

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

**REGULATIONS 2023-24 for Post Graduate Programme
(Outcome Based Education model with Choice Based Credit System)**

M.Sc. Degree

(For the students admitted during the academic year 2023-24 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 (R5)
(2023-24 and onwards)
(OUTCOME BASED EDUCATION WITH CBCS)

Effective from the academic year 2023-24 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, Cognitive Systems, Artificial Intelligence and Machine Learning and Cyber Security and Data Analytics 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 2023–2025 refers to students belonging to a 2-year Degree programme admitted in 2023 and completing in 2025.

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) Internship/Industrial Training (IT)

Students must undertake industrial / institutional training for a minimum of 15 days during the II semester summer vacation. The students will submit the report for evaluation during III semester.

e) 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.

f) 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.

g) 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 University/ 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,

Mark distribution for Theory Courses

Continuous Internal Assessment (CIA) : 40 Marks

End Semester Exams (ESE) : 60 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)	5
2	Model (All 5 Units) (On completion of 85 th working day)	5
3	Attendance	05
4	Library Usage	05
5	Skill Enhancement *	05
Total		25

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 and Assignment.

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 • 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
13	Assignment	<ul style="list-style-type: none"> • Content and Style • Spelling and Grammar • References

ii) Distribution of External Marks

Total : 75
Written Exam : 75

Marks Distribution for Practical course

Total : 100
Internal : 40
External : 60

i) Distribution of Internals Marks

S. No.	Particulars	Distribution of Marks
1	Experiments/Exercises	15
2	Test 1	10
3	Test 2	10
4	Observation Notebook	05
Total		40

ii) Distribution of Externals Marks

S.No.	Particulars	External Marks
1	Practical	40
2	Record	10
3	Viva- voce	10
Total		60

Practical examination shall be evaluated jointly by Internal and External Examiners.

A) Mark Distribution for Project

Total : 200
Internal : 80
External : 120

i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	30
2	Review II	40
3	Attendance	10
Total		80

ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Project Work & Presentation	100
2	Viva -voce	20
Total		120

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 semester. The proposed NPTEL course should cover content/syllabus of exempted core paper in 3rd 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 semester. Out of 2 NPTEL proposed courses, **at least 1 course** should cover content/syllabus of exempted core paper in 3rd semester.

Mandatory

The exempted core paper in the 3rd 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 Semester
			Course II	Option 1- Paper Title Option 2- Paper Title Option 3- Paper Title	
Class Advisor		HoD		Dean	

7. Internship/Industrial Training

Mark Distribution for Internship/ Industrial Training

Total	:	100
Internal	:	40
External	:	60

i) Distribution of Internal Marks

S.No.	Particulars	Internal Marks
1	Review I	15
2	Review II	20
3	Attendance	5
Total		40



ii) Distribution of External Marks

S.No	Particulars	External Marks
1	Internship /Industrial training Presentation	40
2	Viva -voce	20
Total		60

Internship/ Industrial training shall be evaluated jointly by Internal and External Examiners.

9. 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 University/ 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 : [1½ 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 5 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			

CIA Test II/ Model [3 Hours-5 Units] - 75 Marks

SECTION	MARKS	DESCRIPTION	TOTAL	Remarks
Section - A	10 x 1 = 10 Marks	MCQ		
Section - B	5 x 3 = 15 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks	75 Marks	Marks secured will be converted To 5 mark
Section - C	5 x 8 = 40 Marks			
Section - D	1 x 10 = 10 Marks	Compulsory Question		

End Semester Examination [3 Hours-5 Units] - 75 Marks

SECTION	MARKS	DESCRIPTION	TOTAL
Section - A	10 x 1 = 10 Marks	MCQ	75 Marks
Section - B	5 x 3 = 15 Marks	Answer ALL Questions (Either or Type Questions) Each Questions Carry Equal Marks	
Section - C	5 x 8 = 40 Marks		
Section - D	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	



