factors Influencing Glass Transition Temperature, Importance of Glass Transition Temperature, Heat Distortion Temperature, TGA / DTA,Crystallinity of Polymers: Crystalline Behaviour, Degree of Crystallinity.

UNIT IV : POLYMER TECHNOLOGY (10 Hours)

Reactions of Polymers-Hydrolysis, Acidolysis, Aminolysis, Additionand Substitution Reactions (One Example Each) Cyclisation, Cross-Linking and Reactions of Specific Functional Groups in the Polymer.

Polymer technology

Processing of polymers – casting, thermoforming, moulding – extrusion, compression, blow moulding – foaming, lamination, reinforcing – processing of fibres – melt, wet and dry spinning.

UNIT V : SPECIALITY POLYMERS (14 Hours)

Polyelectrolytes, conducting polymers, polymeric supports for solid phase synthesis, biomedical

polymers, liquid crystalline polymers, electroluminescent polymers – two examples of each of these polymers. Polyethylene, PVC, PMMA, polyester; rubber – synthetic and natural, vulcanization of rubber.

Polymer Degradation

Types of Degradation - Thermal, Mechanical, Ultra Sound, Photo Radiation and Chemical Degradation Methods. Rubber-Natural and Synthetic-Structure, Mechanism of Vulcanisation Biodegradable and Non-Biodegradable Polymers.

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. Explain classification of polymers, elastomers, fibres and liquid resins
2. Explain addition and condensation polymerization, mechanical properties of polymers
3. Determine the molecular weight of polymers, and explain the thermal properties of polymers
4. Explain reactions of polymers and polymer processing
5. Discuss speciality polymers like PVC, PMMA, rubbers, biodegradable polymers

TEXT BOOK(S)

1. Gowariker, V. R., Viswanathan, N. V., & Sreedhar, J. (2015). Polymer science. New Age International.
2. Misra, G. S. (2010). Introductory polymer chemistry. Wiley Eastern.
3. Bahadur, P., & Sastry, N. V. (2005). Principles of polymer science. Narosa Publishing House.
4. Ahluwalia, V. K., & Mishra, A. (2008). Polymer science: A textbook. Ane Books India.
5. Morrison, R. T., Boyd, R. N., & Bhattacharjee, S. K. (2024). Organic chemistry (8th ed.). Pearson.
6. *Billmeyer, F. W. (2026).* Textbook of Polymer Science. *Wiley India Pvt. Ltd.*

REFERENCE BOOK(S)

1. Billmeyer, F. W. (2007). Polymer science. Wiley-Interscience.
2. Seymour, R. B., & Carraher, C. E. (1981). Polymer chemistry: An introduction. Marcel Dekker Inc.
3. Sinha, R. (2000). Outlines of polymer technology. Prentice Hall of India.
4. Fried, J. R. (2014). Polymer science and technology (3rd ed.). Prentice Hall of India.
5. Miles, D. C., & Briston, J. H. (1996). Polymer technology (3rd ed.). Chemical Publishing Co Inc.
6. Parameswaranpillai, J., Siengchin, S., Salim, N. V., George, J. J., & Poulose, A. (Eds.). (2024). Polylactic acid-based nanocellulose and cellulose composites. CRC Press.
7. *Young, R. J., & Lovell, P. A. (2026).* Introduction to Polymers. *CRC Press.*

E- RESOURCES

1. https://polymerdatabase.com
2. http://amrita.vlab.co.in/?sub=2&brch=190&sim=603&cnt=1
3. http://www2.chemistry.msu.edu/faculty/reusch/VirtTxtJml/polymers.
4. http://nsdl.niscair.res.in/bitstream/123456789/406/2/Molecular+weigh ts+of+polymers.pdf
5. https://skkatariaandsons.com/view_book.aspx?productid=8043

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
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(For the Candidates admitted in the academic year 2024 – 2025)
DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: VI : EC-IV B Green Chemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE64B**

UNIT -I : Principles and Green Chemistry Synthesis (14 Hours)
Green chemistry - relevance and goals, Anastas‟ twelve principles of green chemistry -Tools of green chemistry: alternative starting materials, reagents, catalysts, solvents and processes with suitable examples.

