

Dr. N.G.P. ARTS AND SCIENCE COLLEGE (Autonomous)

**REGULATIONS 2022-23 for Post Graduate Programme
(Outcome Based Education model with Choice Based Credit System)**

M.Sc. Degree

(For the students admitted during the academic year 2022-23 and onwards)

Programme: M.Sc. Chemistry

Eligibility

A pass in B.Sc. Chemistry as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent there to by the Academic Council subject to such conditions as may be prescribed there to are permitted to appear and qualify for the **Master of Science (CHEMISTRY)** Degree Examination of this College after a course study of two academic years.

Programme Educational Objectives

The Curriculum is designed to attain the following learning goals which students shall accomplish by the time of their graduation:

1. To build the firm foundation in the fundamentals and correlate the application with the current developments in chemistry.
2. To get sufficient expertise in the operational knowledge and laboratory skills in all major fields of chemistry.
3. To emphasize on integrating various disciplines of Science and encourage for interdisciplinary approach.
4. To acquire problem solving capacity, interpretation of results with the use of sophisticated instruments and devises new preparation techniques.
5. To motivate the students to prepare for competitive examinations, job carriers and get trained for industrial entrepreneurship.



PROGRAMME OUTCOMES:

On the successful completion of the program, the following are the expected outcomes.

PO Number	PO Statement
PO1	Make use of knowledge in the major fields of Chemistry which would make them to analyze the significant role played in the field of energy, materials, health sector and environment.
PO2	Select the appropriate modern scientific instruments, to plan and execute in laboratory.
PO3	Interpret the Knowledge and skills to develop independent writing reports and to execute the ideas.
PO4	Take part in research- based knowledge in interdisciplinary approach including design of experiments, analysis and interpretation of data for provide better solution in emerging issues.
PO5	Utilize the knowledge for social, economic, and environmental challenges globally and formulate for life-long learning in the broadest context of technological change.



PG REGULATION (R4)
(Students Admitted in the AY 2022-23)
(OUTCOME BASED EDUCATION WITH CBCS)

Effective from the academic year 2022-23 and applicable to the students admitted to the Degree of Master of Arts/Commerce/Management/Science.

1. NOMENCLATURE

1.1 Faculty: Refers to a group of programmes concerned with a major division of knowledge. Eg. Faculty of Computer Science consists of Programmes like Computer Science, Information Technology, Computer Technology, Computer Applications etc.

1.2 Programme: Refers to the Master of Arts/Management/Commerce/Science Stream that a student has chosen for study.

1.3 Batch: Refers to the starting and completion year of a programme of study. Eg. Batch of 2022–2024 refers to students belonging to a 2-year Degree programme admitted in 2022 and completing in 2024.

1.4 Course: Refers to component of a programme. A course may be designed to involve lectures / tutorials / laboratory work / seminar / project work/ practical training / report writing / Viva voce, etc or a combination of these, to effectively meet the teaching and learning needs and the credits may be assigned suitably.

a) Core Courses A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.

b) Extra Departmental Course (EDC): A course chosen generally from a related discipline/subject, with an intention to seek exposure in the discipline relating to the core domain of the student.

c) Discipline Specific Elective Course (DSE): Elective courses are offered under main discipline/ subject of study.



d) Project Work: It is considered as a special course involving application of knowledge in problem solving/analyzing/exploring a real-life situation. The Project work will be given in lieu of a Core paper.

e) Extra credits Extra credits will be awarded to a student for achievements in co-curricular activities carried out outside the regular class hours. The guidelines for the award of extra credits are given in section two, these credits are not mandatory for completing the programme.

f) Advanced Learner Course (ALC): ALC is doing work of a higher standard than usual for students at that stage in their education. Research work / internships carried out in Universities/ Research Institutions/ Industries of repute in India or abroad for a period of 15 to 30 days.

2. STRUCTURE OF PROGRAMME

- Core Course
- Extra Departmental Course (EDC)
- Discipline Specific Elective (DSE)
- Industrial Training (IT)
- Project

3. DURATION OF THE PROGRAMME

M.Sc. /M.Com. / M.A. Programme must be completed within 2 Years (4 semesters) and maximum of 4 Years (8 semesters) from the date of acceptance to the programme. If not, the candidate must enroll in the course determined to be an equivalent by BoS in the most recent curriculum recommended for the Programme.

4. REQUIREMENTS FOR COMPLETION OF A SEMESTER

Every student shall ordinarily be allowed to keep terms for the given semester in a program of his/ her enrolment, only if he/ she fulfills at least seventy five percent (75%) of the attendance taken as an average of the total number of lectures, practicals, tutorials, etc. wherein short and/or long excursions/field visits/study tours organised by the college and supervised by the faculty as envisaged in the syllabus shall be credited to his attendance. Every student shall have a minimum of 75% as an overall attendance.



5. EXAMINATIONS

The end semester examinations shall normally be conducted after completing 90 working days for each semester. The maximum marks for each theory and practical course as follows,

a) Mark distribution for Theory Courses

Continuous Internal Assessment (CIA) : 50 Marks

End Semester Exams (ESE) : 50 Marks

Total : 100 Marks

i) Distribution of Internal Marks

S.No.	Particulars	Distribution of Marks
1	CIA I (2.5 Units) (On completion of 45 th working day)	15
2	Model (All 5 Units) (On completion of 85 th working day)	15
3	Assignment	05
4	Attendance	05
5	Library Usage	05
6	Skill Enhancement *	05
Total		50

Assignment Rubric

(Maximum -20 marks converted to 5 marks)

Criteria	4 marks	3 Marks	2 Marks	1 MARK
Language	Excellent spelling and Grammar	Good spelling and Grammar	Reasonable spelling and Grammar	Bad spelling and Grammar
Style	Outstanding style beyond usual college level	Attains College level style	Approaches College level style	Elementary form with little or no variety in



				sentence structure
Referencing	Good use of wide range of reference sources	Moderate use of suitable reference materials	Shows signs of plagiarism & using sources without referencing	No reference material used
Development	Main points well developed with high quality and quantity support	Main points developed with quality and quantity supporting details	Main points are present with limited details and development	Main points lack detailed development
Critical thinking/Problem solving	Advanced attempt to interpret the process, content/ analyse and solve the problem	Proficient attempt to interpret the process, content/ analyse and solve the problem	Adequate attempt to interpret the process, content/ analyse and solve the problem	Limited attempt to interpret the process, content/ analyse and solve the problem

Breakup for Attendance Marks:

S.No	Attendance Range	Marks Awarded
1	95% and Above	5
2	90% - 94%	4
3	85% - 89%	3
4	80% - 84%	2
5	75% - 79%	1

Note:

Special Cases such as NCC, NSS, Sports, Advanced Learner Course, Summer Fellowship and Medical Conditions etc. the attendance exemption may be given by principal and Mark may be awarded.



Break up for Library Marks:

S.No	Attendance Range	Marks Awarded
1	10h and above	5
2	9h- less than 10h	4
3	8h - less than 9h	3
4	7h - less than 8h	2
5	6h - less than 7h	1

Note:

In exception, the utilization of e-resources of library will be considered.

***Components for "Skill Enhancement" may include the following:**

Class Participation, Case Studies Presentation/Term paper, Field Study, Field Survey, Group Discussion, Term Paper, Presentation of Papers in Conferences, Industry Visit, Book Review, Journal Review, e-content Creation, Model Preparation & Seminar.

Components for Skill Enhancement

Any one of the following should be selected by the course coordinator

S.No.	Skill Enhancement	Description
1	Class Participation	<ul style="list-style-type: none"> • Engagement in class • Listening Skills • Behaviour
2	Case Study Presentation/ Term Paper	<ul style="list-style-type: none"> • Identification of the problem • Case Analysis • Effective Solution using creativity/imagination
3	Field Study	<ul style="list-style-type: none"> • Selection of Topic • Demonstration of Topic • Analysis & Conclusion
4	Field Survey	<ul style="list-style-type: none"> • Chosen Problem • Design and quality of survey • Analysis of survey
5	Group Discussion	<ul style="list-style-type: none"> • Communication skills • Subject knowledge • Attitude and way of presentation • Confidence



		<ul style="list-style-type: none"> • Listening Skill
6	Presentation of Papers in Conferences	<ul style="list-style-type: none"> • Sponsored • International/National • Presentation • Report Submission
7	Industry Visit	<ul style="list-style-type: none"> • Chosen Domain • Quality of the work • Analysis of the Report • Presentation
8	Book Review	<ul style="list-style-type: none"> • Content • Interpretation and Inferences of the text • Supporting Details • Presentation
9	Journal Review	<ul style="list-style-type: none"> • Analytical Thinking • Interpretation and Inferences • Exploring the perception if chosen genre • Presentation
10	e-content Creation	<ul style="list-style-type: none"> • Logo/ Tagline • Purpose • Content (Writing, designing and posting in Social Media) • Presentation
11	Model Preparation	<ul style="list-style-type: none"> • Theme/ Topic • Depth of background Knowledge • Creativity • Presentation
12	Seminar	<ul style="list-style-type: none"> • Knowledge and Content • Organization • Understanding • Presentation

ii) Distribution of External Marks

Total : 50
Written Exam : 50

Marks Distribution for Practical course

Total : 100
Internal : 50
External : 50

i) Distribution of Internals Marks

S. No.	Particulars	Distribution of Marks
1	Experiments/Exercises	15
2	Test 1	15
3	Test 2	15
4	Observation Notebook	05
Total		50

ii) Distribution of Externals Marks

S.No.	Particulars	External Marks
1	Materials and methods/ Procedures/Aim	10
2	Experiment/ Performance/ Observations/ Algorithm	10
3	Results/ Calculations/ Spotters/ Output	10
4	Inference/Discussion/ Presentation	10
5	Record	6
6	Viva- voce	4
Total		50

A) Mark Distribution for Project

Total : 200
Internal : 100
External : 100



i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	40
2	Review II	40
3	Attendance	20
Total		100

ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Project Work & Presentation	80
2	Viva -voce	20
Total		100

Evaluation of Project Work shall be done jointly by Internal and External Examiners.

6 . Credit Transfer

a. Upon successful completion of 1 NPTEL Course (4 Credit Course) recommended by the department, during Semester I to II, a student shall be eligible to get exemption of one **4 credit course** during the 3rd or 4th semester. The proposed NPTEL course should cover content/syllabus of exempted core paper in 3rd or 4th semester.

S. No.	Course Code	Course Name	Proposed NPTEL Course	Credit
1			Option - 1 Paper title	4
			Option - 2 Paper title	
			Option - 3 Paper title	

b. Upon successful completion of **2 NPTEL Courses** (2 Credit each) recommended by the department, during Semester I to II, a student shall be eligible to get exemption of **one 4 credit course** during the 3rd or 4th semester. Out of 2 NPTEL proposed courses, **at least 1 course** should cover content/syllabus of exempted core paper in 3rd or 4th semester.



Mandatory

The exempted core paper in the 3rd or 4th semester should be submitted by the students for approval before the end of 2nd semester

Credit transfer will be decided by equivalence committee

S. No.	Course Code	Course Name	Proposed NPTEL Course	Credit
1			Option - 1 Paper title	2
			Option - 2 Paper title	
			Option - 3 Paper title	
2			Option - 1 Paper title	2
			Option - 2 Paper title	
			Option - 3 Paper title	

NPTEL Courses to be carried out during semester I - II.					
S. No.	Student Name	Class	Proposed NPTEL Course		Proposed Course for Exemption
			Course I	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	Any one Core Paper in 3 rd or 4 th Semesters
			Course II	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	
Class Advisor		HoD		Dean	



7. Internship/Industrial Training

Students must undertake industrial / institutional training for a minimum of 15 days and not exceeding 30 days during the II semester summer vacation. The students will submit the report for evaluation during III semester.

Mark Distribution for industrial / institutional training

Total	:	100
Internal	:	50
External	:	50

i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	20
2	Review II	20
3	Attendance	10
Total		50

ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Internship /Industrial training Presentation	40
2	Viva -voce	10
Total		50

Evaluation of Internship /Industrial training Presentation shall be done jointly by Internal and External Examiners.

8. Extra Credits: 10

Earning extra credit is not essential for programme completion. Student is entitled to earn extra credit for achievement in Curricular/Co-Curricular/ Extracurricular activities carried out other than the regular class hours.

A student is permitted to earn a maximum of 10 extra Credits during the programme period. A maximum of 1 credit under each category is permissible.



Category	Credit
Self study Course	1
CA/ICSI/CMA (Foundations)	1
CA/ICSI/CMA (Inter)	1
Sports and Games	1
Publications / Conference Presentations (Oral/Poster)/ Awards	1
Innovation / Incubation / Patent / Sponsored Projects / Consultancy	1
Representation in State / National level celebrations	1
Awards/Recognitions/Fellowships	1
Advanced Learner Course (ALC)*	2

Credit shall be awarded for achievements of the student during the period of study only.

GUIDELINES

Self study Course

A pass in the self study courses offered by the department.

The candidate should register the self study course offered by the department only in the III semester.

CA/ICSI/CMA (Foundations)

Qualifying foundation in CA/ICSI/CMA / etc.

CA/ICSI/CMA (Inter)

Qualifying Inter in CA/ICSI/CMA / etc.

Sports and Games

The Student can earn extra credit based on their Achievement in sports in University/ State / National/ International.

Publications / Conference Presentations (Oral/Poster)

Research Publications in Journals

Oral/Poster presentation in Conference

Innovation / Incubation / Patent / Sponsored Projects / Consultancy



Development of model/ Products /Prototype /Process/App/Registration of Patents/
Copyrights/Trademarks/Sponsored Projects /Consultancy

Representation in State/ National level celebrations

State / National level celebrations such as Independence day, Republic day Parade,
National Integration camp etc.

Awards/Recognitions/Fellowships

Regional/ State / National level awards/ Recognitions/Fellowships

*Advanced Learner Course (ALC):

ALC is doing work of a higher standard than usual for students at that stage in their
education.

Research work/internships carried out in Universities/ Research Institutions/
Industries of repute in India or abroad for a period of 15 to 30 days will be considered
as Advanced Learners Course.

QUESTION PAPER PATTERN

CIA Test I: [1^{1/2} Hours-2.5 Units] - 25 Marks

SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section - A	8 x 0.5= 04 Marks	MCQ	25 Marks	Marks secured will be converted To 15 mark
Section - B	3 x 2 = 06 Marks	Answer ALL Questions Either or Type ALL Questions Carry Equal Marks		
Section - C	3 x 05 = 15 Marks	Answer ALL Questions Either or Type ALL Questions Carry Equal Marks		



CIA Test II/ Model [3 Hours-5 Units] - 50 Marks

SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section - A	10 x 1 = 10 Marks	MCQ	50 Marks	Marks secured will be converted To 15 mark
Section - B	5 x 6 = 30 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks		
Section - C	1 x 10 = 10 Marks	Compulsory Question		

End Semester Examination [3 Hours-5 Units] - 50 Marks

SECTION	MARKS	DESCRIPTION	TOTAL
Section - A	10 x 1 = 10 Marks	MCQ	50 Marks
Section - B	5 x 6 = 30 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks	
Section - C	1 x 10 = 10 Marks	Compulsory Question	



Guidelines for Programmes offering for Semesters:

Subjects	No. of Papers	Credit	Semester No.
Core (Credits 2, 3, 4, 5)	17	70	I to IV
Extra Disciplinary Course (EDC)	1	4	II
Discipline Specific Elective (DSE)	4	4 x 4 = 16	I to IV
Internship (IT)	1	2	III
TOTAL CREDITS		92	




M.SC. CHEMISTRY PROGRAMME

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
First Semester										
222CE2A1CA	Core - I	Organic Reaction Mechanisms	4	1	-	3	50	50	100	4
222CE2A1CB	Core - II	Coordination Chemistry	4	1	-	3	50	50	100	4
222CE2A1CC	Core - III	Thermodynamics and Kinetics	4	1	-	3	50	50	100	4
222CE2A1CD	Core - IV	Analytical Techniques	4	1	-	3	50	50	100	4
222CE2A1CP	Core Practical - I	Organic Chemistry	-	-	6	6	50	50	100	3
222CE2A1DA	DSE - I	Advanced Polymer Science and Technology	4	-	-	3	50	50	100	4
222CE2A1DB		Inorganic Materials for Industrial Applications								
222CE2A1DC		Green Organic Synthesis								
Total			20	4	6	-	-	-	600	23



Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Second Semester										
222CE2A2CA	Core - V	Stereochemistry and Pericyclic Reactions	4	1	-	3	50	50	100	4
222CE2A2CB	Core - VI	Bio-inorganic and Organometallic Chemistry	4	-	-	3	50	50	100	4
222CE2A2CC	Core - VII	Molecular Spectroscopy	4	1	-	3	50	50	100	4
222CE2A2CP	Core Practical - II	Inorganic Chemistry	-	-	8	6	50	50	100	4
223BC2A2EA	EDC	Drug Biochemistry	4	-	-	3	50	50	100	4
222CE2A2DA	DSE -II	Chemistry of Cosmetics and Perfumes	4	-	-	3	50	50	100	4
222CE2A2DB		Batteries and Fuel Cells								
222CE2A2DC		Organic Reactions and Reagents								
Total			20	2	8	-	-	-	600	24