PG CURRICULUM
PROGRAMME NAME - M.Sc Chemistry
AY 2023-24

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
First Semester										
232CE2A1CA	Core -I	Organic Reaction Mechanism	4	1	-	3	25	75	100	4
232CE2A1CB	Core - II	Coordination Chemistry	4	1	-	3	25	75	100	4
232CE2A1CC	Core - III	Thermodynamics and Kinetics	4	1	-	3	25	75	100	4
232CE2A1CD	Core - IV	Analytical Chemistry	4	1	-	3	25	75	100	4
232CE2A1CP	Core Practical - I	Organic Chemistry	-	-	6	6	40	60	100	3
232CE2A1DA	DSE - I	Polymer Chemistry	4	-	-	3	25	75	100	4
232CE2A1DB		Industrial Chemistry								
232CE2A1DC		Green Chemistry								
Total			20	4	6	-	-	-	600	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- 13 th 08/06/23	AC - 15 th 14/07/23	GB - 20 th 05/08/23



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 COIMBATORE | INDIA

M.Sc. Chemistry (Students admitted during the AY 2023-24)

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Second Semester										
232CE2A2CA	Core - V	Stereochemistry and Pericyclic Reactions	4	1	-	3	25	75	100	4
232CE2A2CB	Core - VI	Bio-Inorganic Chemistry	4	-	-	3	25	75	100	4
232CE2A2CC	Core - VII	Molecular Spectroscopy	4	1	-	3	25	75	100	4
232CE2A2CP	Core Practical - II	Inorganic Chemistry	-	-	8	6	40	60	100	4
233BC2A2EA	EDC	Drug Biochemistry	4	-	-	3	25	75	100	4
232CE2A2DA	DSE - II	Cosmetic Chemistry	4	-	-	3	25	75	100	4
232CE2A2DB		Electrochemistry								
232CE2A2DC		Organic Reactions and Reagents								
Total			20	2	8	-	-	-	600	24



Course Code	Course Category	Course Name	L	T	P	Exa m (h)	Max Marks			Credits
							CIA	ESE	Total	
Third Semester										
232CE2A3CA	Core – VIII	Chemistry of Natural Products	4	1	-	3	25	75	100	4
232CE2A3CB	Core – IX	Inorganic Chemistry	4	1	-	3	25	75	100	4
232CE2A3CC	Core – X	Quantum Chemistry and Group Theory	4	1	-	3	25	75	100	4
232CE2A3CD	Core – XI	Analytical Spectroscopy	4	1	-	3	25	75	100	4
232CE2A3CP	Core Practical-III	Physical Chemistry	-	-	6	6	40	60	100	3
232CE2A3CT	IT	Internship					40	60	100	2
232CE2A3DA	DSE - III	Dye and Textile Chemistry	4	-	-	3	25	75	100	4
232CE2A3DB		Nanomaterials and Nanotechnology								
232CE2A3DC		Bio-Organic Chemistry								
Total			20	4	6	-	-	-	700	25

Course Code	Course Category	Course Name	L	T	P	Exam (h)	Max Marks			Credits
							CIA	ESE	Total	
Fourth Semester										
232CE2A4CA	Core – XII	Synthetic Organic Chemistry	4	1	-	3	25	75	100	4
232CE2A4CB	Core – XIII	Statistical Thermodynamics and Computational Chemistry	4	1	-	3	25	75	100	4
232CE2A4CV	Core – XIV	Project	-	-	16	-	80	120	200	8
232CE2A4DA	DSE - IV	Environmental Chemistry	4	-	-	3	25	75	100	4
232CE2A4DB		Catalysis								
232CE2A4DC		Medicinal Chemistry								
Total			12	2	16	-	-	-	500	20
*Grand Total									2400	92

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	232CE2A1DA	Polymer Chemistry
2	232CE2A1DB	Industrial Chemistry
3	232CE2A1DC	Green Chemistry

Semester II (Elective II)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	232CE2A2DA	Cosmetic Chemistry
2	232CE2A2DB	Electrochemistry
3	232CE2A2DC	Organic Reactions and Reagents

Semester III (Elective III)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	232CE2A3DA	Dye and Textile Chemistry
2	232CE2A3DB	Nanomaterials and Nanotechnology
3	232CE2A3DC	Bio-Organic Chemistry

Semester IV (Elective IV)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	232CE2A4DA	Environmental Chemistry
2	232CE2A4DB	Catalysis
3	232CE2A4DC	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	232CE2ASSA	Research Methodology
2	232CE2ASSB	Forensic Chemistry and Crime Investigation



