SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE
(AUTONOMOUS)

(Affiliated to Bharathidasan University, Tiruchirappalli)

Accredited by NAAC-An ISO 9001:2015 Certified Institution

SUNDARAKKOTTAI, MANNARGUDI–614016.

TAMILNADU, INDIA.

M.Sc., CHEMISTRY

CHOICE BASED CREDIT SYSTEM - LEARNINIG OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(For the candidates admitted in the academic year 2023-2024)

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 Based 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.

Non Major Elective (NME): A student shall choose at least two Non-major Elective Courses (NME) from outside his/her department.

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, NPTELetc.

Postgraduate Programme:

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

Part –A	:	Core Course (Theory, Practicals) Core Industry Module, Core Project
Part-B (i)	:	Elective courses
Part-B (ii)	:	Non Major Elective, Skill Enhancement course, Professional Competency course
Part-B (iii)	:	Internship
Part –C	:	Extension activity

EXAMINATION

Continuous Internal Assessment (CIA):

PG - Distribution of CIA Marks

Passing Minimum: 50 %

Assignments – 3 = 30%

Tests- 3(Best 2 out of 3) = 50%

Seminar=10 %

Attendance= 10 %

Question Paper Pattern

Part A: includes two subsections

Part A 1 (10X1=10 marks)

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

Two Questions from Each unit

Part A 2(5X2=10 marks)

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/Analysing	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 **II.** (No choice, Two Mark) **ONE** question from each unit	(10x1=10) (5x2=10)	**20**
PART –B (Either/ or type,5-Marks) **ONE** question from each unit	(5x5=25)	**25**
PART –C (3 out of 5) (10Marks) **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 / **PART**	**K1**	**K2**	**K3**	**K4**	**K5**	**K6**	**Total Marks**
PART –A (One Mark, No choice) (10x1=10)	10						**10**
(2-Marks,Nochoice) (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) Courses having only **K5,K6** levels, K5 level- 3 Questions, K6 level- 2 Questions **(One K6 level question is compulsory)**					20	10	**30**
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:

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

i. The classification of final results shall be based on the CGPA, as indicated in Table-2.

ii. For the purpose of Classification of Final Results, the candidates who earn the CGPA 9.00 and above shall be declared to have qualified for the Degree as 'Outstanding'. Similarly the candidates who earn the CGPA between 8.00 and 8.99, 7.00 and 7.99, 6.00 and 6.99 and 5.00 and 5.99 shall be declared to have qualified for their Degree in the respective programmes as 'Excellent', 'Very Good', 'Good', and 'Above Average' respectively.

iii. Absence from an examination shall not be taken an attempt.

Table- 1: Grading of the Courses

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**
Below50	**NA**	**RA**

NA- Not Applicable, RA- Reappearance

The candidates 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/s is indicated by **Cumulative Grade Point Average (CGPA)**

Table-2: 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**

***** The candidates who have passed in the first appearance and within the prescribed duration of the PG 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 M.Sc.,DEGREE PROGRAMMES

PO.No	Programme Outcomes (*Upon completion of the M.Sc.,Degree Programme, the Post graduate will be able to)*
PO-1	**Disciplinary Knowledge**: demonstrate in-depth knowledge and understanding of theories, policies, and practices in one or more disciplines that form a part of a Post Graduate program of study in Master of Science.
PO-2	**Critical Thinking and Problem Solving**: apply analytic thought to a body of knowledge, analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence, identify relevant assumptions or implications, formulate coherent arguments, critically evaluate practices, policies and theories by following scientific approach to knowledge development: solve problems and extrapolate the same to real life situation
PO-3	**Information/digital literacy and Communication Skills:** use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data: communicate thoughts and ideas analytically and effectively in writing and orally using appropriate media, and present complex information in a clear and concise manner to different groups.
PO-4	**Research-related skills:** conduct independent inquiry in a chosen scientific discipline, demonstrate sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesizing and articulating; recognize cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; plan, execute and report the results of an experiment or investigation.
PO-5	**Scientific reasoning and Reflective Thinking:** analyse, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; critically and sensibly evaluate life experiences, with self awareness and reflexivity of both self and society.
PO-6	**Multidisciplinary Approach, Innovation and Entrepreneurship:** propose novel ideas of interdisciplinary approach in providing better solutions and new ideas for the sustainable developments; identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.
PO-7	**Moral and ethical awareness/reasoning:** 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, demonstrate the ability to identify ethical issues related to one's work, avoid unethical behavior such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights, appreciate environmental and sustainability issues, and adopt objective, unbiased and truthful actions in all aspects of work.
PO-8	**Self directed Learning:** work independently, identify appropriate resources required for a project, and manage a project till completion.
PO-9	**Lifelong Learning:** engage in continuous learning for professional growth and development, acquire knowledge and skills, adapt to changing environment and to changing trades and demands of work place through knowledge/skill development/reskilling.
PO-10	**Multicultural Competence, Social Interaction and Effective Citizenship:** understand the values and beliefs of multiple cultures, global perspectives, engage and interact respectfully with diverse groups and elicit views of others, mediate disagreements and help reach conclusions in group settings, and demonstrate empathetic social concern and equity centred national development

PROGRAMME SPECIFIC OUTCOME (PSO)

PSO No.	Program Specific Outcomes **(M.Sc., Chemistry)**
PSO1	**Placement:** To prepare the students who will demonstrate respectful engagement with others' ideas, behaviors, beliefs and apply diverse frames of reference to decisions and actions
PSO2	**Entrepreneur:** To create effective entrepreneurs by enhancing their critical thinking, problem solving, decision making and leadership skill that will facilitate startups and high potential organizations
PSO3	**Research and Development:** Design and implement HR systems and practices grounded in research that comply with employment laws, leading the organization towards growth and development.
PSO4	**Contribution to Business World:** To produce employable, ethical and innovative professionals to sustain in the dynamic business world.
PSO5	**Contribution to the Society:** To contribute to the development of the society by collaborating with stakeholders for mutual benefit

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M.Sc., CHEMISTRY

COURSE STRUCTURE UNDER CHOICE BASED CREDIT SYSTEM - LEARNINIGOUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted form the academic year 2023-2024)

ELIGIBILITY: Candidates who have passed Bachelor level Examination in Chemistry

Sem	Part	Course	Course Code	Title of the Paper	Ins. Hours / Week	Ins. Hours/Week				Credit	Exam Hours	Marks		Total
						L	T	P	S			CIA	ESE	
I	Part A	Core Course –I	P23CH101	Organic Reaction Mechanism-I	6	4	1	-	1	5	3	25	75	100
		Core Course –II	P23CH102	Structure and Bonding in Inorganic Compounds	6	4	1	-	1	5	3	25	75	100
		Core Practical– I	P23CH103P	Organic Chemistry Practical	6	-	-	6	-	3	3	25	75	100
	Part B (i)	Elective Course –I	P23CHE11A/ P23CHE11B	Pharmaceutical Chemistry /Nanomaterials and Nanotechnology	5	5	-	-	-	3	3	25	75	100
		Elective Course -II	P23CHE12A/ P23CHE12B	Electrochemistry/ Molecular Spectroscopy	5	4	1	-	-	3	3	25	75	100
	Part B (ii)	Non Major Elective-I	P23NMECH11	Cosmetic Chemistry	2	2	-	-	-	2	3	25	75	100
				TOTAL	**30**	**19**	**03**	**06**	**02**	**21**	-	-	-	**600**
II	Part A	Core Course –III	P23CH104	Organic reaction mechanism-II	6	4	1	-	1	5	3	25	75	100
		Core Course-IV	P23CH105	Physical Chemistry-I	6	4	1	-	1	5	3	25	75	100
		Core Practical– II	P23CH106P	Inorganic Chemistry Practical	6	-	-	6	-	3	3	25	75	100
	Part B (i)	Elective Course – III	P23CHE23A/ P23CHE23B	Medicinal Chemistry/ Green Chemistry	5	5	-	-	-	3	3	25	75	100
		Elective Course - IV	P23CHE24A/ P23CHE24B	BioInorganic Chemistry/ Material Science	5	4	1	-	-	3	3	25	75	100
	Part B (ii)	Non Major Elective-II	P23NMECH22	Chemistry in Everyday life	2	2	-	-	-	2	3	25	75	100

	Part B(iii)	Internship/Industrial Activity			-	-	-	-	-	-	-	-		
	TOTAL				**30**	**19**	**03**	**06**	**02**	**21**	-	-	-	**600**
Sem	**Part**	**Course**	**Course Code**	**Title of the Paper**	**Ins. Hours / Week**	**Ins. Hours/Week**				**Credit**	**Exam Hours**	**Marks**		**Total**
						L	**T**	**P**	**S**			**CIA**	**ESE**	
III	Part A	Core Course –V		Organic Synthesis And Photochemistry	6	4	1	-	1	5	3	25	75	100
		Core Course –VI		Coordination Chemistry	6	4	1	-	1	5	3	25	75	100
		Core Practical-III		Physical Chemistry Practical	6	-	-	6	-	3	3	25	75	100
		Core Industry Module		Industrial Chemistry	5	4	1	-	-	3	3	25	75	100
	Part B (i)	Elective Course –V		Pharmacognosy and Phytochemistry /Biomolecules and Heterocyclic compounds	5	4	1	-	-	3	3	25	75	100
	Part B (ii)	Skill Enhancement Course		Computational Chemistry	2	2	-	-	-	2	3	25	75	100
	Part B (iii)	Internship/Industrial Activity			-	-	-	-	-	2	-	-	-	-
	TOTAL				**30**	**18**	**04**	**06**	**02**	**23**	**-**	**-**	-	**600**
IV	Part A	Core Course –VII		Research Methodolgy	5	4	1	-	-	5	3	25	75	100
		Core Course-VIII		Physical Chemistry-II	5	4	1	-	-	5	3	25	75	100
		Core Practical– IV		Analytical Instrumentation technique Practicals	6	-	-	6	-	3	3	25	75	100
		Core Project		Project with Viva Voce	8	-	2	6	-	7	3	25	75	100
	Part B (i)	Elective Course – VI		Chemistry of Natural Products /Polymer Chemistry	4	3	1	-	-	3	3	25	75	100
	Part B (ii)	Professional Competency Course		CSIR-UGC NET SET in Chemistry	2	2	-	-	-	2	3	25	75	100
	Part C	Extension Activity			-	-	-	-	-	1	-	-	-	-
			TOTAL		**30**	**13**	**05**	**12**	**-**	**26**	-	-	-	**600**
			GRAND TOTAL		**120**	**69**	**15**	**30**	**06**	**91**				**2400**
		Extra Credit	MOOC/SWAYAM/NPTEL		-	-	-	-	-	**2**	-	-	-	-
			Value added Courses (At least one per Year)		-	-	-	-	-	**2**	-	-	-	-