UNIT -II : Addition And Condensation Reactions (12 Hours)
Addition reactions – Michael addition in [aqueous medium and solid state] – Diels Alder reactions, in aqueous phase. Condensation reactions – Aldol condensation of aldehydes with nitroalkanes and nitriles, Knoevengal condensations–Wittig reactions– Aldol condensation in solid phase – benzoin condensation under catalytic conditions – applications.

UNIT- III : Oxidation And Reduction Reactions (10 Hours)
Oxidation reactions – Baeyer-Villiger oxidation in aqueous phase and solid state enzymatic Baeyer-Villiger oxidation-Reduction reactions – Clemmensen reduction – mechanism -multi-component reactions, limitations – applications.

UNIT -IV : Phase-Transfer Catalyst Reactions (12 Hours)
Heck reaction – Michael addition reaction – oxidation of toluene to benzoic acid – Reimer-Tiemann reaction – Baker-Venkataraman synthesis – Williamson ether synthesis – Dozen reaction. Baker‟s yeast mediated bio-transformations–Bio-catalyst mediated Baeyer-Villiger reactions Microbial polyester synthesis.

UNIT - V : Sono Chemistry (12 Hours)
Barbieri reaction – Reformat sky reaction – Simmons-Smith reaction – Strecker synthesis – Ullmann coupling reaction – Wurtz reaction – Bouveault reaction.

Total Lecture Hours: 60

COURSE OUTCOMES

The students should be able to

1. Understand the 12 principles of green chemistry.
2. Understand the various addition and condensation reactions involved in

green chemistry.

3. Understand the various Oxidation and reduction reactions involved in green chemistry.
4. Learn the mechanism of Phase transfer catalysed reactions.
5. Understand the significance of Sonication reactions.

TEXT BOOK(S)

1. Anju Giyal . 2014. Green chemistry. a new approach towards science, vol. I, discovery chemistry.
2. Mary M Kirchhoff, 2013. Green chemistry – Principles and practice, American chemicalsociety.
3. Mike Lancaster. 2010. Green Chemistry – an introductory text, 2nd Edition, Royal Society of Chemistry publishers,
4. Syed AftabIqbal . 2016. Textbook of green chemistry, Discovery Publishing Pvt.Ltd.
5. Albert Matlack. 2010. Introduction to Green Chemistry, CRC Press, Newyork, London.
6. Das, A., Sadhukhan, A., Chakraborty, S., Bhattacharya, S., Roy, A., & Bhattacharjee, A. (2022). Role of Green Chemistry in Organic Synthesis and Protection of Environment. International Journal for Research in Applied Science and Engineering Technology, 10(12), 1850-1853
7. *Lancaster, M. (2026).* Green Chemistry: An Introductory Text. *Royal Society of Chemistry.*

REFERENCE BOOK(S)

1. Ahluwalia. V. K . 2016. Green Chemistry. 2nd Edition. Ane Books Pvt Ltd. New Delhi.
2. Ahluwalia. V.K and Agarwal . K. 2007. Organic Synthesis, Special Techniques. 2nd Edition. Narosa Publishing House, New Delhi.
3. Anastas .P .T and Warner . J . C 2005. Green chemistry Theory and Practice. Oxford University Press, New York.
4. Kumar .V. 2013. An introduction to Green Chemistry, Vishal publishing Co.
5. Suresh .C. Ameta Rakshit Ameta Garima Ameta 2018, Sonochemistry. An Emerging Green Technology, Apple academic press, Kindle Edition.
6. Mark Anthony Benvenuto and Steven Kosmas,(2023) Green Chemistry in Practice: Greener Material Elsevier
7. *Clark, J. H., & Macquarrie, D. J. (2026).* Handbook of Green Chemistry and Technology. *Wiley-Blackwell.*

E- RESOURCES

1. https://application.wiley-vch.de/books/sample/3527324186_c01.pdf
2. https://chem.pg.edu.pl/documents/614792/2c6c0579-c52b-400e-a396-07a03363f4e0
3. https://www.scribd.com/document/150973913/sonochemistry-pdf
4. https://cbseportal.com/files/chemistry-oxidation-reduction.pdf
5. https://www.nptel.ac.in/content/storage2/courses/104101005/downloads/lecturenotes/chapter%208.pdf

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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: VI : EC-IV C Textile Chemistry

Ins. Hrs. /Week: 4 **Course Credit: 3** **Course Code: U24CHE64C**

UNIT I : CLASSIFICATION OF FIBRES (12 Hours)
General classification of fibres-chemical structure, production, properties and uses of the following natural fibres (a) natural cellulose fibres (cotton and jute) (b) natural protein fibre(woolandsilk).

