

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

**REGULATIONS 2024-25 for Post Graduate Programme
(Outcome Based Education model with Choice Based Credit System)**

M.Sc. Degree

(For the students admitted during the academic year 2024-25 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 CURRICULUM
PROGRAMME NAME – M. Sc Chemistry
A.Y: 2024-25

Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
First Semester												
24CEP1CA	Core -I	Organic Reaction Mechanism	4	1	-	5	60	3	25	75	100	4
24CEP1CB	Core -II	Coordination Chemistry	4	1	-	5	60	3	25	75	100	4
24CEP1CC	Core -III	Thermodynamics and Kinetics	4	1	-	5	60	3	25	75	100	4
24CEP1CD	Core -IV	Analytical Chemistry	4	1	-	5	60	3	25	75	100	4
24CEP1CP	Core Practical -I	Organic Chemistry	-	-	6	6	72	6	40	60	100	3
24CEP1DA	DSE-I	Polymer Chemistry	4	-	-	4	48	3	25	75	100	4
24CEP1DB		Industrial Chemistry										
24CEP1DC		Green Chemistry										
Total			20	4	6	30	360				600	23



Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
						Second Semester						
24CEP2CA	Core -V	Stereochemistry and Pericyclic Reactions	4	1	-	5	60	3	25	75	100	4
24CEP2CB	Core -VI	Bio-Inorganic Chemistry	4	-	-	4	48	3	25	75	100	4
24CEP2CC	Core -VII	Molecular Spectroscopy	4	1	-	5	60	3	25	75	100	4
24CEP2CP	Core Practical -II	Inorganic Chemistry	-	-	8	8	96	3	40	60	100	4
24BCP2EA	EDC	Drug Biochemistry	4	-	-	4	48	3	25	75	100	4
24CEP2DA	DSE - II	Cosmetic Chemistry	4	-	-	4	48	3	25	75	100	4
24CEP2DB		Electrochemistry										
24CEP2DC		Organic Reactions and Reagents										
Total			20	2	8	30	360				600	24



Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits
						Week	Total		CIA	ESE	Total	
Third Semester												
24CEP3CA	Core -VIII	Chemistry of Natural Products	4	1	-	5	60	3	25	75	100	4
24CEP3CB	Core -IX	Inorganic Chemistry	4	1	-	5	60	3	25	75	100	4
24CEP3CC	Core -X	Quantum Chemistry and Group Theory	4	1	-	5	60	3	25	75	100	4
24CEP3CD	Core -XI	Analytical Spectroscopy	4	1	-	5	60	3	25	75	100	4
24CEP3CP	Core Practical - III	Physical Chemistry	-	-	6	6	72	3	40	60	100	3
24CEP3CT	IT	Internship							40	60	100	2
24CEP3DA	DSE - III	Dye and Textile Chemistry	4	-	-	48	48	3	25	75	100	4
24CEP3DB		Nanomaterials and Nanotechnology										
24CEP3DC		Bio-Organic Chemistry										
Total			20	4	6	30	360				700	25




Course Code	Course Category	Course Name	L	T	P	Instruction Hours		Exam (h)	Max Marks			Credits	
						Week	Total		CIA	ESE	Total		
Fourth Semester													
24CEP4CA	Core-XII	Synthetic Organic Chemistry	4	1	-	5	60	3	25	75	100	4	
24CEP4CB	Core-XIII	Statistical Thermodynamics and Computational Chemistry	4	1	-	5	60	3	25	75	100	4	
24CEP4CV	Core-XIV	Project	-	-	-	16	192	-	80	120	200	8	
24CEP4DA	DSE - IV	Environmental Chemistry	4	-	-	4	48		25	75	100	4	
24CEP4DB		Catalysis											
24CEP4DC		Medicinal Chemistry											
Total			12	2	16	30	360				500	20	
*Grand Total										2400	92		

Theory : CIA 25: ESE 75
 Practical/ IT : CIA 40: ESE 60
 Project : CIA 80: ESE 120