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

CREDIT DISTRIBUTION FOR M.Sc., CHEMISTRY

S.No	Course Details	Credit
Part A	Core Course [8 Courses X 5 Credits]	40
	Core Practical [4 Courses X 3 Credits]	12
	Project Work with Viva Voce	07
	Core Industry Module	03
Part B (i)	Elective Course [6 Courses X 3 Credits]	18
Part B (ii)	Non Major Elective[2 Courses X 2 Credits]	04
	Skill Enhancement Course [1 Courses X 2 Credits]	02
	Professional Competency Course [1 Courses X 2 Credits]	02
Part B (iii)	Internship	02
Part C	Extension Activity	01
	Total Credit	**91**

Part A component and Part B (i) will be taken into account for CGPA calculation for the postgraduate programme and the other components of Part B and Part C have to be completed during the duration of the programme as per the norms, to be eligible for obtaining the PG degree.

NON MAJOR ELECTIVE (NME) OFFERED BY THE DEPARTMENT

Semester	Part	Course	Course Code	Title of the Paper
I	Part B (ii)	NME-I	P23NMECH11	Cosmetic Chemistry
II		NME-II	P23NMECH22	Chemistry in everyday life

SEMESTER I

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2023-2024)

DEPARTMENT OF CHEMISTRY

M.Sc., CHEMISTRY

SEMESTER: I - CC-1: ORGANIC REACTION MECHANISM – I

Ins. Hrs. /Week: 6 **Course Credit: 5** **Course Code: P23CH101**

UNIT-I: METHODS OF DETERMINATION OF REACTION MECHANISM: (18 Hours)

Reaction intermediates, The transition state, Reaction coordinate diagrams, Thermodynamic and kinetic requirements of reactions: Hammond postulate.Methods of determining mechanism: non-kinetic methods - product analysis, determination of intermediates-isolation, detection, and trapping. Cross-over experiments, isotopic labelling, isotope effects and stereo chemical evidences. Kinetic methods - relation of rate and mechanism. Effect of structure on reactivity: Hammett and Taft equations. Linear free energy relationship, partial rate factor, substituent and reaction constants.

UNIT-II: AROMATIC AND ALIPHATIC ELECTROPHILIC SUBSTITUTION:

(18 Hours)

Aromaticity: Aromaticity in benzenoid, non-benzenoid, heterocyclic compounds and annulenes. Aromatic electrophilic substitution: Orientation and reactivity of di- and polysubstituted phenol, nitrobenzene and halobenzene. Reactions involving nitrogen electrophiles: nitration,nitrosation and diazonium coupling; Sulphur electrophiles: sulphonation; Halogen electrophiles: chlorination and bromination; Carbon electrophiles: Friedel-Crafts alkylation, acylation and arylation reactions. Aliphatic electrophilic substitution Mechanisms: SE2 and SEi, SE1- Mechanism and evidences.

UNIT-III: AROMATIC AND ALIPHATIC NUCLEOPHILIC SUBSTITUTION:`

(18 Hours)

Aromatic nucleophilic substitution: Mechanisms - SNAr, SN1 and Benzyne mechanisms - Evidences - Reactivity, Effect of structure, leaving group andattacking nucleophile. Reactions: Oxygen and Sulphur-nucleophiles, Bucherer and Rosenmund reactions, von Richter, Sommelet-Hauser and Smiles rearrangements. SN1, ion pair, SN2 mechanisms and evidences. Aliphatic nucleophilic substitutions at an allylic carbon, aliphatic trigonal carbon and vinyl carbon. SN1, SN2, SNi, and SE1 mechanism and evidences, Swain- Scott, Grunwald-Winstein relationship - Ambident nucleophiles.

UNIT-IV: STEREOCHEMISTRY-I: (18 Hours)

Introduction to molecular symmetry and chirality – axis, plane, center, alternating axis of symmetry. Optical isomerism due to asymmetric and dissymmetric molecules with C, N, S based chiral centers. Optical purity, prochirality, enantiotopic and diastereotopic atoms, groups, faces, axial and planar chirality, chirality due to helical shape, methods of determining theconfiguration. Racemic modifications: Racemization by thermal, anion, cation, reversible formation,epimerization, mutarotation. D, L system, Cram's and Prelog's rules: R, S- notations, proR, proS, side phase and re phase Cahn-Ingold-Prelog rules, absolute and relative configurations. Configurations of allenes, spiranes, biphenyls, cyclooctene, helicene, binaphthyls, ansa and cyclophanic compounds, exo-cyclic alkylidene-cycloalkanes. Topicity and prostereoisomerism, chiral shift reagents and chiral solvating reagents. Criteria for optical purity:Resolution of racemic modifications, asymmetric transformations, asymmetric synthesis, destruction. Stereoselective and stereospecific synthesis.

UNIT-V: STEREOCHEMISTRY-II: (18 Hours)

Conformation and reactivity of acyclic systems, intramolecular rearrangements, neighbouring group participation, chemical consequence of conformational equilibrium - Curtin-Hammett Principle. Stability of five and six-membered rings: mono-, di- and polysubstituted cyclohexanes, conformation and reactivity in cyclohexane systems. Fused and bridged rings: bicyclic, poly cyclic systems, decalins andBrett's rule. Optical rotation and optical rotatory dispersion, conformational asymmetry, ORD curves, octant rule, configuration and conformation, Cotton effect, axial haloketone rule and determination of configuration. **TOTAL LECTURE HOURS : 90**

COURSE OUTCOMES

Students will be able

1. To recall the basic principles of organic chemistry.
2. To understand the formation and detection of reaction intermediates of organicreactions.
3. To predict the reaction mechanism of organic reactions and stereochemistry oforganic compounds.
4. To apply the principles of kinetic and non-kinetic methods to determine the mechanismof reactions.
5. To designand synthesize new organic compounds by correlating the stereochemistry of organic compounds.

REFERENCE BOOK

1. J. March and M. Smith, Advanced Organic Chemistry, 5th edition,John-Wiley and Sons.2001.
2. E. S. Gould, Mechanism and Structure in Organic Chemistry, Holt,Rinehart and Winston Inc., 1959.
3. P.S.Kalsi, Stereochemistry of carbon compounds, 8th edition, NewAge International Publishers, 2015.
4. P. Y. Bruice, Organic Chemistry, 7th edn, Prentice Hall, 2013.
5. J.Clayden, N. Greeves, S. Warren, Organic Compounds, 2nd edition,Oxford University Press, 2014.
6. F.A. Carey and R.J. Sundberg, Advanced Organic Chemistry Part-Aand B, 5th edition, Kluwer Academic / Plenum Publishers, 2007.
7. D. G. Morris, Stereochemistry, RSC Tutorial Chemistry Text 1, 2001.
8. N.S. Isaacs, Physical Organic Chemistry, ELBS, Longman, UK, 1987.
9. E. L. Eliel, Stereochemistry of Carbon Compounds, Tata-McGraw Hill,2000.
10. L. Finar, Organic chemistry, Vol-1 & 2, 6th edition, Pearson EducationAsia, 2004.

E RESOURCES

1. https://sites.google.com/site/chemistryebookscollection02/home/organic- chemistry/organic
2. https://www.organic-chemistry.org/

SEMESTER: I – CC - 2-: STRUCTURE AND BONDING IN INORGANIC COMPOUNDS

Ins. Hrs. /Week: 6 **Course Credit:5** **Course code: P23CH102**

UNIT-I: STRUCTURE OF MAIN GROUP COMPOUNDS AND CLUSTERS: (18 Hours)

VB theory – Effect of lone pair and electronegativity of atoms (Bent's rule) on the geometry of the molecules; Structure of silicates - applications of Paulings rule of electrovalence - isomorphous replacements in silicates– ortho, meta and pyro silicates – one dimensional, two dimensional andthree-dimensional silicates. Structure of silicones, Structural and bonding features of B-N, S-N and P-N compounds; Poly acids – types, examples and structures; Borane cluster: Structural features of closo, nido, arachano and klado; carboranes, hetero and metalloboranes; Wade's rule to predict the structureof borane cluster; main group clusters –zintl ions and mno rule.

UNIT-II: SOLID STATE CHEMISTRY – I: (18 Hours)

Ionic crystals: Packing of ions in simple, hexagonal and cubic close packing, voids in crystal lattice, Radius ratio, Crystal systems and Bravis lattices, Symmetry operations in crystals, glide planes and screw axis; point group and space group; Solid state energetics: Lattice energy – Born-Lande equation -Kapustinski equation, Madelung constant.

UNIT-III: SOLID STATE CHEMISTRY – II: (18 Hours)

Structural features of the crystal systems: Rock salt, zinc blende & wurtzite, fluorite and anti-fluorite, rutile and anatase, cadmium iodide and nickel arsenide; Spinels -normaland inverse types and perovskite structures. Crystal Growth methods: From melt and solution (hydrothermal, sol-gel methods) – principles andexamples.

UNIT-IV: TECHNIQUES IN SOLID STATE CHEMISTRY: (18 Hours)

X- ray diffractiontechnique: Bragg's law, Powder diffraction method – Principle and Instrumentation; Interpretation of XRD data – JCPDS files, Phase purity,Scherrer formula, lattice constants calculation; Systematic absence of reflections; Electron diffraction technique – principle, instrumentation and application. Electron microscopy – difference between optical and electron microscopy, theory, principle, instrumentation, sampling methods and applications of SEM and TEM.