Course Code	Course Name	Category	L	T	P	Credit
232CE2A1CA	ORGANIC REACTION MECHANISM	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
- 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, stability of organic compounds	K3
CO2	Utilize various methods to determine the reaction mechanisms	K4
CO3	Summarize reaction mechanisms of nucleophilic substitution reactions	K3
CO4	Illustrate the reaction mechanisms of 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	✓	✓			✓

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



232CE2A1CA	ORGANIC REACTION MECHANISM	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 and 10 electrons – Alternant and non-alternant hydrocarbons, systems of more than 10 electrons – Annulenes – Azulenes – Ferrocene and Syndones – Concept of homoaromaticity

Unit II Methods of Determining Reaction Mechanism 12 h

Thermodynamic and kinetic requirements of reactions: Types of mechanism – Thermodynamic and kinetic control – Methods of determination of reaction mechanism – 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 mechanism- Curtin-Hammett principle – Hammett equation – Significance of substitution and reaction constant – Hammond postulates – Limitations and deviations – Taft equation

Unit III Aliphatic & Aromatic Nucleophilic Substitution Reactions 12 h

SN1, SN2, SNi and neighbouring group participation – Kinetics – Effect of structure, solvent, leaving and entering group and Stereochemistry. Claisen and Dieckmann condensation – Williamson reactions. Mechanism of aromatic nucleophilic substitution – SNAr and Benzyne mechanism – Chichibabin reaction – Cine substitution – Diazonium group as leaving group

Unit IV Aliphatic & Aromatic Electrophilic Substitution Reactions 12 h

SE1 and SE2 reactions – Mechanisms and reactivity – Keto-enol tautomerism – Halogenation of carbonyl compounds – Stork enamine reaction – Aromatic electrophilic substitution – Orientation and mechanism – Nitration – Halogenation and sulphonation – Friedel-Crafts alkylation – Friedel Crafts acylation and Scholl reaction – Vilsmeier-Haack reaction – Gattermann reaction – Bischler Napieralski reaction



Unit V Addition and Elimination Reaction

12 h

Addition to C-C and C-O multiple bonds - Electrophilic - Nucleophilic and free-radical additions - Birch reduction - Michael addition - Diels-Alder reaction - Meerwein-Ponndorf reduction - Stobbe condensation. Elimination reactions - E1 and E2 mechanism - Orientation - Hofmann and Saytzeff rules - Elimination versus substitution - Chugaev reaction - Hofmann degradation and Cope elimination - Mechanism and orientation in pyrolytic elimination

Text Books

- 1 Michael B. Smith, 2015, "March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure", 7th Edition, Wiley & 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." 7th Edition, 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, 2010, "Organic Reactions and Mechanisms", 4th Edition, Narosa Publishing House & New Delhi
- 6 <https://archive.nptel.ac.in/courses/104/101/104101115/>
- 7 <https://archive.nptel.ac.in/courses/104/106/104106119/>



Course Code	Course Name	Category	L	T	P	Credit
232CE2A1CB	COORDINATION CHEMISTRY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- 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, 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	✓	✓			✓

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



232CE2A1CB	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 field 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 - π 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 - Mechanism of redox reaction - 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
- 5 <https://www.dalalinstitute.com/wp-content/uploads/Books/A-Textbook-of-Inorganic-Chemistry-Volume-1/ATOICV1-8-3-Orgel-and-Tanabe-Sugano-Diagrams-for-Transition-Metal-Complexes-d1-d9-States.pdf>
- 6 <https://chem.yonsei.ac.kr/chem/upload/CHE3103-01/125652642990718.pdf>



Course Code	Course Name	Category	L	T	P	Credit
232CE2A1CC	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 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 of electrochemical reactions	K4
CO4	Interpret the knowledge about chemical kinetics in molecular reactions	K5
CO5	Apply concept involved in catalysis and adsorption	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



232CE2A1CC	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 Publishers & USA.
- 4 Bockris. J.O.M and Reddy A. K. N, 1998, "Modern Electrochemistry", 4th Edition, Plenum Press & USA.
- 5 <https://epgp.inflibnet.ac.in/Home/ViewSubject?catid=13G8VouhmrFfuhs6rkiyTA==>
- 6 <https://archive.nptel.ac.in/courses/104/101/104101128/>