Mohi
01.12.2022
BoS Chairman/HoD
Department of Chemistry
Dr. N. G. P. Arts and Science College
Coimbatore - 641 048

			Dr.N.G.P. Arts and Science College		
APPROVED					
BoS- 12 th	AC- 14 th	GB- 19 th			
01/12/2022	19/01/2023	30/01/2023			



Dr.NGPASC
COIMBATORE | INDIA

M.Sc. Chemistry (Students admitted during the AY 2022-23)




Dr.NGPASC
COIMBATORE | INDIA

M.Sc. Chemistry (Students admitted during the AY 2022-23)

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Third Semester										
222CE2A3CA	Core - VIII	Chemistry of Natural Products	4	1	-	3	50	50	100	4
222CE2A3CB	Core - IX	Advanced Inorganic Chemistry	4	1	-	3	50	50	100	4
222CE2A3CC	Core - X	Quantum Chemistry and Group Theory	4	1	-	3	50	50	100	4
222CE2A3CD	Core - XI	Analytical Spectroscopy	4	1	-	3	50	50	100	4
222CE2A3CP	Core Practical-III	Physical Chemistry	-	-	6	6	50	50	100	3
222CE2A3CT	IT	Internship					50	50	100	2
222CE2A3DA	DSE - III	Dye and Textile Chemistry	4	-	-	3	50	50	100	4
222CE2A3DB		Nano Science and Nano Technology								
222CE2A3DC		Bio-Organic Chemistry								
Total			20	4	6	-	-	-	700	25

M. S. S.


BoS Chairman/HoD
Department of Chemistry
Dr. N. G. P. Arts and Science College
Coimbatore - 641 048

 Dr. N.G.P Arts and Science College		
APPROVED		
BoS- 13 th 08/06/23	AC- 15 th 14/07/23	GB- 20 th 05/08/23



Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
222CE2A4CA	Core - XII	Synthetic Organic Chemistry	4	1	-	3	50	50	100	4
222CE2A4CB	Core - XIII	Statistical Thermodynamics and Computational Chemistry	4	1	-	3	50	50	100	4
222CE2A4CV	Core - XIV	Project	-	-	16	-	100	100	200	8
222CE2A4DA	DSE - IV	Environmental Chemistry	4	-	-	3	50	50	100	4
222CE2A4DB		Catalysis								
222CE2A4DC		Medicinal Chemistry								
Total			12	2	16	-	-	-	500	20
*Grand Total									2400	92


 17.10.23
 BoS Chairman/HoD
 Department of Chemistry
 Dr. N. G. P Arts and Science College
 Coimbatore - 641 048

 Dr.N.G.P Arts and Science College		
APPROVED		
BoS- 14 th	AC- 16 th	GB- 21 st
17.10.23	13.12.23	05.01.24



DISCIPLINE SPECIFIC ELECTIVE

Students shall select the desired course of their choice in the listed elective course during Semesters I-IV

Semester I (Elective I)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	222CE2A1DA	Advanced Polymer Science and Technology
2	222CE2A1DB	Inorganic Materials for Industrial Applications
3	222CE2A1DC	Green Organic Synthesis

Semester II (Elective II)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	222CE2A2DA	Chemistry of Cosmetics and Perfumes
2	222CE2A2DB	Batteries and Fuel Cells
3	222CE2A2DC	Organic Reactions and Reagents

Semester III (Elective III)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	222CE2A3DA	Dye and Textile Chemistry
2	222CE2A3DB	Nano Science and Nano Technology
3	222CE2A3DC	Bio-Organic Chemistry

Semester IV (Elective IV)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	222CE2A4DA	Environmental Chemistry
2	222CE2A4DB	Catalysis
3	222CE2A4DC	Medicinal Chemistry



EXTRA CREDIT COURSES

The following are the courses offered under self study to earn extra credits:

Semester III

S.No.	Course Code	Course Name
1	222CE2ASSA	Research Methodology
2	222CE2ASSB	Forensic Chemistry and Crime Investigation



Course Code	Course Name	Category	L	T	P	Credit
222CE2A1CA	ORGANIC REACTION MECHANISMS	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic principles of acids and bases, electronic effects and aromaticity of organic compounds
- About the mechanism involving in the various aliphatic, aromatic electrophilic and nucleophilic substitution reactions
- The basic knowledge about addition, elimination reactions involved in multiple bonds

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Apply the electronic effects in organic chemistry and know about aromaticity in order to understand the stability of organic compounds.	K3
CO2	Utilize various methods to determine the reaction mechanisms.	K4
CO3	Summarize reaction mechanisms of the aliphatic and aromatic nucleophilic substitution reactions.	K3
CO4	Illustrate the reaction mechanisms of the aliphatic, aromatic electrophilic substitution reactions.	K3
CO5	Compare the addition and elimination reactions.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓			✓	✓
CO2		✓	✓	✓	
CO3	✓	✓		✓	
CO4			✓		
CO5	✓	✓			✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A1CA	ORGANIC REACTION MECHANISMS	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Electronic effects and aromaticity 12 h

Electron displacement - Inductive and field effect - Delocalised bonds - Rules of resonance - Steric inhibition of resonance - Steric enhancement of resonance, Hyperconjugation - Hydrogen bonding. Aromaticity: Aromatic systems with 2, 6, 10 electrons - Alternent and non-alternent hydrocarbons, systems of more than 10 electrons - Annulenes - Azulenes - Ferrocene and sydnones - Concept of homoaromaticity.

Unit II Methods of determining reaction mechanisms 12 h

Thermodynamic and kinetic requirements of reactions: Types of mechanism - Thermodynamic and kinetic control - Methods of determination of reaction mechanisms - Product analysis - Determination of the presence of intermediate - Isolation - Detection - Trapping - Cross over experiments - Isotopic labeling - Isotopic effect - Kinetic evidence.

Kinetic methods of determination of reaction mechanisms: Curtin-Hammett principle - Hammett equation - Significance of substitution and reaction constant - Hammond postulates - Limitations and deviations - Taft equation

Unit III Aliphatic and aromatic nucleophilic substitution reactions 12 h

SN1, SN2, SNi and neighbouring group participations - Kinetics - Effects of structure, solvent, leaving and entering group, Stereochemistry. Claisen and Dieckmann condensation - Williamson reactions. Mechanisms of aromatic nucleophilic substitution - SNAr and benzyne mechanism - Chichibabin reaction - Cine substitution - Diazonium group as leaving group.

Unit IV Aliphatic and aromatic electrophilic substitution reactions 12 h

SE1 and SE2 reactions - mechanisms and reactivity - keto-enol tautomerism - halogenation of carbonyl compounds - Stork enamine reactions - Aromatic electrophilic substitution - Orientation and mechanisms - Nitration - Halogenation and sulphonation - Friedel-Crafts alkylation - Friedel Crafts arylation (Scholl reaction) and acylation - Vilsmeier- Haack reaction - Gattermann reaction and Bischler - Napieralski reaction



Unit V Addition and elimination reactions

12 h

Addition to C-C and C-O multiple bonds - Electrophilic - Nucleophilic and free-radical additions - Orientation - Birch reduction - Michael addition - Diels-Alder reactions - Meerwein-Ponndorf reduction - Stobbe condensation.

Elimination reactions - E1 and E2 mechanisms - Orientations - Hofmann and Saytzeff rules - Elimination versus substitution - Chugaev reaction - Hofmann degradation and Cope elimination - Mechanisms and orientation in pyrolytic elimination.

Text Books

- 1 Michael B. Smith, 2015, "March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure", 7th Edition, Willey, USA.
- 2 Morrison R.N. Boyd R.N. and Bhattacharjee, 2010, "Organic Chemistry". 7th Edition, Pearson Education, UK.

References

- 1 Bansal R.K., 2012, "Organic Chemistry Reaction mechanisms." New Age International Private Ltd, New Delhi.
- 2 Lowry and Richardson, 1997, "Mechanism and theory in organic chemistry", 3rd Edition. Pearson Publishers, UK.
- 3 Mukherji and Singh S. P, 1984, "Reactions mechanisms in organic chemistry". 3rd Edition. Macmillan Publishers, USA.
- 4 Clayden J, Greeves N and Warren S, 2014, "Organic Chemistry" 2nd Edition. Oxford University Press, UK.
- 5 Ahluwalia. V.H and Parashar. R.K," Organic Reactions and Mechanisms", 4th Edition, Narosa Publishing House, New Delhi.



Course Code	Course Name	Category	L	T	P	Credit
222CE2A1CB	COORDINATION CHEMISTRY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- About the various theories, reaction mechanism and geometries of coordination complexes.
- The structure and bonding of coordination compounds.
- The basics of electronic spectroscopy and magnetism of transition metal complexes.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Interpret the various theories of coordination compounds, distortion and constructing MO diagrams of complexes.	K3
CO2	Outline the various types of reaction mechanism of coordination complexes.	K3
CO3	Compare the various symmetries/geometries of coordination complexes.	K3
CO4	Examine the structure and bonding of metal carbonyls	K4
CO5	Analyze the importance of electronic spectroscopy using energy level diagram	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2		✓	✓		
CO3	✓	✓		✓	✓
CO4			✓	✓	
CO5	✓	✓			✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A1CB	COORDINATION CHEMISTRY	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Theories of coordination compounds 12 h

VB and CFT theory- Splitting of d orbitals in ligand fields and different symmetries - CFSE - Factors affecting the magnitude of $10 Dq$ - Evidence for crystal field stabilization - Spectrochemical series - Site selection in spinels - Tetragonal distortion from octahedral symmetry - Jahn-Teller distortion - Nephelauxetic effect - MO theory - Octahedral - Tetrahedral and square planar complexes - pi bonding and molecular orbital theory.

Unit II Reaction mechanism in coordination complexes 12 h

Theories of trans effect - The rate law for nucleophilic substitution reaction and mechanism of square planar complexes - Kinetics and substitution reaction mechanism of octahedral complexes. Ligand field effects and reaction rates - Reaction rates influenced by acid and bases - Racemization and isomerization - mechanisms of redox reactions - Outer sphere mechanism - Excited state outer sphere electron transfer reactions - Inner sphere mechanism.

Unit III Structure of coordination complexes 12 h

Complexes with coordination number two, three, four, five six, seven and eight. Site preference in trigonal bipyramidal and square pyramidal complexes - Isomerism in five coordinate complexes - Distortion from perfect octahedral symmetry - Trigonal prism - Geometrical isomerism in octahedral complexes

Unit IV Structure and bonding in metal carbonyls 12 h

Metal carbonyl complexes -Classification- synthesis - Structure and properties - 18 electron and EAN rule - Nature of M-CO bonding - Binding mode of CO and IR spectra of metal carbonyls - Metal carbonyl hydrides -Metal nitrosyl complexes

Unit V Electronic spectra and magnetism 12 h

Microstates, terms and energy levels for $d1 - d9$ ions in cubic and square fields - Selection rules - Band intensities and band widths - Energy level diagrams of Orgel and Tanabe - Sugano - spectra of V^{3+} , Ni^{2+} , Cr^{3+} , Co^{2+} , and Fe^{2+} - Calculation of $10Dq$ and magnetic moment for V^{3+} (oct) and Ni^{2+} (oct) complexes - Charge transfer spectra - Change in magnetic properties of complexes in terms of spin orbit



coupling - Temperature independent paramagnetism.

Text Books

- 1 Huheey. J.E, Keiter. E.A and Keiter. R.L, 2006, "Inorganic Chemistry, Principles of Structure and Reactivity", 4th Edition, Pearson Education, UK
- 2 Cotton. F.A, Wilkinson. G, Murillo. C.A and Bochmann. M, 1999, "Advanced Inorganic Chemistry", 6th Edition, A Wiley - Interscience Publications, John Wiley and Sons, USA

References

- 1 Gopalan. R, Ramalingam. V, 2001, "Concise Coordination Chemistry", 3rd Edition, Vikas Publishing house pvt. Ltd, New Dehli
- 2 Shriver. D. F, Weller. M.T, Overton. T, Rourke. J and Armstrong. F.A, 2014, "Inorganic Chemistry", 6th Edition, New York, W.H. Freeman and Company , USA
- 3 Gurdeep Raj, 2014, "Advanced Inorganic Chemistry", 12th Edition, Geol Publishing House, New Delhi
- 4 Lewis. J and Wilkins. R.G, 1967, "Modern Coordination Chemistry", Inter Science Publisher, New Delhi



Course Code	Course Name	Category	L	T	P	Credit
222CE2A1CC	THERMODYNAMICS AND KINETICS	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The Fundamentals of equilibrium and non- equilibrium thermodynamics
- The adequate knowledge in chemical equilibrium and catalysis
- The application oriented knowledge about electrochemistry

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Analyze the concepts of equilibrium thermodynamics	K4
CO2	Understand the concepts of non-equilibrium thermodynamics	K3
CO3	Analyze the concepts and functions involved in the electrochemical reactions.	K4
CO4	Interpret the knowledge about chemical kinetics in molecular reactions.	K5
CO5	Apply concept involved in catalysis and adsorption for various applications	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2		✓			✓
CO3	✓	✓		✓	
CO4			✓		
CO5	✓	✓			✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics

222CE2A1CC	THERMODYNAMICS AND KINETICS	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Equilibrium thermodynamics 12 h

Gibbs - Helmholtz equation-Maxwell relations - Genesis of third law and its limitations - Thermodynamics of systems of variable compositions - partial molar quantities and their determination - Chemical potential - Gibbs-Duhem equation - Gibbs-Duhem-Margules equation - Fugacity - Determination of fugacity of gases by graphical method and from equations of state - Variation of fugacity with temperature - Fugacity (or activity) coefficient

Unit II Non-equilibrium thermodynamics 12 h

Phenomenological laws and Onsager Reciprocal relations - Conservation of mass and energy in closed and open system- Entropy production in heat flow and chemical reactions - Entropy production and entropy flow in open systems - Principles of microscopic reversibility - Onsager's theory - Validity and its verification.

Unit III Electrochemistry 12 h

Activity - Mean ion activity and mean activity coefficient of electrolytes in solution - Debye-Hückel theory and limiting law - Debye-Hückel-Onsager equation - verification and limitations. The electrical double layer - Structure and models (Helmholtz, Guoy-Chapman and Stern) - Kinetics of electrode processes - Current-potential curve - Butler Volmer relation and its approximations - Tafel equation - Charge transfer resistance

Unit IV Chemical kinetics-I 12 h

Theories of reaction rates - Collision - transition State - Lindemann - Hinshelwood, Rice - Ramsperger-Kassel theory (RRK), Rice-Ramsperger-Kassel-Marcus (RRKM) theory - Slater treatments - Fast reaction kinetics - Stopped flow method - Chemical relaxation method.

Unit V Chemical kinetics-II 12 h

Homogenous catalysis - Hammett acid-base catalysis - Acidity function. Enzyme catalysis - Michaelis - Menton kinetics - Lineweaver Burk plot - Influence of pH and temperature on enzyme catalysis.



Heterogeneous catalysts - Adsorption and free energy relation at interfaces - Gibbs adsorption isotherm - Adsorption isotherms (Langmuir and BET) - Measurement of surface area - Kinetics of heterogeneous catalysis (Langmuir Hinshelwood mechanism and Eley-Rideal mechanism)

Text Books

- 1 Glasstone. S, 2008, "Thermodynamics for Chemists", 11th Edition, Ewp Publishers, USA.
- 2 Atkins. P and Julio de Paula, 2014, "Physical Chemistry" 10th Edition, Oxford University Press, UK.

References

- 1 Grow. D.R, 1994, "Principles and applications of electrochemistry", 4th Edition, CRC Press publishers, UK.
- 2 Laidler. K.J, 2003, "Chemical Kinetics", 3rd Edition. Pearson Education Publishers, India.
- 3 Adamson. A.W, 1982, "Physical chemistry Surfaces", 4th Edition, Wiley-Blackwell, USA.
- 4 Bockris. J.O.M and Reddy A. K. N, 1998, "Modern Electrochemistry", Plenum Press, USA.



Course Code	Course Name	Category	L	T	P	Credit
222CE2A1CD	ANALYTICAL TECHNIQUES	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The nature of errors and their types.
- The various techniques involved in chromatography.
- The principles and instrumentation of thermoanalytical, Radiochemical, Fluorescence and electroanalytical techniques.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify the nature of errors and their analysis.	K3
CO2	Apply the various methods of chromatographic techniques in purification process.	K3
CO3	Examine the basis involved in Spectrophotometry, XRD and Fluorescence Spectroscopy.	K4
CO4	Explain the basic analysis of Thermal methods of analysis.	K4
CO5	Analyze the various electroanalytical techniques.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2		✓	✓		
CO3	✓	✓		✓	✓
CO4			✓		
CO5	✓	✓			✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A1CD	ANALYTICAL TECHNIQUES	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Data and error analysis 12 h

Types of errors (accuracy, precision, significant figures) - Frequency distributions (Binomial, Poisson and normal). Describing data - Population and sample, mean, variance and standard deviation. Way of quoting uncertainty - Robust estimators - Repeatability and reproducibility of measurements. Hypothesis testing - Levels of confidence and significance. Analysis of residuals.