UNIT-V: BAND THEORY AND DEFECTS IN SOLIDS: (18 Hours)

Band theory – features and its application of conductors, insulators and semiconductors, Intrinsic and extrinsic semiconductors; Defects in crystals – point defects (Schottky, Frenkel, metal excess and metal deficient) and their effect on the electrical and optical property, laser and phosphors; Linear defects and its effects due to dislocations. **TOTAL LECTURE HOURS : 90**

COURSE OUTCOMES :

Students will be able

1. Predict the geometry of main group compounds and clusters.
2. Explain about the packing of ions in crystals and apply the radius ratio rule to predictthe coordination number of cations.
3.: Understand the various types of ionic crystal systems and analyze their structural features.
4.: Explain the crystal growth methods.
5. To understand the principles of diffraction techniques and microscopic techniques.

REFERENCE BOOKS

1. A R West, Solid state Chemistry and its applications, 2nd Edition (Students Edition), John Wiley& Sons Ltd., 2014.
2. A K Bhagi and G R Chatwal, A textbook of inorganic polymers,Himalaya Publishing House, 2001.
3. L Smart, E Moore, Solid State Chemistry – An Introduction, 4thEdition, CRC Press, 2012.
4. K. F. Purcell and J. C. Kotz, Inorganic Chemistry; W.B. Saunderscompany: Philadelphia, 1977.
5. J. E. Huheey, E. A. Keiter and R. L. Keiter, Inorganic Chemistry;4th ed.; Harper and Row: NewYork, 1983.
6. D. E. Douglas, D.H. McDaniel and J. J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd Ed, 1994.
7. R J D Tilley, Understanding Solids - The Science of Materials, 2ndedition, Wiley Publication, 2013.
8. C N R Rao and J Gopalakrishnan, New Directions in Solid StateChemistry, 2nd Edition, Cambridge University Press, 199.
9. T. Moeller, Inorganic Chemistry, A Modern Introduction; JohnWiley: New York, 1982.
10. D. F. Shriver, P. W. Atkins and C.H. Langford; Inorganic Chemistry; 3rd ed.; Oxford University Press: London, 2001.

E RESOURCES

1. https://ocw.mit.edu/courses/3-091-introduction-to-solid-state-chemistry-fall-2018/video_galleries/lecture-videos/

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2023-2024)

DEPARTMENT OF CHEMISTRY

M.Sc., CHEMISTRY

SEMESTER: I – CP-I-: ORGANIC CHEMISTRY PRACTICAL

INS. HRS. /WEEK: 6 COURSE CREDIT: 3 COURSE CODE: P23CH103P

UNIT-I: SEPARATION AND ANALYSIS:

a. Two Component Mixtures.

b. Three Component Mixtures

UNIT-II: ESTIMATIONS:

a. Estimation of Phenol (bromination)
b. Estimation of Aniline (bromination)
c. Estimation of Ethyl methyl ketone (iodimetry)
d. Estimation of Glucose (redox)
e. Estimation of Ascorbic acid (iodimetry)
f. Estimation of Aromatic nitro groups (reduction)
g. Estimation of Glycine (acidimetry)
h. Estimation of Formalin (iodimetry)
i. Estimation of Acetyl group in ester (alkalimetry)
j. Estimation of Hydroxyl group (acetylation)
k. Estimation of Amino group (acetylation)

UNIT-III: Two stage preparations:

a. *p*-Bromoacetanilide from aniline
b. *p*-Nitroaniline from acetanilide
c. 1,3,5-Tribromobenzene from aniline
d. Acetyl salicyclic acid from methyl salicylate
e. Benzilic acid from benzoin
f. *m*-Nitroaniline from nitrobenzene
g. *m*-Nitrobenzoic acid from methyl benzoate

COURSE OUTCOMES

Students will be able:

1. To recall the basic principles of organic separation, qualitative analysis and preparation.
2. To explain the method of separation and analysis of separated organic mixtures and convert them as derivatives by suitable preparation method.
3. To determine the characteristics of separation of organic compounds by various chemical reactions.
4. To develop strategies to separate, analyze and prepare organic compounds.
5. To formulate a method of separation, analysis of organic mixtures and design suitable procedure for organic preparations.

REFERENCE BOOKS

1. A R West, Solid state Chemistry and its applications, 2ndEdition(Students Edition), John Wiley & Sons Ltd., 2014.
2. A K Bhagi and G R Chatwal, A textbook of inorganic polymers,Himalaya Publishing House, 2001.
3. L Smart, E Moore, Solid State Chemistry – An Introduction, 4thEdition, CRC Press, 2012.
4. D. E. Douglas, D.H. McDaniel and J. J. Alexander, Concepts and Models in Inorganic Chemistry,3rd Ed, 1994.
5. R J D Tilley, Understanding Solids - The Science of Materials, 2ndedition, Wiley Publication, 2013.
6. C N R Rao and J Gopalakrishnan, New Directions in Solid StateChemistry, 2nd Edition, Cambridge University Press, 199.

E RESOURCES

1. https://ocw.mit.edu/courses/3-091-introduction-to-solid-state-chemistry-fall-2018/video_galleries/lecture-videos/

SEMESTER: I – EC – I (A) PHARMACEUTICAL CHEMISTRY

Ins. Hrs. /Week:5 **Course Credit: 3** **Course code: P23CHE11A**

UNIT-I: PHYSICAL PROPERTIES IN PHARMACEUTICALS: (15 Hours)

Physical properties of drug molecule: physical properties. Refractive index- Definition, explanation, formula, importance, determination, specific & molar refraction. Optical activity\rotation- monochromatic & polychromatic light, optical activity, angle of rotation, specific rotation examples, measurement of optical activity. Dielectric constant & Induced Polarization- Dielectric constant explanation & determination. Rheology of pharmaceutical systems: Introduction, Definition, Applications, concept of viscosity, Newton's law of flow, Kinematic, Relative, Specific, Reduced & Intrinsic viscosity. Newtonian system, non- Newtonian system- Plastic flow, Pseudoplastic flow, Dilatent flow. Viscosity measurements- selection of viscometer for Newtonian and non-Newtonian system.

UNIT-II: ISOTOPIC DILUTION ANALYSIS: (15 Hours)

Principle and applications, Neutron activation analysis: Principle, advantages and limitations, Scintillation counters: Body scanning. Introduction toradiopharmaceuticals. Properties of various types of radiopharmaceuticals, Radiopharmaceuticals as diagnostics, as therapeutics, for research and sterilization. Physico Chemical Properties and drug action. Physico chemical properties of drugs (a) Partition coefficient, (b) solubility (c) surface activity, (d) degree of ionization.

UNIT-III: DRUG DOSAGE AND PRODUCT DEVELOPMENT: (15 Hours)

Introduction to drug dosage Forms & Drug Delivery system – Definition of Commonterms. Drug Regulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugsproducts, need for a dosage form, classification of dosage forms. Drug dosage and product development. Introduction to drug dosage Forms & Drug Delivery system – Definition of Common terms. DrugRegulation and control, pharmacopoeias formularies, sources of drug, drug nomenclature, routes of administration of drugs products, need for a dosage form, classification of dosage forms.

UNIT-IV: DEVELOPMENT OF NEW DRUGS: (15 Hours)

Introduction, procedure followed in drug design, the research for lead compounds, molecular modification of lead compounds. Structure-Activity Relationship (SAR):Factors effecting bioactivity, resonance, inductive effect, isoterism, bioisosterism, spatial considerations, biological properties of simple functional groups, theories of drug activity, occupancy theory, rate theory, induced-fit theory,4.3 Quantitative structure activity relationship(QSAR): Development of QSAR, drug receptor interactions, the additivity of group contributions, physico-chemical parameters, lipophilicity parameters, electronic parameter, ionization constants, steric parameters, chelation parameters, redox potential, indicator-variables.

UNIT-V: COMPUTERS IN PHARMACEUTICAL CHEMISTRY: (15 Hours)

Need ofcomputers for chemistry. Computers for Analytical Chemists- Introduction to computers: Organization of computers, CPU, Computer memory, I/O devices, information storage, software components. Application of computers in chemistry: Programming in high levellanguage (C+) to handle various numerical methods in chemistry – least square fit, solution to simultaneous equations, interpolation, extrapolation, data smoothing, numerical differentiation and integrations.

TOTAL LECTURE HOURS :75

COURSE OUTCOMES :

Students will be able:

1. To identify the suitable drugs for various diseases.
2. To apply the principles of various drug action and drug design.
3.: To acquire the knowledge on product development based on SAR.
4. To apply the knowledge on applications of computers in chemistry.
5. To synthesize new drugs after understanding the concepts SAR.

REFERENCE BOOKS:

1. Physical Chemistry- Bahl and Tuli.
2. Text Book of Physical Pharmaceutics, IInd edition, Vallabh Prakashan-. C.V.S. Subramanyam.
3. Medicinal Chemistry (Organic Pharmaceutical Chemistry), G.RChatwal, Himalaya Publishing house.
4. Instrumental method of Analysis: Hubert H, Willard, 7th edition.
5. Textbook of Pharmaceutical Chemistry by, Jayshree Ghosh, S. Chand & company Ltd. Pharmaceutical Chemistry by Dr. S.Lakshmi, Sultan chand & Sons.
6. Computers in chemistry, K.V. Raman, Tata Mc.Graw-Hill, 1993.
7. Computers for Chemists, S.K Pundir, Anshu bansal, A pragate prakashan., 2 nd edition, New age international (P) limited, New Delhi.
8. Physical Pharmacy and Pharmaceutical Sciences by Martins, Patrick J. Sinko, Lippincott. William and Wilkins.
9. Cooper and Gunn's Tutorial Pharmacy ,6th edition by S.J. Carter, CBS Publisher Ltd.
10. Ansels pharmaceutical Dosage forms and Drug Delivery System byAllen Popvich and Ansel, Indian edition-B.I. Publication Pvt. Ltd.

E RESOURCES:

1. https://www.ncbi.nlm.nih.gov/books/NBK482447/
2. https://training.seer.cancer.gov/treatment/chemotherapy/types.html

SEMESTER: I - EC-I (B): NANO MATERIALS AND NANO TECHNOLOGY

Ins. Hrs. /Week: 5 **Course Credit: 3** **Course code: P23CHE11B**

UNIT-I: **(15 Hours)**

Introduction of nanomaterials and nanotechnologies, Introduction-role of size, classification-0D, 1D, 2D, 3D. Synthesis- Bottom –Up, Top–Down, consolidation of Nano powders. Features ofnanostructures, Background of nanostructures. Techniques of synthesis of nanomaterials, Tools of the nanoscience. Applications of nanomaterials and technologies.

