PG DEPARTMENT OF CHEMISTRY

SYLLABUS

2020-2022 Batch

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NGM COLLEGE (Autonomous)

Affiliated to Bharathiar University

Re-Accredited by NAAC & ISO 9001:2015 certified

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Nallamuthu Gounder Mahalingam College

VISION

Our dream is to make the college an institution of excellence at the national level by imparting quality education of global standards to make students academically superior, socially committed, ethically strong, spiritually evolved and culturally rich citizens to contribute to the holistic development of the self and

MISSION

Training students to become role models in academic arena by strengthening infrastructure, upgrading curriculum, developing faculty, augmenting extension services and imparting quality education through an enlightened management, committed faculty who ensure knowledge transfer, instill research aptitude and infuse ethical, cultural values to transform students into disciplined citizens in order to improve quality of life.

PG DEPARTMENT OF CHEMISTRY

Department of MSc Chemistry was established in July, 2015 with following Vision and Mission. It offers a wide range of courses including Inorganic Chemistry, Organic Chemistry, Physical Chemistry, Medicinal Chemistry, Green Chemistry, Nano chemistry and Analytical chemistry etc. Experts from Pure and Applied Chemistry domain will teach the courses, and students will develop a thorough understanding of fundamentals and experimental concepts of Chemistry. There will be opportunity for the students to participate in an extensive and varied seminar, workshop, conferences, Association, research club activities, extension and internship programmes and gain experience in a large variety of projects. The outcome based education is established in the year 2019.

VISION

An effective Teaching – Learning adjunct to cater the need of industry in the context of the developing needs of the country.

MISSION

The Chemistry Department pledges itself to encourage in the broadest and most liberal manner, the advancement of science and particularly chemistry in all of its branches through its education, research, and service missions.

CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. Therefore, it is necessary to introduce uniform grading system in the entire higher education in India. This will benefit the students to move across institutions within India to begin with and across countries. The uniform grading system will also enable potential employers in assessing the performance of the candidates. In order to bring uniformity in evaluation system and computation of the Cumulative Grade Point Average (CGPA) based on student's performance in examinations, the UGC guidelines to be followed.

Outline of Choice Based Credit System

Core Course:

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

Elective Course

Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.

Project work/Dissertation

It is considered as a special course involving application of knowledge in solving / analyzing /exploring a real life situation / difficult problem. Project/Dissertation work would be of 7 credits.

Outcome Based Education (OBE)

It is the educational approach which focuses on student centric education in the context of development of personal, social, professional and knowledge (KSA) requirements in one's career and life. Outcome Based Education is an approach that focuses on outcomes such as the achievements of students that are measurable, proven and can be improved. It is simply the establishment of expected goals or outcomes for different levels of graduate, and a commitment to ensure that every student achieves at least those minimum proficiencies before being allowed to post graduate.

The authorities of Nallamuthu Gounder Mahalingam College, Pollachi in-lieu of accreditation standards of National Assessment and Accreditation Council, decided to opt for Outcomes Based Education (OBE). As the part of the decision in Academic council meeting was held at the campus. The detailed document is designed and the existing curriculum of the department is transformed in to the framework of OBE. This is the first step towards the implementation of OBE in the department. The document will serve all stakeholders in the effective implementation of the curriculum. The OBE is continuous process for quality enhancement and it will go a long way in order to enhance the competencies and employability of the Post-graduates of the department.

Programme Educational Objectives

- The graduates will become successful professional by demonstrating logical and analytical thinking abilities.
- The graduates will work and communicate effectively in interdisciplinary environment, either independently or in team, and demonstrate scientific leadership in academia and industry.
- Graduates will interact with their peers in other disciplines in their work place and society and contribute to the economic growth of the country.
- The graduates will engage in lifelong learning and will be successful in pursuing higher studies in their chosen field.
- Graduates will pursue career paths in teaching or research.

Programme Outcomes

PO1 Students should have an advanced level understanding of at least three of the following areas of chemistry - Analytical, Inorganic, Organic and Physical Chemistry.

PO2 Students should have a professional Skill to handle standard equipment's and to analyze the data.

PO3 Ability to carry out independent chemical research and present chemical research results to a technically literate audience by means of an oral presentation, scientific poster or a written report.

PO4 Having a clear understanding of professional, ethical responsibility and cross cultural competency exhibited by working as a member or in teams.

PO5 To make the Department a growing center of excellence in teaching, cutting-edge research, curriculum development and popularizing Chemistry.

Programme Specific Outcomes

PSO1 Acquire broad understanding of knowledge and applications of major concepts in all disciplines chemistry.

PSO2 Impart the basic instrumentation in analytical and technical skills to work effectively at an advanced level.

PSO3 Critical thinking and design, carry out, record and analyze the complex chemical experiments as per research standardsis of data, synthetic logic, spectroscopy, team-based problem solving, etc.,

PSO4 Design and execute experiments with proper use of good laboratory practices and proper handling of waste generated in the laboratory.

PSO5 Identify current research problems, formulate the research from literature, the ability to synthesize, separate and characterize compounds using published reactions, protocols, standard laboratory equipment, and modern instrumentation.

OBE RUBRIC MAPPING SYSTEM

The attainment level of the students as Low, Medium and High are replaced by the numerals as 1, 2 and 3.

SCHEME OF SYLLABUS & EXAMINATION

I- SEMESTER

SEM	Course Code	Title of the Paper	Duration in hours per week	Examination				Credits
				Hours	CIA	ESE	Total	
I	20PCY101	Inorganic Chemistry – I- Solid state and Nuclear Chemistry	5	3	25	75	100	5
I	20PCY102	Organic Chemistry – I- Reactions and Mechanisms	5	3	25	75	100	5
I	20PCY103	Physical Chemistry –I- Group Theory and Chemical Kinetics	5	3	25	75	100	5
I	20PCY207	Inorganic Chemistry Practical-I	5	--	--	--	--	--
I	20PCY208	Organic Chemistry Practical-I	5	--	--	--	--	--
I	20PCY209	Physical Chemistry Practical -I	5	--	--	--	--	--
TOTAL MARKS							300	15

II-SEMESTER

SEM	Course Code	Title of the Paper	Duration in hours per week	Examination				Credits
				Hours	CIA	ESE	Total	
II	20PCY204	Inorganic Chemistry –II- Coordination and Organometallic Chemistry	5	3	25	75	100	5
II	20PCY205	Organic Chemistry-II – Organic Reactions and Stereochemistry	5	3	25	75	100	5
II	20PCY206	Physical Chemistry-II – Quantum and Electrochemistry	5	3	25	75	100	5
II	20PCY2N1/ 20PCY2N2	*Non-Major Elective: Chemistry in day today life/ Chemistry in context	1	3	--	100	100	2
II	20PCY207	Inorganic Chemistry Practical - I	5	6	40	60	100	3
II	20PCY208	Organic Chemistry Practical-I	5	6	40	60	100	3
II	20PCY209	Physical Chemistry Practical -I	4	6	40	60	100	4
* Students can choose any one of the papers as electives								
TOTAL MARKS							700	27

III-SEMESTER

SEM	Course Code	Title of the Paper	Duration in hours per week	Examination				Credits
				Hours	CIA	ESE	Total	
III	20PCY310	Organic Chemistry – III – Natural Products and Organic Reagents	5	3	25	75	100	5
III	20PCY3E1 / 3E2/3E3	* Major Elective-I Spectroscopy/ Applied Electro Chemistry/ Polymer Chemistry	5	3	25	75	100	5
III	20PCY311	Physical Chemistry –III – Thermodynamics and Catalysis	5	3	25	75	100	5
III	20PCY3E4 / 3E5/3E6	* Major Elective –II Green, Nano chemistry and Cyber Security/ Water Pollution and Industrial Effluents treatment / Nano Technology and Supra Molecular Chemistry	3	3	25	75	100	3
III	20PCY414	Inorganic Chemistry Practical -II	4	6	--	--	--	--
III	20PCY415	Organic Chemistry Practical -II	4	6	--	--	--	--
III	20PCY416	Physical Chemistry Practical -II	4	6	--	--	--	--
	* Students can choose any one of the papers as electives						400	18

IV-SEMESTER

SEM	Course Code	Title of the Paper	Duration in hours per week	Examination				Credits
				Hours	CIA	ESE	Total	
IV	20PCY412	Inorganic Chemistry –III- Bioinorganic and Inner Transition Elements	5	3	25	75	100	5
IV	20PCY4E7/ 4E8/ 4E9	*** Major Elective-III** Medicinal Chemistry/ Food Science and Technology/ Dye Chemistry	4	3	25	75	100	3
IV	20PCY413	Physical methods in chemistry	5	3	25	75	100	5
IV	20PCY414	Phytochemical techniques and health chemistry	Self - study	--	--	100	100	1
IV	20PCY415	Inorganic Chemistry Practical -II	5	6	40	60	100	3
IV	20PCY416	Organic Chemistry Practical -II	4	6	40	60	100	3
IV	20PCY417	Physical Chemistry Practical -II	4	6	40	60	100	4
IV	20PCY418	Project Work & viva voce	3	6	20	80	100	6
*** Students can choose any one of the papers as electives**							800	30
TOTAL MARKS							**2200**	**90**

LIST OF ELECTIVES

SEMESTER	SUBJECT CODE & TITLE
III	**MAJOR ELECTIVE-I** 20PCY3E1- Spectroscopy 20PCY 3E2- Applied Electro Chemistry 20PCY 3E3- Polymer Chemistry
III	**MAJOR ELECTIVE-II** 20PCY3E4- Green, Nano chemistry and Cyber Security 20PCY 3E5- Water Pollution and Industrial Effluents treatment 20PCY 3E6- Nano Technology and Supra Molecular Chemistry
IV	**MAJOR ELECTIVE-III** 20PCY4E7- Medicinal Chemistry 20PCY 4E8 - Food Science and Technology 20PCY 4E9- Dye Chemistry

VALUE ADDED COURSE

SEM	Course Code	Title of the Paper	Total hours	Examination				Credits
				Hours	**CIA**	**ESE**	**Total**	
II	20PCV201	Cosmetics Chemistry	30	2	-	-	50	Grade
III	20PCV301	Treatment of industrial waste water	30	2	-	-	50	Grade

Bloom's Taxonomy Based Assessment Pattern

K1- Remember; K2- Understanding; K3- Apply; K4-Analyze; K5- Evaluate

1.Theory (Core and Major Electives): 70 + 30 Marks (E+I)

(i) TEST- I & II and ESE:

Knowledge Level	Section	Marks	Description	Total
K1 & K2	A(Answer all)	5x1=5 5x1=5	MCQ Define	70
K3	B (Either or pattern)	5x4=20	Short Answers	
K4& K5	C(Answer 4 out of 6) 16th Question Compulsory	4x10=40	Descriptive/ Detailed	

2.Theory: 100 Marks

Knowledge Level	Section	Marks	Description	Total
K3	A(Answer 5 out of 8)	5x5=25	Short Answers	100
K4 & K5	B (Answer 5 out of 8)	5 x 15=75	Descriptive/ Detailed	

3.Practical Examinations:

Knowledge Level	Section	Marks	Total
K3	Experiment & Record work	60 (External)	100
K4		40 (Internal)	
K5			

4.Project:

Knowledge Level	Section	Marks	Total
K4	1. Literature Review & Presentation (III & IV – Semester) (Internal)	**20**	**100**
K5	Project report present & viva (External)	**80**	

Components of Continuous Assessment

Components		Calculation	CIA Total
Test 1	70	**70+70+20+20+20+10 / 7**	**30**
Test 2	70		
Assignment	20		
Seminar/ Tutorial	20		
Knowledge Enhancement	20		
Information acquisition	10		

VALUE ADDED COURSE SCHEME

Knowledge Level	Section	Marks	Description	Total
K1 & K2	A(Answer all)	5x1=5 5x1=5	MCQ Define	50
K3, K4& K5	B(Answer 5 out of 8)	5x8=40	Descriptive/ Detailed	

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY101**	**Inorganic Chemistry –I – Solid state and Nuclear Chemistry**	**Batch :**	2020-2022
			Semester	I
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To learn about inorganic crystals and structural determination methods of solids.
- To understand the concepts acids and bases.
- To gain knowledge about structure and bonding in inorganic chains and rings.
- To understand the principles of nuclear model, modes of decay and detection, measurement of radio activity, nuclear reactors and applications.

Course Outcomes (CO)

K1	CO1	Distinguish the types of solids and their defects.
K2	CO2	Remember the introduction of acid-base concepts and nuclear chemistry.
K3	CO3	Identify and extend the applications of inorganic compounds as rings and clusters, non-aqueous solvents in reactions.
K4	CO4	Apply the electrical properties of solid state, radioactive and counter techniques.
K5	CO5	Evaluate n/p ratio, binding energy and Q-value of nuclear reactions.

Unit-1

Solid state **13Hrs**

Introduction of solid state-Close packing of spheres - packing efficiency - hexagonal close packed (hcp) and cubic close packed (ccp) structures - coordination number - tetrahedral and octahedral holes - limiting radius ratio rule- point defects in solids - Schottky and Frenkel defects – dislocations-Study of structures of rutile, fluorite, antifluorite, zincblende, wurtzite, perovskite, ilmenite and spinels.

Metallic state - free electron theory and band theory - Electrical properties of solids - insulators - intrinsic semiconductors - super conductivity - Meissner effect - BCS (cooper pair) theory.

Self-study: Impurity Semiconductors (n type and p type)

Unit-2

Modern concepts of Acids and bases **13Hrs**

Lewis concept - levelling solvents - solvent system concept- Lux-flood concept - Cady-Elsey concept - Usanovich concept - HSAB principle - Pearson concept – Theories of Hardness and Softness – Acid and base strength of HSAB, limitations and applications of HSAB.

Non aqueous solvents – Levelling effect of the solvent - classification of solvents – chemical reactions in liquid ammonia, liquid HF, liquid N_2O_4, liquid SO_2 and oxyhalide solvents.

Self-study: Characteristic Properties of Ionizing Solvents

Unit-3

Rings, Cages and Clusters **13Hrs**

Chains – catenation, heterocatenation, isopolyanions, heteropolyanions (explanation with examples).

Cages –Structure and bonding of phosphorous compounds, boranes, carboranes and metallocene carboranes.

Metal clusters - Structure and bonding of dinuclear, trinuclear, tetra nuclear and hexa nuclear clusters - polyatomic zintl anions and cations - chevral phases.