UNIT II : STRUCTURE AND PROPERTIES OF FIBRES (12 Hours)
Chemical structure, production, properties and uses of the following synthetic fibres. (Manmade cellulosic fibres (rayon, modified cellulose fibre) (2) polyamide fibre(different types ofnylon)(3)polyesterfibres.

UNIT III : IMPURITIES OF FIBRES (12 Hours)
Impurities in raw cotton and grew cloth, wool and silk- general principles of the removal –scouring–bleaching–desizing–kierboiling–chemicking.

UNIT IV: DYEING (12 Hours)
Dyeing – Dyeing of wool and silk – Fastness properties of dyed materials – dyeing of nylon,terylene and other synthetic fibres.

UNIT V :FINISHING (12 Hours)
Finishing- finishes given to fabrics – mechanical finishes on cotton, wool and silk, method used inprocess of mercerizing-anti-crease and anti-shrink finishes-waterproofing.

Total Lectures Hours-60

COURSE OUTCOMES

The students should be able to

1. Understand the different types of fibres.
2. Describe the various types of nylon.
3. Discuss the concept of bleaching and chemicking.
4. Understand the process of dyeing.
5. Acquireknowledgeaboutactionsthefinishingandwaterproofingmethodology.

TEXT BOOK(S)

1. Hall.A.J, 2009.TextbookofTextileScience1st edition, Dorling Kindersley (India)Pvt.Ltd., New Delhi.
2. KapurK.2010. TextBookofAppliedChemistry,3rd edn, wiley publications.
3. Thomas Bechtold and Tung Pham, 2019. Textile Chemistry, 1stedn,Springer-Verlag,NewYork.
4. Vishu Arora.2011.TextileChemistry,1stedition,ArtechHouse,Boston.
5. Vatsala R. 2009.Text book of Textilies and Clothing, 1stedn, Atlantic Publishers and Distributors.
6. - Sutlovic, A., Razic, S. E., & Gorjanc, M. (2024). Advances in textile materials chemistry. Mdpi AG.
7. Textile Chemistry: Bechtold, T., & Pham, T. (2023). Textile chemistry. De Gruyter.
8. Trotman, E. R. (2026). *Dyeing and Chemical Technology of Textile Fibres*. Charles Griffin & Company.

REFERENCE BOOK(S)

1. BrunoNuntak.2007.TheIdentificationofTextileFibres,1stedition, RSC publications.
2. DeGruyter.2009.Textile Chemistry, 1stedn, Tung Pham.
3. Maryory L Joseph. 2012. Introduction to Textile Science,3rdedition,John Wiley and Sons,C hichester.
4. SadovF,HorchaginM,MatetshyA.2007.ChemicalTechnologyoffibrousMaterials1st edition,Mirpublishers
5. SherazAhmad,AliAfzal. 2004.AdvancedTextileTestingTechniques,1stedition,DorlingKindersley(India)Pvt.Ltd .,NewDelhi.
6. Wardman, R. H., & Mather, R. R. (2023). Chemistry of textile fibres. Royal Society of Chemistry.
7. *Broadbent, A. D. (2026).* Basic Principles of Textile Coloration. *Society of Dyers and Colourists.*

E-RESOURCES

1. https://www.careers360.com
2. https://www2.cs.arizona.edu
3. https://www.globalspec.com
4. https://www.textileworld.com
5. https://www.myklassroom.com
6. https://www.acs.org

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BHARATHIDASAN UNIVERSITY **TIRUCHIRAPPALLI - 620 024**

PART-IV VALUE EDUCATION COURSE

FOR ALL UG ARTS, SCIENCE, COMMERCE AND MANAGEMENT CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)
(Applicable to the candidates admitted from the academic year 2022-2023 onwards)