UNIT-II: **(15 Hours)**

Bonding and structure of the nanomaterials, Predicting the Type of Bonding in a Substance crystal structure. Metallic nanoparticles,Surfaces of Materials, Nanoparticle Size and Properties. Synthesis-Physical and chemical methods - inert gas condensation, arc discharge, laser ablation, sol-gel, solvothermal and hydrothermal-CVD-types, metallo organic, plasma enhanced, and low-pressure CVD. Microwave
assisted and electrochemical synthesis.

UNIT-III: **(15 Hours)**

Mechanical properties of materials, theories relevant to mechanical properties. Techniques to study mechanical properties of nanomaterials, adhesion and friction, thermal properties of nanomaterials Nanoparticles: gold and silver, metal oxides: silica, iron oxide and alumina - synthesis and properties.

UNIT-IV: **(15 Hours)**

Electrical properties, Conductivity and Resistivity,Classification of Materials based on Conductivity, magnetic properties, electronic properties of materials. Classification of magnetic phenomena. Semiconductor materials – classification-Ge, Si, GaAs, SiC, GaN, GaP, CdS,PbS. Identification of materials as p and n –type semiconductor-Hall effect - quantum and anomalous, Hall voltage - interpretation of charge carrier density. Applications of semiconductors:p-n junction as transistors and rectifiers, photovoltaic and photogalvanic cell.

UNIT-V: **(15 Hours)**

Nano thin films, nanocomposites. Application of nanoparticles in different fields. Core-shell nanoparticles - types, synthesis, and properties.Nanocomposites - metal-, ceramic- and polymer-matrix composites-applications. Characterization – SEM, TEM and AFM - principle, instrumentation and applications. **TOTAL LECTURE HOURS: 75**

COURSE OUTCOMES

Students will be able:

1. To explain methods of fabricating nanostructures.
2. To relate the unique properties of nanomaterials to reduce dimensionality of thematerial.
3. To describe tools for properties of nanostructures.
4. To discuss applications of nanomaterials.
5. To understand the health and safety related to nanomaterial.

REFERENCE BOOKS

1. S.Mohan and V. Arjunan, Principles of Materials Science, MJPPublishers, 2016.
2. Arumugam, Materials Science, Anuradha Publications,2007.
3. Giacavazzo et. al., Fundamentals of Crystallography, InternationalUnion of Crystallography. Oxford Science Publications, 2010
4. Woolfson, An Introduction to Crystallography, CambridgeUniversity Press, 2012.
5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007.

E RESOURCES:

1. http://xrayweb.chem.ou.edu/notes/symmetry.html.
2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf

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DEPARTMENT OF CHEMISTRY
M.Sc., CHEMISTRY

SEMESTER: I – EC-II (A) - ELECTROCHEMISTRY

Ins. Hrs. /Week: 5 **Course Credit: 3** **Course code: P23CHE12A**

(15 Hours)

UNIT-I: IONICS:

Arrhenius theory -limitations, van't Hoff factor and its relation to colligative properties. Deviation from ideal behavior. Ionic activity, mean ionic activity and mean ionic activity coefficient-concept of ionic strength, Debye Huckel theory of strong electrolytes, activity coefficient of strong electrolytes Determination of activity coefficient ionsolvent and ion-ion interactions. Born equation. Debye-Huckel Bjerrummodel. Derivation of Debye-Huckel limiting law at appreciableconcentration of electrolytes modifications and applications. Electrolytic conduction-Debye-Huckel Onsager treatment of strong electrolyte- qualitative and quantitative verification and limitations. Evidence forionic atmosphere. Ion association and triple ion formations.

UNIT-II: ELECTRODE-ELECTROLYTE INTERFACE: (15 Hours)

Interfacial phenomena - Evidences for electrical double layer, polarizable and non-polarizable interfaces, Electrocapillary phenomena - Lippmann equation electrocapillary curves. Electro-kinetic phenomena electro-osmosis, electrophoresis, streaming and sedimentation potentials, colloidal and poly electrolytes. Structure of double layer: Helmholtz -Perrin, Guoy- Chapman and Stern models of electrical double layer. Zeta potential andpotential at zero charge. Applications and limitations.

UNIT-III: ELECTRODICS OF ELEMENTARY ELECTRODE REACTIONS: (15 Hours)

Behavior of electrodes: Standard electrodes and electrodes at equilibrium. Anodicand Cathodic currents, condition for the discharge of ions. Nernst equation, polarizable and non-polarizable electrodes. Model of three electrode system, over potential. Rate of electro chemical reactions: Ratesof simple elementary reactions. Butler-Volmer equation-significance of exchange current density, net current density and symmetry factor. Low and high field approximations. symmetry factor and transfer coefficient Tafel equations and Tafel plots.

UNIT-IV: ELECTRODICS OF MULTISTEP MULTI ELECTRON SYSTEM: (15 Hours)

Rates of multi-step electrode reactions, Butler - Volmer equation for a multi-step reaction. Rate determining step, electrode polarization and depolarization. Transfer coefficients, its significance and determination,Stoichiometric number. Electro-chemical reaction mechanisms-rate expressions, order, and surface coverage. Reduction of I^{3-}, Fe^{2+}, and dissolution of Fe to Fe^{2+}. Overvoltage - Chemical and electro chemical, Phase, activation and concentration over potentials. Evolution of oxygen and hydrogen at different pH. Pourbiax and Evan's diagrams.

UNIT-V: CONCENTRATION POLARIZATION, BATTERIES AND FUEL CELLS: (15 Hours)

Modes of Transport of electro active species - Diffusion, migration and hydrodynamic modes. Role of supporting electrolytes. Polarography- principle and applications. Principle of square wave polarography. Cyclic voltammetry- anodic and cathodic stripping voltammetry and differential pulse voltammetry. Sodium and lithium-ion batteries and redox flow batteries. Mechanism of charge storage: conversion and alloying. Capacitors- mechanism of energy storage, charging at constant current and constant voltage. Energy production systems: Fuel Cells: classification, alkaline fuel cells, phosphoric acid fuel cells, high temperature fuel cells. **TOTAL LECTURE HOURS : 75**

COURSE OUTCOMES :

Students will be able:

1. To understand the behaviour of electrolytes in solution and compare the structures ofelectrical double layer of different models.
2. To predict the kinetics of electrode reactions applying Butler-Volmer and Tafel equations
3. To study different thermodynamic mechanism of corrosion,
4. To discuss the theories of electrolytes, electrical double layer, electrodics and activitycoefficient of electrolytes
5. To have knowledge on storage devices and electrochemical reaction mechanism.

REFERENCE BOOKS:

1. J.O.M. Bockris and A.K.N. Reddy, Modern Electro chemistry, vol.1and 2B, Springer, Plenum Press, New York, 2008.
2. J.O.M. Bockris, A.K.N. Reddy and M.G. Aldeco Morden Electrochemistry, vol. 2A, Springer, Plenum Press, New York, 2008.
3. Philip H. Rieger, Electrochemistry, 2nd edition, Springer, New York,2010.
4. L.I. Antropov, Theoretical electrochemistry, Mir Publishers, 1977.
5. K.L. Kapoor, A Text book of Physical chemistry, volume-3,Macmillan, 2001.
6. D. R. Crow, Principles and applications of electrochemistry, 4thedition, Chapman & Hall/CRC, 2014.
7. J. Rajaram and J.C. Kuriakose, Kinetics and Mechanism of chemical transformations Macmillan India Ltd., New Delhi, 2011.
8. S. Glasstone, Electro chemistry, Affiliated East-West Press, Pvt.,Ltd., New Delhi, 2008.
9. 9. B. Viswanathan, S. Sundaram, R. Venkataraman, K. Rengarajan and P.S. Raghavan, Electrochemistry-Principles and applications, S.Viswanathan Printers, Chennai,2007.
10. Joseph Wang, Analytical Electrochemistry, 2nd edition, Wiley, 2004.

E RESOURCES:

1. https://www.pdfdrive.com/modern-electrochemistry-e34333229.

SEMESTER: I - EC—II (B) : MOLECULAR SPECTROSCOPY

Ins. Hrs. /Week: 5 **Course Credit: 3** **Course Code**: **P23CHE12B**

UNIT-I: ROTATIONAL AND RAMAN SPECTROSCOPY: (15 Hours)

Rotational spectra of diatomic and polyatomic molecules. Intensities of rotational spectral lines, effect of isotopic substitution. Non-rigid rotators. Classical theoryof the Raman effect, polarizability as a tensor, polarizability ellipsoids, quantum theory of the Raman effect, Pure rotational Raman spectra of linear and asymmetric top molecules, Stokes and anti-Stokes lines.Vibrational Raman spectra, Raman activity of vibrations, rule of mutualexclusion, rotational fine structure-O and S branches, Polarization of Raman scattered photons.

UNIT-II: VIBRATIONAL SPECTROSCOPY: (15 Hours)

Vibrations of molecules, harmonic and anharmonic oscillators- vibrational energy expression, energy level diagram, vibrational wave functions and their symmetry, selection rules, expression for the energies ofspectral lines, computation of intensities, hot bands, effect of isotopic substitution. Diatomic vibrating rotor, vibrational-rotational spectra of diatomic molecules, P, R branches, breakdown of the Born- Oppenheimer approximation. Vibrations of polyatomic molecules – symmetry properties, overtone and combination frequencies. Influence of rotation on vibrational spectra of polyatomic molecule, P, Q, R branches, parallel and perpendicular vibrations of linear and symmetric top molecules.

UNIT-III: ELECTRONIC SPECTROSCOPY: (15 Hours)

Electronic Spectroscopy: Electronic spectroscopy of diatomic molecules, Frank-Condon principle, dissociation and predissociation spectra. $\pi \rightarrow \pi^*$, $n \rightarrow \pi^*$ transitions and their selection rules. Photoelectron Spectroscopy: Basic principles, photoelectron spectra of simple molecules, Xray photoelectron spectroscopy (XPS). Lasers: Laser action, population inversion, properties of laser radiation, examples of simple laser systems.