Unit II Chromatography 12 h

Principles, instrumentation and uses of ion exchange - Paper - Thin-layer and column chromatography - HPTLC(High Performance Thin Layer Chromatography) - HPLC (High Performance Liquid Chromatography) - GC-MS (Gas Chromatography - Mass Spectroscopy) - GC-FID (Gas Chromatography- Field Ionization Detector), GC-ECD (Gas Chromatography - Electron Capture Detector) and GC-PFPD (Gas Chromatography - Pulsed Flame Photometric Detector).

Unit III Spectrophotometry, XRD and fluorescence spectroscopy 12 h

Principles, instrumentation and applications of Atomic Absorption Spectrophotometry (AAS) - Flame Emission Spectroscopy (FES) and Inductively Coupled Plasma - Atomic Spectroscopy (ICP-AES) - Single crystal and powder XRD (X-ray diffraction) - Fluorescence spectroscopy.

Unit IV Thermal methods of analysis 12 h

Principles, instrumentations and applications of thermogravimetry analysis (TGA), Differential Thermal Analysis (DTA) - TGA and DTA of $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$ (Calcium oxalate monohydrate), CaCO_3 (Calcium carbonate) and Differential Scanning Calorimetry (DSC) - PLA (poly lactic acid).

Unit V Electroanalytical techniques 12 h

Electrochemical sensors - Ion-sensitive electrodes - Glass - membrane, solid - liquid membrane - Gas sensor. Principles and instrumentations of polarography - Cyclic voltammetry and Amperometric titrations.



Text Books

- 1 Skoog and West, 2014, "Instrumental methods of analysis" 6th Edition, Cengage Publishers, USA.
- 2 Sharma B.K, 2011, "Instrumental methods of chemical analysis", 1st Edition, Krishna Prakashan Media pvt. Ltd, New Delhi.

References

- 1 Willard H.W, Merrit. L.I, Dean. J.J.A and Settle. F.A, 2004, "Instrumental methods of analysis". 7th edition, CBS Publishers, New Delhi.
- 2 Srivastava.V.K and Srivastava. K.K, 1985, "Introduction to Chromatography" 2nd Edition, Holden Day, New York.
- 3 Hibbert. D.B and Gooding. J.J, 2006, "Data Analysis for Chemistry", 1st Edition, Oxford University Press, UK.
- 4 Bard. A. J and Faulkner. L. R, 2001, "Electrochemical Methods-Fundamentals and Applications", 2nd Edition, John Wiley & Sons, USA.



222CE2A1CP	ORGANIC CHEMISTRY	SEMESTER I
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Total Credits: 3
Total Instructions Hours: 72 h

S.No	Contents
1	Analysis of two component mixtures - separation and characterization of the components - I
2	Analysis of two component mixtures - separation and characterization of the components - II
3	Analysis of two component mixtures - separation and characterization of the components - III
4	Analysis of two component mixtures - separation and characterization of the components - IV.
5	Analysis of two component mixtures - separation and characterization of the components - V.
6	Estimation of phenol.
7	Estimation of Aniline
8	Estimation of Glucose
9	Preparation of Acetylsalicylic acid from methyl salicylate
10	Preparation of Benzilic acid from benzoin (rearrangement).
11	Preparation of Benzanilide from benzophenone (rearrangement)
12	Preparation of p-Bromoacetanilide from aniline

Note: Out of 12 – 10 Mandatory



References

- 1 Gnanaprakasam. N.S and Ramamurthy. G, 1998, "Organic Chemistry - Lab Manual", S. Viswanathan Co.Pvt. Ltd & Chennai .
- 2 Furniss. B.S, Brian. S, Hannaford. A.J and Antony. J, 2016, "Vogel's Text book of Practical Organic Chemistry", 5th Edition, ELBS/ Longman, UK.
- 3 Mann. F.G, Saunders, 2011, "Practical Organic Chemistry", 4th Edition, Pearson & India.
- 4 Ahluwalia. V.K, Bhagat. P and Agarwal. R, 2005, "Laboratory Techniques in Organic Chemistry", I. K. International Publishing House Pvt. Ltd & New Delhi.



Course Code	Course Name	Category	L	T	P	Credit
222CE2A1DA	ADVANCED POLYMER SCIENCE AND TECHNOLOGY	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The significance of Polymers
- Polymer structure, properties and characteristics
- Polymer processing techniques and its applications

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Summarize the Mechanism of polymerization process. Illustrate the difference between polymers and plastics	K2
CO2	Categorize the different polymerization techniques	K4
CO3	Analyze the various characteristics of polymers using physical and chemical methods	K4
CO4	Examine the structure, properties and fabrication techniques	K4
CO5	Summarize the functionalities of commercial polymers and polymer additives	K2

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		✓	✓	✓	✓
CO2		✓			
CO3	✓	✓		✓	
CO4			✓		
CO5	✓	✓		✓	✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics

Dr.NGPASC
COIMBATORE | INDIA

M.Sc.-Chemistry (Students admitted during the AY 2022-23)



222CE2A1DA	ADVANCED POLYMER SCIENCE AND TECHNOLOGY	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Chemistry of polymers 10 h

Types (Addition, Condensation) - Mechanism (free radical, ionic, coordination Ziegler-Natta polymerization) - Kinetics of polymerization - Kinetic chain length - Factors affecting chain polymerization - Inhibition and retardation - Carother's equation. Difference between polymers and plastics. Compounding of plastics - Fillers, plasticizers, colourants, auto oxidants, fire retardants and thermal stabilizers.

Unit II Polymerization techniques and types 10 h

Polymerization Techniques (bulk, solution, suspension, emulsion, melt, interfacial solid-gas phase condensation). Types of copolymerization - Free radical - Ionic - Polycondensation - Copolymer equation - Significance - Monomer and radical reactivity - Q-e scheme - Determination of monomer reactivity ratio - Mayo-Lewis and Fineman Ross methods - Block and graft copolymerization - Methods of preparation and mechanism.

Unit III Polymer characteristics and characterization 10 h

Types of degradation - thermal, mechanical and photodegradations. The concept of number average and weight average molecular weight methods. Separation of polymers - Precipitation and analytical methods - Determination of molecular weights - Osmotic pressure - Viscosity - Ultra centrifugation. Analysis and testing of polymers - Spectroscopic methods, x-ray diffraction study.

Unit IV Polymer properties and fabrication 10 h

Morphology and order in crystalline polymers - Configurations of polymer chain - Tacticity (Mono and disubstitute polyethylene, polypropylene, polybutadiene). Significance of stereoregularity. Polymer structure and physical properties - Crystalline melting point (T_m) - Melting points of homogeneous series - Effect of chain flexibility and heat of fusion. The glass transition temperature (T_g) - Relationship between T_m and T_g . Fabrications of polymers - Moulding, casting and spinning.

Unit V Commercial polymers and applications 8 h



Preparation, properties and applications of polyethylene, polyvinyl chloride, polyamides, polyesters, polymethylmethacrylate, polystyrene, polycarbonates, phenolic resins and epoxy resins. Types and applications of dendrimers and conducting polymers. Liquid crystalline polymer.

Text Books

- 1 Gowariker. V.R and Viswanathan. N.V, 2019, "Polymer science", 3rd Edition, New Age International Publishers, New Delhi.
- 2 Billmeyer. F.W, 2007, "Text book of Polymer science", 3rd Edition, Wiley India Pvt. Ltd, New Delhi.

References

- 1 Manas Chanda, 2013, "Introduction to Polymer Science and Chemistry", 2nd Edition, CRC Press, USA.
- 2 Goel R. Fried, 2003, "Polymer science and technology", 2nd Edition, Prentice Hall, New Jersey.
- 3 George Odian, 2007, "Principles of polymerization", 4th Edition, Wiley India Pvt. Ltd, New Delhi.
- 4 Ghosh. P, 2017, "Polymer Science and Technology: Plastics, Rubber, Blends and Composites", 3rd Edition, McGraw Hill Education, New Delhi.

Course Code	Course Name	Category	L	T	P	Credit
222CE2A1DB	INORGANIC MATERIALS FOR INDUSTRIAL APPLICATIONS	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The properties, manufacture of glass products
- The coating techniques
- The classification and properties of alloys

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Summarize the properties and preparation of glass products	K3
CO2	Analyse the coating process of paint and pigments	K3
CO3	Illustrate the various types and properties of alloying materials	K2
CO4	Utilize the types and manufacturing process of fertilizer	K2
CO5	Compare the various types and manufacturing process of cement and ceramics	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2		✓			
CO3	✓	✓		✓	✓
CO4			✓		
CO5	✓	✓			✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A1DB	INORGANIC MATERIALS FOR INDUSTRIAL APPLICATIONS	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Silicon industries 10 h

Glass: Glassy state and its properties, classification (silicate and non-silicate glasses). Manufacture and processing of glass. Composition and properties of the following types of glasses: Soda lime - Lead - Armoured - Safety - Borosilicate - Fluorosilicate - Coloured - Photosensitive. Chemistry of refractories and Abrasives

Unit II Surface coatings 10 h

Objectives of coatings surfaces - Preliminary treatment of surface - Classification of surface coatings. Paints and pigments - Formulation and composition - Oil paint, Vehicle, Pigments, toners and lakes pigments, Fillers, Thinners, Enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint). Wax polishing-Water and Oil paints - Additives. Metallic coatings (electrolytic and electroless). Metal spraying and anodizing

Unit III Alloys 10 h

Classification of alloys (ferrous and non-ferrous) -Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization and dephosphorisation, Surface treatment, argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels

Unit IV Fertilizer 10 h

Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, polyphosphate, superphosphate, and triple super phosphate. Compound and mixed fertilizers - Potassium chloride - Potassium sulphate.

Unit V Ceramics and cements 8 h

Ceramics: clays and feldspar-Manufacture of ceramics and their types - High technology ceramics and their applications. Superconducting and semiconducting oxides - Fullerenes - Carbon nanotubes and carbon fibre. Cements: Classification of cement - Ingredients and their role - Manufacture of cement and the setting process



- Quick setting cements

Text Books

- 1 Jain and Jain. 2017. Engineering Chemistry, 17th Edition. Dhanpat Rai & Sons, New Delhi.
- 2 B. K. Sharma. 2003. Reprint, Industrial Chemistry. 22nd edition. Goel Publishing House, Meerut.

References

- 1 White. H.L, 1986, "Introduction to Industrial Chemistry", 1st Edition, A Wiley Interscience Publication, USA.
- 2 Pawar. R.A, Gugale. G.S, Nagawade. A.V, Gadave. K.M, 2017, "A Book of Industrial Chemistry", 1st Edition, Nirali Prakashan Publishers & Pune.
- 3 Alan Heaton, 1996, "An Introduction to Industrial chemistry", 3rd Edition, Chapman & Hall Publishers, UK.
- 4 Uppal. M.M, 2001, "Textbook of Engineering Chemistry", 6th Edition, Khanna Publishers, New Delhi.



Course Code	Course Name	Category	L	T	P	Credit
222CE2A1DC	GREEN ORGANIC SYNTHESIS	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basics of Green chemistry
- An idea about green chemistry and its limitations
- The reactions and applications of green chemistry

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gain knowledge on green chemistry principles.	K3
CO2	To understand the few methods of Green synthesis.	K3
CO3	To develop the basic knowledge of the various green reactions.	K3
CO4	To compare Aqueous phase, Solid state and PTC reactions.	K3
CO5	Analyze the Photochemical, Microwave, Sonication and Ionic liquid reactions.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓			✓	✓
CO2		✓	✓		
CO3	✓	✓		✓	✓
CO4	✓		✓		✓
CO5	✓	✓			✓

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A1DC	GREEN ORGANIC SYNTHESIS	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Principles of green chemistry 10 h

Twelve principles of green chemistry - Explanation. Planning a green synthesis - Percentage atom utilization - Evaluating type of reaction involved - Selection of appropriate solvent - Reagent - protecting groups - use of catalyst - energy requirement.

Unit II Green synthesis 10 h

Adipic acid, catechol, disodiumiminodiacetate, Hoffmann elimination, Benzoic acid from methyl benzoate and toluene - Diels-Alder reaction- Decarboxylation - Safe marine antifoulant

Unit III Green reactions 8 h

Mechanism and application of Acyloin condensation - Aldol condensation - Arndt-Eistert-synthesis - Baeyer-Villiger oxidation - BakerVenkatraman Rearrangement- Barbier reaction - Barton reaction - Baylis-Hillman Reaction - Backmann rearrangement - Benzil-Benzilic rearrangement - Biginelli reaction.

Unit IV Aqueous phase, solid state and PTC reactions 10 h

Aqueous phase reaction - Hydolysis of methyl salicylate - Chalcone - p-ethoxy aetanilide- p-acetamido phenol - Vanillidene acetone. SFE (Super Critical Fluid Extraction) - Liquid CO₂ in green synthesis. Solid state - Diphenyl carbinol - Phenyl benzoate - azomethines. PTC(Phase Transfer Catalyst) reaction - phenylisocyanide - Diphenyl-7-Hydroxy-coumarin

Unit V Photochemical, microwave, sonication and ionic liquid reactions 10 h

Photochemical reactions - Benzopinacol, trans Azobenzene to cis-azobenzene, trans stilbene to cis-stilbene. Microwave reactions-3-methyl-1-phenyl-5-pyrazolone, copper phthalocyanine. Sonication reaction - Butyraldehyde, 2-chloro-N-Aryl anthranilic acid. Ionic liquid reactions-1-Acetyl naphthalene-Ethyl-4-methyl-3-Cyclohexene carboxylate.



Text Books

- 1 Ahluwalia. V. K. 2011, Green Chemistry-Greener Alternatives to synthetic alternatives to synthetic organic transformations, 1st Edition, Narora Publishing House, New Delhi.
- 2 Ahluwalia V. K, 2019, "Green Chemistry", 3rd Edition, Ane Books India, New Delhi.

References

- 1 Asim. K. Das and Madhua. Das, 2012, Environmental Chemistry with Green Chemistry, Books and Allied Pvt. Ltd, New Delhi.
- 2 Rashmi S, Srivastava M.M, 2009. "Green Chemistry" Fourth Reprint, Narosa Publishing House, New Delhi.
- 3 Indu Tucker Sidhwani, Rakesh K. Sharma, 2020, An Introductory Text on Green Chemistry: For Undergraduate Students, 1st Edition, Wiley & Sons Germany.
- 4 Kumar V, 2010, "An Introduction to Green Chemistry", Vishal Publishing Co, New Delhi.



Course Code	Course Name	Category	L	T	P	Credit
222CE2A2CA	STEREOCHEMISTRY AND PERICYCLIC REACTIONS	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic principles of stereochemistry and conformational analysis of organic compounds.
- The concepts of Photochemistry and Pericyclic reaction mechanisms
- The Mechanism of various molecular rearrangement reactions

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Inspect the stereochemistry of organic molecules in 3-D arrangements	K4
CO2	Categorize the various methods of conformational analysis of organic molecules	K4
CO3	Interpret the various light induced photo reactions and their rearrangements	K5
CO4	Examine the basic principles involved in the pericyclic reactions	K4
CO5	Analyze the reaction mechanism of various molecular rearrangement reactions	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓			✓
CO3	✓	✓	✓	✓	
CO4	✓	✓	✓		
CO5	✓	✓		✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A2CA	STEREOCHEMISTRY AND PERICYCLIC REACTIONS	SEMESTER II
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Stereochemistry 12 h

Stereoisomerism – Symmetry – Enantiomers and diastereomers – R and S / E and Z nomenclature. Topicity – Homotopic, heterotopic enantiotopic and diastereotopic systems. Stereochemistry of biphenyls, allenes, spiranes, Ansa compounds and helical structures. Cram's and Prelog's rules.

Unit II Conformational Analysis 12 h

Conformational Analysis of acyclic system: Conformations of ethane, butane and halogenoalkanes - Addition and elimination reaction of acyclic systems. Conformational Analysis of Cyclic Compounds: Cyclohexane - Mono and disubstituted cyclohexane. Conformation of cyclohexane derivatives and decalins.

Unit III Organic photochemistry 12 h

Fundamental concepts – Jablonski diagram – Photoreduction, photooxidation and photosensitization. Photoreactions of ketones and enones – Norrish Type I and II reactions – Paterno-Büchi reaction – Photo-Fries rearrangement – Photochemistry of alkenes, dienes and aromatic compounds – Di- π -methane rearrangement- Barton reaction.

Unit IV Pericyclic reactions 12 h

Concerted reactions: Conservation of orbital symmetry – Woodward-Hoffman rules. Electrocyclic reactions – 1, 3-dienes and 1, 3, 5-trienes. Analysis of reaction using orbital correlation diagram and FMO methods. Cycloadditions [2+2] and [4+2] – Analysis using correlation diagram and FMO methods. Sigmatropic rearrangements – Cope and Claisen rearrangements.

Unit V Molecular rearrangements 12 h

Classification – Mechanism and applications of Wagner - Meerwein, Neber, Baeyer-Villiger, Dienone phenol, Favorski, Benzidine, Stevens, Schmidt rearrangements.