Rings - borazines - phosphonitrilic compounds- sulphur - nitrogen ring compounds (S_4N_4).

Self-study: Fullerenes and their Applications

Unit-4

Nuclear Chemistry -I **13Hrs**

Stability of nuclei - packing fraction - even - odd nature of nucleons - n/p ratio - nuclear potential - binding energy and exchange forces - shell model and liquid drop model.

Decay of radio nuclei: rate of decay - determination of half-life period - secular equilibrium and decay series. Modes of decay: alpha, beta, gamma and orbital electron capture- nuclear isomerism - internal conversions.

Nuclear Reactions

Q – value, columbic barrier – nuclear cross section – different types of nuclear reactions projectile capture – particle emission, spallation, fission and fusion – Product distributions – theories of fission, use of fission products, fissile and fertile isotopes- U-238, U-235, Pu-239, Th-232.

Self-study: Stellar Energy

Unit-5

Nuclear Chemistry -II **13Hrs**

Radioactive and Counting techniques - tracer technique, neutron activation analysis, Particle acceleration: linear accelerator - cyclotron and synchrotron - betatron - G.M counter - proportional and scintillation counters.

Radio Isotopes: Applications – isotopes as tracers – uses in structure and mechanistic studies – carbon dating, industry, medicine and agriculture- Hot-atom chemistry-Safety measures.

Self-study: Disposal of Nuclear Waste

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=O377ShVgLi0&list=PLFW6lRTa1g82yuaxHUfC72ZPBViN95T-D&index=1
https://www.youtube.com/watch?v=Xs7SFulW4oE&list=PLXLBkCN7a8rn9Em3D5CRAOANhjwvC4CUK&index=1

Text Books:

1. Puri, B.R., Sharma,L.R and Madan S. Pathania (2006). *Principles of Inorganic Chemistry*. 41st edition. Vishal Publishing Co.
2. Gurdeep Raj, N. (2014). *Advanced Inorganic Chemistry*. 12th Edition. Geol Publishing House
3. Madan, R.D. (2011). *Advanced Inorganic Chemistry*. 3rd Edition. S. Chand & company, New Delhi.
4. Arnikar, H.J. (2000). *Essentials of Nuclear Chemistry*. 4th Edition. New Age International.
5. James E. Huheey. (1997). *Inorganic chemistry Principles of structure and reactivity*, 4th Edition. Pearson India Limited.

Reference Books:

1. Keith F. Purcell and John, C. Kotz. (1980). *Inorganic chemistry*, Holt- Saunders International Editions
2. Cotton, F. A. and Wilkinson,G. (2014). *Advanced Inorganic Chemistry*. 6th edition. Wiley & Sons.
3. Bodie E. Douglas, Darl H. McDaniel and John J. Alexander.(1970), *Concepts and Models of Inorganic Chemistry*, 3rd edition. Wiley & Sons.
4. Gary L. Miessler and Tarr,D. A (2004), *Inorganic Chemistry*,3rd edition, Pearson Publication.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	3	2	3	3
CO2	3	2	3	3	3
CO3	2	3	3	2	2
CO4	2	3	3	2	3
CO5	3	3	3	2	3

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms.R.Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY102**	**Organic Chemistry –I – Reactions and Mechanisms**	**Batch :**	2020-2022
			Semester	I
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To understand aromaticity and reaction mechanism.
- To provide knowledge about electrophilic, Elimination reactions and nucleophilic substitution reactions.
- To learn about the basic ideas about organic reaction intermediates.

Course Outcomes (CO)

K1	CO1	Remember the aromaticity of compounds and Develop skills for identifying the kinetics of reactions.
K2	CO2	Understand the mechanism of different types of substitution, addition and elimination reactions for synthesizing organic compounds.
K3	CO3	Apply the mechanisms in solving chemical reactions.
K4	CO4	Inspect the different types of reactions involved in chemical synthesis.
K5	CO5	Evaluate the various types of reaction intermediate.

Unit-1

Aromaticity **13Hrs**

Aromatic character – Huckel's Molecular orbital theory for aromaticity (HMO), concept of aromaticity and anti aromaticity – Critereia for aromaticity, Non-benzenoid aromatic compounds- Monocyclic and bicyclic non-benzenoid neutral compounds (Annulenes and azulenes).Antiaromatic and Homoaromatic compounds- Alternant and non-alternant hydrocarbons**.**

Kinetic and Non-kinetic Methods of Determination of Reaction Mechanisms

Reaction Mechanism: Kinetic methods- Mechanistic implications of rate law- Isotope effects. Kinetic and thermodynamic control of reactions - Hammonds postulates, linear free energy relationship- Hammett and Taft equations. Types of reactions and mechanisms, Non kinetic methods- Product analysis, intermediate criteria (isolation, trapping and detection) - Isotopic labeling and cross over experiments- Stereochemical evidence.

Self-study: Tautomerism ‑keto ‑enol, amido ‑imido and nitro ‑acinitro systems, Primary and secondary kinetic isotopic effects.

Unit-2 - Electrophilic substitution reactions **13Hrs**

Aliphatic electrophilic substitution reactions – Mechanism

SE1, SE2 and SEi mechanism. Factors affecting reactivity in SE reactions - Typical reactions – hydrogen exchange and migration of double bond, halogenation of carbonyl compounds.

Aromatic electrophilic substitution reactions

Arenium ion mechanism - orientation and reactivity in mono substituted benzene rings – steric effects and ortho/para ratios - ipso attack, orientation in di-substituted benzene rings. Typical reactions - Friedel Crafts alkylation & acylation, Vilsmeier-Haack reaction, Gattermann-Koch reaction, Hofmann-Martius, Jacobsons reaction, Houben-Hoesch reaction, Diazonium coupling.

Self-study: Stork enamine reactions, cyclic mechanism, Bradsher reaction and Bischler-Napieralski reaction

Unit-3 - Nucleophilic substitution reactions 13Hrs

Aliphatic nucleophilic substitution

S_N1, S_N2 and S_Ni reactions and mechanisms - factors affecting nucleophilic substitution reaction - ambident nucleophiles and ambident substrates. Substitution at vinyl carbon and allylic carbon - hydrolysis of esters ($A_{Ac}1$, $A_{Ac}2$ and $B_{Ac}2$ only). Typical reactions - Wurtz reaction - Claisen and Dieckmann condensation - Williamson reactions.

Aromatic nucleophilic substitution: S_NAr - benzyne mechanism - Zeigler alkylation - Chichibabin reaction - Vonbraun reaction - Cine substitution.

Self-study: Neighbouring group participation by σ and π bonds, anchimeric assistance, Rosendmund Reactions, Von Richter rearrangement

Unit-4

Addition and elimination reactions 13Hrs

Addition to C-C and C-O multiple bonds - electrophilic, nucleophilic and free-radical additions - additions to conjugated systems - orientation - Birch reduction - hydroboration - Michael condensation - 1,3 dipolar additions - Diels-Alder reactions - carbene addition to double bonds - hydration of olefines.

Elimination reactions-E1, E2, E1cB - stereochemistry of elimination, Hofmann and Saytzeff's rules - elimination versus substitution - pyrolytic cis elimination.

Self-study: Mannich reaction - Meerwein-Pondorf reduction - Darsen - Wittig - Thorpe and benzoin condensations, Chugaev reaction – dehydration of alcohols, dehydro halogenation of vicinal dihalides, Hofmann degradation, Cope elimination

Unit-5

Reactive Intermediates 13Hrs

Classical and non-classical carbocations, carbanions, radical- anions, radical-cations, carbenes, arynes and nitrenes. General methods of generation**,** detection and reactivity of these intermediates.

Types of free radical reactions, Mechanism of free radical reaction, mechanism at an aromatic substrate, Reactivity in aliphatic substrate, alkenes, alkyl side chain aromatic compound and at bridgehead. Effect of solvent on reactivity.

Self-study: Sandmeyar, Gomberg, Ullman, Pschorr and Hunsdiecker reactions.

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=T1ePwEQ4Fa0
https://www.youtube.com/watch?v=QkQUJhJYPA0
https://www.youtube.com/watch?v=hsBn-BxuN0M
https://www.youtube.com/watch?v=RtV_JxzZoss
https://www.youtube.com/watch?v=-D8tYR3LTsI

Text Books:

1. Mukherjee, S.M and Singh, S.P. (2004), *Reaction Mechanism in Organic Chemistry*. 10th Edition, Macmillan India Ltd.
2. Agarwal, O.P. (2014), *Reactions and Reagents in Organic Chemistry*. 49th Edition. Goel publishing house.
3. Ahluwalia, V.K. Rakesh K. Parashar (2010). *Organic Reaction Mechanisms*. 4th Edition. Narosa Publsihing House.
4. Tewari, Vishnoi, K.S, (2006). *Text book of Organic Chemistry*. 3rd Edition. Vikas Publication.
5. JagadambaSingh and Yadav, L.D.S, (2014), *Advanced Organic Chemistry*. 20thEdition. Pragati prakasham publishers.

Reference Books:

1. Finar, I.L. (2002) *Organic Chemistry. Vol.1*. 5th Edition. Pearson India Ltd.
2. Jerry March (2007) *Advanced organic chemistry*. 4th Edition, A Wiley-Interscience.
3. Morrison, R.T, Boyd, R.N (2013) *Organic Chemistry*.7th Edition. Pearson India Ltd.
4. Skyes, P, (2001), Guide Book to Mechanism in Organic Chemistry, Pearson Education.

Mapping

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Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY103**	**Physical Chemistry –I – Group Theory and Chemical Kinetics**	**Batch :**	2020-2022
			Semester	I
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To give a thorough introduction to the study of group theory.
- To learn about rate and order of the various reactions.
- To learn the concept of photochemistry and its applications.

Course Outcomes (CO)

K1	CO1	Classify molecules based on their different point groups and recollect rate of chemical reactions.
K2	CO2	Apply the point groups of various molecules and construct the character table for point groups and understand the different theories of chemical kinetics.
K3	CO3	Predict the IR and Raman active vibration modes for molecules and type of hybridization in nonlinear molecules based on group theory.
K4	CO4	Detect the principles of Photochemistry and its important applications.
K5	CO5	Examine hybridization scheme for orbital in simple molecules.

Unit-1

Group theory-I: **13Hrs**

Symmetry elements and symmetry operations - identity element - centre of symmetry- reflections symmetry planes - proper and improper rotation axes of symmetry. Group definition, properties-order of group- types of groups-sub group, isomorphic group - similarity transformation and classes.

Point group classification- identification of point groups of simple molecules -group multiplication table (c_{2v} and c_{3v} point group) – Matrix representation of symmetry operations – Reducible and Irreducible representations - orthogonality theorem and properties of irreducible representations.

Self-study: Abelian group, Non - abelian group

Unit-2

Group theory-II **13Hrs**

Character tables –construction of the character table for C_{2v} and C_{3v} point groups - direct product representation - wave function as bases for irreducible representation - spectral transition probabilities - Symmetry Adapted Linear Combinations (SALC) - projection operators and their use to construct SALC - Huckel approximation -concept of hybridization - secular determinant - symmetry factoring of secular equations.

Symmetry selection rule for IR, Raman spectra and rotational spectroscopy - infrared spectral activity of vibrational modes in NH_3 and H_2O molecules - classification of vibrational modes -

application of group theory to bonding: hybridization scheme for orbital in simple molecules - AB_4 (T_d, CH_4), AB_5 (D_{3h} $Fe(CO)_5$) and AB_6 (O_h $[Co(NH_3)_6]^{3+}$).

Self-study: Mutual Exclusion Principle

Unit-3

Chemical Kinetics-I **13Hrs**

Simultaneous reactions - opposing, parallel and consecutive reactions - theories of reaction rates - Arrhenius theory - collision theory - classical collision theory- modified collision theory - causes of weaknesses of the collision theory - absolute reaction rate or transition state theory - Statistical mechanical derivation of the rate equation - thermodynamical formulation of reaction rate, Lindeman's theory of unimolecular reactions.

Kinetics in liquid solution - Salt effect - primary salt effect and secondary salt effect - significance of salt effect - effect of pressure on rates of reactions in solutions.

Self-study: The Steady State Approximation

Unit-4

Chemical Kinetics-II **13Hrs**

Experimental methods of fast reactions - shock tubes and pulse radiolysis techniques - kinetics of decomposition of N_2O_5, H_2-Cl_2.

Photochemical reactions and H_2-Br_2 thermal reaction - non-stationary chain reaction - H_2-O_2 reaction and explosion limits. Effect of temperature, relative permittivity, ionic strength and solvent (Grunwald-Winstein equation) on reaction rates.

Self-study: Chain Reactions - general characteristics

Unit-5

Fundamentals of Photochemistry **13 Hrs**

Physical properties of the electronically excited molecules- excited state dipole moment- geometry of some electronically excited molecules - types of photophysical pathways.

Fluorescence emission – Phosphorescence – luminescence - Photophysical kinetics of unimolecular processes - Stern-Volmer equation – quenching - delayed fluorescence - study of excited states - flash photolysis, laser, maser and its applications.

Self-study: excited state acidity constants - pK* values

Power point Presentations, Group discussions, Seminar ,Quiz, Assignment, Experience Discussion, Brain storming activity and Case study

Web links:

https://www.youtube.com/watch?v=SmZ7CSvETNo
https://www.youtube.com/watch?v=Av9f25sqLG0
https://www.youtube.com/watch?v=5m8ubFNFJUU
https://www.youtube.com/watch?v=-we7yTR7exI

Text Books:

1. Raman, K.V. (1996), *Group Theory and its applications to chemistry*, Tata McGraw Hill publishing company Ltd.
2. Bhattacharya, P.K. (1986),*Group theory and its chemical applications*, Himalaya Publishing House
3. Gopinathan, M. S. and Ramakrishnan, V. (1988), *Group Theory in Chemistry*, Vishal Publishers.
4. Gurudeep Raj, (2014), *Chemical Kinetics*, Krishna Educational Publishers.
5. Bajpai, D.N. (1992), *Advanced Physical Chemistry,* S. Chand Publishing Limited.