*Total Credits does not exceed 92 credits

10/11
 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- <i>06-04-24</i>	AC - <i>17-04-24</i>	GB -



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	24CEP1DA	Polymer Chemistry
2	24CEP1DB	Industrial Chemistry
3	24CEP1DC	Green Chemistry

Semester II (Elective II)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	24CEP2DA	Cosmetic chemistry
2	24CEP2DB	Electrochemistry
3	24CEP2DC	Organic Reactions and Reagents

Semester III (Elective III)

List of Elective Courses

S.No.	Course Code	Name of the Course
1	24CEP3DA	Dye and Textile Chemistry
2	24CEP3DB	Nanomaterials and Nanotechnology
3	24CEP3DC	Bio-Organic Chemistry



Semester IV (Elective IV)**List of Elective Courses**

S.No.	Course Code	Name of the Course
1	24CEP4DA	Environmental Chemistry
2	24CEP4DB	Catalysis
3	24CEP4DC	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	24CEPSSA	Research Methodology
2	24CEPSSB	Forensic Chemistry and Crime Investigation



Semester - I
CORE I: ORGANIC REACTION MECHANISM

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CEP1CA	ORGANIC REACTION MECHANISM	CORE	48	12	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> 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
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Prerequisite Knowledge on Organic Chemistry

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Apply the electronic effects in organic chemistry, stability of organic compounds	K3
CO2	Utilize various methods to determine the reaction mechanisms	K3
CO3	Summarize reaction mechanisms of nucleophilic substitution reactions	K3
CO4	Illustrate the reaction mechanisms of electrophilic substitution reactions	K4
CO5	Compare the addition and elimination reactions	K4

Mapping with Program Outcomes:

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



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	<p>Electronic Effects and Aromaticity</p> <p>Electron displacement – Inductive and field effect – Delocalized bonds – Rules of resonance - Steric inhibition of resonance - Steric enhancement of resonance – Hyper conjugation – 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 homo aromaticity</p>	12	Text Book
II	<p>Methods of Determining Reaction Mechanism</p> <p>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</p>	12	Reference Book
III	<p>Aliphatic & Aromatic Nucleophilic Substitution Reactions</p> <p>SN₁, SN₂, SN_i and neighboring group participation - Kinetics - Effect of structure, solvent, leaving and entering group and Stereochemistry. Claisen and Dieckmann condensation - Williamson reactions. Mechanism of aromatic nucleophilic substitution - S_NAr and Benzyne mechanism - Chichibabin reaction - Cine substitution - Diazonium group as leaving group</p>	12	Text Book
IV	<p>Aliphatic & Aromatic Electrophilic Substitution Reactions</p> <p>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</p>	12	NPTEL
V	<p>Addition and Elimination Reaction</p> <p>Addition to C-C and C-O multiple bonds – Electrophilic - Nucleophilic and free- radical additions - Birch reduction - Michael addition - Diels-Alder reaction - Meerwein - Ponderf reduction - Stobbe condensation. Elimination reactions - E₁</p>	12	You Tube Videos



	and E ₂ mechanism - Orientation - Hofmann and Saytzeff rules - Elimination versus substitution - Chugaev reaction - Hofmann degradation and Cope elimination - Mechanism and orientation in pyrolytic elimination		
	Total	60	

Text Book	1.	Michael B. Smith, 2015, "March's Advanced Organic Chemistry: Reactions, Mechanisms and Structure", 7 th edition, Willey & USA.
Reference Books	1.	Morrison R.N. Boyd R.N. and Bhattacharjee, 2010, "Organic Chemistry", 7 th edition, Pearson Education &UK.
	2.	Bansal R.K., 2012, "Organic Chemistry Reaction mechanisms."7 th edition, New Age International Private Ltd & New Delhi.
	3.	Lowry and Richardson, 1997, "Mechanism and theory in organic chemistry", 3 rd edition. Pearson Publishers & UK
	4.	Clayden J, Greeves N and Warren S, 2014, "Organic Chemistry" 2 nd edition, Oxford University Press & UK.