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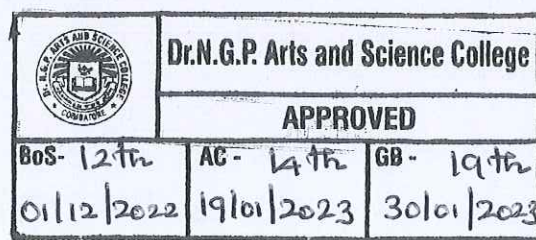
*M.Sc. Chemistry (Students admitted during the AY 2022-23)**M.Sc. Chemistry (Students admitted during the AY 2022-23)*

Text Books

- 1 Nasipuri. D, 2018, "Stereochemistry of Organic Compounds: Principles and Applications", 3rd Edition, New Age International Publishers, Delhi
- 2 Bochmann. M, 1994, "Organometallics II: Complexes with transition metal-carbon p-bonds", 1st Edition, Oxford science publications & UK

References

- 1 Michael B Smith. B, 2015, "March's Advanced Organic Chemistry: Reactions Mechanisms and Structure", 7th Edition, Wiley, Delhi
- 2 Kalsi. P.S, 2015, "Stereochemistry: Conformation and Mechanism", 10th Edition, New Age International Private Limited, Delhi
- 3 Depuy. C.H, 1972, "Molecular Reactions and Photochemistry", 1st Edition, Prentice Hall, Delhi.
- 4 Turro. N. J, 2010, "Modern Molecular Photochemistry of Organic Molecules", 10th Edition, University Science Books, United States.
- 5 <https://nptel.ac.in/courses/104106127>
- 6 <https://nptel.ac.in/courses/104106077>



Course Code	Course Name	Category	L	T	P	Credit
222CE2A2CB	BIO-INORGANIC AND ORGANOMETALLIC CHEMISTRY	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The structure and bonding of Cobalamines, Heme and Non Proteins Hemoglobin.
- The structure and reactions of Metal - alkylidene - alkene - alkyne complexes
- The importance of trace elements in biological systems, medicinal applications of bioinorganic compounds

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain the broad idea about the Cobalamines, Heme and Non Proteins Hemoglobin	K4
CO2	Analyze the synthesis and reactivity of Metalalkylidene/alkene/alkyne complexes	K4
CO3	Evaluate the synthesis and applications of metallocene compounds	K5
CO4	Identify the toxic and non-toxic metal ions to the biological systems	K3
CO5	Interpret the role of inorganic complexes in medicinal applications	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓	✓	✓		✓
CO3	✓	✓		✓	
CO4	✓	✓	✓		
CO5	✓	✓	✓	✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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222CE2A2CB	BIO-INORGANIC AND ORGANOMETALLIC CHEMISTRY	SEMESTER II
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Cobalamines, Heme and Non Proteins Hemoglobin 10 h

Reactions of the alkyl cobalamins- One-electron Reduction and Oxidation - Co-C Bond Cleavage - coenzyme B12 - Alkylation reactions of methylcobalamin. Hemoglobin and Myoglobin -Blue copper proteins- Oxygen transport and storage - Electron transfer and Oxygen activation. Cytochromes, Ferredoxins and Rubredoxins - Model systems, mononuclear non-heme iron enzymes.

Unit II Metal-alkylidene/alkene/alkyne complexes 10 h

Synthesis of alkylidene complexes in low oxidation states and in high oxidation states. Alkene complexes - Synthesis - Bonding - Reactivity - Ligand substitution - Reactions with nucleophiles. Alkyne complexes - Synthesis by reduction method. Insertion reactions - Cobalt catalyzed alkyne cycloaddition with nitrile, alkene and alkyne.

Unit III Metallocenes 10 h

Cyclopentadienyl complexes - Metallocenes - Synthesis of metallocenes - Reactions of metallocenes -Redox and substitution reactions of ferrocene - Application of ferrocenes - Blood glucose sensors - Synthesis of bent metallocene complexes - Substitution, bonding and structure of arene complexes

Unit IV Metal ions in Biological System 10 h

Classification of elements according to their action in biological systems, Na & K ion transport, Na / K pump. Consequences of excess and deficiency of trace metals. Toxicity of metal ions (Hg, Pb, Cd and As) - reasons for toxicity. Use of chelating agents in medicine - Cis platin mode of action.

Unit V Nitrogen Fixation and Photosynthesis 8 h

Nitrogenase enzyme: Introduction, types of nitrogen fixing microorganisms, metal clusters in nitrogenase. Nitrogen fixation pathway. Biological redox reactions. Chlorophyll - Light and dark phase reactions of photosynthesis.




Text Books

- 1 Asim K Das, 2013. "Bioinorganic chemistry" 5th Edition, Books & Allied Pvt Ltd, Kolkatta.
- 2 Bochmann. M, 1994, "Organometallics II: Complexes with transition metal-carbon p-bonds", 1st Edition, Oxford science publications & UK

References

- 1 Hussain Reddy, K. 2007, "Bioinorganic Chemistry", 1st Edition, New Age Internation (P) limited, New Delhi.
- 2 Collman. J. P, 1987, "Principles and Applications of Organotransition Metal Chemistry", 1st Edition, Macmillan Publishers & USA
- 3 Crabtree. R.H, 2019, "The Organometallic Chemistry of Transition Metals", 7th Edition, Wiley-VCH & Germany
- 4 Rosette M Roat-Malone, 2007, "Bioinorganic chemistry - A short course", 2nd Edition, A John Wiley & Sons Inc. Publication, USA
- 5 Stephen J Lippard, 2005, "Principles of Bioinorganic Chemistry", 2nd Edition, Panima publishing corporation, New Delhi
- 6 <https://nptel.ac.in/courses/104104109>
- 7 https://onlinecourses.nptel.ac.in/noc20_cy12

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01/12/2022		19/01/2023		30/01/2023	



Course Code	Course Name	Category	L	T	P	Credit
222CE2A2CC	MOLECULAR SPECTROSCOPY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The principle and mechanism of different types of molecular spectroscopy.
- The applications of various spectroscopic techniques.
- The characterization techniques to resolve structure of molecules.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Construct the fundamental concepts of microwave and Raman spectroscopy.	K3
CO2	Apply intense knowledge about the basic principles instrumentation of IR spectroscopy and electronic spectroscopy.	K3
CO3	Inspect the basic principles of NMR spectroscopy.	K4
CO4	Examine the Mossbauer Spectroscopy	K4
CO5	Conclude the basic principles involved in ESR spectroscopy	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓		✓	✓
CO4	✓		✓	✓	
CO5	✓	✓	✓		✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A2CC	MOLECULAR SPECTROSCOPY	SEMESTER II
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Microwave Spectroscopy 12 h

Electromagnetic radiation - Interaction of electromagnetic radiation with molecules - Types of molecular spectroscopy - Microwave Spectroscopy - Rotation of molecules - Rotational spectra of rigid rotator, intensities of rotational lines, effect of isotopic substitution - Rotational spectrum of non-rigid rotator - Linear & symmetric top molecules - Stark effect. Applications of microwave spectroscopy - Determination of bond length, bond angle dipole moment and atomic mass from microwave spectra.

Unit II Electronic and Infrared spectroscopy 12 h

Electronic Spectra of diatomic molecules - Frank Condon principle- vertical transitions- Selection rules- parity, symmetry and spin selection rules - Polarization of transitions- Russell Sanders coupling - Different types of electronic transitions- UV-Vis instrumentation.

Infrared Spectroscopy: vibrating diatomic molecule - harmonic and anharmonic oscillators - Fermi resonance - selection rules - diatomic vibrating rotator - vibrations of polyatomic molecules - molecular vibrations, types of molecular vibrations - Factors influencing vibrational frequencies - Fourier transformation in IR spectroscopy- Instrumentation-Applications.

Unit III NMR Spectroscopy-I 12 h

¹H NMR Spectroscopy - Multiplicity - Coupling constant - First order and second order proton, Spin-spin splitting - Dependence of J on dihedral angle - Vicinal and geminal coupling constants - Karplus equation - Long range coupling constants - Factors influencing coupling constant, splitting of nmr signals- AB, AX and AMX types - Influence of stereochemical factors on chemical shift of protons. ¹³C nucleus, chemical shifts, spin -spin splitting, double resonance techniques - homonuclear and hetero nuclear decoupling, broad band decoupling, off resonance decoupling

Unit IV Mossbauer Spectroscopy 12 h

Principle-Recoil-free emission and absorption-Instrumentation-Nuclear



Quadrupole interaction-Zeeman splitting- Mossbauer nuclides- Mossbauer effect- Doppler velocity shift-Doppler effect-Effect of Magnetic field and applications.

Unit V ESR Spectroscopy 12 h

Theory of ESR- Instrumentation - Presentation of the spectrum-EPR spectrum of hydrogen and methyl radicals (first order treatment) - g factors-Deviation of the value of g - Hyperfine splitting: nuclear spin interaction with electron spin - hyperfine coupling constants - spin densities and McConnell relationship - zero-field splitting and Kramers degeneracy - applications of EPR.

Text Books

- 1 Pavia. D.L, 2011, "Spectroscopy", 5th Edition, Brooks/Cole Publications & UK
- 2 Gurdeep R Chatwal. M.S, 2014, "Instrumental methods of chemical analysis", 5th Edition, Himalya publishing House & Mumbai..

References

- 1 Drago. R.S, 1978, "Physical methods in Inorganic Chemistry", 1st Edition, East west Pvt.Ltd & New Delhi.
- 2 Kalsi. P.S, 2014, "Spectroscopy of Organic Compounds", 6th Edition, New Age International (P) Ltd & New Delhi.
- 3 Silverstein. R.M, 2009, "Spectrometric Identification of Organic compounds", 6th Edition, John Wiley Publications & Germany
- 4 William Kemp, 2008, "Organic Spectroscopy", 3rd Edition, Palgrave Publications & USA.
- 5 Sharma. Y.R, 2013, "Elementary Organic Spectroscopy", 5th Edition, S. Chand and Company Pvt Ltd & New Delhi.
- 6 <https://nptel.ac.in/courses/104101099>
- 7 <https://nptel.ac.in/courses/104106122>



222CE2A2CP	CORE PRACTICAL: INORGANIC CHEMISTRY	SEMESTER II
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Total Credits: 4

Total Instructions Hours: 72 h

S.No	Contents
1	Semi micro qualitative Analysis of mixtures containing two common and two less common cations Mixture - I
2	Semi micro qualitative Analysis of mixtures containing two common and two less common cations Mixture - II
3	Semi micro qualitative Analysis of mixtures containing two common and two less common cations Mixture - III
4	Semi micro qualitative Analysis of mixtures containing two common and two less common cations Mixture - IV
5	Analysis involving Volumetric and gravimetric estimations of Cu and Ni
6	Analysis involving Volumetric and gravimetric estimations of Zn and Cu
7	Analysis involving Volumetric and gravimetric estimations of Fe and Zn
8	Complexometric titrations -Estimation of calcium
9	Complexometric titrations -Estimation of magnesium
10	Complexometric titrations -Estimation of zinc
11	Colorimetric estimation of iron using photoelectric colorimeter
12	Colorimetric estimation of copper using photoelectric colorimeter

Note: Any 10 Experiments



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References

- 1 Venkateswaran. V, Veeraswamy. R and Kulandaivelu. A.R, 2017, "Principles of Practical Chemistry", 1st Edition, S. Chand & Sons & New Delhi.
- 2 Giri. S, Bajpai. D.N and Panday. O.P, 2013, "Practical Chemistry Vol. I & II", 30th Edition, S. Chand & Company & New Delhi.
- 3 Bassart. J, Denny. R.C, Jeffery. G.H and Mendham, 1989, "Vogels text book of qualitative Inorganic analysis", 5th Edition, The ELBS & Longman & UK
- 4 Ramanujam. V.V, 1988, "Inorganic Semimicro Qualitative Analysis" 3rd Edition, National Pubs & London.

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Course Code	Course Name	Category	L	T	P	Credit
223BC2A2EA	DRUG BIOCHEMISTRY	EDC	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The drug types, characteristics and action of drugs on the body.
- The basic knowledge on mechanism of action, therapeutic uses, kinetics and adverse effects of drugs used for various clinical conditions
- The principles of chemotherapy, treatment strategies for cancer

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the concepts of pharmacokinetics	K2
CO2	Explain the key principles of pharmacodynamics	K3
CO3	Analyze the mechanism of drugs acting on Central Nervous system	K4
CO4	Examine the mechanism of action of drugs for peptic ulcer, inflammation, thyroid disorders and Diabetes	K4
CO5	Illustrate the mechanism of anticancer drugs and basic concepts in patenting of drugs	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2		✓	✓	✓	
CO3	✓	✓	✓	✓	✓
CO4		✓	✓	✓	✓
CO5	✓	✓	✓	✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input checked="" type="checkbox"/>	Innovations
<input checked="" type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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223BC2A2EA	DRUG BIOCHEMISTRY	SEMESTER II
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Pharmacology and Pharmacokinetics 10 h

Pharmacology: Classification of drugs, sources, Routes of drug administration: sublingual, buccal, oral, rectal, intravenous, intramuscular, subcutaneous, transdermal, inhalational and topical administration. Pharmacokinetics: drug absorption, drug distribution, drug biotransformation (role, formation and phases), drug excretion: quantitative pharmacokinetics, bioavailability, drug clearance.

Unit II Pharmacodynamics 8 h

Drug receptors: Types, classification, drug-receptor interaction, Agonist, antagonist, Inverse agonist, partial agonist. Dose-response relationships (graded and quantal). Adverse effects of drugs. Factors affecting drug safety and efficacy.

Unit III Antidepressant Drugs and Neurodegenerative Diseases 10 h

Antidepressant drugs: Mechanism of action and therapeutic uses of tricyclic antidepressants and monoamine oxidase inhibitors.

Treatment of neurodegenerative diseases: Parkinson's Diseases - Introduction, Monoamine oxidase inhibitors. Alzheimer diseases- Mode of action Galantamine, rivastigmine. Hypnotic drug - zolpidem or zaleplon.

Unit IV Drugs for peptic ulcer, Inflammation, Thyroid Disorders and Diabetes 10 h

Anti-peptic ulcer drugs: H₂ receptor antagonists and inhibitors of H⁺K⁺ ATP-ase pump. Anti-inflammatory drugs: Mechanism of action, therapeutic uses, pharmacokinetics and adverse effects of Anti-inflammatory drugs -aspirin and colchicine. Antimicrobial drugs - Sulfonamides, trimethoprim, penicillin, aminoglycosides and bacterial resistance. Thyroid and anti- thyroid drugs, Insulin and oral anti- diabetic drugs.

Unit V Anticancer Drugs 10 h

Anticancer drugs: Mode of action and its mechanism - Cyclophosphamide & methotrexate. Antibiotics (Dactinomycin & Bleomycin), microtubule inhibitor



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(Vincristine & Vinblastine). Patenting of Drug, Marketing, and Computer aided drug design.

Text Books

- 1 Richard D. Howland, Mary. J. Mycek, Willaim L. Wilkins, 2006, "Lippincott's illustrated reviews: pharmacology", 3rd Edition, Wolters Kluwer health (India) Pvt. Ltd., Delhi
- 2 George M. Brunner, Craig W. Stevans. 2011, "Pharmacology", 3rd Edition, Saunders, an imprint of Elsevier Inc, United States

References

- 1 Sharma H.L, Sharma, K. K., 2011, "Principles of Pharmacology", 2 Edition, Paras Medical Publisher, India.
- 2 Satoskar, R. S, Nirmala N, Reje, Bhandarkar S. D, 2011, "Pharmacology and Pharmacotherapeutics", 22nd Edition, Popular Prakashan Pvt. Ltd, India
- 3 Aronson J.K., Smith D GG ,2008, Oxford textbook of clinical pharmacology and drug therapy, Oxford University Press, India
- 4 Tripathi,K.D. 2013, Essentials of Medical Pharmacology, 7th Edition, Jaypee Brothers, India

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Course Code	Course Name	Category	L	T	P	Credit
222CE2A2DA	CHEMISTRY OF COSMETICS AND PERFUMES	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic principles of Skin Creams and Humectants.
- Concepts and methods of Mask and aroma therapy.
- The knowledge on various methods of oil extraction.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Construct basics of Skin Creams and Humectants.	K3
CO2	Analyze the Bath and Oils.	K4
CO3	Examine the methods of Mask and aroma therapy.	K4
CO4	Organize the separation of Essential oils.	K3
CO5	Inference the industrial important Essential oils.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓			✓
CO2	✓	✓		✓	
CO3		✓	✓		✓
CO4		✓		✓	✓
CO5	✓		✓	✓	

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input checked="" type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A2DA	CHEMISTRY OF COSMETICS AND PERFUMES	SEMESTER II
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Skin Creams and Humectants 8 h

Skin Creams- Classification of skin creams, cleansing creams, Night and massage creams, Moisturizing, vanishing and foundation creams, Pigmented foundation creams, hand creams, hand and body cream. Humectants - Drying out, types, hygroscopicity, stability, safety, Application of humectant. Antioxidants and Application of antioxidants.

Unit II Bath and Oils 8 h

Bath Preparation: Foam baths, formulation and foam baths, types of products, product assessment, bath salts, ingredient and formulations. Bath Oils: introduction floating and spreading oils, dispersible or blooming oils soluble oils, foaming oils.