VALUE EDUCATION

Ins. Hrs. /Week: 2 **Credit: 2** **Subject Code : 24UGVED**

OBJECTIVES

To understand the philosophy of life and values through Thirukural
To analyse the components of values education to attain the sense of citizenship
To understand different types of values towards National Integration and international understanding
To learn yoga as value education to promote mental and emotional health
To understand human rights, women rights and other rights to promote peace and harmony

UNIT I : PHILOSOPHY OF LIFE AND SOCIAL VALUES:
Human Life on Earth (Kural 629) -Purpose of Life (Kural 46) -Meaning and Philosophy of Life (Kural 131, 226) -Family (Kural 45), Peace in Family (Kural 1025) Society (Kural 446), The Law of Life (Kural 952), Brotherhood (Kural 807) Five responsibilities / duties of Man (a) to himself (b) to his family (c) to his environment (d) to his society, (e) to the Universe in his lives (Kural 43, 981).

UNIT-II – HUMAN VALUES AND CITIZENSHIP

Aim of education and value education: Evolution of value oriented education, Concept of Human values: types of Values- Character Formation – Components of Value education- A P J Kalam's ten points for enlightened citizenship- The role of media in value building.

UNIT-III VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT:

Constitutional or national values: Democracy, socialism, secularism, equality, Justice, liberty, freedom and fraternity - Social Values: Pity and probity, self-control, universal brotherhood - Professional Values - Knowledge thirst, sincerity in profession, regularity, punctuality and faith - Religious Values: Tolerance, wisdom, character - Aesthetic Values- Love and appreciation of literature and fine arts and respect for the same-National Integration and International Understanding.

UNIT IV : YOGA AND HEALTH

Definition, Meaning, Scope of Yoga - Aims and objectives of Yoga - Yoga Education with modern context - Different traditions and schools of Yoga - Yoga practices: Asanas, Pranayama and Meditation.

UNIT V : HUMAN RIGHTS

Concept of Human Rights: Indian and international perspectives- Evolution of Human Rights- definitions under Indian and International documents -Broad classification of Human Rights and Relevant Constitutional Provisions: Right to Life, liberty ad Dignity-Right to equality- Right against exploitation- Cultural and Educational Right- Economic Rights- Political Rights- Social Rights - Human Rights of Women and Children – Peace and harmony.

UNIT - VI: CURRENT CONTOURS: (for continuous internal assessment only):

REFERENCE BOOK(S)

a) Leah Levin, Human Rights, NBT, 1998
b) V.R. Krishna Iyer, Dialetics and Dynamics of Human Rights in India, Tagore Law Lectures.
c) Yogic Thearpy - Swami Kuvalayananda and Dr.S.L.Vinekar, Government of India, Ministry of Health, New Delhi.
d) SOUND HEALTH THROUGH YOGA - Dr.K.Chandrasekaran, Prem Kalyan Publications, Sedaptti, 1999.
e) Grose. D. N – "A text book of Value Education' New Delhi (2005)
f) Gawande . EN – "Value Oriented Education" – Vision for better living. New Delhi (2002) Saruptsons
g) Brain Trust Aliyar- "Value Education for Health, Happiness and Harmony" Erode (2004) Vethathiri publications
h) Thirukkural with English Translation of Rev. Dr. G.U. Pope, Uma Publication, 156, Serfoji Nagar, Medical College Road, Thanjavur 613 004
i) Kaur, B. (2026). *Value Education*. Deep & Deep Publications.

COURSE OUTCOMES

After completion of the course, the student will be able to:

1. Apply the values in thirukural to be peaceful, dutiful and responsible in family and society
2. Develop character formation and sense of citizenship
3. Be secular, self-control, sincere, respectful and moral
4. Master yoga , asana and meditation to promote mental health
5. Be attitudinal to follow the constitutional rights

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SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
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DEPARTMENT OF CHEMISTRY
B.Sc., CHEMISTRY

Semester: VI -Professional Competency Course -Chemistry for Competitive Examinations

Ins. Hrs. /Week: 2 **Course Credit: 2** **Course Code: U24PCCH61**

UNIT 1 : INORGANIC CHEMISTRY

S-block Elements: Alkali and alkaline earth metals ,d & f Block Elements: Properties, electronic configuration, complex formation. Coordination Compounds: Nomenclature, isomerism, bonding theories. p-block elements: Properties, reactions of p-block elements.