Journal and Magazines	https://www.sciencedirect.com/topics/chemistry/michael-addition
E-Resources and Website	https://archive.nptel.ac.in/courses/104/101/104101115/

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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Semester - I

CORE II: COORDINATION CHEMISTRY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CEP1CB	COORDINATION CHEMISTRY	CORE	48	12	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none"> The characteristics of different types of matrices The basic concept of sequence and series The rule for finding the limit
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Prerequisite Knowledge on Coordination Chemistry

Course Outcomes (COs)

CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy 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 and geometries of coordination complexes	K3
CO4	Examine the structure and bonding of metal carbonyls	K4
CO5	Analyze the importance of electronic spectroscopy	K4

Mapping with Program Outcomes:

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



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	<p>Theories of coordination compounds</p> <p>Valence bond and Crystal field theory - Splitting of d orbitals in ligand field and different symmetries - Crystal Field Stabilization Energy - 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 - Molecular orbital theory - Octahedral - Tetrahedral and square planar complexes - π bonding and molecular orbital theory</p>	12	Text Book
II	<p>Reaction mechanism in coordination complexes</p> <p>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</p>	12	Reference Book
III	<p>Structure of coordination complexes</p> <p>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</p>	12	Text Book
IV	<p>Structure and bonding in metal carbonyls</p> <p>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</p>	12	NPTEL
V	<p>Electronic spectra and magnetism</p> <p>Microstates, terms and energy levels for $d^1 - d^9$ 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</p>	12	You Tube Videos



	Total	60	
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Text Book	1.	Huheey. J.E, Keiter. E.A and Keiter. R.L, 2006, "Inorganic Chemistry, Principles of Structure and Reactivity", 4 th edition, Pearson Education & UK.
Reference Books	1.	Cotton. F.A, Wilkinson. G, Murillo. C.A and Bochmann. M, 1999, "Advanced Inorganic Chemistry", 6 th edition, A Wiley - Interscience Publications, John Wiley and Sons & USA.
	2.	Gopalan. R, Ramalingam. V, 2001, "Concise Coordination Chemistry", 3 rd edition, Vikas Publishing house pvt. Ltd & New Dehli.
	3.	Gurdeep Raj, 2014, "Advanced Inorganic Chemistry", 12 th edition, Geol Publishing House & New Delhi
	4.	Shriver. D. F, Weller. M.T, Overton. T, Rourke. J and Armstrong. F.A, 2014, "Inorganic Chemistry", 6 th Edition, New York, W.H. Freeman and Company & USA.

Journal and Magazines	https://www.tandfonline.com/journals/gcoo20
E-Resources and Website	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

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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Semester - I
CORE III: THERMODYNAMICS AND KINETICS

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CEP1CC	THERMODYNAMICS AND KINETICS	CORE	48	12	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none"> • The Fundamentals of equilibrium and non- equilibrium thermodynamics • The chemical equilibrium and catalysis • The application-oriented knowledge about electrochemistry 	
Prerequisite	Knowledge on Basic of Thermodynamics	
Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy 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	K4
CO5	Apply concept involved in catalysis and adsorption	K3

Mapping with Program Outcomes:

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



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	<p>Equilibrium thermodynamics</p> <p>Gibbs - Helmholtz equation - Maxwell relations - 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</p>	12	Text Book
II	<p>Non-equilibrium thermodynamics</p> <p>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</p>	12	Reference Book
III	<p>Electrochemistry</p> <p>Activity - Mean ion activity and mean activity coefficient of electrolytes in solution - Debye-Huckel 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</p>	12	Text Book
IV	<p>Chemical Kinetics - I</p> <p>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</p>	12	NPTEL
V	<p>Chemical Kinetics - II</p> <p>Homogenous catalysis - Hammett acid-base catalysis - Acidity function - Enzyme catalysis - Michaelis - Menton kinetics - Lineweaver Burk plot - Influence of PH and temperature on enzyme catalysis</p> <p>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</p>	12	You Tube Videos