Reference Books:

1. Cotton, F.A. (1990), *Chemical applications of group theory*, 3rd Edition, A Wiley Interscience Publication.
2. Laidler. K. J (1987),*Chemical Kinetics* 3rd Edition. Pearson Education India.
3. Rohatgi-Mukherjee. K.K, (2014), *Fundamentals of Photochemistry*, 3rd Edition, New Age International Publishers.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	2	2
CO2	3	2	3	2	3
CO3	3	2	3	2	3
CO4	3	3	3	2	2
CO5	3	3	3	2	3

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Nameand Signature	Name and Signature	CDC	COE
Name: Ms. K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY204**	**Inorganic Chemistry - II Coordination and Organometallic Chemistry**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To know about theories of bonding in inorganic complexes and application, substitution reaction mechanism of coordination complexes, electron transfer mechanism of coordination complexes.
- To apply the knowledge of coordination chemistry to research.
- To promote awareness about organometallic compounds.

Course Outcomes (CO)

K2	CO1	Explain the bonding characteristics in coordination compounds in terms of Crystal Field Theory and Molecular Orbital Theory.
K4	CO2	Examine the spectra of complexes using TS and Orgel diagrams.
K5	CO3	Formulate mechanisms for reactions of transition metal complexes.
K3	CO4	Appraise the preparation, properties and uses of metal carbonyls.
K4	CO5	Apply coordination complexes as catalyst for reactions.

Unit-1

Coordination Chemistry –I **13 Hrs**

Theories of coordination compounds - valence bond theory- crystal field theory - splitting of d orbitals in different symmetries - crystal field stabilization energy - factors affecting the magnitude of 10 Dq - evidence for crystal field stabilization - Spectrochemical series - applications of CFSE- tetragonal distortion from octahedral symmetry - Jahn-Teller distortion. Molecular orbital theory - octahedral complexes - pi bonding theory - experimental evidence for pi bonding.

Stability of complex ions-factors affecting the stability of complex ions- Irving-William series- relation between stepwise formation constant and overall formation constant, determination of stability constant by electrochemical method.

Self-study: Magnetic Properties - I row transition metal complexes: comparison of magnetic properties of Oh, Td & square planar Fe(II), CO(II), Ni(II) & Cu(II) complexes.

Unit-2

Coordination Chemistry –II **13 Hrs**

Quantum number of multi electron atoms- R-S coupling and micro states- ground state terms of d^1 to d^{10}- Hund's rule in determination of low energy states - derivation of terms for p^2, $p^3$and d^1, d^2 ions.

Electronic spectra of coordination compounds - selection rules - band intensities and band widths - Nephelauxetic effect, Orgel diagrams - Tanabe-Sugano diagrams (for d^2 and d^5 systems only) - calculation of 10Dq and B for V^{3+}(oct) and Ni^{2+}(oct) complexes.

Self-study: Charge transfer spectra- effect of Jahn-Teller distortion and spin orbit coupling on Spectra

Unit-3

Coordination Chemistry –III **13 Hrs**

Labile and inert complexes - Substitution reactions in square planar complexes - the rate law for nucleophilic substitution in a square planar complex - trans effect - theories of trans effect - uses of trans effect. Ligand substitution reactions in octahedral complexes - types and mechanism of substitution reactions S_N1 and S_N2 type - acid hydrolysis reaction- catalysed aquation type, base hydrolysis reaction - S_N2 and S_N1CB mechanism - anation reactions.

Mechanisms of redox reactions - outer sphere mechanisms - excited state outer sphere electron transfer reactions - inner sphere mechanisms

Self-study: Complementary and Non-complementary reactions

Unit-4

Organometallic Chemistry – I **13 Hrs**

Definition of organometallic compound - 18 electron rule - EAN rule - concept of hapticity - classification of organometallic compound - the metal carbon bond types - ionic bond - sigma covalent bond - electron deficient bond - dative bond.

Metal carbonyls - methods of preparation, structure, reactions - metal carbonyl bonding - IR spectroscopy of metal carbonyls. Carbonylate ions, carbonyl hydrides, carbonyl halides - metal nitrosyls.

Self-study: Wades rule, Sytx number and Isolobal relationship

Unit-5

Organometallic Chemistry – II **13 Hrs**

Synthesis, reactions, bonding and structure in metal alkene, alkyne, allyl ,dienylsand Cyclobutadiene complexes.

Preparation, properties, structure and bonding in cyclopentadienyl complexes (Ferrocene), arene complexes (Di benzene chromium), cyclo hepta trienyl complexes - basic concept of fluxional molecules.

Self-study: Basic concept of fluxional molecules

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Text Books:

1. Atkins, P.W., Overton, T.L., Rourke, J.P., Weller,M.T., Armstrong, F.A., (2010) *Inorganic Chemistry*, 5th Edition, Oxford University Press
2. Malik, U.K., Tuli, G.D., and Madan, R.D., (2010). *Selected Topics in Inorganic Chemistry*, S. Chand Publication.
3. Gopalan, R., Ramalingam, V., (2001). *Concise Coordination Chemistry*, 3rd edition, Vikas Publishing house pvt Ltd

4. Cotton, F.A., and Wilkinson,G., (1998). *Advanced Inorganic Chemistry*, 4th& 5th Edns, Wiley Interscience, New York,

Reference Books:

1. Keith F. Purcell, John. C. Kotz. (1980),*Inorganic chemistry*, Holt- Saunders International Editions.
2. James E. Huheey. (1997),*Inorganic chemistry Principles of structure and reactivity*, 4th Edition. Pearson India Limited.
3. Basolo, F. & Pearson. R.G. (1967),*Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution.* Wiley Eastern Limited.

Web links:

https://www.youtube.com/watch?v=rlz3_1ofdQs&list=PL8TbBPqune7T-MwkLf-2FTAtE1WjjgCQr
https://www.youtube.com/watch?v=mlI1hnJZleo&list=PL8TbBPqune7T-MwkLf-2FTAtE1WjjgCQr&index=2
https://www.youtube.com/watch?v=HvwswG8FmqE
https://www.youtube.com/watch?v=M38GJOTjwr0
https://www.youtube.com/watch?v=CPTu1YswO1w
https://www.youtube.com/watch?v=86rNPVAtj0Y
https://www.youtube.com/watch?v=vPdEtYNAyp0
https://www.youtube.com/watch?v=yjNpuBHlSVc

Mapping

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3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY205**	**Organic Chemistry –II – Organic reactions and Stereochemistry**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To give a thorough introduction to the study of Oxidation, Reduction and alkaloids.
- To know the concept of Organic Photochemistry.
- To enable a comprehensive knowledge on conformational stereochemistry and pericyclic reactions.

Course Outcomes (CO)

K1	CO1	Understand the basic of oxidation and reduction reactions, and photochemistry.
K2	CO2	Outline the importance of pericyclic reactions, to figure out isomerism and conformational analysis of stereochemistry and to understand the structural elucidation of alkaloids.
K3	CO3	Implement the basic values and analyze the functions of the natural product such as alkaloids.
K4	CO4	Analyse the reagents in chemical reactions, to execute photochemical and pericyclic reactions.
K5	CO5	Evaluate the stereochemical isomerisation, configuration and conformations of molecules.

Unit-1

Oxidation **13 Hrs**

DMSO with either Ac_2O or oxalyl chloride, Dess-Martin reagent. Synthesis involving phase transfer catalysis (PTC), use of crown ethers, Oppanauer oxidation, Jones oxidation.

Reduction

Catalytic hydrogenation - Wilkinson catalyst, dehydrogenation, reduction with $LiAlH_4$, $NaBH_4$, tertiary butoxy aluminum hydride, $NaCNBH_3$, tributyl tin hydride, alkali metals for reduction, reductions involving hydrazines,

Self-study: Chromyl chloride, ozone, DDQ, dioxiranes, selenium dioxide Clemmensen and Wolff kishner reduction, Birch reduction, MPV reduction.

Unit-2

Organic photochemistry **13 Hrs**

Jablonski diagram - chemical actinometry - photosensitization - quenching. Photochemistry of carbonyl compounds - photoreduction - Norrish type I and type II reactions, Photoadditions - Barton reaction-Patterno-Buchi reaction.

Photochemistry of olefins - cis and trans isomerization - dimerization reactions - cycloaddition reactions - 1,2 cycloadditions – photooxidation.

Self-study: Laws of photochemistry - Beer-Lambert, Grothus-Draper law, Stark-Einstein law –

electronic excitation - energy transfer - quantum efficiency, Photo substitution reactions of benzene derivatives

Unit-3

Pericyclic reactions **13 Hrs**

Conservation of molecular orbital symmetry - symmetry properties of molecular orbitals. Electrocyclic reactions - 1,3-diene and 1,3,5-triene systems, correlation diagram and FMO method, Woodward-Hoffman selection rule for electroyclic reactions -con rotatory and dis rotatory motions 4nπ and (4n+ 2)π systems.

Cycloadditions reactions - correlation diagram and FMO approach, π2s + π2s, π2s + π4s (Diels-Alder reaction) systems. Woodward-Hoffman selection rule for cycloaddition reactions,

Sigmatropic rearrangements - analysis of sigmatropic rearrangements by FMO method - 1,3 & 1,5 sigmatropic rearrangements,

Self-study:Simple problems in pericyclic reaction, other sigmatropic shifts - Cope and Claisen rearrangements, ene reaction

Unit-4

Stereochemistry **13 Hrs**

Optical isomerism of biphenyls, allenes and spiranes -optical isomerism of ansa compounds and cyclophanes - Optical isomerism of over – crowded molecules - R, S – nomenclature of compounds having one and more than one chiral centres - enantiotopic and diastereotopic ligands & faces - stereo selective and stereo specific reactions – stereochemistry of sulfur and nitrogen compounds.

Geometrical Isomerism

stereoismerism of cyclic compounds (up to six membered ring)– aldoximes & ketoximes.

Conformational Analysis

configuration and conformation – Conformation of acyclic compounds –ethane, butane, cyclohexane, decalins – stability and reactivity in relation to conformation –perhydro phenanthrenes.

Self-study: Optical isomerism – concept of chirality - concept of prochirality - axial chirality and planar chirality, helicity, E, Z – notation – Determination of configuration of geometrical isomers

Unit-5

Alkaloids **13 Hrs**

Structural elucidation and synthesis of morphine, reserpine, quinine, atropine and papaverine.

Self-study: Introduction-isolation of alkaloids

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=uwia3_Her8s
https://www.youtube.com/watch?v=qB9V2uMaxA8
https://www.youtube.com/watch?v=Pp0LeL0SkRg
https://www.youtube.com/watch?v=J_b1Y4QhhZc
https://www.youtube.com/watch?v=JROZc-9DayM
https://www.youtube.com/watch?v=BBljnB-6420
https://www.youtube.com/watch?v=wNyijTBpOrI

TextBooks:

1. Mukerjee S.M. & Singh, S.P. (2013),*Reaction mechanism in organic chemistry*, 3rd Edition, McMillan India Ltd
2. Ahluwalia, V.K. Rakesh K. Parashar (2010). *Organic Reaction Mechanisms*. 4th Edition. Narosa Publsihing House.
3. Kalsi. P.S. (1995). *Stereochemistry, Conformation and Mechanism*. 3rd edition. John Wiley sons.
4. Nasipuri. D (1994). *Stereochemistry of Organic Compounds.* New age International.
5. Agarwal O. P. (2001),*Natural product Chemistry*. 20th Edition Goel Publishing house.
6. Jagadambal and Singh (2014),*Advanced Organic Chemistry.* 20thEdition. Pragati prakasham publishers.

Reference books:

1. Depuy,C.H. & Chapman. O.S. (1972),*Molecular reactions and photochemistry*.Prentice Hall.
2. Eliel. E.L, Wilen. S.H. (1994),*Stereochemistry of Organic Compounds.* Wiley International
3. Potapov, V.M. Beknazarov. A. (1980),*Stereochemistry*. Mir Publications. Russia.
4. Jerry March (2007), *Advanced organic chemistry*. 4th Edition, AWiley-Interscience.

Mapping

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3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY206**	**Physical Chemistry –II – Quantum and Electrochemistry**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To motivate the students to comprehend a knowledge on quantum mechanics.
- To apply the quantum mechanical concept to simple molecules
- To learn the concepts of Electrochemistry.

Course Outcomes (CO)

K1	CO1	Remember the dual character of electrons. To understand the concepts of classical and quantum mechanics, to picture out the failure of classical mechanics.
K2	CO2	Understand the Schrödinger wave equation to particles in a system.
K3	CO3	Comprehend the approximate methods in quantum mechanics and apply it to simple molecules.
K4	CO4	Analyze the final solution, energy and wave function for H atom and to review the mechanisms.
K5	CO5	Estimate the Current- Voltage relationship and Theories of Elecrokinetics.

Unit-1

Quantum Chemistry-I **13 Hrs**

Success of quantum theory and the failure of classical mechanics - basic concepts - time dependent and time independent Schrodinger equation - requirement of an acceptable wave function - operator concept as applied to quantum mechanics (basic ideas) – Derivation of energy and angular momentum operator-ladder operators -eigen functions and eigen values - postulates of quantum mechanics - application of Schrodinger equation to the particle in a box (1-D& 3-D Boxes) - particle in a ring & particle in spherical orientation.

Self-study: black body radiation

Unit-2

Quantum Chemistry-II **13 Hrs**

Harmonic oscillator and rigid rotator - central force problem - H-atom - method of separation of variables - final solution - the energy and wave function for the problem

Approximation Methods: Approximate methods in quantum mechanics - need for the approximation methods - perturbation and variation methods applicable to H atom in ground state - He atom in the ground state and excited state, He^{+} in the ground state - electron spin and Pauli's principle.

Self-study: Quantum numbers - shapes of the wave functions

Unit-3

Quantum Chemistry-III **13 Hrs**

Slater determinants - HMO treatment of simple and conjugated π- electron systems - ethylene, allyl, butadiene and benzene systems - delocalization energy- construction and use of hybrid orbitals - determination of bond order.

Self-study: Introduction to LCAO - MO methods

Unit-4

Electrochemistry -I **13 Hrs**

Debye- Huckel- Onsager equation- Falkenhagen effect, Wein effect - ionic strength, Debye-Huckel limiting law and its verifications - electrode potential - concentration cells - liquid junction potential.

Electrokinetic phenomena: Theories of double layer - Helmoltz-Perrin, Gouy-Chapmann & Stern theories –Theories of over voltage and zeta potential- elecrodics - mechanism of electrode reactions - polarization and over potential - Butler-Volmer equation - electrophoresis and electro osmosis.

Self-study: Conductance - transport number

Unit-5 **13 Hrs**

Electrochemistry –II

Current-voltage relationships - Voltametry – Polarography - mass transfer - diffusion limited currents - kinetic currents - adsorption currents - amperometry, coulometry, cyclic voltametry, rotating disc electrodes, chronoamperometry, chronopotentiometry, chronocoulometry, (basic principles and applications only in all the above methods).