UNIT II : ORGANIC CHEMISTRY

Haloalkanes and Haloarenes: Preparation, properties, reactions. Alcohols, Phenols, and Ethers: Nomenclature, structure, properties, reactions. Aldehydes, Ketones, and Carboxylic Acids: Nomenclature, structure, properties, reactions. Amines: Nomenclature, structure, properties, reactions, Hydrocarbons: Alkanes, alkenes, alkynes, and aromatic hydrocarbons. Stereochemistry of Organic Compounds: Chirality, isomerism.

UNIT III : PHYSICAL CHEMISTRY - 1

Atomic Structure: Bohr's model, quantum numbers, electronic configuration. Chemical Bonding: Valence bond theory, molecular orbital theory. Gaseous State: Gas laws, kinetic theory of gases. Thermodynamics: Enthalpy, entropy, free energy.

UNIT IV : PHYSICAL CHEMISTRY - 11

Solutions: Concentration, types of solutions, colligative properties. Electrochemistry: Redox reactions, electrochemical cells, Faraday's laws. Chemical Kinetics: Rate of reaction, factors affecting kinetics, order of reaction.

UNIT V : INTERDISCIPLINARY TOPICS

Biomolecules: Carbohydrates, proteins, lipids, nucleic acids. Polymers: Types of polymers, polymerization reactions. Environmental Chemistry: Pollution, green chemistry. Green

Chemistry: the principle and application of green chemistry. Nanotechnology and materials science. Medicinal chemistry, Supra chemistry.

COURSE OUTCOMES

The students should be able to

1. Understand the Chemical periodicity and Organometallic compounds.
2. Observe the basic principles of quantum mechanics, Electrochemistry and Chemical Kinetics.
3. Interpret the molecular spectroscopy,Chemical and Statistical thermodynamics.
4. Recall the basic principles of organic chemistry and to understand the various reactions organic compounds with reaction mechanisms.
5. Illustrate the Chemistry of Nanoscience and technology, Medicinal Chemistry, Supramolecular Chemistry and Environmental Chemistry.

TEXT BOOK(S)

1. Banerjea, D. (1993). Co-ordination chemistry. Tata McGraw Hill.
2. Prasad, R. K. (2010). Quantum chemistry (4th revised ed.). New Age International Publishers.
3. Vincent, A. (2013). Molecular symmetry and group theory: A programmed introduction to chemical applications (2nd ed.). John Wiley & Sons Ltd.
4. Carey, F. A., & Sundberg, R. J. (2003). Advanced organic chemistry (5th ed.). Tata McGraw-Hill.
5. Kumar, A., & Gupta, S. K. (1970). Fundamentals of polymer science and engineering. Tata McGraw-Hill.
6. Jespersen, N. D. (2024). AP chemistry premium, 2025: Prep book with 6 practice tests + comprehensive review + online practice. Barron's Educational Series.
7. Dinesh Publications. (2026). *XCEL Series New Millennium Chemistry Book for Class 12 (2026–2027 Session)*. Dinesh Publications.

REFERENCE BOOK(S)

1. Flurry, R. L. (1980). Symmetry group theory and chemical applications. Prentice Hall.
2. Cotton, F. A. (2003). Chemical applications of group theory (2nd ed.). John Wiley & Sons.
3. Figgis, B. N. (1976). Introduction to ligand fields. Wiley Eastern Ltd.
4. March, J., & Smith, M. (2007). Advanced organic chemistry (5th ed.). John Wiley & Sons.
5. Kumar, A., & Gupta, S. K. (n.d.). Fundamentals of polymer science and engineering. Tata McGraw-Hill. (No date provided)
6. TPB Publishing. (2020). AP chemistry 2021 and 2022 test prep: AP chem review book with practice exam questions (2nd ed.). Test Prep Books. ISBN: 978-1628456912.
7. Morrison, R. T., & Boyd, R. N. (2026). *Organic Chemistry*. Pearson Education.