	Hinshelwood mechanism and Eley-Rideal mechanism)		
	Total	60	

Text Book	1.	Atkins. P and Julio de Paula, 2014, "Physical Chemistry" 10 th edition, Oxford University Press & UK.
Reference Books	1.	Glasstone. S, 2008, "Thermodynamics for Chemists", 11 th edition, Ewp Publishers & USA.
	2.	Grow. D.R, 1994, "Principles and applications of electrochemistry", 4 th edition, CRC Press publishers & UK.
	3.	Laidler. K.J, 2003, "Chemical Kinetics", 3 rd edition. Pearson Education Publishers & India.
	4.	Bockris. J.O.M and Reddy A. K. N, 1998, "Modern Electrochemistry", 4 th edition, Plenum Press & USA.

Journal and Magazines	https://link.springer.com/journal/10800
E-Resources and Website	https://archive.nptel.ac.in/courses/104/101/104101128/

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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Semester - I
CORE IV: ANALYTICAL CHEMISTRY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CEP1CD	ANALYTICAL CHEMISTRY	CORE	48	12	-	4

Preamble	<p>This course has been designed for students to learn and understand</p> <ul style="list-style-type: none"> • The nature of errors and their types • Various techniques involved in chromatography • The thermo analytical, Radiochemical, Fluorescence and electroanalytical techniques
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Prerequisite	Knowledge on Analytical Chemistry
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Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy 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 Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓	✓	✓	✓	✓
CO2		✓			✓
CO3	✓				✓
CO4		✓	✓	✓	
CO5	✓		✓	✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Data and error analysis 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	12	Text Book
II	Chromatography 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)	12	Reference Book
III	Spectrophotometry, XRD and fluorescence spectroscopy 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	12	Text Book
IV	Thermal methods of analysis Principles - Instrumentations and applications of thermogravimetry analysis (TGA) - Differential Thermal Analysis (DTA) - TGA and DTA of CaC ₂ O ₄ .H ₂ O (Calcium oxalate monohydrate), CaCO ₃ (Calcium carbonate) - Differential Scanning Calorimetry (DSC) - PLA (poly lactic acid)	12	NPTEL
V	Electroanalytical techniques Electrochemical sensors - Ion-sensitive electrodes - Glass membrane - Solid - liquid membrane - Gas sensor. Principles and instrumentations of polarography - Cyclic voltammetry - Amperometric titrations	12	You Tube Videos
	Total	60	



Text Book	1.	Skoog and West, 2014, "Instrumental methods of analysis" 6 th edition, Cengage Publishers & USA.
Reference Books	1.	Sharma B.K, 2011, "Instrumental methods of chemical analysis", 1 st edition, Krishna Prakashan Media pvt. Ltd & New Delhi
	2.	Willard H.W, Merrit. L.I, Dean. J.J.A and Settle. F.A, 2004, "Instrumental methods of analysis". 7 th edition, CBS Publishers & New Delhi
	3.	Srivastava.V.K and Srivastava. K.K, 1985, "Introduction to Chromatography," 2 nd edition, Holden Day & New York.
	4.	Hibbert. D.B and Gooding. J.J, 2006, "Data Analysis for Chemistry", 1 st edition, Oxford University Press & UK.

Journal and Magazines	https://www.jscimedcentral.com/journal-info/JSM-Spectroscopy-and-Chromatography
E-Resources and Website	http://www.issp.ac.ru/ebooks/books/open/X-Ray_Spectroscopy.pdf

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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24CEP1CP	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



- 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



Semester - I
DSE I: POLYMER CHEMISTRY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CEP1DA	POLYMER CHEMISTRY	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none"> • The significance of polymers • Polymer structure, properties and characteristics • Polymer processing techniques and its applications 	
Prerequisite	Knowledge on Polymer Chemistry	
Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy 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 Program Outcomes:

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



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	<p>Chemistry of polymers</p> <p>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</p>	10	Text Book
II	<p>Polymerization techniques and types</p> <p>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</p>	08	Reference Book
III	<p>Polymer characteristics and characterization</p> <p>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</p>	10	Text Book
IV	<p>Polymer properties and fabrication</p> <p>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</p>	10	NPTEL
V	<p>Commercial polymers and applications</p> <p>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</p>	10	You Tube Videos



	polymers		
	Total	48	

Text Book	1.	Gowariker. V.R and Viswanathan. N.V, 2019, "Polymer science", 3 rd Edition, New Age International Publishers & New Delhi
Reference Books	1.	Billmeyer. F.W, 2007, "Text book of Polymer science", 3 rd Edition, Wiley India Pvt. Ltd & New Delhi.
	2.	Manas Chanda, 2013, "Introduction to Polymer Science and Chemistry", 2 nd Edition, CRC Press & USA.
	3.	Goel R. Fried, 2003, "Polymer science and technology", 2 nd Edition, Prentice Hall & New Jersey
	4.	George Odian, 2007, "Principles of polymerization", 4 th Edition, Wiley India Pvt. Ltd & New Delhi.

Journal and Magazines	https://onlinelibrary.wiley.com/journal/26424169
E-Resources and Website	https://nitsri.ac.in/Department/Chemical%20Engineering/M3__Polymer_Technology.pdf

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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Semester - I
DSE I: INDUSTRIAL CHEMISTRY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CEP1DB	INDUSTRIAL CHEMISTRY	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none"> • The properties and manufacture of glass products • The coating techniques • The classification and properties of alloys 	
Prerequisite	Knowledge on industrial chemistry	
Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy 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	K3

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓		✓	✓	✓
CO2		✓	✓		
CO3	✓	✓		✓	✓
CO4			✓		
CO5	✓	✓		✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	<p>Silicon industries</p> <p>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</p>	10	Text Book
II	<p>Surface coatings</p> <p>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</p>	10	Reference Book
III	<p>Alloys</p> <p>Classification of alloys (ferrous and non-ferrous) -Specific properties of elements in alloys. Manufacture of Steel (removal of silicon decarbonization, demanganization, desulphurization and dephosphorization, Surface treatment, argon treatment, heat treatment, nitriding, carburizing). Composition and properties of different types of steels</p>	10	Text Book
IV	<p>Fertilizer</p> <p>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.</p>	10	NPTEL
V	<p>Ceramics and cements</p> <p>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</p>	8	You Tube Videos
	Total	48	



Text Book	1.	Jain and Jain , 2017," Engineering Chemistry", 17 th edition , Dhanpat Rai & Sons&New Delhi
Reference Books	1.	Sharma.B .K , 2003 ,"Industrial Chemistry", 22 nd edition , Goel Publishing House & Meerut.
	2.	White. H.L, 1986, "Introduction to Industrial Chemistry", 1 st edition, A Wiley Interscience Publication & USA.
	3.	Pawar. R.A, Gugale. G.S, Nagawade. A.V, Gadave. K.M, 2017, "A Book of Industrial Chemistry",1 st edition, NiraliPrakashan Publishers & Pune.
	4.	Alan Heaton, 1996, "An Introduction to Industrial chemistry", 3 rd edition, Chapman & Hall Publishers & UK.

Journal and Magazines	https://sist.sathyabama.ac.in/sist_coursematerial/uploads/SCH1604.pdf
E-Resources and Website	https://www.scribd.com/document/491788610/Metal-and-Metal-Alloys-Notes#

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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Semester - I
DSE I : GREEN CHEMISTRY

Semester	Course Code	Course Name	Category	L	T	P	Credits
I	24CEP1DC	GREEN CHEMISTRY	DSE	48	-	-	4