Self-study: Conductometric and Potentiometric titrations

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=LnmCsNQsR68
https://www.youtube.com/watch?v=uPvWlwOhCTo
https://www.youtube.com/watch?v=p82enyv3XA0
https://www.youtube.com/watch?v=_MCbWJa4u-4
https://www.youtube.com/watch?v=AYRuPNK6WNM
https://www.youtube.com/watch?v=gLesbQ8MPlU
https://www.youtube.com/watch?v=ASPuNKrCzDE

Text Books:

1. Ira N. Levine. (2014) Quantum Chemistry, 7th Edition., PHI learning Pvt Ltd.,
2. Puri B.R & Sharma. L R. (2009) *Advanced Physical Chemistry*, 2nd Edition., Milestone Publishers & Distributors
3. Bajpai, D.N. (1992) *Advanced Physical Chemistry*, S. Chand Publishing Limited.

4. Chandra, A.K (1994) *Introductory Quantum Chemistry*, 3rd Edition, Tata McGraw Hill Publishing Company.
5. R. K. Prasad, Quantum Chemistry, TMH, 1995.
6. P.W. Atkins, Physical Chemistry, 6th Edn., Oxford University Press, 1998

Reference Books:

1. Hanna. M. (1969) *Quantum Mechanics in Chemistry*. 2nd Edition. Addison Wesley Longman.
2. Mcquarrie, D.A. (2008) *Quantum Chemistry*. 2nd Edition University Science Book.
3. John O' M. Bockris, Amulya K.N. Reddy, Maria Gamboa-Aldeco, Maria E. Gamboa- Aldeco (1986). *Modern Electrochemistry*, Volume 2, Part 1 2nd Edition Springer International.
4. Glasstone, An Introduction to Electrochemistry (1943), Van Nostrand Co. Inc., Newyork.

Mapping

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3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name:Ms. M.Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY2N1**	**Non Major Elective-I Chemistry in Day to Day Life**	**Batch :**	2020-2022
			Semester	II
Hrs/Week:	1	**Total Hrs:** 13	**Credits:**	2

Course Objective

- To understood industrial preparations and materials of application in day today life.
- To get an awareness about eco-friendly products to lead sustainable life.
- To enable the student to understand about the manufacture of commercial products.

Course Outcomes (CO)

K1	CO1	Remember fundamental concepts of applied chemistry
K2	CO2	Understand the drugs used in day to day life.
K3	CO3	Test the various forms of drugs, cosmetics and milk products in day to day life.
K4	CO4	Predict the knowledge about the paints and cleansing agents
K5	CO5	Analyze the composition of fertilizers, pesticides and milk products.

Unit-1

Food and Medicines **3 Hrs**

Medicines - Antacid - Tranquilizers (Psychotherapeutic Drugs) – Analgesics – Antipyretics – Antimicrobials – Antibiotics – Antiseptics – Disinfectants

Chemistry in Food and Cosmetics - Artificial Sweetening Agents - Food Preservatives

Self-study: Analysis of pesticides and heavy metals, other adulterant

Unit-2

Fertilizer and Pesticides **3 Hrs**

Fertilizer type- need for fertilizers- essential requirements-NPK ratio-sources of fertilizers. Effect of nitrogen, potassium and phosphorous on plant growth.

Pesticides -classification of insecticides, fungicides, herbicides as organic and inorganic - general methods of application and toxicity, Identification of pesticides in food.

Self-study: Safety measures when using pesticides

Unit-3

Paints **2 Hrs**

Paints, varnish and lacquers- ingredients, characteristics and their uses.Chemistry in Colouring Matter - Classification of Dyes on the Basis of Constitution.

Self-study: Classification of Dyes on the Basis of Application

Unit-4

Cleansing agents **2 Hrs**

Cleansing agents - Soaps - classification, manufacture, dry cleaning-properties.

Self-study: Cleansing agents- importance of cleansing

Unit-5

Milk and Milk products **3 Hrs**

Milk and Milk products-composition of Milk; Flavour and aroma of Milk; Physical properties of Milk; milk products; Cream; butter; ice Cream; milk powder.

Self-study: Effect of heat on Milk; pasteurization; Homogenization

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=Pm9pZlwQAu8
https://www.youtube.com/watch?v=uKEwzpcqXVI
https://www.youtube.com/watch?v=qMhLFu8v4H4
https://www.youtube.com/watch?v=T2d2Jsmu430
https://www.youtube.com/watch?v=VeOBt2PG4SA

Textbooks:

1. Jayashree Ghosh, S.(2005), *Fundamental Concepts of Applied Chemistry*, Chand, Publications.

Reference books:

1. Ronald Bailey, Herbert Clark, James Ferris, Sonja Krause, Robert Strong (2001), *Chemistry of the environment* 2nd Edition Elsevier publications.
2. Jain.P.C. and Monica Jain (2005),*Engineering chemistry* 17th Edition, Dhanpat Rai, Publishing Company (P) Ltd.
3. http://www.ncerthelp.com.

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Name and Signature	Name and Signature	CDC	COE
Name: Ms.K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry

Course Code:	20PCY2N2	Non Major Elective-II Chemistry In Context	Batch :	2020-2022
			Semester	II
Hrs/Week:	1	Total Hrs: 13	Credits:	2

Course Objective

- To enable the student to understand about ecological systems.
- To gain knowledge about biological effects, energy sources and plastics.
- To get an awareness about eco-friendly products to lead sustainable life.

Course Outcomes (CO)

K1	CO1	Remember different types of pollution
K2	CO2	Understand harmful effects of air pollution, applications of solar energy and nuclear energy.
K3	CO3	Implement the disposal of plastics.
K4	CO4	Analyze the hazards of air pollution and radioactivity
K5	CO5	Implement to reduce global warming.

Unit-1

Composition of Environment **3 Hrs**

Environment segment- The atmosphere- the air we breathe - composition of air - burning of hydrocarbons - fog - air quality - ozone - oxygen / ozone screen - ozone formation and distribution in the atmosphere - paths of ozone destruction - chlorofluorocarbons and their interactions with ozone - the antartic ozone hole.

Self-study: Biological effect of UV radiation

Unit-2

Global warms **3 Hrs**

Chemistry of global warms - earth's energy balance - vibrating molecules and the greenhouse effect - molecular response to radiation - methane and other greenhouse gases - climate modeling.

Self-study: Greenhouse effect

Unit-3

Renewable energy **3 Hrs**

Solar energy - fuel from sun light - splitting of water - hydrogen from sunlight - hydrogen economy - fuel cells - batteries.

Self-study: Photovoltaics - stealing the sun

Unit-4 **2 Hrs**

Non-renewable energy

Nuclear energy - nuclear fission and fusion - production of electricity by a nuclear reactor - radioactivity - living with nuclear power.

Self-study: Hazards of radioactivity

Unit-5

Plastics and polymers **2 Hrs**

The world of plastics and polymers -3R principle-Reduce, Reuse and Recycle- polymers - polyethylene - plastics and recreation - paper or plastics.

Self-study: disposal of plastics

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=5BM4wXCP3Vc
https://www.youtube.com/watch?v=BPJJM_hCFj0
https://www.youtube.com/watch?v=KdR_6Taga5A
https://www.youtube.com/watch?v=8Su2UrnQlGo

Textbooks:

1. Jayashree Ghosh, S. (2005), *Fundamental Concepts of Applied Chemistry*, Chand, Publications.

Reference books:

1. Conard L. Stanitski. Luey Pyrde Eubenks. Catherine H. Middle Camp and Wilmer J. Stratton (2000),*Chemistry in Context: Applying Chemistry to Society*, 3rd Edition, Tata Mc Graw Hill.
2. Bailey, Clark, Ferris, Isrause, Strong, (2001),*Chemistry of the environment* 2nd Edition Elsevier publications.

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Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. M. Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY207**	**Inorganic Chemistry Practical -I**	**Batch :**	2020-2022
			Semester	I &II
Hrs/Week:	5 & 5	**Total Hrs:** 130	**Credits:**	3

Course Objective

- To enable the students to separate the common and rare cations in a mixture
- To characterize two common and two less familiar cations
- To prepare inorganic complexes.

Course Outcomes (CO)

K3	CO1	Remember the analysis of cations alone.
K4	CO2	Separate common and rare cations
K5	CO3	Analyse and report cations in a mixture
K5	CO4	Prepare and report coordination compounds
K5	CO5	Develop skills in the synthesis of inorganic complexes.

A. Semimicro QualitativeAnalysis:

Qualitative Analysis employing semi micro methods & spot tests of mixtures of common cations & ions of the following less familiar elements.

Less Familiar Cations:

Molybdenum, Uranium, Thorium, Tungsten, Selenium, Cerium, Titanium, Zirconium, Vanadium & Lithium.

Familiar Cations:

Lead, Copper, Bismuth, Cadmium, Nickel, Manganese, Zinc, Barium, Strontium, Calcium, Ammonium, Magnesium

Note: A minimum of FIVE inorganic mixtures, each containing of two familiar and two less familiar metal cations has to be analyzed by each student during the course.

B. Preparation of Inorganic Complexes

Any Five preparations selected from the following list:

Hydroxylamine hydrochloride,
Chrome alum Copper(I)Chloride,
Trithio urea copper(I),
Potassium trioxalatochromate(III),
Potassiumtrioxalatoferrate(III),
Hexaminecobalt(III)chloride,
Chloropentamminechromium(III)chloride,
Tetrammine copper(II) Sulphate,
Ammonium hexachloro stannate (IV).

Reference books:

1. Ramanajum V.V, (1985) *Semimicro Qualitative Inorganic Analysis*.
2. VenkateswaranV, Veeraswamy R and Kulandaivelu A.R, (1997) *Principles of Practical Chemistry Sultan* Chand & Sons. 2nd Edition.
3. Giri. S. Bajpai D.N. & Panday, O.P. (1990). *Practical Chemistry* Vol. I & II, S. Chand & Co.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	1	1	2
CO2	3	3	1	3	3
CO3	3	3	1	1	3
CO4	3	2	3	1	3
CO5	3	1	2	3	3

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY208**	**Organic Chemistry Practical –I**	**Batch :**	2020-2022
			Semester	I &II
Hrs/Week:	5 & 5	**Total Hrs:** 130	**Credits:**	3

Course Objective

- To enable the students to separate two components in an organic mixture
- To identify the separated components by qualitative tests
- To prepare organic compounds

Course Outcomes (CO)

K3	CO1	Remember the analysis of organic compounds and aromatic substitution reactions.
K4	CO2	Separate organic mixtures by solvent extraction.
K5	CO3	Analyze organic compounds
K5	CO4	Develop skills in the synthesis of organic compounds
K5	CO5	Determine boiling point /melting point

A. Analysis of two component organic mixtures.

(Separation and characterization of individual compounds)

Note: Each student has to complete the analysis of minimum of FIVE Mixtures during the course

B. Single stage Preparations and Recrystallisation (Any Five)

1. **Hydrolysis:**
   Preparation of Benzoic acid from Benzamide.
2. **Acetylation:**
   Preparation of Acetanilide from Aniline.
3. **Bromination:**
   Preparation of p-Bromoacetanilide from Acetanilide.
4. **Nitration:**
   Preparation of m-dinitrobenzene from Nitrobenzene.
5. **Benzoylation:**
   Preparation of Benzanilide from Aniline.
6. **Oxidation:**
   Preparation of Benzoic acid from Benzaldehyde.
7. Preparation of Glucose pentaacetate

C. Demonstration only

1. Thin Layer Chromatography
2. Melting point of synthesized compounds

Reference books:

1. Gnanaprakasam and Ramamurthy (1998), *Organic Chemistry Laboratory Manual*, Ananda Book Depot,Chennai.
2. Vishnoi N.K (2001). *Advanced Practical Organic Chemistry*, Vikas Publishing House.
3. Jagmohan. R (2002). *Advanced Practical Organic Chemistry*, Vol. I &II.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	1	3
CO2	4	3	3	3	3
CO3	2	2	2	3	3
CO4	2	3	3	3	3
CO5	3	3	2	3	2

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms.M.Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY209**	**Physical Chemistry Practical –I**	**Batch :**	2020-2022
			Semester	I &II
Hrs/Week:	5&4	**Total Hrs: 117**	**Credits:**	4

Course Objective

- To make the students to understand the principle and to carry out the potentiometric titrations.
- To determine the pH and P^{Ka} values of buffers and acids
- To determine the molecular weight of solutes.
- To construct the Phase diagram of two components systems

Course Outcomes (CO)

K3	CO1	Recollect the concept of potentiometric titration. .
K4	CO2	Understand the simple eutectic system, molecular weight determination by Rast method, partition coefficient and estimation of metal ions using colorimetry.
K4	CO3	Examine the strength of the solutions and Ka values by potentiometry
K5	CO4	Calculate the molecular weight of chemical compounds from K_f values by Rast micro method.
K5	CO5	Estimate the metal ions using colorimetry.

Non Electrical Experiments

1. Properties of Matter

Simple Eutectic System- determination of unknown compositions

2. Molecular weight determination

Determination of Molecular weight by Rast's micro method

3. Partition coefficient

Determination of Equilibrium constant for the reaction

$KI + I_2 \leftrightarrow KI_3$

Electrical Experiments -Potentiometric Titrations:

A. Acid-Base titrations (using quinhydrone electrode)

4. Titration of Strong acid against Strong base
5. Titration of Weak acid against Strong base
6. Titration of mixture of (strong & weak) acids against Strong base
7. Determination of P^H (acidic solutions)
8. Determination of P^{Ka} of weak acid
9. P^H, P^{Ka} for Phosporic acid

B. Redox titrations

10. Titration of Potassium Iodide against Potassium Permanganate
11. Titration of Ferrous Ammonium Sulphate against Potassium dichromate

C. Precipitation titrations (using silver electrode)

12. Titration of Potassium chloride against Silver nitrate
13. Titration of mixture of halides (chloride and iodide) against silver nitrate

D. Colorimetric Estimations (using photoelectric colorimeter)

Estimation of Copper, Iron, Nickel, Manganese and Chromium.