Course Code	Course Name	Category	L	T	P	Credit
232CE2A1CD	ANALYTICAL CHEMISTRY	CORE	4	1	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The nature of errors and their types
- Various techniques involved in chromatography
- The 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	K3
CO3	Examine the Spectrophotometry, XRD and Fluorescence Spectroscopy	K3
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	✓		✓	✓	✓

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



232CE2A1CD	ANALYTICAL CHEMISTRY	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 and Mass Spectroscopy) - GC-FID (Gas Chromatography and Field Ionization Detector), GC-ECD (Gas Chromatography and Electron Capture Detector) and GC-PFPD (Gas Chromatography and 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 Emission 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) - 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 - 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, Merritt. 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.
- 5 https://www.whitman.edu/chemistry/edusolns_software/GC_LC_CE_MS_2017/CH%201%202017.pdf
- 6 http://www.issp.ac.ru/ebooks/books/open/X-Ray_Spectroscopy.pdf
- 7 https://web.stanford.edu/class/engr1n/Precision_E1.pdf



232CE2A1CP	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: Any 10 Experiment**References**

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



Course Code	Course Name	Category	L	T	P	Credit
232CE2A1DA	POLYMER CHEMISTRY	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	CC Statement	Knowledge Level
CO1	Summarize the Mechanism of polymerization process	K3
CO2	Categorize the different polymerization techniques	K4
CO3	Analyze the various characteristics of polymers	K4
CO4	Examine the structure, properties and fabrication techniques	K4
CO5	Summarize the functionalities of commercial polymers	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

232CE2A1DA	POLYMER CHEMISTRY	SEMESTER I
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Total Credits: 4

Total Instruction Hours: 48 h

Syllabus

Unit I Chemistry of polymers 10 h

Addition and Condensation polymers - Mechanism (free radical, ionic, Zeigler-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 8 h

Types of degradation - Thermal- Mechanical - 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 - Configuration 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

10 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 polymers

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", 3 Edition, McGraw Hill Education & New Delhi.
- 5 <https://onlinelibrary.wiley.com/journal/10991581>
- 6 https://nitsri.ac.in/Department/Chemical%20Engineering/M3__Polymer_Technology.pdf

Course Code	Course Name	Category	L	T	P	Credit
232CE2A1DB	INDUSTRIAL CHEMISTRY	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The properties and 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	Utilize the coating process of paint and pigments	K3
CO3	Illustrate the various types and properties of alloying materials	K3
CO4	Analyze the types and manufacturing process of fertilizer	K4
CO5	Develop 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	✓	✓			✓

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



232CE2A1DB	INDUSTRIAL CHEMISTRY	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 glasses - Soda lime - Lead - Armoured - Safety - Borosilicate - Fluorosilicate - Coloured - Photosensitive. Chemistry of refractories and Abrasives

Unit II Surface coatings 10 h

Objective of coating surfaces - Preliminary treatment of surface - Classification of surface coatings - Paints and pigments - Formulation and composition of 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 - Metallic coatings (electrolytic and electroless). Metal spraying and anodizing

Unit III Alloys 8 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 10 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 Sharma. B .K , 2003 , "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.
- 5 https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCH1604.pdf
- 6 <https://www.scribd.com/document/491788610/Metal-and-Metal-Alloys-Notes#>



Course Code	Course Name	Category	L	T	P	Credit
232CE2A1DC	GREEN CHEMISTRY	DSE	4	-	-	4

PREAMBLE

This course has been designed for students to learn and understand

- The basics of Green chemistry
- The advantages of green synthetic methods of organic compounds
- 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	Understand various methods of Green synthetic routes	K 3
CO3	Develop the basic knowledge of the various green reactions	K 3
CO4	Compare Aqueous phase, Solid state and PTC reactions	K 3
CO5	Analyze the Photochemical, Microwave, Sonication and Ionic liquid reactions	K 4

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



232CE2A1DC	GREEN CHEMISTRY	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 - 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 - Baker Venkatraman 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 - Hydrolysis 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" 4th Edition, 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", 2nd Edition , Vishal Publishing Co & New Delhi.
- 5 https://simons.hec.utah.edu/papers/BOOK2_C7.PDF
- 6 <https://www.uou.ac.in/sites/default/files/slm/MSCH-604.pdf>


 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 4/07/23	GB- 20 th 05/08/23