Unit III Mask and Aroma Therapy 10 h

Setting masks-Peel off masks- Thermal types- Paraffin wax masks - Non-setting masks-Hot oil marks. Aroma therapy- Methods of extraction of essential oils, Blending & precautions, Properties of essential oils & carrier oils, Patch testing, safety & precautions- Different aroma therapy formulations for skin and hair care.

Unit IV Extraction Methods of Essential Oils 12 h

Essential oils - Methodology of production, water distillation, Steam distillation, treatment of condensate water after distillation-Flower oils - Extraction with cold fat and hot fat, alcoholic extracts, absolute of enflurages and chassis. Extraction with volatile solvents, selection of solvent and extraction apparatus.

Unit V Industrial Important Essential Oils 10 h

Properties & uses of Eugenol, Pinene, Linalool, Citral and Geraniol. Flavours - Sources and properties of Vanilla, Rose, Pineapple, Peppermint, Mango, Raspberry, Orange & Lemon.



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Text Books

- 1 Poucher, W.A. 2012, "Perfumes, Cosmetics and Soaps: Volume II The Production, Manufacture and Application of Perfumes", 9th Edition, Springer
- 2 Vimaladevi, M, 2019, "Text book of herbal cosmetics". 1st Edition, New Delhi .

References

- 1 Butler, H. 2010, "Poucher's Perfumes, Cosmetics and Soaps", 10th Edition, Springer.
- 2 Asha Ram , 1997, "Herbal Indian Perfumes and Cosmetics", Sri Satguru Publications, India.
- 3 Susan Stewart, 2007, "Cosmetics and Perfumes in the Roman World", The History Press Ltd, UK.
- 4 Deore, S. V. Gaikwad, S. D. Gaikwad D.D. and Gugale G.S. 2022, "Chemistry of cosmetics and perfumes", Nirali Prakashan, India.
- 5 <https://www.tutorialsduniya.com/notes/chemistry-of-cosmetics-perfumes-notes/>
- 6 <https://www.slideshare.net/tanujanautiyal/cosmetics-chemistry-by-dr-tanuja-nautiyal>

		
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Course Code	Course Name	Category	L	T	P	Credit
222CE2A2DB	BATTERIES AND FUEL CELLS	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- To gain knowledge about the efficiency of battery/discharge cycle
- To learn about the different types of fuel cells and other storage devices.
- To understand the technology behind battery electric and Hybrid vehicles.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Articulate the basic concepts of electrochemistry related to batteries	K3
CO2	Explain the concepts of primary and secondary batteries and to explore their operations	K5
CO3	Identify the different batteries used in recent electric and hybrid vehicles	K3
CO4	Analyze the operations of batteries to hydrogen fuel cells and other types of fuel cells	K4
CO5	Interpret the energy storage devices and renewable energy	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2	✓		✓		✓
CO3		✓		✓	
CO4			✓		
CO5	✓	✓		✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



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222CE2A2DB	BATTERIES AND FUEL CELLS	SEMESTER II
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Electrochemistry 10 h

The reaction quotient, Q , for a chemical reaction - The potential, E , for non-standard conditions using the Nernst Equation - Rates of reactions and types of over-voltages in galvanic and electrolytic cells and the Tafel Equation - Efficiency of chemical energy conversion: batteries versus heat engines.

Unit II Introduction to Batteries 10 h

Primary cells - Secondary batteries - Battery charging and discharging curves for secondary batteries - Specific power and specific energy, Ragone plot - Energy efficiency of batteries, energy out during discharge - Energy in during charge - Energy efficiency of batteries versus that of heat engines for converting chemical energy into work

Unit III Batteries for Electric and Hybrid Vehicles 10 h

Battery packs, voltage and state of charge, coulomb counting - Energy in a battery (kW h) and charge in a battery (A h); C-rate of charging and discharging, Peukert Equation - Coulombic efficiency of batteries and battery lifetime - Battery pack control module.

Unit IV Fuel cells 10 h

Fuel Cells: Description, working principle, anodic, cathodic and cell reactions, fabrication of electrodes and other components, applications, advantages, disadvantages and environmental aspects of the following types of fuel cells: Proton Exchange Membrane Fuel Cells, alkaline fuel cells, phosphoric acid, solid oxide, molten carbonate, direct methanol fuel cells.

Unit V Additional Energy Storage Devices and Renewable Energy 8 h


Hydrogen fueling system and hydrogen storage aboard vehicles- Comparison of fuel cells and batteries for powering electric vehicles. Capacitors: storing charge- Flywheels: storing kinetic energy - Compressed air: storing potential energy - Renewable energy and synergy with electric vehicles.

Text Books

- 1 Aubrecht, G. 2005, "Energy: Physical, Environmental, and Social Impact" 3rd Edition. San Francisco, CA: Pearson Addison-Wesley, USA.
- 2 Aulice Scibioh.M and Viswanathan, B. 2006, "Fuel Cells - Principles and Applications", University Press, India

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- 1 Barbir.F, 2012, "PEM Fuel Cells: Theory and Practice", Elsevier, Burlington, MA,.
- 2 Sharma, B.K, 2016, "Industrial Chemistry", Krishna Prakashan Media P.Ltd, Meerut..
- 3 Stochi.E, 1990, "Industrial chemistry Vol-1", Ellis Horwood Ltd. UK.
- 4 Jain , P.C, Jain.M, 2015, "Engineering chemistry", Dhanpat Rai &sons , Delhi.
- 5 [https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_The_Central_Science_\(Brown_et_al.\)/20%3A_Electrochemistry/20.07%3A_Batteries_and_Fuel_Cells](https://chem.libretexts.org/Bookshelves/General_Chemistry/Map%3A_Chemistry_The_Central_Science_(Brown_et_al.)/20%3A_Electrochemistry/20.07%3A_Batteries_and_Fuel_Cells)
- 6 <https://www.youtube.com/watch?v=L2VSOccUrSk>

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BOS- 12 th 01/12/2022	AC- 14 th 19/01/2023	GB- 19 th 30/01/2023



Dr.NGPASC

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M.Sc. Chemistry (Students admitted during the AY 2022-23)
M.Sc. Chemistry (Students admitted during the AY 2022-23)

Course Code	Course Name	Category	L	T	P	Credit
222CE2A2DC	ORGANIC REACTIONS AND REAGENTS	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic principle and applications of oxidative and reductive reagents involved in organic synthesis
- The applications of various important organic reactions.
- The Reaction and Reagents involved in functional group transformations.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Identify the mechanism and applications of various oxidation reagents.	K3
CO2	Examine the mechanism and applications of reducing reagents.	K4
CO3	Analyze the various metal mediated and multi component reactions and their applications.	K4
CO4	Inference the basic principles and applications involved in name reaction on substitution.	K4
CO5	Explain the reaction and reagents functional group transformations	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2		✓	✓		✓
CO3	✓		✓	✓	
CO4				✓	✓
CO5	✓	✓	✓		✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A2DC	ORGANIC REACTIONS AND REAGENTS	SEMESTER II
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Reagents in Oxidation Reactions 10 h

Chromium oxidant - PCC, PDC, CrO₃, Chromic acid, Jones reagents, Manganese oxidant - KMnO₄, MnO₂. Peracids - Alkenes, ketones and heterocycles, singlet oxygen, ozone, OsO₄, HIO₄, Ag₂O, Bio-oxidations - Bacterium acetic, invertase, putida, Micrococcus sp, Gibberella, Streptomyces.

Unit II Reagents in Reduction Reactions 10 h

Palladium / platinum / nickel based heterogeneous catalysts for hydrogenation, Wilkinson's catalyst, Noyori asymmetric hydrogenation - Reductions using Li/Na/Ca in liquid ammonia. Metal hydrides - LiAlH₄, NaBH₄, NaBH₃CN - Hydrazine, tin hydrochloride, NaHSO₃, NaSH, Luche reduction.

Unit III Name reactions and their Applications-I 10 h

Mechanism and applications of Epoxidation - Jacobsen and Shi. Suzuki coupling, Heck reaction, Sonogashira reaction and Stille Coupling. Multicomponent reactions: Strecker synthesis, Hantzsch pyridine synthesis, Biginelli synthesis, Multicomponent reactions using alkyl isocyanides: Passerini and Ugi-4-component synthesis. Domino/cascade reactions.

Unit IV Name Reactions and Their Applications-II 10 h

Mechanism and applications of Robinson Annulation, Ene reaction, Hofmann isonitrile synthesis, Doebner-Miller synthesis, Nef reaction, Eschweiler Clark reaction, Bucherer reaction, Leukart reaction Willegerodt-Kindler reaction.

Unit V Reagents and Their Applications 8 h

Synthesis and application of Lead tetraacetate (LTA), Lead diacetate (LDA), Dicyclohexylcarbodiimide (DCC), 2,3-Dichloro-5,6-dicyano-1,4-benzoquinone (DDQ), Trimethylsilyl iodide (TMS-iodide), Trimethylsilyl cyanide (TMS-cyanide), Tert-Butyldimethylsilyl chloride (TBDMS) Chloride, 1,3-Dithiane (reactivity and umpolung), Merrifield resin, Baker's yeast.





Text Books

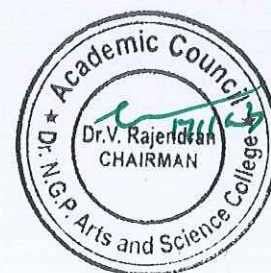
- 1 Ahluwalia. V.H and Parashar. R.K, 2009, "Organic Reactions and Mechanisms", 4th Edition, Narosa Publishing House & New Delhi..
- 2 Fieser. L.S, Fieser. M and Tse-Lok Ho, 2006, "Fieser and Fieser's Reagents for Organic Synthesis", 1st Edition, Wiley-Balckwell & USA

References

- 1 Chatwal. G.R, 2015. "Reaction Mechanism and Reagents in Organic Chemistry", 4th Edition, Himalaya Publisher House & Delhi
- 2 Mundy. B.P, Eller. M. G and Favarolo. F.G, 2015," Name Reactions and Reagents in Organic Synthesis", 2nd Edition. Wiley-Blackwell& USA
- 3 Sanyal. S.N, 2019, "Reactions, Rearrangements and reagents" 4th Edition, Bharati Bhawan Publishers & Bengaluru
- 4 Norman. R.O.C, 2017, "Principles of organic Synthesis", 2nd Edition. Taylor and Francis & UK
- 5 <https://nptel.ac.in/courses/104103023>
- 6 https://onlinecourses.nptel.ac.in/noc22_cy55


01.12.2022
BoS Chairman/HoD
Department of Chemistry
Dr. N. G. P Arts and Science College
Coimbatore – 641 048

		
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BoS- 12 th 01/12/2022	AC - 14 th 19/01/2023	GB - 19 th 30/01/2023



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M.Sc. Chemistry (Students admitted during the AY 2022-23)

Course Code	Course Name	Category	L	T	P	Credit
222CE2A3CA	CHEMISTRY OF NATURAL PRODUCTS	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The isolation and structural elucidation and synthesis of various terpenoids, steroids and alkaloids
- The chemistry of proteins and nucleic acids
- The synthesis and reactions of heterocyclic compounds

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Classify the isolation and synthesis of terpenoids	K4
CO2	Interpret the various methods involved in the structure determination of steroids	K5
CO3	Analyze the various pathways to synthesize the alkaloids	K4
CO4	Examine preparation, properties and structure of proteins and nucleic acids.	K4
CO5	Distinguish the chemistry of heterocyclic compounds and their synthesis	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2	✓	✓		✓	✓
CO3	✓	✓	✓	✓	✓
CO4		✓	✓		
CO5	✓		✓	✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A3CA	CHEMISTRY OF NATURAL PRODUCTS	SEMESTER III
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Terpenoids 12 h

Isolation and classification of terpenoids - Structural elucidation and synthesis of zingiberene, eudesmol, juvenile hormone, abeitic acid and caryophyllene

Unit II Steroids 12 h

Introduction - Structural elucidation and synthesis of cholesterol, ergosterol, equilenin, estrone, testosterone and progesterone

Unit III Alkaloids 12 h

Introduction - Isolation of alkaloids - Structural elucidation and synthesis of morphine, reserpine, quinine, atropine and glaucine

Unit IV Proteins and Nucleic acids 12 h

Proteins - Classification and properties (denaturation, isoelectric point and electrophoresis), primary, secondary, tertiary and quaternary structures of proteins - Synthesis of peptides and polypeptides - N-terminal and C-terminal residue analysis

Nucleic acids - Structure and synthesis of nucleosides and nucleotides - Genetic code - Structure of RNA and DNA and their biological importance

Unit V Heterocyclic compounds 12 h

Heterocyclic compounds - Structure, synthesis and reactions of natural oxygenated heterocyclics - Flavones, isoflavones - Purines (adenine and guanine) - Anthocyanins (cyanin and pelargonin) and Uric acid. Synthesis and reactivity of nitrogen heterocycles - Oxazoles - Imidazoles - Thiazoles - Isooxazoles - Aziridines - Oxiranes - Azetidines - Pyrazines - Pyridazines - 1,2,3-triazoles - 1,2,4-triazoles



Text Books

- 1 Finar. I.L, 2009,"Organic Chemistry", 7th Edition, Pearson education Ltd & NewDelhi
- 2 Bhat. S.V, Nagasampagi. B.A and Sivakumar. M, 2005, "Chemistry of Natural Products", 2nd Edition, Springer Science & Business Media & Germany

References

- 1 Michael B Smith, 2015, "March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure", 7th Edition, Wiley and Sons Inc & USA
- 2 Stanforth. S.P, 2006,"Natural Product Chemistry at a Glance", 1st Edition, Wiley-Blackwell, USA
- 3 Nicolaou. K.C and Sorensen. E.J. 1996, "Classics in Total Synthesis, Targets, Strategies", 1st Edition, Wiley VCH & Germany
- 4 Gurdeep Chatwal, 2019, "Organic Chemistry of Natural Products, Vol II", 5th Edition, Himalaya Publishing House & New Delhi
- 5 <https://www.britannica.com/science/heterocyclic-compound/Melting-and-boiling-points>
- 6 https://www.wlww.k12.or.us/cms/lib/OR01001812/Centricity/Domain/1338/NOTES%20-%20PPT_Ch%205%20Proteins-Nuc%20Acids_NEW.pdf



Course Code	Course Name	Category	L	T	P	Credit
222CE2A3CB	ADVANCED INORGANIC CHEMISTRY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- To gain knowledge on solid state chemistry
- The general characteristics of f-block elements
- The basics of nuclear chemistry, types of nuclear reactions and its applications

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Relate the basics of solid state chemistry to crystal structure	K2
CO2	Examine crystal structure and defects in crystals.	K4
CO3	Analyze the general characteristics of f-block elements and the electronic and magnetic properties	K4
CO4	Infer the basic concepts of nuclear chemistry and types of nuclear reactions	K4
CO5	Identify the applications of nuclear chemistry in various fields.	K5

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4	✓	✓	✓		
CO5	✓	✓	✓		✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A3CB	ADVANCED INORGANIC CHEMISTRY	SEMESTER III
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Solid State Chemistry I 12 h

Cells and description of crystal structure - Close packing of spheres - Packing efficiency - Hexagonal close packed (hcp) and cubic close packed structures (ccp) - Coordination number - Relative density of packing in simple cubic - Tetrahedral and octahedral holes - Limiting radius ratio rule. Radius ratio for trigonal, tetrahedral, octahedral and cubic sites

Unit II Solid State Chemistry II 12 h

Perovskite structure of spinels - Stoichiometric defects - Schottky and Frenkel defects - Non-stoichiometric defects - Metal excess and metal deficiency defects - Extended defects - Line and plane defects. Band theory - Semiconductors - Intrinsic and extrinsic type - Fermi level - Flow of current in semiconductors - Hopping mechanism - Band structure - p and n type semiconductors - p-n junction - Superconductivity - 1,2,3-superconductor - Photovoltaic effect

Unit III Lanthanides 12 h

General characteristics of lanthanides - Electronic configuration - Oxidation state Lanthanide contraction - Term symbols for Lanthanide ions (Derivation not required) - Factors that mitigate against the formation of lanthanide complexes - Electronic spectra and magnetic properties of lanthanide complexes - Lanthanide complexes as shift reagents - Difference between 4f and 5f orbital elements

Unit IV Nuclear Chemistry I 12 h

Nuclear structure - Stability of nuclei - Packing fraction - Even and Odd nature of nucleons - n/p ratio - Nuclear potential - Binding energy and exchange forces - Shell model and Liquid drop model. Decay of radio nuclei - Rate of decay - Determination of half-life period. Modes of decay - Alpha, beta, gamma and orbital electron capture - Nuclear isomerism - Internal conversions - Q value - Nuclear cross section - Threshold energy and excitation functions. Particle acceleration and counting techniques - Linear accelerator - Cyclotron - Synchrotron - Betatron - Bevatron



Unit V Nuclear Chemistry II

12 h

Applications of isotopes - Esterification - Friedal Craft's reaction - Structural determination of PCl_5 - Solubility of sparingly soluble substance - Isotope dilution analysis - Carbon dating - Thyroiditis - Assessing the volume of blood in a patient - Brain tumor location and bone fracture healing control of predatory insects

Text Books

- 1 J.D.Lee, 2023, "Concise Inorganic Chemistry", 5th Edition, Wiley Publication & India
- 2 M. G. Arora, M. Singh, 1994, "Nuclear Chemistry", 2nd Edition, Anmol Publications & India