Reference books:

1. Palit S.R and De S.K (2003),*Practical Physical Chemistry*, Science Book Agency, Calcutta.
2. Sharma P.C and Agarwal (1996),*Practical Chemistry*, Goel Publishing House, Meerut.
3. Venkateswaran Vand Kulaindaivelu A.R (1987),*Practical Physical Chemistry* S.Chand & Co.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	3	1
CO2	3	3	3	2	1
CO3	2	3	3	3	1
CO4	2	3	2	3	2
CO5	3	3	3	3	2

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY310**	**Organic Chemistry –III - Natural Products and Organic Reagents**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To promote an awareness in the student about natural products and their synthesis.
- To introduce new reagents available in organic synthesis.
- To synthesize eco-friendly reagents and chemical pathways for the development of green chemistry

Course Outcomes (CO)

K1	CO1	Remember the classes of natural products and the fundamental of condensation and molecular rearrangement reactions.
K2	CO2	Understand isolation, classification and structural elucidation of terpenoids, steroids and naming reactions which includes condensation, molecular rearrangements.
K3	CO3	Implement the biosynthetic idea of proteins and polypeptides.
K4	CO4	Apply the reagents in organic synthesis.
K5	CO5	Predict the reagents involved in organic synthesis and retro synthesis.

Unit-1

Terpenoids **13 Hrs**

Structural elucidation and synthesis of zingiberene, eudesmol, abeitic acid and caryophyllene, α-pinene, α-santonin, Linalool.

Self-study: Introduction - Isolation and classification of terpenoids - isoprene rule, gem-dialkyl rule

Unit-2

Steroids **13 Hrs**

Structural elucidation of cholesterol (synthesis not required), ergosterol, Vitamin-D, Bile acid, testosterone and progesterone.

Self-study: Introduction-steroids

Unit-3

Proteins and Polypeptides **13 Hrs**

N- terminal(Hydrazinolysis, reduction and carboxypeptidase methods only) and C- terminal residue analysis (phenylthiohydantoin, cyanate and DNP methods only)

Synthesis of polypeptides (Sheehan's, Halpen's and Fischer's methods only), - structure of DNA and RNA and their biological importance.

Heterocyclic compounds: Structure, synthesis and reactions of flavones, isoflavones, purines (adenine and guanine) and anthocyanins (cyanin and pelargonin) thymine, uracil, cytosine.

Self-study:Introduction- Primary, secondary and tertiary structures of proteins Enzymes and biosynthesis of proteins, application of catechin, kaempferol and quercetin.

Unit-4

Molecular rearrangements **13 Hrs**

Introduction - Wagner - Meerwein rearrangements, dienone phenol, Wolf, Favorski, Neber rearrangement, Baeyer-Villiger rearrangement, Stevens, Chapman, Benzidine, Fries, Ardnt Eister synthesis, Lossen and Wallac rearrangements, Curtius, Hoffmann- Loflller- Freytag, Demjanov, Von-Richter rearrangement, Sommelet-Hauser rearrangement, Smiles rearrangement

Self-study: Condensation reactions

Unit-5

Reagents in organic synthesis **13 Hrs**

Gilmans reagent, lithium di-methyl cuprate, lithium diisopropyl amide (LDA), trimethyl silyl iodide, Peterson's synthesis, Vilsmeier reaction. Preparations and synthetic applications of DBU (1,5-diazabicyclo[5.4.0] undecene-5), DCC (dicyclohexylcarbodiimide) , NBS, PCC, PDC, Wilkinson's catalyst. Retro synthetic Analysis - use of activation and protecting groups in synthesis

Self-study: Retro synthetic analysis of simple organic compounds.

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://youtu.be/pel8P2atSEg
https://youtu.be/sdN9LgeKLAo
https://youtu.be/diksW7rHXms
https://youtu.be/AYB_E9gdzx0
https://youtu.be/nm0rkDiobvc
https://youtu.be/baAaUzf_psy
https://youtu.be/2DyeKE5q8Go

Text books:

1. Finar. I. L (1998), *Organic Chemistry Vol. II*, Longman Publishing Group.
2. Agarwal O. P (2001), *Natural product Chemistry*, 20th Edition, Goel Publishing house.
3. Gurdeep Chatwal (2001), *Organic Chemistry of Natural Products Vol I& II*, Himalaya Publishing House.
4. Ahluwalia, V.K. Rakesh K. Parashar (2010), *Organic Reaction Mechanism*. 4th Edition, Narosa Publsihing House.
5. Stuart Warren. (1994). *Designing Organic Syntheses.* 1st edition. John Wiley and sons.
6. Bansal,R. K, (2006), *Organic reaction mechanism* , 11th Ed, Tata McGraw-Hill, Noida.

Reference books:

1. Jerry March (2007), *Advanced organic chemistry*, 4th Edition, A Wiley-Interscience.
2. Newman, A.A (1972, *Chemistry of Terpenes and Terpenoids,* Academic press publishers.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	2	2	3
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CO5	3	2	3	2	2

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3E1**	**Major elective-I Spectroscopy**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To enable the students to understand the principles and instrumentation of various spectroscopic techniques.
- To learn the applications of NMR spectra.
- To acquire knowledge in the structural determination of unknown compounds and various spectroscopic methods.
- To apply the spectral techniques in research.

Course Outcomes (CO)

K1	CO1	Remember about electromagnetic radiation and its frequency region.
K2	CO2	Analyze the vibrations of molecules and identify the functional group present in it.
K3	CO3	Predict the structure of compound using 1D and 2D NMR techniques.
K4	CO4	Describe the mass to charge ratio for the sample under test and to propose the fragmentation pattern.
K5	CO5	Interpret and solve structural problems using various spectra.

Unit-1

UV Visible Spectroscopy **13 Hrs**

Introduction to spectroscopy - Properties of electromagnetic radiation- Electromagnetic spectrum

Simple chromophoric groups- auxochromes - effects of conjugation - Woodward - Fischer rules - aromatic system and systems with extended conjugation –λ_{max} calculation of butadiene and carbonyl compounds- applications to organic compounds - instrumentation.

Self-study: Absorption and emission spectra

Unit-2

IR Spectroscopy and Raman spectra **13Hrs**

The vibrating diatomic molecules - the simple harmonic oscillator- the diatomic rotator - vibrations of polyatomic molecules - the influence of rotation on the spectrum of polyatomic molecules - factors influencing vibrational frequencies - characteristic group absorptions of organic molecules- finger print region -identification of functional groups - applications to simple organic molecules -medical diagnosis (cancer)- instrumentation- FT- IR,NIR

Raman spectra – introduction – characteristic properties of Raman lines – differences between Raman spectra and IR spectra – mechanism of Raman Effect – Intensity of Raman lines

Self-study: Applications of Raman spectroscopy

Unit-3

Mass Spectrometry **13 Hrs**

Theory - instrumentation - isotopic abundance - determination of molecular weights and formula, ionisation techniques (CI, FD, FAB & ESI, APCI) - nitrogen rule -metastable ions and peaks - ion fragmentation mechanisms - Retro Diels-Alder rearrangement -Mclafferty rearrangement -elimination due to ortho groups. Fragmentation associated with functional groups - benzyl alcohol, phenol, methyl phenyl ether, benzaldehyde, 2-hexanone, benzoic acid, n-propyl ethanoate, and benzamide.

Self-study: HR-MS, MS-MS, HREMS.

Unit-4

Nuclear Magnetic Resonance Spectroscopy -^{1}HNMR **13 Hrs**

Magnetic properties of nuclei - theory of nuclear resonance - chemical shift and its measurement - factors influencing chemical shift - chemical equivalence and magnetic equivalence - solvents and NMR spectra - spin-spin coupling, spin-spin splitting systems - proton exchange reactions - heteronuclear coupling - deuterium exchange - double resonances - chemical shift reagents - applications to organic compounds.

Self-study: Instrumentation - CW and FT NMR

Unit-5 **13 Hrs**

^{13}C NMR: Magnetic moment and natural abundance- broad band decoupling - Off-resonance decoupling - deuterium coupling - NOE effect- - peak assignments using DEPT spectrum - structural applications of simple organic molecules.

2D NMR Techniques: Theory - ^{1}H-^{1}H COSY, ^{1}H-^{13}C COSY: HETCOR, Proton detected HETCOR: HMQC, HMBC, NOESY.

Solving problems using IR, UV, NMR and mass spectra for simple molecules.

Self-study: Magnetic moment and natural abundance

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/results?search_query=https%3A%2F%2Fwww.khanacademy.org%2Fscience%2Forganic-chemistry%2Fspectroscopy-jay

https://www.youtube.com/watch?time_continue=1153&v=bEzlTtaEfDU

Text Books:

1. Sharma, Y.R. (2005), *Elementary Organic Spectroscopy*, 3rd Edition, S. Chand & Company Ltd.
2. Banwell. C.N. (1994), *Fundamentals of molecular spectroscopy*, 3rd Edition, Tata McGraw Hill Publishing Company Ltd.
3. Kemp, W. (1991), *Organic Spectroscopy*, 3rd Edition, Mc Millan Press Ltd.

4. Jagmohan, (2005) ,*Organic Spectroscopy Principles and Applications*, 2nd Edition , Narosa publishing house.
5. Kalsi, P.S. (2004), *Spectroscopy of Organic Compounds*, 6th Edition, New Age International Publishers.

Reference Books :

1. Dyer, J. (1965), *Application of absorption spectroscopy of organic compounds*, Prentice and Hall of India Pvt., New Delhi.
2. Silverstien, Bassler and Morril, (2014), *Spectrometric identification of organic compounds*, 8th Edition, John Wiley and Sons, INC

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	1	2
CO2	3	3	3	1	3
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CO5	3	3	3	1	2

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R.Mini, M.Anusuya K.Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3E2**	**Major Elective –I Applied Electrochemistry**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To learn about Current - Voltage relationship, Electrochemical cells, Electroplating.
- To gain knowledge about batteries and its commercial applications
- To understand about corrosion and its control.

Course Outcomes (CO)

K1	CO1	Recollect the fundamentals of electrochemistry.
K2	CO2	Understand the principles and applications of various current-voltage instruments.
K3	CO3	Appraise the process of Electroplating.
K4	CO4	Analyze current and voltage using various techniques.
K5	CO5	Discuss the types of batteries, fuel cells, theories of corrosion & its mechanism.

Unit-1

Potential Sweep methods **8 Hrs**

Current-voltage relationships -Voltametry – Polarography - mass transfer - diffusion limited currents - kinetic currents - adsorption currents - amperometry, coulometry, cyclic voltametry, rotating disc electrodes, chronoamperometry, chronopotentiometry, chronocoulometry (basic principles and applications only in all the above methods).

Self-study: Conductometric and potentiometric titrations

Unit-2

Cells **8 Hrs**

Electrochemical cells - Types of cells - divided and undivided cells - chlor-alkali cells mercury, diaphragm and membrane cells - electro-inorganic chemicals - chlorates, perchlorates - electrosynthesis of fluorine - electro-organic chemicals - electro-reduction of nitro and carbonyl groups - Kolbe synthesis-electro dimerisation - adiponitrile.

Self-study: Components of electrochemical cells

Unit-3

Batteries **8 Hrs**

Thermodynamics of batteries and fuel cells - half cell reactions in batteries - characteristic requirements of a battery system - porous electrodes - separators -evolution of batteries - charge - discharge characteristics - primary batteries, lead acid batteries - Leclanche cells - lithium cells - Ni-Cd cells - High temperature batteries - sodium-sulphur system – H_2-O_2 fuel cell.

Self-study: Components of batteries

Unit-4

Electrometallurgy and Electroplating **7 Hrs**

Electrowinning and electro refining of Cu and Ni, production of aluminium - Hall-Heroult process - Electrolytic production of magnesium and sodium - Electroplating operations - preplating operations - precious metal plating - anodizing of Al.

Self-study: Electroplating of nickel and chromium

Unit-5

Corrosion and Corrosion Control **8 Hrs**

Thermodynamics of corrosion – Pourbaix diagrams – kinetics of corrosion – evans diagram – corrosion current and corrosion potential – Metal oxidation – atmospheric corrosion – crevice corrosion – bimetallic corrosion – stress corrosion – cracking – corrosion control and corrosion inhibitors –cathodic protection – protection by sacrificial anodes.

Self-study: Painting for corrosion control

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=Y5JcWEd4Mws
https://www.youtube.com/watch?v=lrdeauk2QUI&t=233s
https://www.youtube.com/watch?v=1EWiEENa4Gs
https://www.youtube.com/watch?v=hKVXo4rgLIc
https://www.youtube.com/watch?v=0G_aqTI9Oos
https://www.youtube.com/watch?v=0P61i7jBitE
https://www.youtube.com/watch?v=A_rI9rNVgR8
https://www.youtube.com/watch?v=HHgPBMMZ26w
https://www.youtube.com/watch?v=YDeqYSNB_eU
https://www.youtube.com/watch?v=5bEdD3zKm1o
https://www.youtube.com/watch?v=NClagKbLUMM
https://www.youtube.com/watch?v=5kmVun3q34U

Text books :

1. Glasstone. S, (2011), *Introduction to Electrochemistry*, 10th Printing, EastWest Press Private Ltd.
2. Bard and Faulkner. (2001). *Electrochemical Methods*. 2nd edition,John Wiley and sons.
3. Bockris and Reddy. (2002). *Modern Electrochemistry*, (Vol. II). 2nd edition, Kluwer academic publishers.
4. Jain and Jain. (2005). *Engineering Chemistry*. 15th edition, Dhanpat Rai Publishing Company.

Reference books:

1. Pletcher. (1990). *Industrial Electrochemistry.* 2nd edition, Chapmann and Hall.
2. Banerjee. (1985). *Introduction to the Science of Corrosion and its Inhibition*. Oxonian Press.
3. Raj Narayanan, (1998), *An Introduction to Metallic Corrosion & its Prevention*, 1stEdn., Oxford & IBH Publishing Co., Pvt Ltd.

Mapping

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CO5	3	3	2	3	3

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. K. Vimaladevi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3E3**	**Major Elective –I Polymer Chemistry**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- The objective of the course is to stress the importance of polymers.
- To understand various polymerization techniques and characterization of polymers.
- To understand polymer structure, properties and to know the polymer processing techniques, and the chemistry of commercially available polymers and polymer additives.

Course Outcomes (CO)

K1	CO1	Recollect the principles and concepts of contemporary polymer chemistry.
K2	CO2	Understand the basic concepts of polymer synthetic techniques.
K3	CO3	Categorize the basic reactions in polymer chemistry.
K4	CO4	Analyze the physical properties of different polymers and Characterize the polymers using various experimental techniques.
K5	CO5	Apply the Polymerization techniques for Commercial Polymers

Unit-1

Types and Chemistry of Polymerization 13 Hrs

Classification of polymers, Types of polymerization – addition, free radical, ionic and coordination polymerization – Ziegler-Natta, Stereo regular polymerization, Condensation polymerization – Mechanism and Kinetics of polymerization – degree of polymerization – kinetic chain length – inhibition and retardation – Carother's equation.