UNIT-IV: NMR AND ESR SPECTROSCOPY: (15 Hours)

Chemical shift, Factors influencing chemical shifts: electronegativity and electrostatic effects; Mechanism of shielding and deshielding. Spin systems: First order and second order coupling of AB systems, Simplification of complex spectra.Spin-spin interactions: Homonuclear coupling interactions - AX,AX2, AB types. Vicinal, germinal and long-range coupling-spin decoupling. Nuclear Overhauser effect (NOE), Factors influencing coupling constants and Relative intensities. 13CNMR and structural correlations, Satellites. Brief introduction to 2D NMR – COSY, NOESY. Introductionto 31P, 19F NMR. ESR spectroscopy Characteristic features of ESR spectra, line shapes and line widths; ESR spectrometer. Theg value and the hyperfine coupling parameter (A), origin of hyperfine interaction. Interpretation ofESR spectra and structure elucidation of

organic radicalsusing ESR spectroscopy; Spin orbit coupling and significance of g- tensors, zero/non-zero field splitting, Kramer's degeneracy, application to transition metal complexes (having one to five unpaired electrons) including biological molecules and inorganic free radicals. ESR spectra of magnetically dilute samples.

UNIT-V: MASS SPECTROMETRY, EPR AND MOSSBAUER SPECTROSCOPY: (9 Hours)

Ionization techniques- Electron ionization (EI), chemical ionization (CI), desorption ionization (FAB/MALDI), electrospray ionization (ESI), isotope abundance, molecular ion, fragmentation processes of organic molecules, deduction of structure through mass spectral fragmentation, high resolution. Effect of isotopes on the appearance of mass spectrum. EPR spectra of anisotropic systems - anisotropy in g- value, causes of anisotropy, anisotropy in hyperfine coupling, hyperfine splitting caused by quadrupole nuclei. Zero-field splitting (ZFS) and Kramer's degeneracy. Applications of EPR to organic and inorganic systems. Structural elucidation of organic compounds by combined spectral techniques. Principle of Mossbauer spectroscopy: Doppler shift,recoil energy. Isomer shift, quadrupole splitting, magnetic interactions. Applications: Mossbauer spectra of high and low-spin Fe and Sn compounds

.TOTAL LECTURE HOURS: 75

COURSE OUTCOMES

Students will be able:

1. To understand the importance of rotational and Raman spectroscopy.

2. To apply the vibrational spectroscopic techniques to diatomic and polyatomic molecules.

3. To evaluate different electronic spectra of simple molecules using electronic spectroscopy.

4. To outline the NMR, ^{13}C NMR, 2D NMR – COSY, NOESY, Introduction to ^{31}P, ^{19}FNMR and ESR spectroscopic techniques.

5. To develop the knowledge on principle, instrumentation and structural elucidation ofsimple molecules using Mass Spectrometry, EPR and Mossbauer Spectroscopy techniques.

REFERENCE BOOKS:

1. C. N. Banwell and E. M. McCash, *Fundamentals of Molecular Spectroscopy*, 4th Ed., Tata McGraw Hill, New Delhi, 2000.
2. R. M. Silverstein and F. X. Webster, *Spectroscopic Identification of Organic Compounds*, 6th Ed., John Wiley & Sons, New York, 2003
3. W. Kemp, *Applications of Spectroscopy*, English Language Book Society, 1987.
4. D. H. Williams and I. Fleming, *Spectroscopic Methods in OrganicChemistry,* 4th Ed., Tata McGraw-Hill Publishing Company, New Delhi, 1988.
5. R. S. Drago, *Physical Methods in Chemistry*; Saunders: Philadelphia, 1992.
6. P.W. Atkins and J. de Paula, *Physical Chemistry*, 7th Ed., Oxford University Press, Oxford, 2002.
7. N. Levine, *Molecular Spectroscopy*, John Wiley & Sons, New York, 1974.
   Rahman, *Nuclear Magnetic Resonance-Basic Principles*, Springer-Verlag, New York,1986.
8. K. Nakamoto, *Infrared and Raman Spectra of Inorganic and coordination Compounds*, PartB: 5th ed., John Wiley& Sons Inc., New York, 1997.
9. J. A. Weil, J. R. Bolton and J. E. Wertz, *Electron Paramagnetic Resonance*; Wiley Interscience, 1994.

E RESOURCES:

1. https://onlinecourses.nptel.ac.in/noc20_cy08/preview
2. https://www.digimat.in/nptel/courses/video/104106122/L14.html

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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For the Candidates admitted in the academic year 2023-2024)

DEPARTMENT OF CHEMISTRY

M.Sc., CHEMISTRY

SEMESTER: I - NME—I : COSMETIC CHEMISTRY

Ins. Hrs. /Week: 2 **Course Credit: 2** **Course Code:P23NMECH11**

UNIT I : HISTORY OF COSMETICS: **`(6 Hours)**

History of cosmetics, classification of cosmetics, professional image of self grooming, beauty and wellness. Cosmetics emulsions: cream, cleansers, powders, moisturisers, sun screen, acne and anti agingcreams. Chemical peels and peeling agents, lasers and light devices, Electro Chemistry, bath salts, gels,soaps, bubble baths and scrubs.

UNIT II: REQUIREMENT AND CLASSIFICATION OF COSMETICS:
(6 Hours)

Cosmetics- introduction and classification.Face powder- requirements and ingredients of a face powder.Face cream- (cold and vanishing) - ingredients, formulation and uses. Lipstick- requirement of a lipstick and common ingredients of a lipstick. Mascara – requirements and Formulation.

UNIT-III: **PERALS AND PEARL ESSENCE :** **(6 Hours)**

Definitions, commercial uses, production methods, synthetic pearly substances. Ion exchange resins and their cosmetic uses in case of purified water, Raw water,standards forwater as per IP, BP, USP (with recent amendments).

UNIT IV: SOLID FORMULATIONS AND SEMISOLID FORMULATIONS:
(6 Hours)

Solid formulations -Bulk powders, incorporation of different varieties of powders viz. dusting,compact,face and talcum. Incompatibility – physical and chemical Properties.

Semisolid formulations - Ointments, paste, creams, jellies, sticks, selection of ideal bases, preparation and stability and packing.

UNIT-V: PACKAGING AND DISPENSING OF COSMETIC FORMULATIONS: (6 Hours)

Importance of different materials for containers and closures. Packaging of cosmetic product and labeling. Environmental aspects of packaging materials, appropriate recycling and disposal. Green packaging. Hydrocolloids – definition classification, properties and significance in cosmetics.- Field Project.

TOTAL LECTURE HOURS: 30

COURSE OUTCOMES :

Students should be able to

1. To know about the history of cosmetics.
2. To know the requirements and Classification of Cosmetics.
3. To understand the chemical aspects and applications of Pearl and Pearl Essence.
4. To understand chemical aspects and applications of Solid Formulation and SemisolidFormulations.
5. To understand the methods of packaging and dispensing of Cosmetic formulations.understand the hazards of cosmetic products.

REFERENCE BOOKS:

1. Chemistry & Manufacture of Cosmetics by M. G. DeNavarre.
2. Text Book of Cosmeticology – by Harry's.
3. Wilkinson J B E and Moore R J, (1997) Harry's cosmeticology, 7th ed.,Chemical Publishers,London.
4. George Howard, (1987) Principles and practiceof perfumes and cosmetics.
5. Thankamma Jacob, (1997) Foods, drugs and cometics – A consumer guide,Macmillanpublication, London.

E RESOURCES:

1. http://www.khake.com/page75.html
2. Net.foxsm/list/284

SEMESTER II

SEMESTER: II – CC3-: ORGANIC REACTION MECHANISM – II

Ins. Hrs. /Week: 6 **Course Credit: 5** **Course code: P23CH104**

UNIT-I: ELIMINATION AND FREE RADICAL REACTIONS: (18 Hours)

Mechanisms: E2, E1, andE1cB mechanisms. Syn- and anti-eliminations. Orientation of the double bond: Hoffmann and Saytzeff rules. Reactivity: Effect of substrate, attacking bases, leaving group and medium. Stereochemistry of eliminations in acyclic and cyclic systems, pyrolytic elimination. Long lived and short-lived radicals – Production of radicals by thermal and photochemical reactions, Detection and stability of radicals, characteristics of free radical reactions and free radical, reactions of radicals; polymerization, addition, halogenations, aromatic substitutions, rearrangements. Reactivity: Reactivity on aliphatic, aromatic substrates, reactivity in the attacking radical, effect of solvent.

UNIT-II: OXIDATION AND REDUCTION REACTIONS: (18 Hours)

Mechanisms: Direct electron transfer, hydride transfer, hydrogen transfer, displacement, addition-elimination, oxidative and reductive coupling reactions. Mechanism of oxidation reactions: Dehydrogenation by quinones, selenium dioxides, ferricyanide, mercuric acetate lead tetraacetate, permanganate, manganesedioxide, osmium tetroxide, oxidation of saturated hydrocarbons, alkyl groups, alcohols, halides and amines. Reactions involving cleavage of C-C bonds - cleavage of double bonds, oxidative decarboxylation, allylic oxidation, oxidation by chromium trioxide-pyridine, DMSO-Oxalyl chloride (Swern oxidation) and Corey-Kim oxidation, dimethyl sulphoxide- dicyclohexyl carbodiimide (DMSO-DCCD). Mechanism of reduction reactions: Wolff- Kishner, Clemmenson, Rosenmund, reduction with Trialkyl and triphenyltin hydrides, McFadyen-Steven's reduction, Homogeneous hydrogenation,Hydroboration with cyclic systems, MPV and Bouveault-Blanc reduction.