Preamble	This course has been designed for students to learn and understand <ul style="list-style-type: none"> • The basics of Green chemistry • The advantages of green synthetic methods of organic compounds • The reactions and applications of green chemistry 	
Prerequisite	Knowledge on Green Chemistry	
Course Outcomes (COs)		
CO Number	Course Outcomes (COs) Statement	Bloom's Taxonomy Knowledge Level
CO1	Gain knowledge on green chemistry principles	K3
CO2	Understand various methods of Green synthetic routes	K3
CO3	Develop the basic knowledge of the various green reactions	K3
CO4	Compare Aqueous phase, Solid state and PTC reactions	K4
CO5	Analyze the Photochemical, Microwave, Sonication and Ionic liquid reactions	K3

Mapping with Program Outcomes:					
COs / POs	PO1	PO2	PO3	PO4	PO5
CO1	✓			✓	✓
CO2		✓	✓		
CO3	✓	✓		✓	
CO4	✓		✓		✓
CO5	✓	✓		✓	✓



Syllabus

Unit	Content	Hours	E-Contents / Resources
I	Principles of green chemistry 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	10	Text Book
II	Green synthesis Adipic acid - Catechol - Disodiumiminodiacetate - Hoffmann elimination - Benzoic acid from methyl benzoate - Toluene - Diels-Alder reaction- Decarboxylation - Safe marine antifoulant	10	Reference Book
III	Green reactions 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	10	Text Book
IV	Aqueous phase, solid state and PTC reactions Aqueous phase reaction - Hydrolysis of methyl salicylate - Chalcone - p-ethoxy acetanilide- p-acetamido phenol - Vanillidene acetone. SFE (Super Critical Fluid Extraction) - Liquid CO ₂ in green synthesis. Solid state - Diphenyl carbinol - Phenyl benzoate - Azomethines. PTC (Phase Transfer Catalyst) reaction - Phenylisocyanide- Diphenyl-7-Hydroxy-coumarin	10	NPTEL
V	Photochemical, microwave, sonication and ionic liquid reactions 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-3Cyclohexenecarboxylate	8	You Tube Videos
	Total	48	




Text Book	1.	Ahluwalia. V. K. 2011, "Green Chemistry-Greener Alternatives to synthetic alternatives to synthetic organic transformations" , 1 st edition, Narora Publishing House & New Delhi.
Reference Books	1.	Ahluwalia V. K, 2019, "Green Chemistry", 3 rd edition, Ane Books India & NewDelhi.
	2.	Asim. K. Das and Madhua. Das, 2012, "Environmental Chemistry with Green Chemistry" , Books and Allied Pvt. Ltd &New Delhi.
	3.	Rashmi S, Srivastava M.M, 2009. "Green Chemistry" 4 th edition, NarosaPublishing House & New Delhi.
	4.	Indu Tucker Sidhwani, Rakesh K. Sharma, 2020," An Introductory Text on Green Chemistry: For Undergraduate Students", 1 st edition, Wiley & Sons &Germany

Journal and Magazines	https://simons.hec.utah.edu/papers/BOOK2_C7.PDF
E-Resources and Website	https://www.uou.ac.in/sites/default/files/slm/MSCCH-604.pdf

Learning Method	Chalk and Talk/Assignment/Seminar
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Focus of the Course	Skill Development/Employability
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 Dr.N.G.P. Arts and Science College		
APPROVED		
BoS-	AC -	GB -
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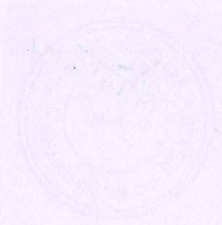
Dr.NGPASC

COIMBATORE | INDIA

M.Sc. Chemistry (Students admitted during the AY 2024-25)

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<p>1. Name of the Candidate</p> <p>2. Roll Number</p> <p>3. Name of the Institute</p> <p>4. Name of the Branch</p> <p>5. Name of the City</p>	
<p>6. Name of the Examinator</p> <p>7. Name of the Examiner</p> <p>8. Name of the Invigilator</p> <p>9. Name of the Supervisor</p> <p>10. Name of the Head of the Institute</p>	
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