Self-study: factors affecting chain polymerization

Unit-2

Copolymerization and Polymerization Techniques 13 Hrs

Types of copolymers- ideal, alternating, block and graft copolymer – Types of copolymerization – Free radical ionic copolymerization – polycondensation – copolymer equation – significance – monomer and radical reactivity – Q-e scheme - Determination of monomer reactivity ratio – Mayo-Lewis and Fineman Ross methods.

Self-study: block and graft copolymerization – methods of preparation and mechanism.

Unit-3

Polymer Characteristics and Characterization 13 Hrs

Types of degradation – thermal, mechanical and photo degradations – management of plastics in the environment. The concept of number average and weight averages. Molecular weight methods - Molecular weight distribution, separation of polymers – precipitation and analytical methods – determination of molecular weights – Osmotic pressure, light scattering, viscosity and end group analysis, ultra centrifugation methods.

Self-study: Analysis and testing of polymers- physical / mechanical and chemical analysis of polymers – spectroscopic methods, x-ray diffraction study.

Unit-4

Structure, Properties and Fabrication of Polymers **13 Hrs**

Morphology and order in crystalline polymers – configurations of polymer chain –types of stereo isomerism in polymer – tacticity (eg. Mono and disubstitute polyethylene, polypropylene, polybutadiene) significance of stereoregularity.

Polymer structure and physical properties – crystalline melting point Tm – melting points of homogeneous series – effect of chain flexibility and heat of fusion. The glass transition temperature, Tg-relationship between Tm and Tg, effects of molecular weight, chemical structure, property requirements and polymer utilization.

Self-study: Fabrications of polymers –Moulding, casting and spinning polymers.

Unit-5

Chemistry of Commercial Polymers and Polymer Additives **13 Hrs**

Organic polymers polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins. Dendrimers – Types and applications.

Inorganic polymers – silicon polymers, glass, poly (organophosphazenes) polymers, Basic concept of conducting polymers, liquid crystal polymer, biopolymer and biomedical polymer.

Self-study: Polymer additives: Fillers, plasticizers, colourants, auto oxidants, fire retardants and thermal stabilizers – polymer blends and composites.

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=Cw3NLcsMCwI
https://www.youtube.com/watch?v=CCiBMz2ig5E
https://www.youtube.com/watch?v=FnsfSsFOyYo
https://www.youtube.com/watch?v=pOGpXZ-UMfo
https://www.youtube.com/watch?v=vzVjbd8_Ur0

Text Books:

1. Billmeyer, F. W. (1984) *Text book of polymer science*, 3rd Edition, John Wiley & Sons
2. Gowariker (V.R) & Viswanathan, N.V (1984) *Text book of Polymer science* 1st Edition, New Age International Private Ltd.
3. Introductory polymer chemistry, G.S. Misra, Wiley eastern Ltd

Reference Books:

1. Text book of polymer science, F.W. Billmeyer Jr. 3rd Edn., Wiley, India 2007.
2. Principles of polymerization, George Odian, 4th Edn., John wiley and sons, 2007.
3. Polymer science and technology, Goel R. Fried, Prentice – Hall of India, New delhi, 2000.
4. Polymer science and technology of plastics and rubbers, P. Ghosh, Tata McGraw-Hill, New delhi, 1998.

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3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. M. Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY311**	**Physical Chemistry –III Thermodynamics and Catalysis**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To enable the students to understand and apply the concept of fugacity, activity and chemical potential
- To acquire knowledge on third law of thermodynamics and probability and ensembles.
- To gain knowledge about the distribution laws (classical and statistical) and their applications
- To understand the fundamentals of Surface chemistry.

Course Outcomes (CO)

K1	CO1	Remember the fundamentals of thermodynamics and surface chemistry.
K2	CO2	Comprehend the quantum statistics and partition function.
K3	CO3	Calculate the molecular velocities based on Maxwell Boltzmann distribution law.
K4	CO4	Apply thermodynamic concepts to evaluate the relationship between thermodynamic properties.
K5	CO5	Evaluate statistical thermodynamics to the properties of identical indistinguishable particles like electrons.

Unit-1

Themodynamics and Non-ideal systems **13 Hrs**

Review of the laws of thermodynamics – free energy, chemical potential, entropy-Fugacity - determination of fugacity of gases by graphical method, approximate calculation method, generalized method and from equations of state. Variation of fugacity with temperature and pressure. Fugacity of a gas in a mixture of real gases - Lewis Randal rule.

Definition of activity - activity coefficient of a gas - relation between fugacity and activity coefficient of gas - variation of activity of a gas with temperature and pressure.

Self-study: Activity and activity coefficient of solutions-mean activity and mean activity coefficient

Unit-2

Third Law of Thermodynamics **13 Hrs**

Probability and third law - Nernst heat theorem, thermodynamic quantities at absolute zero, helium at low temperature-negative absolute temperature - entropy of gases - entropy at absolute zero - entropy and probability (Boltzmann Expression) - Boltzmann - Planck equation - significance of thermodynamic probability - entropy of expansion of ideal gas.

Mathematical Introduction: Theories of permutation & combination - laws of probability - Gaussian distribution.

Self-study: Need for third law

Unit-3

Statistical Thermodynamics **13 Hrs**

Introduction - combination and permutation laws – Macroscopic and microscopic probabilities- distinguishable and indistinguishable objects - Maxwell - Boltzmann statistics – Fermi-Dirac statistics-Bose-Einstein statistics- thermodynamic probability- Boltzmann expression for entropy - Stirling's approximation - States of maximum thermodynamics probability - Legrangian multipliers - Maxwell - Boltzmann distribution law - Evaluation of alpha and beta in M.B. distribution law.

Self-study: Thermodynamic probabilities of systems in equilibrium

Unit-4

Partition function **13 Hrs**

Partition function – canonical ensembles - Molecular partition function and canonical function - evaluation of translational, rotational and vibrational partition function – Evaluation of E, Cv and entropy from the partition functions - The relation between partition function and thermodynamic function (E, H, S, A, G, Cv and Cp) - ortho and para hydrogen.

Self-study: Study of monoatomic and diatomic ideal gas molecule on the basis of partition functions

Unit-5

Catalysis **13 Hrs**

Catalysis- acid-base catalysis - enzyme catalysis - Michaelis-Menten equation - effect of temperature on enzyme catalysis - heterogenous catalysis - kinetics of heterogeneous catalysis - Langmuir- Hinshelwood, Rideal - Eley mechanism - pH dependence of rate constants of catalyzed reactions - auto catalysis and oscillatory reactions.

Surface phenomenon - physisorption and chemisorptions - applications - factors influencing adsorption - adsorption isotherms: Langmuir, Freundlich, BET and Gibbs adsorption isotherm - measurement of surface area.

Self-study: Catalysis- Characteristics

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=UIVJ4JkqjaI

https://www.youtube.com/watch?v=NrtZAJtEH3c&list=PLdBDmcnzLC_ZfA9evETgll7NX6N_45M77

https://www.youtube.com/watch?v=ogw0iojLBEQ

https://www.youtube.com/watch?v=1yf2LBUb39g
https://www.youtube.com/watch?time_continue=506&v=Lz0xqu3HvD0

Text books:

1. Puri B.R & Sharma. L R (2009), *Advanced Physical Chemistry*, 2nd Edition., Milestone Publishers & Distributors.
2. Bajpai, D.N. (1992), *Advanced Physical Chemistry,* 1stEdition Reprint (2015) S. Chand Publishing Limited.
3. Gupta, M.C. (1990), *Statistical thermodynamics*,1st Edition, Wiley Eastern Limited.
4. Rajaram Kuriacose (2006), *Statistical thermodynamics*, 4th edition, Shoban lal & Co.
5. Gurudeep Raj (2016). *Chemical Kinetics*, 40th Edition, Krishna Educational Publishers.

Reference books:

1. Aktins. P. W, (1978), *Physical Chemistry*, 1stEdition,Oxford University
2. Klotz, L. M, Rosenberg R.M. & Benjamin, W.A (1974), *Chemical thermodynamics*, 3rd Edition, Pearson publications.
3. Samuel Glasstone, (1964), *Thermodynamics for chemists,* 2nd Edition Reprint (2002), Van Nostrands.
4. Nash, L.K. (1976), *Chemical Thermodynamics*, 2nd Edition, Addision Wesley Publishing.
5. Gabor A. Somorjai and Yimin Li (2010), *Introduction to Surface Chemistry and Catalysis*, 2nd Edition,Willey Publishers.
6. Adamson, A.W, (1997), *Physical Chemistry of Surfaces*, 6th edition, Wiley &Sons

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	3	1
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CO3	3	2	3	2	2
CO4	3	3	3	2	2
CO5	3	3	3	3	3

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3E4**	**Major Elective - II Green, Nano Chemistry and Cyber Security**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	3	**Total Hrs: 52**	**Credits:**	3

Course Objective

- To stimulate students to have in-depth knowledge in green chemistry.
- To introduce the various type of greener reactions, materials.
- To acquire a clear idea about various synthesis of Nanomaterials and techniques.
- To know about literature review, writing a project etc.,

Course Outcomes (CO)

K1	CO1	Recollect the hazardous effect of chemicals and solvents used in laboratory.
K2	CO2	Understand the basic principles of green chemistry, to comprehend the importance of nanotechnology and to understand the fundamentals of nanotechnology. To get the idea about problem selection, literature review and project writing. To get the idea about cyber security.
K3	CO3	Apply the concept of green chemistry in synthesis.
K4	CO4	Review the preparation and experimental techniques of Nanomaterials.
K5	CO5	Synthesize CNT and examine their properties in various fields

Unit-1

Green Chemistry Principles & Greener Reactions **11 Hrs**

Definition, twelve basic principles of green chemistry - planning a green synthesis in a chemical laboratory - Atom efficient processes and atom efficiency, atom economy (with specific reaction).

Water as greener solvent- reactions in ionic-liquid, solvent free reaction - solid supported organic synthesis, phase transfer catalyst (PTC), use of microwaves and sonication (any four specific reactions with mechanism).

Self-study: need of green chemistry

Unit-2

Preparation of Nano Structured Materials **11 Hrs**

Introduction- definition – types, properties of nano materials, Bottom up and Top down approaches - methods of preparation of nano materials - plasma arching, chemical vapour deposition, electrodeposition, sol-gel synthesis.

Experimental Techniques

Instrumentation, principle and applications of scanning electron microscopy (SEM), transmission electron microscopy (TEM), atomic force microscopy (AFM), scanning tunnelling microscopy (STM) and ESCA

Self-study: Applications of Nanomaterials - Catalysis, environmental and biomedical (drug delivery) applications. Nanomaterials - environmental hazards.

Unit-3

Research Methodology **10 Hrs**

Problem selection- literature survey- primary sources - journals, patents, journals of different fields of chemistry (organic, inorganic, physical, polymer, analytical and nano) - secondary sources- books, indexes, chemical abstracts, review articles - literature searching online. E-journal.

Writing a project report - dissertation - style and conventions - title, abstract, introduction, review of literature, experiments, results and discussion, foot notes, figures, presenting data, tables, summary and bibliography.

Self-study: plagiarism, Intellectual property rights

Unit-4

Over view of cyber security **10 Hrs**

Confidentiality, integrity and availability – **Threats:** Malicious software (viruses, Trojans, rootkits, worms, botnets), Memory exploits (buffer overflow, heap overflow, integer overflow, format string)

Self-study: Cryptography- Authentication, password system- windows security.

Unit-5 **10 Hrs**

Software security: Vulnerability auditing, penetration testing, sandboxing, control flow integrity – **web security**: user authentication- **Legal and ethical issues:** Cyber crime, intellectual property rights, copy right, patent, trade secret, hacking and intrusion, privacy, identity theft.

Self-study: Network security: Network intrusion detection and prevention system, firewalls.

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=C2pN3l2BGc4
https://www.youtube.com/watch?v=b_BA7kymfg4
https://www.youtube.com/watch?v=-emrdVazBN8
https://www.youtube.com/watch?v=ooJSgsB5fIE

Text Books:

1. Pradeep.T (2007), *Nano The Essentials*, McGraw Hill Education (India) Pvt.Ltd.
2. Pradeep.T (2012), *Text Book of Nano science and Nanotechnology*, McGraw Hill Education (India) Pvt.Ltd.
3. Kothari. C.R, *Research Methodology* (2004) New Age International (P) Limited.
4. Ahluwalia, V.K. & Kidwai. M, *New Trends in Green Chemistry* (2004), Springer Science &Business media.
5. Ahluwalia. V.K, *Green Chemistry (Environmental benign Reactions)* (2006), Ane Books Pvt. Ltd.
6. WM. Arthur Conklin, Greg White, TMH "Principles of Computer Security"

Reference Books:

1. Poole C.P & Owns F.J. (2003), *Introduction to Nanotechnology* John Wiley & Sons.
2. Chwan- Hwa (John) Wu, J.David Irwin, Computer Networks & Cyber security (2016) CRC Press.
3. Mike O'Leary, Cyber O (2016) – Apress Publications
4. Jeff Kramer, Nicolas Burrus, Florian Editler, Matt Parker, "Hacking the Kinect", (2016), Technology in cation Publications.
5. Karkare. M. (2008). *Nanotechnology Fundamentals and Applications*. K. International Pvt. Ltd.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	2	1	1	1
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CO5	3	2	3	3	3

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Dr. V.Prabhu Ms. M.Anusuya Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3E5**	**Major Elective – II** **Water Pollution and Industrial Effluents treatment**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	3	**Total Hrs: 52**	**Credits:**	3

Course Objective

- To stimulate students to have in-depth knowledge in water, air and soil pollutants.
- To create the awareness about various water treatment techniques and reduce the water pollution.

Course Outcomes (CO)

K1	CO1	Understand the essential role of water in industries and to preserve the same.
K2	CO2	Acquire knowledge about Pollution of water and its Harmful effects
K3	CO3	Analyze the complete physico chemical examination of water.
K4	CO4	Recognize the industrial effluents and their treatment in brief.
K5	CO5	Apply the Treatment of Industrial Effluents to the various industries.