UNIT-III: REARRANGEMENTS: (18 Hours)

Rearrangements to electron deficient carbon: Pinacol-pinacolone and semi-pinacolone rearrangements - applications and stereochemistry, Wagner-Meerwein, Demjanov, Dienone-phenol, Baker-Venkataraman, Benzilic acid and Wolff rearrangements. Rearrangements to electron deficient nitrogen: Hofmann, Curtius, Schmidt, Lossen, Beckmann and abnormal Beckmann rearrangements. Rearrangements to electron deficient oxygen: Baeyer-Villiger oxidation and Dakin rearrangements. Rearrangementsto electron rich atom: Favorskii, Quasi-Favorskii, Stevens, [1,2]-Wittig and [2,3]-Wittig rearrangements. Fries and Photo Fries rearrangement. Intramolecular rearrangements – Claisen, abnormal Claisen, Cope, oxy-Cope Benzidine rearrangements.

UNIT-IV: ADDITION TO CARBON MULTIPLE BONDS: (12 Hours)

Mechanisms: (a) Addition to carbon-carbon multiple bonds- Addition reactions involving electrophiles,

nucleophiles, free radicals, carbenes and cyclic mechanisms-Orientation and reactivity, hydrogenation of double and triple bonds, Michael reaction, additionof oxygen and Nitrogen; (b) Addition to carbon-hetero atom multiple bonds: Mannich reaction, acids, esters, nitrites, addition of Grignard reagents, Wittig reaction, Prins reaction. Stereochemical aspects of addition reactions. Additionto Carbon-Hetero atom Multiplebonds: Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and unsaturated carbonyl compounds. Mechanism of condensation reactions involving enolates –Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

UNIT-V: REAGENTS AND MODERN SYNTHETIC REACTIONS: (18 Hours)

Lithium diisopropylamine (LDA), Azobisisobutyronitrile (AIBN), Sodium cyanoborohydride ($NaBH_3CN$), *meta*-Chloroperbenzoic acid (m-CPBA),Dimethyl aminiopyridine (DMAP), n-Bu_3SnD, Triethylamine (TEA), Diazobicyclo[5.4.0]undec-7-ene (DBU), Diisopropylazodicarboxylate (DIAD), Diethylazodicarboxylate (DEAD), *N*-bromosuccinimide (NBS),Trifluoroacetic acid (TFA), Tetramethyl piperiridin-1-oxyl (TEMPO), Phenyltrimethylammonium tribromide (PTAB). Diazomethane and Zn-Cu, Diethyl maleate (DEM), Copper diacetylacetonate ($Cu(acac)_2$), $TiCl_3$, $NaIO_4$, Pyridinium chlorochromate (PCC), Pyridinium dichromate (PDC), Meisenheimer complex**.** Suzuki coupling, Heck reaction, Negishi reaction,
Baylis-Hillman reaction. **TOTAL LECTURE HOURS: 90**

COURSE OUTCOMES :

Students will be able:

1. To recall the basic principles of aromaticity of organic and heterocyclic compounds.
2. To understand the mechanism of various types of organic reactions.
3. To predict the suitable reagents for the conversion of selective organic compounds.
4. To correlate the principles of substitution, elimination, and addition reactions.
5. : To design new routes to synthesis organic compounds.

REFERENCEBOOKS:

1. J. March and M. Smith, *Advanced Organic Chemistry*, 5th ed.,John-Wiley and Sons.2001.
2. E. S. Gould, *Mechanism and Structure in Organic Chemistry,* Holt,Rinehart and WinstonInc., 1959.
3. P. S. Kalsi, *Stereochemistry of carbon compounds*, 8thedn, New AgeInternational Publishers,2015.
4. P. Y.Bruice, *Organic Chemistry*, 7thedn.,Prentice Hall, 2013.
5. R. T. Morrison, R. N. Boyd, S. K. Bhattacharjee*Organic Chemistry*, 7th edn., Pearson Education, 2010.
6. S.H.Pine,*Organic Chemistry*, 5thedn, McGraw HillInternational Edition, 1987.
7. L. F. Fieser and M. Fieser, *Organic Chemistry*, Asia PublishingHouse, Bombay, 2000.
8. E.S. Gould, *Mechanism and Structure in Organic Chemistry*, Holt,Rinehart and WinstonInc., 1959.
9. T. L. Gilchrist, *Heterocyclic Chemistry*, Longman Press, 1989.
10. J. A. Joule and K. Mills, *Heterocyclic Chemistry*, 4thed., John-Wiley,2010.

E RESOURCES:

1. https://sites.google.com/site/chemistryebookscollection02/home/organic- chemistry/organic
   https://www.organic-chemistry.org/

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DEPARTMENT OF CHEMISTRY
M.Sc., CHEMISTRY

SEMESTER: II – CC4-: PHYSICAL CHEMISTRY-I

Ins. Hrs. /Week: 6 **Course Credit: 5** **Course code: P23CH105**

UNIT-I: CLASSICAL THERMODYNAMICS: (18 Hours)

Partial molar properties - Chemical potential, Gibb's- Duhem equation-binary and ternary systems. Determination of partial molar quantities. Thermodynamics of real gases - Fugacity- determination of fugacity by graphical and equation of state methods-dependence of temperature, pressure and composition. Thermodynamics of ideal and non-ideal binary mixtures , Duhem - Margulus equation applications of ideal and non-ideal mixtures, Activity and activity coefficients-standard states - determination-vapour pressure, EMF and freezing point methods.

UNIT-II: STATISTICAL THERMODYNAMICS: (18 Hours)

Introduction of statistical thermodynamics concepts of thermodynamic and mathematical probabilities-distribution of distinguishable and non-distinguishable particles. Assemblies, ensembles, canonical particles. Maxwell -Boltzmann, Fermi Dirac & Bose-Einstein Statistics- comparison and applications. Partition functions-evaluation of translational, vibrational and rotational partition functions for monoatomic, diatomic and polyatomic ideal gases. Thermodynamic functions in terms of partition functions-calculation of equilibrium constants. Statistical approach to Thermodynamic properties: pressure, internal energy, entropy, enthalpy, Gibb's function, Helmholtz function residual entropy, equilibrium constants and equipartition principle. Heat capacity of monoand di atomic gases-ortho and para hydrogen. Heat capacity of solids-
Einstein and Debye models.

UNIT-III: IRREVERSIBLE THERMODYNAMICS: (18 Hours)

Theories of conservation ofmass and energy entropy production in open systems by heat, matter and current flow, force and flux concepts. Onsager theory-validity and verification- Onsager reciprocal relationships. Electro kinetic and thermomechanical effects-Application of irreversible thermodynamics to biological systems.S

UNIT-IV: KINETICS OF REACTIONS: (18 Hours)

Theories of reactions-effect of temperature on reaction rates, collision theory of reaction rates, Unimolecular reactions -Lindeman and Christiansen hypothesis- molecular beams, collision cross sections, effectiveness of collisions, Potential energy surfaces. Transition state theory-evaluation of thermodynamic parameters of activation-applications of ARRT to reactions between atoms and molecules, time and true order-kinetic parameter evaluation. Factors determine the reaction rates in solution - primary salt effect and secondary salt effect, Homogeneous catalysis-acid- base catalysis-mechanism of acid base catalyzed reactions- Bronsted catalysis law, enzyme catalysis-Michelis-Menton

catalysis.

UNIT-V: KINETICS OF COMPLEX AND FAST REACTIONS: (18 Hours)

Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions. Chain reactions-chain length, kinetics of $H_2 - Cl_2$ & $H_2 - Br_2$ reactions (Thermal and Photochemical reactions) - Rice Herzfeld mechanism. Study of fast reactions-relaxation methods-temperature andpressure jump methods electric and magnetic field jump methods - stopped flow flash photolysis methods and pulse radiolysis. Kinetics of polymerization-free radical, cationic, anionic polymerization - Polycondensation. **TOTAL LECTURE HOURS : 90**

COURSE OUTCOMES :

Students will be able:

1. To explain the classical and statistical concepts of thermodynamics.
2. To compare and correlate the thermodynamic concepts to studythe kinetics of chemical reactions.
3. To discuss the various thermodynamic and kinetic determination.
4. To evaluate the thermodynamic methods for real gases ad mixtures.
5. To compare the theories of reactions rates and fast reactions.

REFERENCE BOOKS:

1. J. Rajaram and J.C. Kuriacose, Thermodynamics for Students of Chemistry, 2nd edition,S.L.N.Chand and Co., Jalandhar, 1986.
2. I.M. Klotz and R.M. Rosenberg, Chemical thermodynamics, 6th edition, W.A. BenjaminPublishers, California, 1972.
3. M.C. Gupta, Statistical Thermodynamics, New Age International,Pvt. Ltd., New Delhi, 1995.
4. K.J. Laidler, Chemical Kinetics, 3rd edition, Pearson, Reprint -2013.
5. J. Rajaram and J.C. Kuriokose, Kinetics and Mechanisms ofchemical transformation,M acmillan India Ltd, Reprint - 2011.
6. D.A. Mcqurrie And J.D. Simon, Physical Chemistry - A Molecular Approach, Viva Books Pvt. Ltd., New Delhi, 1999.
7. R.P. Rastogi and R.R. Misra, Classical Thermodynamics, VikasPublishing, Pvt. Ltd., New Delhi, 1990.
8. S.H. Maron and J.B. Lando, Fundamentals of Physical Chemistry, Macmillan Publishers, New York, 1974
9. K.B. Ytsiimiriski, "Kinetic Methods of Analysis", PergamomPress,1996.
10. Gurdeep Raj, Phase rule, Goel Publishing House, 2011.

E RESOURCES:

1. https://nptel.ac.in/courses/104/103/104103112/
2. https://bit.ly/3tL3GdN

SEMESTER: II – CP-II-: INORGANIC CHEMISTRY PRACTICAL

Ins. Hrs. /Week: 6 **Course Credit: 3** **Course code: P23CH106P**

UNIT-I: ANALYSIS OF MIXTURE OF CATIONS:

Analysis of a mixture of four cations containing two common cations and two rare cations.

Cations tobe tested.

Group-I : W, Tl and Pb.

Group-II : Se, Te, Mo, Cu, Bi and Cd.

Group-III : Tl, Ce, Th, Zr, V, Cr, Fe, Ti and U.

Group-IV : Zn, Ni, Co and Mn.

Group-V : Ca, Ba and Sr.

Group-VI : Li and Mg.