References

- 1 Chakrabarthy D.K. 2005,"Solid State Chemistry", 2nd Edition, New Age International Publishers & New Delhi
- 2 Arnikar H.J. 2001,"Essential of Nuclear Chemistry", 2nd Edition, Wiley-Eastern Ltd. & NewDelhi.
- 3 Freindlander G., Kennedy J. W., Macias E.S and Miller J.M John, 1991, "Nuclear and Radiochemistry", 1st Edition, Wiley and Sons & US
- 4 Gurdeep Raj. 2014, "Advanced Inorganic Chemistry", 12th Edition, Geol Publishing House & India
- 5 <https://wou.edu/chemistry/courses/online-chemistry-textbooks/ch103-allied-health-chemistry/ch103-chapter-3-radioactivity/>
- 6 [https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_\(Inorganic_Chemistry\)/Descriptive_Chemistry/Elements_Organized_by_Block/4](https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Supplemental_Modules_and_Websites_(Inorganic_Chemistry)/Descriptive_Chemistry/Elements_Organized_by_Block/4)



Course Code	Course Name	Category	L	T	P	Credit
222CE2A3CC	QUANTUM CHEMISTRY AND GROUP THEORY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic concepts and applications of quantum chemistry.
- The operators and Eigen functions and formulate the approximation methods to construct molecular orbitals.
- The point groups of molecules and apply the concepts of group theory to predict the spectroscopic properties

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Make use of basic concepts and categorize the operators and Eigen functions	K3
CO2	Explain the concepts involved in the basics and theories of quantum chemical approach	K3
CO3	Analyze the approximation methods to construct molecular orbitals	K4
CO4	Summarize the basic concepts of group theory.	K3
CO5	Identify the point groups of molecules and construct the character table for point groups	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2		✓		✓	✓
CO3	✓	✓		✓	✓
CO4		✓	✓		
CO5	✓		✓	✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A3CC	QUANTUM CHEMISTRY AND GROUP THEORY	SEMESTER III
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Quantum Chemistry I 12 h

Failure of classical mechanics and the success of quantum theory in explaining black body radiation - Photoelectric effect and the H-atom spectrum - De Broglie's matter waves - Heisenberg's uncertainty principle - Schrodinger equation - Born's interpretation of the wave function - Requirements of acceptable wave function

Algebra of operators - Sums and products of operators - Commutator - Linear operators - Eigen functions and Eigen values - Correspondence between physical quantities in classical mechanics and Operators in quantum mechanics - Hamiltonian operator - Quantisation of angular momentum and its spatial orientation - Average (expectation) values - Postulates of quantum mechanics

Unit II Quantum Chemistry II 12 h

Particle in a one dimensional box - Quantization of energy - Normalisation of wave function - Orthogonality of the particle in a one-dimensional box wave functions - Average position and average momentum of a particle in a one-dimensional box - Illustration of the uncertainty principle and correspondence principle with reference to the particle in a one-dimensional box - Particle in a three-dimensional box - Separation of variables - Degeneracy

Schrodinger equation for simple harmonic oscillator of a diatomic molecule - Illustration of the uncertainty principle and correspondence principle with reference to harmonic oscillator. Schrodinger equation for a rigid rotor of a diatomic molecule. Schrodinger equation for the H-atom (or H - like species) - Separation of variables - Energy levels - Radial factors of the H-atom wave functions

Unit III Quantum Chemistry - III 12 h

Need for approximation methods - The perturbation theory (first order only) application of the perturbation method to He-atom - The variation method - Applications of variation method to He-atom - Electron spin and the Pauli's principles - Symmetric and anti-symmetric nature of the wave functions - Slater determinants - Approximate wave function of many electron atoms - Maxwell-Boltzman, Bose-Einstein, Fermi-Dirac, Born Oppenheimer approximation - Stirling's approximation

Unit IV Group Theory I 12 h

Symmetry elements and symmetry operations. Inverse operations - Definition of a group - Properties of a group, definition of abelian group, cyclic group, finite group, infinite



group, sub-group and isomorphic group - Group multiplication tables - Symmetry classification of molecules into point groups (Schoenflies symbols only) - Matrices - Definition of matrix - Diagonal matrix - Null matrix - Unit matrix - Symmetric matrix - Skew matrix - Conjugate matrix - Matrix multiplication - Determination of inverse matrix - Block multiplication of matrices. Matrix notations of symmetry operations of C_{2v} and C_{3v} point groups.

Unit V Group Theory II

12 h

Definition of reducible and irreducible representations - Irreducible representation as orthogonal vectors - Direct product rule - The Great Orthogonality Theorem and its consequences (statement only, proof not needed) - Construction of character table of C_{2v} and C_{3v} point groups - Calculation of binary co-ordinates in the character tables for C_{2v} and C_{3v} point groups - Calculation of character values of reducible representations per unshifted atom for each type of symmetry operation - Determination of total Cartesian representation - Determination of direct sum from total Cartesian representation. Type of hybridization of atomic orbitals in acetylene, CH_4 and $[PtCl_4]^{2-}$ - Group theory and Vibrational spectroscopy - Vibrational modes as basis for group representation - Symmetry selection rules for IR and Raman spectra - Mutual Exclusion Principle - Classification of vibrational modes.

Text Books

- 1 Chandra, A.K, 2017, "Introductory Quantum Chemistry", 4th Edition, McGraw Hill Education & New Delhi
- 2 Veera Reddy, K, 2009, "Symmetry and Spectroscopy of Molecules", 2nd Edition, New age publishers & New Delhi.

References

- 1 Levine, 2016, "Quantum Chemistry", 7th Edition, Pearson Education & New Delhi
- 2 Mcquarrie, D.A, 2016, "Quantum Chemistry", 1st Edition, Viva Books & New Delhi
- 3 Atkins, P, 2006, "Physical Chemistry", 8th Edition, Oxford University Press & London
- 4 Cotton, F.A, 2008, "Chemical Applications of Group Theory", 3rd Edition, Wiley & London
- 5 https://chem.libretexts.org/Courses/Mount_Royal_University/Chem_1201/Unit_1%3A_Quantum_Chemistry
- 6 <https://www.cantorsparadise.com/an-invitation-to-group-theory-c81e21ab739a>



Course Code	Course Name	Category	L	T	P	Credit
222CE2A3CD	ANALYTICAL SPECTROSCOPY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The principles and theory of spectroscopic techniques and the application to structure determination.
- The interpretation of organic molecules using spectral data
- The applications of spectroscopy in interpreting unknown molecules and basics of photochemistry.

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Illustrate the fundamentals of Inorganic Photochemistry	K3
CO2	Examine the basic principle of Mass spectroscopy and to apply the concept in finding the structure of organic compounds	K4
CO3	Apply the concepts of IR spectroscopy and Raman spectroscopy to elucidate the structure of compounds	K3
CO4	Apply the knowledge of spectroscopy to examine the structure of compounds based on 1D and 2D NMR techniques	K4
CO5	Analyze and evaluate the conjoint knowledge of the spectroscopic techniques in solving the structure of unknown compounds	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓		✓
CO2		✓	✓	✓	✓
CO3	✓	✓		✓	✓
CO4	✓	✓			
CO5	✓	✓	✓		✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A3CD	ANALYTICAL SPECTROSCOPY	SEMESTER III
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I IR and Raman Spectroscopy 12 h

Application of IR in Organic chemistry - Characteristic group frequencies - Finger print region. Combined application of Infrared and Raman spectra for structural elucidation of N_2O , ClF_3 , ClO_4^- and NO_3^- Group theoretical approach to find the IR and Raman active vibrations of simple compounds - Effect of coordination upon ligand vibrations of H_2O , CNS^- , NO_3^- , CN^- & SO_2

Unit II Applications of NMR Spectroscopy 12 h

NMR active nuclei - Equivalent and non-equivalent protons and number of signals - Chemical shifts - Spin spin coupling and coupling constant - Nuclear overhauser effect - Nuclear Quadrupolar resonance - J-resolved - H,H -COSY - C,H -COSY - NOESY spectra. Application of NMR in the structural elucidation of inorganic compounds - ^{31}P NMR spectra of P_4S_3 , H_3PO_3 , and HPF_2 - ^{19}F NMR spectra of ClF_3 , BrF_5 and equimolar mixture of TiF_6^{2-} and TiF_4 in ethanol - Applications of NMR spectroscopy in the structural analysis of organic compounds

Unit III ^{13}C NMR Spectroscopy 12 h

Difficulties and solution for recording ^{13}C NMR spectra- ^{13}C NMR spectra scale - Signals and their positions - Multiplicity - Proton coupled and Decoupled ^{13}C spectra - Off resonance technique - Chemical shifts in ^{13}C spectra - Use of ^{13}C spectra in differentiating primary, secondary and tertiary carbons by DEPT technique. Theory and Principles of 2D NMR Spectroscopy, Interpretation of 1H 1H COSY, 1H ^{13}C HETCOR, HMQC, HMBC

Unit IV Mass Spectroscopy 12 h

Mass Spectrometry - Instrumentation - Resolution - ESI, EI, CI, MALDI and FAB method - Presentation of spectral data - Molecular ions - Meta stable ions - Molecular ion peak - Nitrogen rule - Isotopic abundance - Fragmentation process - Scission with rearrangement - Retro Diels Alder rearrangement - Mc Lafferty rearrangement. Fragmentation associated with functional groups - Aliphatic compounds, aldehydes, ketones, carboxylic acids, esters, amides, alcohols, thiols, amines, ethers, sulphides and halides, aromatic compounds - Elimination due to ortho groups



Unit V Spectroscopic Problems

12 h

Woodward rule for calculating absorption maximum in conjugated dienes, polyenes, α , β - unsaturated carbonyl compounds and benzenoid systems. Conjoint spectroscopic problems - Structure determination of organic compounds using UV-Vis, IR, ^1H , ^{13}C -NMR and Mass spectroscopic techniques - Simple molecules - Restricted to 12 carbon systems with/ without one hetero system

Text Books

- 1 Pavia, D.L, 2011, "Spectroscopy", 5th Edition, Brooks/Cole Publications & UK
- 2 Yadav, M.S, 2011, "Molecular Spectroscopy", 1st Edition, Arise Publishers and Distributors & New Delhi

References

- 1 Kalsi, P.S, 2014, "Spectroscopy of organic compounds", 6th Edition, New Age International (P) Ltd & New Delhi
- 2 Abraham, R. J, 1988, "Introduction to NMR Spectroscopy" 6th Edition, Chichester, Wiley & New York
- 3 William Kemp, 2008, "Organic Spectroscopy", 3rd Edition, Palgrave Publications & USA.
- 4 Banwell C.N, 1983, "Fundamentals of molecular spectroscopy", 3rd Edition, McGraw Hill Book Company & Europe
- 5 <http://chemistry.emory.edu/msc/tutorial/mass-spectrometry-ionization.html>
- 6 <https://archive.nptel.ac.in/courses/104/108/104108078/>



222CE2A3CP	PHYSICAL CHEMISTRY	SEMESTER III
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Total Credits: 3
Total Instructions Hours: 72 h

S.No	Contents
1	Determination of molecular weight by Rast Method
2	Determination of rate constant of acid catalyzed hydrolysis of ester Chemical kinetics-First order reaction
3	Determination of temperature coefficient and Arrhenius parameter- Phase Rule
4	Two component systems - Simple eutectic form-Phase Rule
5	Determination of CST of Phenol-water system
6	Surface Chemistry: Verification of Freundlich and Langmuir adsorption Isotherm of oxalic acid on activated charcoal
7	Conductometric titration: Acid-base titration-Determination of the strength of strong acid and weak acid.
8	Conductometric titration: Precipitation titration-Determination of the strength of KCl, KI, KCl and KI in the mixture
9	Potentiometric titration: Titration of HCl Vs NaOH
10	Potentiometric titration: Titration of Mixture of acids Vs strong base
11	Potentiometric titration: Titration of CH ₃ COOH Vs NaOH
12	Potentiometric Titration: Redox titration-Titration of Ferrous ammonium sulphate against Potassium dichromate
13	Verification of Ostwald's dilution law and determination of molar Conductance at infinite dilution of strong electrolyte using Kohlraush's law.
14	Verification of Ostwald's dilution law and determination of molar Conductance at infinite dilution of weak electrolyte using Kohlraush's law.

Note: Any ten experiments



References

- 1 Peter Mathews. G, 1985, "Experimental Physical Chemistry", 1st Edition, Oxford Science Publications & UK
- 2 Findlay,A.J& Kitchener, 1973, "Practical Physical Chemistry", Longmann Publication
- 3 Khosala. D.D, Khosala. A and Gard.V.C, 1975, "Senior Practical Physical Chemistry", 1st Edition, R.Chand& Co & New Delhi
- 4 Viswanathan. B and Raghavan. P.S, 2008, "Practical Physical Chemistry", 2ndEdition, Viva Books Pvt.Ltd& New Delhi



Course Code	Course Name	Category	L	T	P	Credit
222CE2A3DA	DYE AND TEXTILE CHEMISTRY	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The chemistry of dyes and intermediates.
- The dyeing methods and printing process
- The problems caused by dye and dyeing process

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Analyze and classify dyes based on their chemical structure and applications	K3
CO2	Apply the chemistry of dyes and intermediates	K4
CO3	Examine the skills on dye processing on fibres	K3
CO4	Explore the broad idea on methods of printing.	K3
CO5	Illustrate the importance of pollution control eco-friendly processing	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4			✓	✓	✓
CO5	✓	✓		✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A3DA	DYE AND TEXTILE CHEMISTRY	SEMESTER III
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Dyes 10 h

Quinonoid dyes - Anthroquinone and Mordant dyes - Synthesis and applications of Alizarin -Phthalocyanin dyes - Copper phthalocyanin - Diphenylmethane dyes - Auramine - Triphenylmethane dyes - Malachite green - Crystal violet - Phthalein dyes - Phenolphthalein - Preparation and applications

Unit II Dyestuff Intermediates 10 h

Synthesis of important dye intermediates - Alcohols - Aliphatic and aromatic carboxylic acids - Esters - Acid chlorides - Aldehydes and ketones - Aliphatic amines- Commercial processes of Azo dyes, reactive dyes, thermal sensitive dyes, disperse dyes

Unit III Processing of Dyes 10 h

Singeing - Process of singeing - Plate singeing - Roller singeing - Gas flame singeing - Desizing -Acid and enzyme desizing - Scouring - Process of scouring- Lime-soda and enzyme scouring - Bleaching agents- Oxidising and reducing agents- Optical brightening agents

Unit IV Printing 10 h

Comparison between dyeing and printing - Styles and methods of printing- Ingredients in printing paste- Screen and Rotary screen design preparation -Table screen printing - Flat bed screen printing machine- Rotary screen printing machine- Study of curing machine and steamer- Batik style on cotton with reactive dyes

Unit V Quality control 8 h

Aim of ISO standard in quality control- ISO 9000:2000 and ISO 9001:2000 - Fastness properties - Importance of eco-friendly processing - List of banned dyes and chemicals, Eco labels



Text Books

- 1 Shenai V. A, 1991, "Textile Fibres" (Vol. I), Mahajan Publishers, Ahmedabad, India.
- 2 K. Venkataraman, 1952, "Chemistry of Synthetic Dyes", Vol-1, Academic Press, London.

References

- 1 Gurdeep R. Chatwal, 2016, "Synthetic Dyes" 4th Edition, Himalaya publishing house, New Delhi.
- 2 Robert R Mather and Roger H Wardman , 2015, "The Chemistry of Textile fibres", 2nd Edition, RSC Publishing, London.
- 3 Arora M.G, 2002, "Text Book of Dyes", 3rd Edition, Anmol Publications Private Ltd., New Delhi
- 4 Nierstrasz. V. A, 2010, "Advances in textile technology" Elsevier.
- 5 <https://www.yourarticlelibrary.com/production-management/12-importance-or-benefits-of-quality-control-production-management/26173>
- 6 <https://www.textileblog.com/various-classification-of-dyes/>



Course Code	Course Name	Category	L	T	P	Credit
222CE2A3DB	NANO SCIENCE AND NANO TECHNOLOGY	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The fundamentals and current state of the art of nanotechnology
- The synthesis, characterization of nanostructured materials
- The utilization of nanomaterials in diverse applications

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Analyse the basics in the field of nanotechnology	K3
CO2	Identify the properties of nano objects such as nanotubes and nanoparticles.	K3
CO3	Examine the synthesis of nanomaterials using chemical and physical routes.	K3
CO4	Explain the various characterization techniques for nano materials	K4
CO5	Evaluate the applications of nano structured materials in different fields.	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		✓	✓	✓	✓
CO2		✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4			✓	✓	
CO5		✓	✓	✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A3DB	NANO SCIENCE AND NANO TECHNOLOGY	SEMESTER III
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Nano Science 10 h

Nano science, nanomaterials - Scale of materials natural and manmade - Properties - Classification of nanomaterials - Origin, phase composition, constituents, dimensions - Energy at bulk and nano scale - Size effect of Nanomaterials - Shape, density, melting point, specific surface area, band gap variation - Quantum confinement

Unit II Carbon Nanostructures 10 h

Introduction - Carbon molecules - Nature of the carbon bond - New carbon structures; carbon clusters - Carbon nanotubes, Graphene, Graphene oxide, Reduced Graphene Oxide (RGO) - Fabrication - Structure - Electrical properties - Mechanical properties; applications of carbon nanotubes - Field emission and shielding - Computers - Fuel cells - Chemical sensors - Catalysis - Mechanical reinforcement

Unit III Synthesis of Nanomaterials 8 h

Chemical methods - Chemical precipitation and co-precipitation, sol-gel synthesis, solvothermal synthesis, microwave heating synthesis, sonochemical synthesis, electrochemical synthesis and photochemical synthesis. Physical Methods - Inert gas condensation, ion sputtering, laser ablation, laser pyrolysis, chemical vapour deposition and electro deposition

Unit IV Characterization Techniques 10 h

Structural characterization - Electron microscopy techniques - Scanning electron microscopy, transmission electron microscopy - X-ray diffraction. Surface characterization - XPS, atomic force microscopy

Unit V Applications of Nanomaterials 10 h

Nanomaterials for Solar cells - Smart materials - Biosensors - Drug delivery and therapy - Food packaging - Detection of cancerous cells, nano polymer composite in defense and aerospace. Nanoscale catalysts for energy and automobile industries - Nanomaterials for electrodes and wearable electronics - Nanobased coating and paints.