Unit-1

Characteristics of Water **10 Hrs**

Problems on calculation of hardness – Disadvantages of hard water – Scale and sludge formation in boiler – Boiler Corrosion - Softening methods – problems on softening – desalination of Brackish water: Distillation, Electro dialysis and reverse osmosis.

Self-study: Introduction – sources of water – Hardness of water - Units of hardness

Unit-2

Water Pollution **10 Hrs**

Physical and chemical pollution of water – ground water pollution – harmful effects of ground water pollution – surface water. River water and sea water pollution, Oil pollution of water. Effects oil pollution in marine water – Radioactive materials in water.

Self-study: Introduction – Definition of water pollution – water Pollutants

Unit-3

Physico chemical Examination of water **11 Hrs**

Collection of samples – colour – odour Turbidity pH – temperature – Soilds: Total Solids, Dissolved solids, suspended solids, settable solids – Acidity – Free carbon dioxide – Alkalinity – Hardness – calcium,Magnesium, Sodium - Potassium - Iron – Aluminum – Sulphate – Silica – Heavy metal such as Arsenic, Calcium, chromium – copper – lead - Manganese – Mercury – Nickle – Selenium – Tin and Zinc –Permanganate value – Ammonia Nitrogen – Albuminoidal nitrogen – Total Kjeldhal Nitrogen etc.

Self-study: Dissolved Oxygen, BOD, COD

Unit-4

Industrial Effluents **10 Hrs**

Pulp and paper industries Cotton Processing – Cane sugar industry - Distillery – Dairy– Iron production. Electroplating in industry – oil field and oil refinery – Fertilizer industry - Pesticide manufacture - Rubber wastes –Slaughter House and Meat packing – Soaps and Detergents manufacture - Soft Drinks Manufactures. Viscose rayon Manufacture –

Self-study: Radioactive Pollution.

Unit-5 **11 Hrs**

Treatment of Industrial Effluents

Primary Treatment: Screening – Sedimentation – Equalization – Neutralization – Coagulation. Secondary Treatment: Aerated Lagoons – Trickling Filtration – Activated sludge process – Oxidation. Ditch – Oxidation Ponds - Anaerobic digestion. Tertiary Treatment: Evaporation – Reverse osmosis – Dialysis – Ion Exchange – chemical precipitation Activated Carbon Treatment.

Self-study: Tolerance limits for Industrial Effluents.

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=W46FPc67TPc
https://www.youtube.com/watch?v=RTBcg5Ivg48
https://www.youtube.com/watch?v=cNiRWfMjOMU
https://www.youtube.com/watch?v=BTJL8IrbLgU

Text Books:

1. Agarwal. S.K. (2005) *Water Pollution*, APH Publishing.
2. Chakrabarty, B.N. (1981) *Industrial Chemistry*, Oxford & IBH Publishing Co., New Delhi.
3. Singh, P.P. Joseph, T.M. Dhavale, R.G (1983) *College Industrial Chemistry*, Himalaya Publishing House, Bombay, 4th Edition
4. De. A.K. (1989) *Environmental Chemistry*, 11th Edition, Wiley Eastern Ltd. Meerut

Reference Books:

1. Mukhlyonov. I(1979) *Chemical Technology*, Moscow, 3rd Edition. Mir publication
2. Norris Shreve. R &. Brink, J.A (1977) *Chemical Process Industries.* 4th Edition. McGraw Hill, Tokyo.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	1	1	1
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CO5	3	3	3	2	1

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Dr. V.Prabhu & Ms. M.Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY3E6**	**Major Elective - II Nano Technology And Supramolecular Chemistry**	**Batch :**	2020-2022
			Semester	III
Hrs/Week:	3	**Total Hrs: 52**	**Credits:**	3

Course Objective

- To understand knowledge on application of nanomaterials.
- To apply nano devices as sensors
- To provide a concise introduction and applications of supramolecular chemistry.

Course Outcomes (CO)

K1	CO1	Recollect the characteristic of Sensors and Energy devices in Nanotechnology.
K2	CO2	Understand the synthesis and structure of supra molecules, supramolecular interactions and applications.
K3	CO3	Analyze the multiple H-bonding interactions used in crystal engineering
K4	CO4	Apply supra molecular chemistry in appropriate fields.
K5	CO5	Examine molecular assembly to the field of supramolecular chemistry.

UNIT I
Sensors **10 Hrs**

Static and Dynamic Characteristics - Inorganic Nanotechnology Enabled Sensors - Gas Sensing with Nanostructured Thin Films - Nanotechnology Enabled Mechanical Sensors - Nanotechnology Enabled Optical Sensors - Magnetically Engineered Spintronic Sensors –

Self-study: Organic Nanotechnology Enabled Sensors - Surface Materials and Surface Modification.

UNIT II
Energy Devices **10 Hrs**

Nanoscale Electronic and Ionic Transport – Energy Conversion and Storage in Electrochemistry - Overview of the Principles of Operation of Energy Conversion and Storage Devices - Solar Cells -Nanomaterials and Nanostructured Films as Electro active Electrodes - Nanomaterials as Electrolytes - Lithium Ion Batteries - Fuel Cells.

Self-study: Quantum Dot Sensitizers

UNIT III
Introduction to Supramolecular Chemistry **11 Hrs**

Definition of supra molecular chemistry. Nature of binding interactions in supra molecular structures: ion-ion, ion-dipole, dipole-dipole, H-bonding, cation-p, anion-p, p-p, and Vander Waals interactions.

Relevance of supramolecular chemistry to mimic biological systems: cyclodextrins as enzyme mimics, ion channel mimics.

Self-study: supramolecular catalysis

UNIT IV
Synthesis and structure **10 Hrs**

Synthesis and structure of crown ethers, lariat ethers, podands, cryptands, spherands, calixarenes, cyclodextrins, cyclophanes, cryptophanes, carcerands and hemicarcerands., Host-Guest interactions, pre-organization and complimentarity, Binding of cationic, anionic, ion pair and neutral guest molecules.

Self-study: lock and key analogy.

UNIT V
Supra molecular assembly and Devices **11 Hrs**

Self-assembly molecules: design, synthesis and properties of the molecules, self assembling by H-bonding, metal-ligand interactions and other weak interactions, metallomacrocycles, catenanes, rotaxanes, helicates and knots. Crystal engineering: role of H-bonding and other weak interactions.

Self-study: Molecular devices: molecular electronic devices, molecular wires, molecular rectifiers, molecular switches, molecular logic.

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:
https://www.youtube.com/watch?v=XI49uFm5HRE
https://www.youtube.com/watch?v=WqOjyumEAsY
https://www.youtube.com/watch?v=OGpLKwTxYP0
https://www.youtube.com/watch?v=4Gb3KZmfrH8

Text Books:

1. Pradeep,T (2008): Nano: The Essentials: Understanding Nanoscience and Nanotecnology Tata McGraw-Hill Publishing Company Limited, New Delhi.
2. J.-M. Lehn; Supramolecular Chemistry-Concepts and Perspectives (Wiley-VCH,1995)
3. P. D. Beer, P. A. Gale, D. K. Smith; Supramolecular Chemistry (Oxford University Press,1999)

Reference Books:

1. Rao,C. N. R, Thomas,P. J. andKulkarni,G. U (2007): Nanocrystals: Synthesis, Properties and Applications, Springer .
2. Kourosh Kalantar-zadeh and Benjamin Fry (2008): Nanotechnology - Enabled Sensors,Springer.

3. Guozhong Gao (2004): Nanostructures & Nanomaterials: Synthesis, Properties & Applications, ImperialCollegePress .
4. J. W. Steed and J. L. Atwood; Supramolecular Chemistry (Wiley, 2000)

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
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3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Ms. R. Mini Ms. M.Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.R. Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY412**	**Inorganic Chemistry - III Bioinorganic and Inner Transition Elements**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To allow the students to get introduced to the study of inner transition elements.
- To acquire knowledge in the nature, preparation and properties metal carbonyl complexes, photochemistry of metal complexes.
- To gain knowledge about various applications and the role of metals in biological systems.

Course Outcomes (CO)

K1	CO1	Remember the general properties of Inner Transition elements and applications of inorganic metal complexes in photochemistry.
K2	CO2	Understand the magnetic properties of Inner Transition elements and homogeneous catalysis of organometallic.
K3	CO3	Apply the catalytic property of organometallic in synthesis.
K4	CO4	Analyze the mechanism involved in organometallic and the biological function of essential and non- essential elements.
K5	CO5	Evaluate the importance of biological function of certain metals.

Unit-1

Chemistry of Inner transition elements **13 Hrs**

Color and complex formation inner transition elements- comparison between‘d’ and ‘f’ block elements - magnetic properties of Lanthanides and Actinides - complex formation and color absorption spectra of lanthanides and actinides. Comparison between lanthanides and actinides.

Self-study: Use of lanthanide compounds as shift reagents

Unit-2

Homogeneous catalyst by organometallics **13 Hrs**

Olefin hydrogenation, olefin dimerization and metathesis, Monsanto acetic acid synthesis, olefin isomerization, Wacker oxidation of alkenes, hydroformylation, water gas shift reaction, template synthesis, alkene hydrosilation, acetic acid from ethylene. Heterogeneous catalysis - Zieglar- Natta Catalysis.

Self-study: Types of reactions in Homogeneous catalyst- Zeise’s salt, Vaska complexes

Unit-3 **13 Hrs**

Inorganic Photochemistry

Introduction, $[Ru(bipy)_3]^{2+}$ complexes in solar energy, Photochemical reactions of metal carbonyls, Photolysis of water. Photochemistry of metal beta diketonates.

Insertion reaction- Introduction - CO insertion and SO_2 insertion reactions - insertion involving alkenes.

Oxidative addition and reductive elimination- Introduction, one-electron oxidative addition-addition of oxygen-mechanism, 5-coordinate 18-electron reactants, 4-coordinate 16-electron reactants, 4-coordinate 18-electron reactants.

Self-study: concerted Vs free radical mechanism, reductive elimination

Unit-4

Bioinorganic chemistry:I **13 Hrs**

Essential and non-essential elements, Biochemistry of Sodium and Potassium - The Sodium-Potassium pump - Biochemistry of Calcium-Storage and transport of Calcium-Calmodulin-Muscle constaction and blood clotting-Biochemistry of Copper- Stuctural features of different Copper proteins- Storage and transport of Copper.

Self-study: Biological Function and toxicity of Some Elements (Cr, Mn, Co, Ni, Se, Mo, Cd, Pb)

Unit-5

Bioinorganic Chemistry:II **13 Hrs**

Metalloporphyrins (heme and non-heme proteins) - cytochromes, heomoglobin, myoglobin, chlorophyll, ferridoxins, rubredoxins - Vitamin B_{12} and B_{12} coenzymes (structure and functions) - nitrogen fixation (invitro and invivo) - Metallo enzymes - Carboxypeptidase - Metallo drugs for cancer theraphy (Cis-platin).

Self-study: Cytochrome-P-450 and Carbonic anhydrase

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=7qb1RDkU9BU
https://www.youtube.com/watch?v=OgqPPFg4t6s
https://www.youtube.com/watch?v=6fRxAjMdMvE&list=PLR-lh4Ip2fLusw2XTKlgOS9c5sGHCDlqW
https://www.youtube.com/watch?v=k7Bf9p4-Kzo
https://www.youtube.com/watch?v=vnVMS_Dp0dU
https://www.youtube.com/watch?v=HkgsP0Jlc_o
https://www.youtube.com/watch?v=darVtuigUJA
https://www.youtube.com/watch?v=xzyR8Nsxloc
https://www.youtube.com/watch?v=plhLipR8yYQ

Text Books:

1. Gurdeep Raj. (2014). *Advanced Inorganic Chemistry*. 12th Edition. Geol Publishing House
2. Madan. R.D. (2011). *Advanced Inorganic Chemistry*. 3rd Edition. S. Chand & company, New Delhi.
3. Malik, U.K, Tuli, G.D & Madan, R.D (2010) *Selected Topics in Inorganic Chemistry*, S. Chand Publication.
4. Asim K. Das. (2015). *Bio-inorganic chemistry*. Books and Allied Pvt. Ltd.
5. Lehinger. ( ) *Bio-inorganic chemistry*.

Reference Books:

1. Keith F. Purcell, John. C. Kotz. (1997). *Inorganic chemistry*, Holt- Saunders International Editions.
2. James E. Huheey. (1993). *Inorganic Chemistry*, Fourth edition, HarperCollins College Publishers. (Units I, II, III, IV)
3. Basolo, F. & Pearson. R.G. (1967) *Mechanisms of Inorganic Reactions: Study of Metal Complexes in Solution.* Wiley Eastern Limited.
4. IvanoBertini, Harry B. Gray, Stephen J.Lippard, and Joan Selverstone Valentine. (1998). *Bioinorganic Chemistry*, VIVA books private Ltd. (Units III, IV).

Mapping

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Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Ms. R.Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY4E7**	**Major Elective -III Medicinal Chemistry**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	4	**Total Hrs: 60**	**Credits:**	3

Course Objective

- The course is to enable students to understand drug actions.
- To learn chemistry of various types of drugs such as antibiotics, analgesics, antipyretics, cardiovascular, anti-tubercular drugs, antihistamines and antimalarial.

Course Outcomes (CO)

K1	CO1	Outline the physicochemical properties of drugs
K2	CO2	Describe drug absorption, distribution, metabolism and excretion
K3	CO3	Synthesize and study novel Antibiotics for future generations
K4	CO4	Formulate the synthesis of few important drugs such as analgesics, antipyretics, cardiovascular, anti-tubercular drugs, antihistamines and antimalarial
K5	CO5	Evaluate the application of Antibiotics, cardiovascular and anti-malarial drugs

Unit-1

Drug action and sulpha drugs **12Hrs**

Physiochemical properties in relation to biological action - influence of route of administration.Biotransformation-absorption from stomach -absorption from intestines –sites of loss -metabolism and excretion.

Sulpha drugs -sulphathiazole, sulphamerazine, sulphaguanidine and other sulpha drugs,-synthesis, mechanism of action -uses.

Self-study: harmful drugs and their side effects

Unit-2

Antibiotics **12Hrs**

Antibiotics -A study of Chloramphenicol, Penicillin - semisynthetic Penicillin -gross structural features Streptomycin-Cephalasporin and Tetracycline.

Polyene antifungal antibiotics-nystatin, fusicidic acid-griesofulvin. (gross structural features not needed).