UNIT-II: Preparation of metal complexes:

Preparation of inorganic complexes:

1. Preparation of tristhioureacopper(I)sulphate
2. Preparation of potassium trioxalate chromate(III)
3. Preparation of tetramminecopper(II) sulphate
4. Preparation of Reineck's salt
5. Preparation of hexathioureacopper(I) chloridedihydrate
6. Preparation of *cis*-Potassium tri oxalate diaquachromate(III)
7. Preparation of sodium trioxalatoferrate(III)
8. Preparation of hexathiourealead(II) nitrate.

UNIT-III: Complexometric Titration:

1. Estimation of zinc, nickel, magnesium, and calcium.
2. Estimation of mixture of metal ions-pH control, masking anddemasking agents.
3. Determination of calcium and lead in a mixture (pH control).
4. Determination of manganese in the presence of iron.
5. Determination of nickel in the presence of iron.

COURSE OUTCOMES :

Students will be able:

1. :To identify the anions and cations present in a mixture of salts.
2. To apply the principles of semi micro qualitative analysis to categorize acid radicals andbasic radicals.
3. To acquire the qualitative analytical skills by selecting suitable confirmatory tests andspot tests.
4. To choose the appropriate chemical reagents for the detection of anions and cations.
5. To synthesize coordination compounds in good quality.

REFERENCE BOOKS:

1. JeyaRajendran, Microanalytical Techniques in Chemistry:Inorganic Qualitative Analysis, United global publishers, 2021.
2. V. V. Ramanujam, *Inorganic Semimicro Qualitative Analysis*; 3rded.,The National Publishing Company, Chennai, 1974.
3. *Vogel's Text book of Inorganic Qualitative Analysis,* 4thed., ELBS,London.
4. G. Pass, and H. Sutcliffe, *Practical Inorganic Chemistry*; ChapmanHall, 1965.
5. W. G. Palmer, Experimental *Inorganic Chemistry*; CambridgeUniversity Press, 1954.

E RESOURCES:

1. https://ocw.mit.edu/courses/3-091-introduction-to-solid-state-chemistry-fall-2018/video_galleries/lecture-videos/

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M.Sc., CHEMISTRY

SEMESTER: II - EC-III –A : MEDICINAL CHEMISTRY

Ins. Hrs. /Week: 5 **Course Credit: 3** **Course code: P23CHE23A**

UNIT-I: INTRODUCTION TO RECEPTORS: (15 Hours)

Introduction, targets, Agonist,antagonist, partial agonist. Receptors, Receptor types, Theories of Drug–receptor interaction, Drug synergism, Drug resistance, physicochemical factors influencing drug action.

UNIT-II: ANTIBIOTICS: (15 Hours)

Introduction, Targets of antibiotics action, classification of antibiotics, enzyme-based mechanism of action, SAR of penicllins and tetracyclins, clinical application of penicillins,cephalosporin.Current trends in antibiotic therapy.

UNIT-III: ANTIHYPERTENSIVE AGENTS AND DIURETICS: (15 Hours)

Classification of cardiovascular agents, introduction to hypertension, etiology, types, classification of antihypertensive agents, classification and mechanism of action of diuretics, Furosemide, Hydrochlorothiazide, Amiloride.

UNIT-IV: ANTIHYPERTENSIVE AGENTS AND DIURETICS: (15 Hours)

Classification of cardiovascular agents, introduction to hypertension, etiology, types, classification of antihypertensive agents, classification and mechanism of action of diuretics, Furosemide, Hydrochlorothiazide, Amiloride.

UNIT-V: ANALGESICS, ANTIPYRETICS AND ANTI-INFLAMMATORY DRUGS: (15 Hours)

Introduction, Mechanism of inflammation, classification and mechanism of action and paracetamol, Ibuprofen, Diclofenac, naproxen,indomethacin, phenylbutazone and meperidine. Medicinal Chemistry of Antidiabetic Agents Introduction, Types of diabetics, Drugs used for the treatment, chemical classification, Mechanism of action, Treatment of diabetic mellitus. Chemistry of insulin, sulfonyl urea.

TOTAL LECTURE HOURS:75

COURSE OUTCOMES :

Students will be able:

1. Predict a drugs properties based on its structure.

2. Describe the factors that affect its absorption, distribution, metabolism, and excretion,and

hence the considerations to be made in drug design.

3. Explain the relationship between drug's chemical structure and its therapeutic properties.

4. Designed to give the knowledge of different theories of drug actions at molecularlevel.

5. To identify different targets for the development of new drugs for the treatment ofinfectious and GIT.

REFERENCE BOOKS:

1. Wilson and Gisvold's textbook of organic medicinal andpharmaceutical chemistry,
2. Wilson, Charles Owens: Beale, John Marlowe; Block, John H,Lipincott William, 12th edition, 2011.
3. Graham L. Patrick, An Introduction to Medicinal Chemistry, 5th edition, Oxford University Press, 2013. Jayashree Ghosh, A text book of Pharmaceutical Chemistry, S. Chand and Co. Ltd, 1999,1999 edn.
4. O. LeRoy, Natural and synthetic organic medicinal compounds,Ealemi, 1976.
5. 5.S. Ashutosh Kar, Medicinal Chemistry, Wiley Eastern Limited, NewDelhi, 1993, New edn.
6. Foye's Princles of Medicinal Chemistry, Lipincott Williams, SeventhEdition, 2012
7. Burger's Medicinal Chemistry, Drug Discovery and Development,Donald J. Abraham, David P. Rotella, Alfred Burger, Academic press, 2010.
8. Wilson and Gisvold's Textbook of Organic Medicinal and Pharmaceutical Chemistry, John M. Beale Jr and John M. Block,Wolters Kluwer, 2011, 12th edn.
9. P. Parimoo, A Textbook of Medical Chemistry, New Delhi: CBSPublishers.1995.
10. S.Ramakrishnan, K.G.Prasannan and R.Rajan,Textbook of Medical Biochemistry,Hyderabad: Orient Longman. 3rd edition, 2001.

E RESOURCES:

1. https://www.ncbi.nlm.nih.gov/books/NBK482447/
2. https://training.seer.cancer.gov/treatment/chemotherapy/types.html
3. https://www.classcentral.com/course/swayam-medicinal-chemistry- 12908

SEMESTER: II – EC-III-(B)-: GREEN CHEMISTRY

Ins. Hrs. /Week: 5 **Course Credit: 3** **Course code: P23CHE23B**

UNIT-I: **(15 Hours)**

Introduction- Need for Green Chemistry. Goals of Green Chemistry. Limitations/ of Green Chemistry. Chemical accidents, terminologies, Internationall green chemistry organizations and Twelve principles of Green Chemistry with examples.

UNIT-II: **(15 Hours)**

Choice of starting materials, reagents, catalysts and solvents in detail, Green chemistry in day today life. Designing green synthesis- green reagents: dimethyl carbonate. Green solvents: Water,Ionic liquids-criteria, general methods of preparation, effect on organic reaction. Supercritical carbon dioxide-properties, advantages, drawbacks and a few examples of organic reactions in CO_2. Green synthesis-adipic acid and catechol.

UNIT-III: **(15 Hours)**

Environmental pollution, Green Catalysis-Acid catalysts, Oxidation catalysts, Basic catalysts, Polymer supported catalysts-Poly styrene aluminum chloride, polymeric super acid catalysts, Poly supported photosensitizers.

UNIT-IV: **(15 Hours)**

Phase transfer catalysis in green synthesis-oxidation using hydrogen peroxide, crown ethers-esterification, saponification, anhydride formation, Elimination reaction, Displacement reaction. Applications in organic synthesis.

UNIT-V: **(15 Hours)**

Micro wave inducedgreen synthesis- Introduction, Instrumentation, Principle and applications. Sonochemistry - Instrumentation, Cavitation theory - Ultra sound assisted green synthesis and Applications. **TOTAL LECTURE HOURS : 75**

COURSE OUTCOMES :

Students will be able:

1. To recall the basic chemical techniques used in conventional industrial preparations andin green innovations.

2. To understand the various techniques used in chemical industries and in laboratory.

3. To compare the advantages of organic reactions assisted by renewable energy sourcesand non-renewable energy sources.

4. To apply the principles of PTC, ionic liquid, microwave and ultrasonic assisted organic synthesis.

5. To design and synthesize new organic compounds by green methods.

REFERENCE BOOKS:

1. Ahluwalia, V.K. and Kidwai, M.R. New Trends in Green Chemistry, Anamalaya Publishers, 2005.
2. W. L. McCabe, J.C. Smith and P. Harriott, Unit Operations of Chemical Engineering, 7thedition, McGraw-Hill, NewDelhi,2005.
3. J. M. Swan and D. St. C. Black, Organometallics in Organic Synthesis, Chapman Hall,1974.
4. V. K. Ahluwalia and R. Aggarwal, Organic Synthesis: Special Techniques, Narosa Publishing House, New Delhi,2001.
5. A. K. De, Environmental Chemistry, New Age Publications, 2017.

E RESOURCES:

1. https://www.organic-chemistry.org/
2. https://www.studyorgo.com/summary.php

SEMESTER: II – EC-IV(A) : BIO-INORGANIC CHEMISTRY

Ins. Hrs. /Week: 5 **Course Credit: 3** **Course code: P23CHE24A**

UNIT-I: ESSENTIAL TRACE ELEMENTS: (15 Hours)

Selective transport and storage of metal ions: Ferritin, Transferrin and sidorphores; Sodium and potassiumtransport, Calcium signalling proteins. Metalloenzymes: Zinc enzymes–carboxypeptidase and carbonic anhydrase. Iron enzymes–catalase, peroxidase. Copper enzymes – superoxide dismutase, Plast ocyanin, Ceruloplasmin, Tyrosinase. Coenzymes - Vitamin-B12 coenzymes.

UNIT-II: TRANSPORT PROTEINS: (15 Hours)

Oxygen carriers -Hemoglobin and myoglobin - Structure and oxygenation Bohr Effect. Binding of CO, NO, CN– to Myoglobin and Hemoglobin. Biological redox system: Cytochromes-Classification, cytochrome a, b and c. Cytochrome P-450.Non-heme oxygen carriers-Hemerythrin and hemocyanin. Iron-sulphur proteins- Rubredoxin and Ferredoxin- Structure and classification.