Text Books

- 1 B.S. Murty et.al., 2013, "Textbook of Nanoscience and Nanotechnology", 1st edition, Springer-Verlag Berlin Heidelberg, Universities Press (India) Private Limited, New Delhi.
- 2 T.Pradeep., 2008, "Nano: The Essentials: Understanding Nanoscience and Nanotechnology", McGraw-Hill Professional Publishing, New Delhi..

References

- 1 G. Cao., 2004, "Nanostructures & Nanomaterials: Synthesis, Properties & Applications", 2nd edition, Imperial College Press, New Delhi..
- 2 J. Dutta, H.F. Tibbals and G.L. Hornyak., 2008, "Introduction to Nanoscience", 2nd edition, CRC press, Boca Raton, New Delhi..
- 3 CNR Rao et.al., 2006, "Chemistry of Nanomaterials : Synthesis, properties and applications" 3rd edition , Royal Society of Chemistry, Cambridge, UK
- 4 R.W. Kelsall, W.H.M. Geoghegan., 2005, "Nanoscale Science and Technology", 4th edition, John Wiley & Sons, Ltd. UK.
- 5 <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=+4mIqRALksfwQH9v8YSMrw==>
- 6 https://drive.google.com/file/d/1ug4enjbji1x3PRDzFFxJ7vqkaIVoKv2_/view



Course Code	Course Name	Category	L	T	P	Credit
222CE2A3DC	BIO-ORGANIC CHEMISTRY	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basics of carbohydrates and lipids
- The structure and biological functions of enzymes and cofactors
- The concept of bioenergetics and biosynthesis of lipids

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain the classification of carbohydrate and carbohydrate metabolism	K3
CO2	Summarize chemical nature and biological functions of enzymes and cofactors	K4
CO3	Analyze the structure and properties of lipids	K3
CO4	Apply concept of energy in living organisms and relate free energy to the chemical equilibria	K4
CO5	Examine nature and biosynthesis of long chain fatty acids	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2		✓	✓	✓	
CO3	✓	✓			✓
CO4			✓		
CO5	✓	✓		✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A3DC	BIO-ORGANIC CHEMISTRY	SEMESTER III
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Carbohydrates 10 h

Classification of carbohydrates. Occurrence, structure, properties and uses - Sucrose, lactose - Starch - Cellulose. Carbohydrate metabolism: glycolysis, gluconeogenesis, glycogen metabolism (overview only, structures not required). Diabetes mellitus (elementary details)

Unit II Enzymes and Cofactors 10 h

Chemical nature of enzymes - Characteristics of enzymes - Colloidal nature, catalytic nature. Mechanism of enzymes - Michaelis - Menten hypothesis - Fischer's lock and key model, induced fit model. Structure and biological functions of coenzyme A, NAD and FAD

Unit III Lipids 8 h

Lipids - Definition - Simple lipids - Fats and oils - Compound lipids - Phospholipids - Phosphoglyceride - Derived lipids - C₂₄ steroids - Low density lipids and High density lipids - Physical properties - Solubility, melting point, surface tension, emulsification and geometric isomerism - Chemical properties - reaction involving -COOH group -OH group and double bonds

Unit IV Bioenergetics 10 h

Concept of energy - Law of Thermodynamics - Conservation of energy, - Transformation of energy - Free energy - Exergonic and Endergonic reactions - Relationship between standard free energy change and Equilibrium constant.

Standard free energy values of chemical reactions - Adenosine triphosphate (ATP) hydrolysis and Equilibria of coupled reactions - Inter conversion of adenine nucleotides

Unit V Biosynthesis of lipids 10 h

Nature and distribution of fat - Biosynthesis of fatty acid - Palmitic acid - Carbon source for fatty acid synthesis - Formation malonyl-CoA - Reaction of fatty acid synthetase system - Acyl carrier protein - Priming reaction - Malonyl transfer step - Biosynthesis of cholesterol - Biosynthesis of steroid hormones - Aldosterone



Text Books

- 1 Jain, J. L ,2016,"Fundamentals of Biochemistry",7th Edition., S. Chand and Co & New Delhi
- 2 Finar, I. L. , 2002, "Organic Chemistry" Vol.II. 5thEdition., India: Pearson Education&New Delhi

References

- 1 Kagan, H. B., 2009, "Asymmetric Synthesis",1st Edition., Thieme Medical Publishers & Germany
- 2 Carey, F.A., 2008, "Advanced Organic Chemistry: Part-A and Part-B", 5th Edition., Springer & Germany.
- 3 Harish. K., 2013,"Bio-Organic Chemistry", 1st Edition., Alpha Science International Limited & United Kingdom.
- 4 Price, N.C.,1999, "Fundamental of Enzymology", 1st Edition., Oxford University Press & UK..
- 5 https://www.angelo.edu/faculty/kboudrea/index_2353/Chapter_07.pdf
- 6 <http://www.jiwaji.edu/pdf/ecourse/pharmaceutical/Enzymes%20pdf.pdf>



222CE2ASSA	RESEARCH METHODOLOGY	SEMESTER III
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Total Credit: 1

Syllabus

Unit I Research Concepts & Literature Survey

Importance of research in Science - Criteria of good research - Qualities of a good researcher - Sources of a research problem - Types of research - Sources of information - Primary, Secondary, Tertiary sources - Journals - Journal abbreviations - Current titles - Abstracts - Reviews - Acquisition of information - Web resources - E-journals - Journal access - Building up of own literature collection - Hot articles - Citation index - Impact factor - H-index - I10 index - UGC info net- Search engines - Google Scholar - Chem Industry - Databases - Chem Spider - Science Direct - Sci Finder - Web of science - SCI - Scopus

Unit II Scientific Writing and Computer aided packages

Components of a good research report - Tabulation and computation of data- illustration of graphical data - Compilation of results - Characterization of research - Presentation - Synopsis preparation and thesis writing - Writing scientific papers - Justification for scientific contributions - Bibliography - Description of methods - conclusions -The need for illustration - Style - Publications of scientific work - Writing ethics - Avoiding plagiarism
Computer packages - Data presentations using formulas and functions - Generating graphs/charts - Applications and uses of common softwares in chemistry, MS- Excel - SPSS - Origin -Chems sketch - Chemdraw. Basic ideas on the use of Internet in Chemistry education

Unit III X-ray Crystallography

Diffraction of X-rays by crystal lattice - Laue's formulation of X-ray diffraction - Diffraction methods - Laue Diffraction - Rotating crystal method - Oscillation method - Powder method - X-ray diffractometer - Data collection

Unit IV Structure Determination and Thin Film Technology

Scattering factor - Structure factor - Phase problem - Structure determination - Structure refinement - Structure analysis. Thermal evaporation-General consideration-Evaporation methods- Chemical methods-Electro deposition- Chemical vapour deposition-Miscellaneous methods

Unit V Sputtering

Cathodic sputtering-Sputtering process-Glow discharge methods-Sputtering variants-Low pressure sputtering -Reactive sputtering-Sputtering of multi component materials -Vacuum-Deposition apparatus-Vacuum systems-



Substrate deposition Technology-Thickness measurement-Microbalance monitors-Optical Interference methods-Analytical methods-Chemical methods. Structural Analysis. Structure growth process- General Description-Liquid like coalescence

Text Books

- 1 D.Velmurugan, 2008, "Elementary Crystallography", 1st Edition, MJP publishers & New Delhi
- 2 Kasturi L. Choprah, 1969, "Thin Film Phenomena", 2nd Edition, McGraw Hill Company & UK

References

- 1 Kothari. C.R, 2004, "Research Methodology Methods and Techniques", 3rd Edition, New age international publishers & New Delhi
- 2 GH. Stout and LH. Jensen, 1989, "X-ray structure determination", A practical guide, 2nd Edition wiley publications & UK
- 3 Drago. R.S, 1978, "Physical methods in Inorganic Chemistry", 1st Edition, East west Pvt. Ltd & New Delhi
- 4 Gurdeep Raj. 2014,"Advanced Inorganic Chemistry", 12th Edition, Geol Publishing House.&India
- 5 https://uomustansiriyah.edu.iq/media/lectures/6/6_2020_08_27!09_52_58_PM.pdf
- 6 https://webstor.srmist.edu.in/web_assets/srm_mainsite/files/files/X%20RAY%20CRYSTALLOGRAPHY.pdf



222CE2ASSB	FORENSIC CHEMISTRY AND CRIME INVESTIGATION	SEMESTER III
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Total Credit: 1

Syllabus

Unit I Forensic Chemistry Introduction

History - Definition - Role of a forensic chemist - Scope and significance in forensic Science - Techniques employed in forensic chemistry - Cases encountered in forensic chemistry

Sample Collection - Sample Integrity - Theory of forensic analysis, Identification, Presumptive analysis, Confirmatory analysis - Comparative analysis, Class characteristics-Individual characteristics - Instrumental techniques employed in forensic chemistry

Unit II Drug Abuse

Introduction-Drug abuse - Classification of Drugs of abuse - Stimulants - Depressants - Hallucinogens - Narcotics - Cannabis - Volatile solvents - Other common drugs of abuse - Psychoactive drugs - Classification of psychoactive drugs - Narcotics - Stimulants - Depressants - Hallucinogens - Mode of action-Forensic analysis of drugs - Colour - Spot tests - Microcrystal tests - Confirmatory tests.

Unit III Forensic Toxicology

Introduction to toxicology - History of toxicology - Classification of toxicology - Analytical toxicology - Mechanistic toxicology - Forensic toxicology - Concept of forensic toxicology and its significance - Development and advances of forensic Toxicology- Plant Poisons, Organic Poisons, Microbial Poisons, Inorganic Poisons.

Unit IV Chemical Analysis of Explosives

Forensic examination of explosives - Chemical composition explosives- Chemical analysis of explosives- Ignition susceptibility test, Colorimetric tests - diphenylamine test, anthrone spot test, barium chloride and silver nitrate spot tests. Microcrystalline tests for explosives - Crophen microcrystalline test

Unit V Identification of Fingerprints

Sources of latent fingermark residue - Aqueous components, Lipid components, Amino acid sensitive reagents - Detection of Latent Fingerprints - Iodine Method, silver nitrate method, Ninhydrin method, Powder techniques, Cyanoacrylate fuming method, Vacuum metal deposition method- Amino acid sensitive reagents- Lipid-Sensitive reagents.



Text Books


- 1 Dikshit P.C. 2013, "Textbook of Forensic Medicine and Toxicology", 2nd Edition, Peepee Publishers and Distributors (P) Ltd & New Delhi
- 2 Narayan Reddy K.S, 2017, "The Essentials of Forensic Medicine and Toxicology", 4th Edition, JayPee Brothers & New Delhi..

References

- 1 Jay Seigal, 2020, "Forensic Chemistry: Fundamentals and Applications", John Wiley & Sons & UK
- 2 Richard Saferstein, 2017, "Criminalistics and introduction to forensic science", Prentice Hall of India & New Delhi.
- 3 James, S.H and Nordby, J.J. 2003, "Forensic Science: An introduction to scientific and investigative techniques". CRC Press & New Delhi.
- 4 Kelly M. E, 2019 "Introduction to Forensic Chemistry" CRC Press & USA
- 5 <http://www.remondini.net/newsite/?q=system/files/forensic%20chemistry.pdf>
- 6 https://sites.ffclrp.usp.br/enqfor/arquivos/Conferencia%2010%20-%20Forensic%20Chemistry____.pdf

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BoS Chairman/HoD
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APPROVED		
BoS- 13 th 08/06/23	AC- 15 th 14/07/23	GB- 20 th 05/08/23



Course Code	Course Name	Category	L	T	P	Credit
222CE2A4CA	SYNTHETIC ORGANIC CHEMISTRY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basics involved in the disconnection approaches
- About the importance of protection and deprotection methods
- The importance of named reaction and asymmetric synthesis in organic chemistry

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Outline the methods involved in retero synthetic approaches	K3
CO2	Interpret methods of two group C-C and C-X disconnections	K3
CO3	Analyze the various protective and deprotecting groups in organic synthesis	K4
CO4	Examine the various named reactions and their synthetic applications	K4
CO5	Analyze the various asymmetric synthetic methods and their selectivity	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓		✓	✓
CO2	✓	✓	✓	✓	
CO3	✓		✓	✓	
CO4	✓	✓		✓	✓
CO5	✓	✓	✓		✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A4CA	SYNTHETIC ORGANIC CHEMISTRY	SEMESTER IV
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Introduction to Retrosynthesis 12 h

Synthon, synthetic equivalent, target molecule, electron donors (nucleophiles), electron acceptors (electrophiles), functional group interconversion, disconnection approach, importance of the order of events in organic synthesis. Chemo selectivity, one group C-C and C-X disconnection (disconnection of alcohols and carbonyl compounds)

Unit II Two group C-C & C-X Disconnections 12 h

1,3 and 1,5 difunctionalized compounds, α , β -Unsaturated carbonyl compounds, control in carbonyl condensation, synthesis of 3, 5 and 6 membered rings in organic synthesis. Diels- Alder reaction. Retrosynthesis of 5 and 6 membered heterocycles containing two nitrogens. Designing synthesis: Disconnection approach in Ibuprofen, Rosiglitazone and captopril

Unit III Protection and Deprotection Chemistry 12 h

Need for protection and deprotection of functional groups during chemical reactions. Protection and cleavage of hydroxyl groups (by ethers) - Methoxymethyl ether (MOM), Tetrahydropyranyl (THP) and protection and cleavage of hydroxyl groups (by esters) - Trichloroacetate and 2,4,6-trimethylbenzoate. Protection and cleavage of 1,2 and 1,3-diols - Methylene dioxy derivative - Methoxy methyleneacetal, ethyldieneacetal. Protection and cleavage of Amino groups - Butoxy Carbonylation (BOC), Fluorenyl Methoxy Carbonyl (FMOC), N-Acylation

Unit IV Name Reactions in Organic Synthesis 12 h

Bamford, Stevens reaction, McCombie reaction (Barton Deoxygenation), Corey-Chaykovsky reaction, Hosomi-Sakurai reaction, Suzuki coupling, Nazarov cyclization - Weinreb ketone synthesis - Yamaguchi macrolactonization - McMurry reaction - Palladium based reactions: Negishi-Kumada - Fukuyama coupling - Tsuji-Trost reaction

Unit V Asymmetric Synthesis 12 h

Asymmetric synthesis and control of stereochemistry. Resolution - Enzymatic



resolution and chiral chromatography, chiral pool. Methods of asymmetric induction – Substrate, reagent and catalyst-controlled reactions. Determination of enantiomeric and diastereomeric excess, enantio-discrimination

Text Books

- 1 Warren S, 2008, "Organic Synthesis: The disconnection Approach". 2nd Edition, Wiley and sons & UK
- 2 Carruthers W and Coldham I, 2015, "Modern Methods of Organic Synthesis", 4th Edition, Cambridge University Press & UK

References

- 1 Michael B Smith, 2015, "March's Advanced Organic Chemistry: Reactions Mechanisms and Structure", 7th Edition, Wiley & US
- 2 Wuts G. M. P, and Theodora W. G. 2011, "Greene's Protective Groups in Organic Synthesis", 4th Edition, Wiley India Pvt Ltd & New Delhi
- 3 Warren S, 2009, "Designing Organic Syntheses: A programmed introduction to the synthon Approach", 2nd Edition. Wiley and sons & US
- 4 Clayden J, Greeves N and Warren S, 2014, "Organic Chemistry", 2nd Edition, Oxford University Press & UK
- 5 <https://tmv.ac.in/ematerial/chemistry/sat/SEM%20IV%20Two-Group%20Disconnection.pdf>
- 6 <https://www.vanderbilt.edu/AnS/Chemistry/Rizzo/chem223/protect.pdf>



Course Code	Course Name	Category	L	T	P	Credit
222CE2A4CB	STATISTICAL THERMODYNAMICS AND COMPUTATIONAL CHEMISTRY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic of statistical thermodynamics and its applications
- The concept in solid and liquid phase kinetics
- The basic of computational chemistry and its applications