E- RESOURCES

1. https://sites.google.com/site/chemistryebookscollection02/home/polymer-chemistry/or
2. www.freebookcentre.net
3. www.spinger.com
4. www.buecher.com
5. www.rachidscience.com

BHARATHIDASAN UNIVERSITY TIRUCHIRAPPALLI - 620 024

PART-V GENDER STUDIES

COURSE FOR ALL UG ARTS, SCIENCE, COMMERCE AND MANAGEMENT CHOICE BASED CREDIT SYSTEM – LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2022-2023 onwards)

Ins. Hrs. /Week: 1 Course Credit: 1 Subject Code : 24UGGS

Objectives

- To make students to aware of Gender constructions and gendering Process
- To explore existing gender biases in the society and to understand the need to work towards the inclusive society
- To inculcate sensitivity and build gender perspectives.
- To use the course to bring attitudinal cum behavioral changes towards gender neutral ambience and promote the humanistic values

UNIT- I INTRODUCTION TO GENDER STUDIES CONCEPTS

Gender Spectrum.-Sex – Gender distinction – Biological Determinism – Patriarchy – Feminism – Gender Socialization and Stereotyping-Gender Discrimination – Gender Division of labour and roles– Gender Sensitivity and awareness – Gender Equity – Equality – Gender Main streaming and Gender Analysis.

UNIT- II UGC INITIATIVES ON WOMEN'S STUDIES

Definition of Women's Studies –Gender Studies –UGC Initiatives and guidelines on Women's Studies - Beijing Conference, UN Initiatives – Convention on Elimination of All forms of 1 2 Discrimination Against Women (CEDAW)- Sustainable Development Goals on Gender Equality (SDG 5) and targets.

UNIT- III AREAS OF GENDER DISCRIMINATION

Gender Socialization- Sex Ratio– Health and Nutrition– – Literacy and Education Employment-Governance – participation in decision making- politics- property rights and access to credit- gender based violence- Social institutions –Family, Caste, Class, religion, gender, State. Market – Media – Politics – Judiciary.

UNIT -IV WOMEN DEVELOPMENT AND GENDER EMPOWERMENT

Towards Equality Report of Status of Women in India 1974 – International Women's Decade – International Women's Year – National Policy for Empowerment of Women 2001.

UNIT -V WOMEN'S MOVEMENTS AND SAFEGUARDING MECHANISM

In India National /State Commission for Women(NCW) – All Women Police Station – Family Court Legislations safeguarding women –Transgender Policy—Constitutional amendments for women's political participation.

UNIT - VI CURRENT CONTOURS: (for continuous internal assessment only):

Tamil Nadu State Policy for Women 2021- National Policy for Women 2015 – Prevention of Sexual

Harassment at Work places Act 2013- Protection of Children from Sexual Offences Act, 2012 - Analysis of regressive and progressive High court and supreme court judgments- women proactive policies, programmes, interventions.

REFERENCE BOOK(S)

1. Bhasin Kamala, Understanding Gender : Gender Basics , New Delhi : Women Unlimited , 2004
2. Bhasin Kamala, Exploring Masculinity: Gender Basics , New Delhi: Women Unlimited ,2004
3. Bhasin Kamala , What is Patriarchy? : Gender Basics, New Delhi :Women Unlimited ,1993
4. Arya Sadhna Women ,Gender Equality and the State ,New Delhi :Deep &Deep Publication ,2000
5. Mishra .O.P,Law Relating to Women &Child ,Allahabad :Central Law Agency ,2001
6. Uma Chakravarti, Gendering Caste Through a Feminist Lens, Sage Publication 2003
7. Bhattacharya Malini , Sexual Violence and Law ,Kolkata; West Bengala Commission for Women ,2002
8. Sexual Harassment at the Workplace – A Guide , New Delhi ;Sakshi,1999
9. https://www.schooloflegaleducation.com/women-and-law-in-india-e-book/

COURSE OUTCOMES

- Students would have gained a perspective and understood the social reality of gender society understood the differences of gender and sex and may resort to building alternative perspectives and critical thinking.
- Gained knowledge on the various social institutions governing gender and the intersectionality.
- Exposed to the kind of initiatives of the State towards gender equality

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