UNIT-III: NITROGEN FIXATION: (15 Hours)

Introduction, types of nitrogen fixing microorganisms. Nitrogenase enzyme - Metal clusters in nitrogenase- redox property - Dinitrogen complexes transition metal complexes of dinitrogen - nitrogen fixation via nitride formation and reduction of dinitrogen to ammonia. Photosynthesis: photosystem-I and photosystem-II-chlorophylls structure and function.

UNIT-IV: METALS IN MEDICINE: (15 Hours)

Metal Toxicity of Hg, Cd, Zn, Pb, As, Sb. Therapeutic Compounds: Vanadium-Based Diabetes Drugs; Platinum-Containing Anticancer Agents.Chelation therapy; Cancer treatment. Diagnostic Agents: Technetium Imaging Agents; GadoliniumMRI Imaging Agents. temperature and critical magnetic Field.

UNIT-V: ENZYMES : (15 Hours)

Introduction and properties -nomenclature andclassification. Enzyme kinetics, free energy of activation and the effects of catalysis. Michelis - Menton equation - Effect of pH, temperature on enzyme reactions. Factors contributing to the efficiency of enzyme.

TOTAL LECTURE HOURS: 75

COURSE OUTCOMES :

Students will be able:

1. The students will be able to analyses trace elements.
2. Students will be able to explain the biological redox systems.
3. Students will gain skill in analyzing the toxicity in metals.
4. Students will have experience in diagnosis.
5. Learn about the nitrogen fixation and photosynthetic mechanism.

REFERENCE BOOKS:

1. Williams,D.R. –Introdution to Bioinorganic chemistry.
2. F.M. Fiabre and D.R. Williams– The Principles of Bioinorganic Chemistry,RoyolSoceity of Chemistry, Monograph for Teachers-31
3. K.F. Purcell and Kotz., Inorganic chemistry, WB Saunders Co.,USA.
4. G.N. Mugherjea and Arabinda Das, Elements of BioinorganicChemistry - 1993.
5. R. Gopalan, V. Ramalingam, *Concise Coordination Chemistry*, S. Chand, **2001**.
6. M.Satake and Y.Mido, Bioinorganic Chemistry- Discovery Publishing House, New Delhi (1996)
7. M.N. Hughes, 1982, The Inorganic Chemistryof Biological processes,II Edition, Wiley London.
8. R. W. Hay, Bio Inorganic Chemistry, Ellis Horwood, 1987.
9. R. M. Roat-Malone, Bio Inorganic Chemistry, John Wiley, 2002.
10. T. M. Loehr, Iron carriers and Iron proteins, VCH, 1989.

E RESOURCES:

1. https://www.pdfdrive.com/instant-notes-in-inorganic-chemistry- the-instant-notes-chemistry-series-d162097454.html
2. https://www.pdfdrive.com/shriver-and-atkins-inorganic-chemistry-5th-edition-d161563417.html

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SEMESTER: II- EC-IV- (D)-B: MATERIAL SCIENCE

Ins. Hrs. /Week: 5 **Course Credit: 3** **Course code: P23CHE24B**

UNIT-I: CRYSTALLOGRAPHY: **(15 Hours)**

Symmetry - unit cell and Miller indices -crystal systems - Bravais lattices - point groups and space groups - X- ray diffraction-Laue equations-Bragg's law-reciprocal lattice and its application to geometrical crystallography. Crystal structure–powderand single crystal applications. Electron charge density maps, neutron diffraction-method and applications.

UNIT-II: CRYSTAL GROWTH METHODS: **(15 Hours)**

Nucleation–equilibrium stability and metastable state. Single crystal –Low and high temperature, solution growth– Gel and sol-gel. Crystal growth methods- nucleation– equilibrium stability and metastable state. Single crystal–Low and high temperature, solution growth– Geland sol-gel. Melt growth - Bridgeman-Stockbarger,Czochralski methods.Flux technique, physical and chemical vapour transport. Lorentz andpolarization factor - primary and secondary extinctions.

UNIT-III: PROPERTIES OF CRYSTALS: **(15 Hours)**

Optical studies - Electromagnetic spectrum (qualitative) refractive index – reflectance – transparency, translucency and opacity. Types of luminescence – photo-, electro-, and injection luminescence, LEDs – organic, Inorganic and polymer LED materials - Applications. Dielectric studies- Polarisation - electronic, ionic, orientation, and space charge polarisation. Effect of temperature. dielectric constant, dielectric loss. Types of dielectric breakdown– intrinsic, thermal, discharge, electrochemical and defect breakdown.

UNIT-IV: SPECIAL MATERIALS: **(15 Hours)**

Superconductivity: Meissner effect, Critical temperature and critical magnetic Field, Type I and II superconductors, BCS theory-Cooper pair, Applications. Soft and hard magnets – Domain theory Hysteresis Loop-Applications. Magneto and gian magneto resistance. Ferro, ferri and antiferromagnetic materials- applications, magnetic parameters for recording applications. Ferro-, Piezo-, and pyro electric materials – properties and applications. Shape memory Alloys-characteristics and applications, Non-linear optics- Second Harmonic Generators, mixing of Laser wavelengths by quartz, ruby and $LiNbO_3$

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UNIT-V: MATERIALS FOR RENEWABLE ENERGY CONVERSION: **(15 Hours)**

Solar Cells: Organic, bilayer, bulk heterojunction, polymer, perovskite based. Solar energyconversion: lamellar solids and thin films, dye-sensitized photo voltaic cells, coordination compounds anchored onto semiconductor surfaces - Ru(II) and Os(II) polypyridyl complexes. Photochemicalactivation and splitting of water, CO_2 and N_2. Manganese based photosystems for water-splitting. Complexes of Rh, Ru, Pd and Pt - photochemical generation of hydrogen from alcohol.**TOTAL LECTURE HOURS :75**

COURSE OUTCOMES :

Students will be able:

1. To understand and recall the synthesis and characteristics of crystal structures,semiconductors, magnets, nanomaterials and renewable energy materials.
2. To integrate and assess the structure of different materials and their properties.
3. To analyse and identify new materials for energy applications.
4. To explain the importance of crystal structures, piezoelectric and pyroelectric materials, nanomaterials, hard and soft magnets, superconductors, solar cells, electrodes, LED uses, structures and synthesis.
5. To design and develop new materials with improved property for energy applications.

REFERENCE BOOKS:

1. S. Mohan and V. Arjunan, Principles of Materials Science, MJPPublishers, 2016.
2. Arumugam, Materials Science, Anuradha Publications, 2007.
3. Giacavazzo et. al., Fundamentals of Crystallography, InternationalUnion of Crystallography. Oxford Science Publications, 2010
4. Woolfson, An Introduction to Crystallography, Cambridge UniversityPress, 2012.
5. James F. Shackelford and Madanapalli K. Muralidhara, Introduction to Materials Science for Engineers. 6th ed., PEARSON Press, 2007.
6. M.G. Arora, Solid State Chemistry, AnmolPublications, New Delhi, 2001.
7. R.K. Puri and V.K. Babbar, Solid State Physics, S Chand and CompanyLtd, 2001.
8. C. Kittel, Solid State Physics, John-Wiley and sons, NY, 1966.
9. H.P. Meyers, Introductory Solid State Physics, Viva Books PrivateLimited, 1998.
10. A.R. West, Solid State Chemistry and Applications, John-Wiley andsons, 1987.

E RESOURCES

1. http://xrayweb.chem.ou.edu/notes/symmetry.html.
2. http://www.uptti.ac.in/classroom-content/data/unit%20cell.pdf.
3. https://bit.ly/3QyVg2R

SEMESTER: II – NME-II : CHEMISTRY IN EVERY DAY LIFE

Ins. Hrs. /Week: 2 **Course Credit: 2** **Course Code: P23NMECH22**

UNIT I: CHEMISTRY IN HEALTH CARE AND BEAUTY (6 Hours)

Vitamins and Proteins- sources, functions and deficiency diseases
Cosmetics: Face powder- Face cream- Lipstick- Mascara-Nail polish- Perfumes-Shampoo-Tooth paste-Ingredients and uses.

UNIT II: CHEMISTRY IN MEDICINE (6 Hours)

Analgesics, Antimicrobials, Antifertility drugs, Anaesthetics, Antibiotics, Antacids, Antihistamines, Tranquilizers, Hypnotics and Antidepressant drugs- definition, examples, usesand side effects.

UNIT III: CHEMISTRY IN HOUSEKEEPING (6 Hours)

Soaps- definition, varieties of soap and their uses- cleansing action of soap -detergents, deodorants, acid cleaners, laundry aids, alkaline cleaners, metal polishes, solvent cleaners, floor seal, abrasive, antiseptics, disinfectants- definition, ingredients and examples.

UNIT IV: CHEMISTRY IN INDUSTRY (6 Hours)

Food industry: Food adulterants and testing, Food colorants, Food preservatives and Food additives. Paints and varnishes : Definition, types and composition.Glass : Composition, manufacture, types and uses.

UNIT V : CHEMISTRY OF PHOTOGRAPHY (6 Hours)

Role of Chemistry in photography- photographic process- preparation of sensitive plates-exposure-developing- fixing- printing- toning- colour photography.

TOTAL LECTURE HOURS : 30

COURSE OUTCOME

The students are able to

1. The Students are able to understand the preparation , properties and uses of cosmetics.
2. Learn how chemical compounds used as medicines.
3. Learn about how certain chemicals used housekeeping .
4. Understand the manufacturing process of Paints ,Varnishes and glass.
5. Predict the role of chemistry in photography.

TEXTBOOK(S):

1. Text book of Applied hemistry
2.A Text of Pharmaceutical Chemistry – Jayashreeghosh, Sultan chand &sons, NewDelhi,1997.
3.Industrial Chemistry Mark Antony Benvenuto
4.Clinical Medicine A.B.M.Abdullah

REFERENCE BOOK(S):

1.Chemistry in everyday life –Shandendukislaya Discovery Publishing Pvt. Ltd.,(1January2001).
2.Chemistry in daily life by Singh K prentice Hall India Learning Private Limited, Third edition (1January 2012).
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