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concept of statistical thermodynamics	K4
CO2	Examine statistical thermodynamics to the properties of identical indistinguishable particles like electrons	K5
CO3	Analyze the reaction paths and concepts in solid and liquid phase kinetics	K4
CO4	Interpret the principles of computational chemistry	K3
CO5	Inspect the compounds using the computational applications	K4

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2	✓			✓	✓
CO3		✓	✓	✓	
CO4	✓	✓	✓		
CO5	✓	✓		✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A4CB	STATISTICAL THERMODYNAMICS AND COMPUTATIONAL CHEMISTRY	SEMESTER IV
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Total Credits: 4

Total Instruction Hours: 60 h

Syllabus

Unit I Statistical Thermodynamics-I 12 h

Mathematical introduction - Theories of permutations and combinations - Laws of probability. Maxwell-Boltzmann statistics - Thermodynamic probability - Thermodynamic probabilities of system in equilibrium - Boltzmann expression for entropy - Stirling's approximation - State of maximum thermodynamic probability - Lagrangian multipliers - Thermodynamics probabilities of systems involving energy levels - Gaussian distribution- Maxwell-Boltzmann distribution law and evaluation of alpha and beta

Unit II Statistical Thermodynamics - II 12 h

Bose-Einstein and Fermi-Dirac Statistics: Bose-Einstein distribution law - Entropy of Bose- Einstein gas - Plank distribution law for black body radiation - Fermi-Dirac distribution law - Entropy of a Fermi-Dirac gas - Heat capacity of electron gas and the heat capacity of metals - Helium at low temperature - Negative absolute temperature

Unit III Chemical and Phase Equilibria 12 h

Reaction free energy/ reaction potential - Reaction isotherm and direction of spontaneity - Standard reaction free energy - Calculation from thermochemical, electrochemical and equilibrium data - Temperature coefficient of reaction free energy and equilibrium constant. Gibbs phase rule - Thermodynamic derivation - Application of phase rule to three component systems - Formation of one pair and two pairs of partially miscible liquids - Common ion effect - Salting out

Unit IV Introduction to Computational Chemistry 12 h

Introduction to computational chemistry - History and evolution of cheminformatics - Use of cheminformatics, prospects of cheminformatics - Database management, cheminformatics database - Introduction to molecular modeling and drug design

Unit V Application of Computational Chemistry 12 h

Concepts of computational chemistry - Molecular mechanics: general features,



bond stretching, angle bending, improper torsions, out of plane bending, non-bonded interactions, point charges, calculation of atomic charges, polarization, Van der - Waals interactions- Molecular docking studies - Chem draw

Text Books

- 1 Gupta, M.C, 1990, "Statistical Thermodynamics ", 1st Edition, Wiley Eastern Publications & UK.
- 2 Rajaram J, Kuriacose J. C, 2013, "Chemical Thermodynamics: Classical, Statistical and Irreversible", 1st Edition, Pearson Education & New Delhi

References

- 1 Sears F. W and Salinger G. L, 2013, " Thermodynamics, Kinetic & Statistical Thermodynamics", 3rd Edition, Narosa Publishing House & New Delhi
- 2 Laidler Keith J, 2023, "Chemical Kinetics", 1st Edition, Visionias, Inc, & US
- 3 Andrew R, Leach and Valerie J. Gillet, 2007, "An Introduction to Cheminformatics", Springer & US
- 4 Drago R.S, 2016, " Physical Methods for Chemists", 2nd Edition, Affiliated East West Press Pvt. Ltd. & New Delhi
- 5 <https://shop.elsevier.com/books/theory-and-applications-of-computational-chemistry/dykstra/978-0-444-51719-7>
- 6 <https://www.amazon.in/Computational-Chemistry-Methods-Ponnadurai-Ramasami-ebook/dp/B08FZCN417>



Course Code	Course Name	Category	L	T	P	Credit
222CE2A4DA	ENVIRONMENTAL CHEMISTRY	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic knowledge about the structure of atmosphere and various energy resources and environment
- The different types of pollution, health effects and control measures
- Identify the various toxic chemicals and analysis methods of polluted samples

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Examine the composition, structure of atmosphere and various energy resources in the environment	K3
CO2	Identify the aquatic pollution and their monitoring techniques	K3
CO3	Explain the sources, effects and control measures of air pollution	K3
CO4	Summarize the toxic chemicals and their health effects, sources of nuclear pollution and nuclear disaster management	K3
CO5	Examine various analysis methods of pollutants	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		✓		✓	✓
CO2	✓	✓	✓		✓
CO3	✓		✓	✓	
CO4		✓	✓		✓
CO5	✓	✓		✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A4DA	ENVIRONMENTAL CHEMISTRY	SEMESTER IV
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Atmosphere, Energy and Environment 10 h

Composition of Atmosphere, Atmosphere structure, Earth radiation balance, particles, ions and radicals in the atmosphere. Chemical and photochemical reactions in the atmosphere - Oxygen and ozone chemistry - EL Nino phenomenon asian brown cloud. Mineral resources - Metals and non-metals - Major renewable and non-renewable resources for energy - Consumption and conservation

Case study

Unit II Aquatic Pollution and Monitoring Techniques 10 h

Aquatic environment - Polluting agents - Pesticides, insecticides - Cyclodiene organo phosphates - Carbamates - Detergents - Naphtheno aromatics - Radioactive materials - Coral-Reef crisis - Eutrophication. Mineral pollution - Copper, lead, mercury, selenium and chromium - Minamatta disease. General methods of monitoring pollution - Polarographic, neocuproine, dithizone, persulphate and phenanthroline. Tests for identifying phenols, pesticides, surfactants, tanin and lignin

Case study

Unit III Air Pollution 8 h

Sources of air pollution - Natural and manmade - Classification and effects of air pollutants - CO, CO₂, SO₂, SO₃, NO and NO₂ - Hydrocarbon as pollutant - Reactions of hydrocarbons and effects - Particulate pollutants sources and effects of organic and inorganic particulates - Greenhouse effect - Impact on global climate - Control measures - Role of CFC's - Ozone holes - Effects of ozone depletion - Smog components of photochemical smog - Effects of photochemical smog

Case study

Unit IV Chemical Toxicology and Nuclear Pollution 10 h

Toxic chemicals in Environment - Impact of toxic chemicals on enzymes - Effects of metals and metallic compounds - Sources, toxicology and health risks of iron, arsenic, cadmium, chromium, lead, mercury and nickel. Nuclear pollution - Sources - Effects of ionizing and non-ionizing radiation - Genetic and somatic effects - Effects of Cesium-137, Krypton-85, Iodine-131 and Strontium-90 - Storage of



nuclear waste and disposal of nuclear waste - Nuclear disasters and their management

Case study

Unit V Analysis and Control

10 h

Analysis of pollutants - CO, NO, SO₂, H₂S, hydrocarbons and particulate matter. Analysis of ammonia, nitrate and nitrites, chlorides, fluorides, cyanides, sulphide, sulphate and phosphates, boron, silica and arsenic. Controlling techniques - Scrubbing - Cold trapping - Filtration - Cyclone separator - Gravity settling - Electrostatic precipitators and thermal precipitators

Case study

Text Books

- 1 De A. K, 2016, "Environmental Chemistry", 8th Edition. New Age International Publishers & New Delhi
- 2 Narayanan P, 2018, " Environmental Pollution Principles Analysis and Control ", CBS Publishers & New Delhi

References

- 1 Sharma B. K, 2019, " Environmental Chemistry ", 1st Edition, Goel Publishing House & New Delhi
- 2 Dr. Sanjay Kumar Batra, Dr. Kanchan Batra and Dr. Harpreet Kaur, 2023, " Environmental Science ", 6th Edition, Taxmann & New Delhi
- 3 Manahan S, 2017, "Environmental chemistry", 10th Edition, CRC Press & US
- 4 Kaur H, 2023, "Environmental Chemistry ", 1st Edition, Pragati Prakashan & Meerut
- 5 <https://www.dcp-3.org/sites/default/files/dcp2/DCP43.pdf>
- 6 <https://www.lkouniv.ac.in/site/writereaddata/siteContent/202005012116016435Ranvijay-Pratap-Singh-Environmental-Pollution.pdf>



Course Code	Course Name	Category	L	T	P	Credit
222CE2A4DB	CATALYSIS	CORE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basic principles of homogeneous and heterogeneous catalysis reactions and their types
- The mechanism involving in the various C-C, C-X coupling reactions and C-H activation reactions
- The basic knowledge about photocatalysis reactions involved in multiple bonds

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Apply the knowledge of catalysis in green, enzyme, nano and phase transfer catalytic reactions	K3
CO2	Utilize the different reactions to conduct C-C, C-X and C- H type of reactions.	K3
CO3	Determine various surface parameters using different spectral techniques	K3
CO4	Illustrate the reaction mechanism of heterogeneous catalytic reactions.	K3
CO5	Outline the different photocatalysis reactions and it's applications	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1	✓			✓	✓
CO2	✓	✓	✓		✓
CO3		✓	✓	✓	✓
CO4	✓	✓	✓		
CO5		✓	✓	✓	✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A4DB	CATALYSIS	SEMESTER IV
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Introduction to Catalysis 10 h

Fundamental aspects of catalysis - Homogeneous and Heterogeneous catalysis - Enzyme catalysis - Green catalysis - Nano catalysis. The role of catalytic processes in modern chemical manufacturing - Organometallic catalysts - Catalysis in organic polymer chemistry - Catalysis in petroleum industry - Catalysis in environmental control - Catalytic poison and Phase transfer catalysis

Unit II Homogeneous Catalysis 10 h

Metal mediated C-C and C-X coupling reactions - Negishi and Nozaki-Hiyama, Buchwald-Hartwig, Ullmann coupling reactions. Ruthenium, Osmium, Rhodium and Iridium catalyzed C-H activation reactions and their synthetic utility. Molybdenum, Tungsten and Rhodium based carbene and nitrene complexes, cyclopropanation. Introduction to N-heterocyclic carbene metal complexes

Unit III Characterization of Solid Catalysts 8 h

Surface area - Structure, surface morphology, porosity, pore volume, diameter, particle size. Instrumentation and applications of Scanning Electron Microscope (SEM), Transmission Electron Microscopy (TEM) and Atomic Force Microscope (AFM). Temperature Programmed Desorption (TPD), Temperature - Programmed Reaction (TPR) for acidity and basicity of the catalysts. Boundary layer theory - Wolkenstein theory - Balanding's approach

Unit IV Heterogeneous Catalysis 10 h

Adsorption isotherms - Catalysis by metals - Semiconductors and solid acids - Supported metal catalysts - Catalyst preparation - Deactivation and regeneration - Ammonia synthesis - Hydrogenation of carbon monoxide - Hydrocarbon conversion - Selective catalytic reduction - Polymerization

Unit V Photocatalysis 10 h

Introduction to photocatalysis - Semiconductor as photocatalysts - Porphyrins - Phthalocyanines. Generation of hydrogen by photocatalysts, photocatalytic break down of water and harnessing solar energy, photocatalytic degradation of dyes, environmental applications.



Text Books

- 1 Chakrabarty D. K and Viswanathan B, 2008, "Heterogeneous catalysis", 1st Edition, New Age International (P) Ltd & New Delhi
- 2 Hegedus L. S, 1999, "Transition metals in the synthesis of complex organic III molecules" 3rd Edition, University Science Books & USA

References

- 1 Emmet P. H, 1954, "Catalysis (Vol I & II)", 1st Edition, Reinhold & USA
- 2 Kaneko M and Okura, I, 2003, "Photocatalysis: Science and Technology", Springer & Germany
- 3 Schlosser M, 1996, "Organometallics in Synthesis, A manual", 1st Edition, John Wiley & USA
- 4 Viswanathan B, Kannan S and Deka R. C, 2010, "Catalysis and Surfaces: Characterization Techniques", 1st Edition, Alpha Science International Ltd & UK
- 5 http://www.nanoer.net/d/img/fundamental%20concepts%20in%20heterogeneous%20catalysis-Jens_K._Nrskov,_Felix_Studt,_Frank_Abild-Pederse.pdf
- 6 https://www.researchgate.net/publication/324164107_Photocatalysis_Present_past_and_future/link/5e439fb7299bf1cdb92107a4/download



Course Code	Course Name	Category	L	T	P	Credit
222CE2A4DC	MEDICINAL CHEMISTRY	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The types of drugs, synthesis and their pharmacological action
- The synthesis and mode of action of nonsteroidal anti-inflammatory drugs
- The natural and synthetic sources of drugs in chemotherapy

COURSE OUTCOMES

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Interpret the synthesis and pharmacological application of sulpha drugs in various infectious diseases	K3
CO2	Identify and appraise the synthesis and mode of action of mycobacterial and thyroid drugs	K3
CO3	Analyze the anesthetics and anesthetics and analgesics	K3
CO4	Appraise the application and synthesis of an analgesics and anesthetics.	K3
CO5	Analyze the mode of action and synthetic route of anti- malarial drugs.	K3

MAPPING WITH PROGRAMME OUTCOMES

COs/POs	PO1	PO2	PO3	PO4	PO5
CO1		✓	✓		
CO2	✓	✓	✓	✓	✓
CO3	✓	✓	✓	✓	✓
CO4				✓	
CO5	✓	✓	✓		✓

COURSE FOCUSES ON

<input checked="" type="checkbox"/>	Skill Development	<input type="checkbox"/>	Entrepreneurial Development
<input checked="" type="checkbox"/>	Employability	<input type="checkbox"/>	Innovations
<input type="checkbox"/>	Intellectual Property Rights	<input type="checkbox"/>	Gender Sensitization
<input type="checkbox"/>	Social Awareness/ Environment	<input type="checkbox"/>	Constitutional Rights/ Human Values/ Ethics



222CE2A4DC	MEDICINAL CHEMISTRY	SEMESTER IV
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Antibacterial Sulpha Drugs 10 h

Introduction, Synthesis and mode of action of sulphonamides for general infections - Sulphanilamide - Sulphapyridine - Sulphadiazine. Urinary infections - Sulphacetamide - Sulphafurazole - Sulphisoxazoleacetyl. Intestinal infections - Sulphaguanidine - Phthalylsulphathiazole. Local infection - Sulphacetamide sodium - Mafedine - Dapsone

Unit II Anti-Mycobacterial, Thyroid and Antithyroid Drugs 10 h

Introduction - Synthesis and mode of action of pyrazinamide, fluoroquinolones and ofloxacin. Structure and mode of action of cycloserine, amino glycosides, clofazimine, ciproflaxacin hydrochloride and capreomycin. Synthesis and uses of Thyroxine, carbimazole, methimazole, propylthiouracil. Structure and uses of levothyroxine sodium and liothyronine sodium

Unit III Anesthetics and Analgesics 10 h

Introduction to anesthetics - Preparation of inhalation anesthetics - Ether - Ethyl chloride - Fluroxene - Halothane. Structure of intravenous anesthetics - Ketamine hydrochloride - Methohexital sodium - Thiamylal sodium. Introduction to analgesics, characteristic features of opioids, morphine analogues - Morphine sulphate - Diamorphine hydrochloride (structure only). Morphinan analogues - Levorphanol tartrate - Dextromethorphan hydrobromide (structure only). Synthesis and advantages of phenylpiperidine analogues - Pethidine hydrochloride - Diphenoxylate hydrochloride. Phenyl propylamine analogues - methadone hydrochloride - Dextropropoxyphene hydrochloride

Unit IV Non-Steroidal Anti-Inflammatory Drugs 10 h

Introduction, classification, synthesis and mode of action of indomethacine, sulindac, tolmetin sodium, ibuprophen, ibuphenac, dichlorophenal sodium, flubiprofen, naproxen, auranofin and allopurinol

Unit V Antimalarial Drugs 8 h

Introduction, synthesis and mode of action of chloroquine phosphate, pamaquine, primaquine phosphate, proguanil hydrochloride, pyrimethamine, trimethoprim




Text Books

- 1 Razdan B, 2010, " Medicinal Chemistry", 1st Edition, CBS Publishers and Distributors & New Delhi
- 2 Ahluwalia V.K and Madhu Chopra, 2008, "Medicinal Chemistry", 4th Edition, AneBooks & New Delhi

References

- 1 Ashutosh Kar, 2015,"Medicinal Chemistry", 6th Edition, New Age International Ltd & New Delhi.
- 2 Jayashree G, 2014,"A Text Book of Pharmaceutical Chemistry", 5th Edition, S. Chand and Company Ltd & New Delhi.
- 3 Graham L. P, 2005, "An Introduction to Medicinal Chemistry", 3rd Edition, Oxford university press & UK
- 4 Malleshappa N, Anurekha Jain and Harun M, 2014,"Textbook of Medicinal Chemistry Volume I", 1st Edition, CBS publishers and distributors Pvt Ltd & New Delhi
- 5 <https://www.ramauniversity.ac.in/online-study-material/pharmacy/dpharma/2year/pharmaceuticalchemistry-ii/lecture4.pdf>
- 6 https://www.researchgate.net/publication/344177762_Anesthetic_Drugs/link/5f591c61a6fdcc1164046b54/download

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