Self-study: Antibiotics - Erithromycin, Chloromycetin

Unit-3

Analgesics and antipyretics **12Hrs**

Study of morphine-structure activity relationship (SAR)-morphine analogues – Codeine -synthetic analgesics- pethidines and methadones -narcotic antagonist. Antipyretic analgesics - salicylic acid, pyrazole and para amino phenol derivatives.

Self-study: Sedatives -Barbiturates, Benzodiazepines

Unit-4

Cardio Vascular and anti-tubercular drugs **12Hrs**

Cardio Vascular Drugs -classification, cardiac glysocides, anti-hypertensive and hypotensive agents -mode of action –anti-arythamic agents.

Anti-tuberculardrugs -sulphanamides -sulphones, p-amino salicylic acid –INH.

Self-study: Anti-tubercular drugs- ethambutal, Rifampicin.

Unit-5

Anti-histamines and anti-malarials **12Hrs**

Anti-histamines-introduction -mode of action of anti-histamines - SAR -ethylene diamine, ethanol amine, propyl amine and –cyclizine derivatives -synthesis.

Self-study: Anti-malarials-classification –quinine, 4-amino and 8-amino quinolines and pyrimidines

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=Rpk_nm_sFxA
https://www.youtube.com/watch?v=NGwP471sehI
https://www.youtube.com/watch?v=2I19apoKqbE
https://www.youtube.com/watch?v=C2OqqEDPyEs
https://www.youtube.com/watch?v=yC7g2LCFa8c
https://www.youtube.com/watch?v=N9pr28Ht_EQ

Text Books:

1. Patric, G. L. (2005), *An Introduction to Medicinal Chemistry*. 3rded, Oxford University Press.

2. Silverman, R. B. (2004), *The Organic Chemistry of Drug Design and Drug Action*. 2nd Edition, Academic Press.

3. Williams, D. A., Lemke, T. L. (2006), Foye's, *Principles of Medicinal Chemistry*. 5th Edition.Wolters Kluwer Health (India) Pvt. Ltd.

ReferenceBooks:

1. Burger, A., (1990), Medicinal Chemistry, Vol – I and II, Wiley inter Science, New York.

2.Wilson, O., Giswold, O., George, F., (1991), *Text book of organic, Medicinal and Pharmaceutical Chemistry*, Lippincott Company, Philadelphia, 9thEdn.

3. Bentley and Driver, *Text book of Pharmaceutical Chemistry*

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	3	2	2	2	1
CO2	3	3	2	3	3
CO3	3	3	2	3	3
CO4	3	3	3	3	3
CO5	3	3	3	3	3

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Dr. V. Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY4E8**	**Major Elective - II Food Science and Technology**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	4	**Total Hrs: 60**	**Credits:**	3

Course Objective

- To enable the students understand the effect of various methods of food processing.
- To knowledge about the structure and composition of food materials.
- To identify different cooking methods and common adulterants in foods.

Course Outcomes (CO)

K1	CO1	Understand the outlines of cereal and pulse processing technology.
K2	CO2	Describe the importance of nutrients in milk, fruits and vegetables.
K3	CO3	Comprehend the nutritive value of fleshy foods.
K4	CO4	Recognize the composition of sugar, spices, nuts and oilseeds.
K5	CO5	Detect the food adulterants and control process.

Unit I

Physico-chemical properties of foods **12Hrs**

Moisture in Foods, Hydrogen Bonding, Bound Water, Water Activity in Foods, Determination of Moisture Content in Foods, True Solutions, Dispersions, Sols, Gels, Foams.

Cereals and millets

structure, nutritive value, processing outlines of some common cereals (rice, wheat). Pulses: structure and composition of pulses, toxic constituents in pulses, processing of pulses-soaking, germination, Malting.

Self-study: Colloids and Emulsions

Unit II

Vegetables, Fruits and Milk **12Hrs**

Classification of fruits and vegetables, general composition, enzymatic browning, names and sources of pigments.Milk and milk products, composition, nutritive value, properties.

Self-study: Processing of milk

Unit III

Fleshy Foods **12Hrs**

Egg: structure, composition, nutritive value, measures of quality. Meat: Structure, composition, classification, nutritive value, tenderization and curing of meat; Poultry: composition, classification, nutritive value and processing;

Self-study: Fish: composition, classification, nutritive value

Unit IV

Sugar, Fats and Oil Seeds **12Hrs**

Sugar - composition, nutritive value, stages of sugar boiling. Nuts and oilseeds: classification, composition, nutritive value, uses of nuts and oilseeds.

Self-study: Spices and condiments: types, functions and uses.

Unit V

Methods of cooking **12Hrs**

Moist heat, dry heat and fat as a media of cooking, merits and demerits. Food adulteration, detection.

Self-study: Control of common food adulterants

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:
https://www.youtube.com/watch?v=f0im--5zC5M
https://www.youtube.com/watch?v=AV3PGI1Kzrk
https://www.youtube.com/watch?v=9ej5w7v6tpE
https://www.youtube.com/watch?v=5GJRHCx370I

Text books:

1. ShakuntalaManay, Shadaksharaswamy. M (2017),*Foods, Facts and Principles*, New Age International Pvt Ltd Publishers, 2nd Edition
2. Chandrasekhar, U. (2002), *Food Science and applications in Indian Cookery*, Phoenix Publishing House, New Delhi
3. Swaminathan, M.(2015),*Food ScienceChemistry and Experimental Foods*, Bappco Publishers, Bangalore.

Reference books:

1. Srilakshmi, B. (2015),*Food Science*, New age International P. Ltd, New Delhi.

2. Williams, Mc. (2007),*Food Fundamentals*, John Willey and sons, New York.

3. Mahindru, S.N. (2009),*Food Science and Technology*, Hardbound P.Ltd, New Delhi.

4. Norman N. Potter (2009),*Food Science*,FifthEdition, Springerlink, Newyork.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
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Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Ms. R. Mini Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY4E9**	**Major Elective - III Dye Chemistry**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	4	**Total Hrs: 60**	**Credits:**	3

Course Objective

- To stimulate students to have in-depth knowledge in Dye chemistry.
- To design dyes into reusable or degradable dyes.
- To motivate the students to design ecofriendly dyes for future generation.

Course Outcomes (CO)

K1	CO1	Understand the chemistry of dyes
K2	CO2	Interpret the various types of dyes, synthesis, reactions and applications
K3	CO3	Recognize the pigments, cosmetics and colouring agents
K4	CO4	Synthesize new dyes for the sustainable development using green chemistry principles.
K5	CO5	Apply the natural pigments in the various industries.

Unit-1

Colour and Constitution **12Hrs**

Relationship of colour observed to wavelength of light absorbed – Terms used in colour chemistry – chromophores, Hypsochrmic shift. Quinonoid theory and modern theories: Valence bond theory, molecular orbital theory.

Self-study: Auxochromes, Bathochromic shift

Unit-2

Chemistry of organic intermediates used in dye manufacture. **12Hrs**

Benzene, Naphathalene and Anthroqucnone intermediates. Nitrosodyes, Azo dyes – principles governing azo coupling – mechanism of diazotization coupling with amines, coupling with phenols. Classification according to the number of azo groups and application – Tautomerism in azo dyes.

Self-study: Nitro dyes

Unit-3 **12Hrs**

Synthesis of specifics dyes and uses

Orange IV, Diamond Block F, Metanil yellow, Tartrazines Direct Deep Black, Eriochrome Black T, Eriochrome Red B, Cellition Scarlet B, methylene blue, Safranine – T, Acid

Magenta, Cyanin Green G, Alizarine, Benzanthrone, Indigo, Copper phthalo cyanine, Sulphur black – T .

Self-study: Congo Red, Malachite green

Unit-4 **12Hrs**

Synthesis, reactions and applications of dyes

Xanthene dyes, Cyanine dyes, acridine dyes, Sulphur dyes, Anthranquinone dyes: Anthraquinone mordant dyes, Anthroquinone acid dyes and Anthraqyinone disperse dyes.

Self-study: Eco friendly pigments for sustainable development.

Unit-5 **12Hrs**

Pigments

Introduction - Types of Pigments – Applications. Eco friendly approach. Fluorsecent. Brightening agents – application of dyes in other areas, – Leather, paper, medicine, chemical analysis, cosmetics, colouring agents Food and Beverages.

Self-study: Requirements of organic pigments

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=PmZM5gAEr54
https://www.youtube.com/watch?v=2sHlLNzTpUU
https://www.youtube.com/watch?v=4KqKFwIG1VI
https://www.youtube.com/watch?v=Db-POJSetPI
https://www.youtube.com/watch?v=jOh5uuXLaOA

Text books:

1. Gurdeep R Chatwal, Synthetic Dyes, Published by Himalaya Publishing House.
2. Venkataraman, The chemistry of synthetic dyes volume I,Ademic Press Jnc, Publishers, New York.
3. B.K. Sharma, An introduction to industrial chemistry. Krishna publications.

Reference books:

1. Finar, I.L. (2002) *Organic Chemistry. Vol.1*. 5th Edition. Pearson India Ltd.
2. Jerry March (2007) *Advanced organic chemistry*. 4th Edition,A Wiley-Interscience.
3. Morrison, R.T, Boyd, R.N (2013) *Organic Chemistry*.7th Edition. Pearson India Ltd.

Mapping

PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5
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Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Dr. V. Prabhu Signature:	Name: Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY413**	**Physical methods in Chemistry**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	5	**Total Hrs: 65**	**Credits:**	5

Course Objective

- To introduce the principles of error analysis to the students.
- To enable the students to attain knowledge on various chromatographic techniques and thermo analytical methods.
- To gain knowledge in ESR, Mossbauer spectroscopy and AAS, AES, Polarimetry and Photo Electron Spectrometry.

Course Outcomes (CO)

K1	CO1	Remember the various analytical methods.
K2	CO2	Understand the analysis of data. To comprehend the basic principle, instrumentation and applications of various chromatographic techniques, thermal analysis. To understand basic principle, instrumentation and applications of photoelectron spectroscopy, AAS, FES, electron spin resonance and Mossbauer spectroscopy. To know about polarimetry.
K3	CO3	Apply data analysis, various chromatographic techniques to separate the compounds. To apply electron spin resonance and Mossbauer spectroscopy.
K4	CO4	Interpret the data in chemical analysis.
K5	CO5	Evaluate the molecular structures in various fields.

Unit-1

Data Analysis **13 Hrs**

Defining terms: mean, median, accuracy and precision, improving accuracy of analysis - mean, standard deviation and Q-test, comparison of results - least square, t-test, f-test and chi square test, P-value, levels of confidence and significance, population and sample and reproducibility of measurements

Analysis of variance (ANOVA)- Correlation and Regression - curve fitting , fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals - general polynomial equation fitting , linearizing transformations, exponential function fit - r and its abuse - multiple linear regression analysis, elementary aspects.

Self-study: Errors and classification in chemical analysis

Unit-2

Chromatographic methods **13 Hrs**

Solvent extraction - Methods of extraction and applications of solvent extraction. Solid phase extraction - methods and applications - chromatography - ion exchange chromatography and size exclusion chromatography, HPLC - outline study of instrument modules. UPLC, UHPLC and HPLC-Mass spectroscopy, LCMS.

Gas chromatography - basic instrumental set up - carriers, columns, detectors and comparative study of TCD, FID, ECD and NPD.

Self-study: thin layer chromatography

Unit-3 **13 Hrs**

Thermal analysis

Thermogravimetric Analysis (TGA), Differential Thermal Analysis (DTA), Differential Scanning Calorimetry (DSC) and Thermometric titrations - basic principles, Instrumentation and application.

Atomic absorption spectroscopy and Flame emission spectroscopy

Basic principles - Instrumentation and applications.

Photoelectron Spectroscopy

ESCA (XPS): principle, chemical shifts - description of ESCA spectrometer, X-ray sources, samples, analysis, detectors and recording devices, applications, Auger electron spectroscopy (AES) and UV photo electron spectroscopy (UPS) - principles, applications and instrumentation.

Self-study: Introduction to photoelectron spectroscopy

Unit-4 **13 Hrs**

Electron spin resonance

Theory - derivative curves -'g' values, Kramer's degeneracy - zero field splitting - hyperfine splitting - isotropic and anisotropic systems - identification of free radicals (CH_3 and C_6H_5 radicals, Copper complex) - applications.

Mossbauer spectroscopy

Principle and theory- Doppler effect, Isomer shift - quadruple interactions - magnetic interactions – applications.

Self-study: Introduction to Mossbauer spectroscopy

Unit-5 **13 Hrs**

Polarimetry

Circular Dichroism and Optical rotatory dispersion -Basic principles of ORD and CD - Cotton effects - Octant rule - axial halo ketone rules - applications of ORD and CD.

Molecular fluorescence and phosphorescence

Principles of Fluorometers -Phosphorometers and their applications

Self-study: Fluorescence and phosphorescence

Power point Presentations, Group discussions, Seminar, Quiz, Assignment, Experience Discussion, Brain storming activity and Case study.

Web links:

https://www.youtube.com/watch?v=qV-WoquC4dA
https://www.youtube.com/watch?v=A8lTfhWdAwE
https://www.youtube.com/watch?v=2tJqZStFwjU
https://www.youtube.com/watch?v=B3cmvQc8xxU
https://www.youtube.com/watch?v=LeYEgfdVFC0

Text books:

1. Gurdeep R. Chatwal &Anand, S.K. (2003) *Instrumental Methods of Chemical Analysis*, Himalaya Publishing House.
2. Sharma, B.K. (1999) *Instrumental methods of Chemical analysis*, 18th Edition. Goel Publishing house.
3. Ghosh, Introduction to Photoelectron Spectroscopy.

Reference books:

1. Skoog, D.A. West, D.M, Holder F.J & Grouch, S.R (2000) *Analytical chemistry an Introduction*, 6th Edition, Saunders College publishing.
2. Willard, H.H, Merrit L.L & Dean, J.A (2002). *Instrumental method of analysis*, 7th Edition, CBS Publishers & Distributors.
3. Drago, R.S (1964) *Physical methods in Inorganic chemistry*, 1st Edition, W. B. Saunders Company.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
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3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Ms. R.Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY414**	**Phytochemical techniques and health chemistry**	**Batch :**	2020-2022
			Semester	IV
Hrs/Week:	**Self-study**		**Credits:**	1

Course Objective

- To enable post graduate students in Chemistry to gain knowledge on phyto chemical techniques.
- To enable them to be familiar with techniques of extraction, separation and purification and simple identification strategies of drugs/natural products.
- To acquaint with health and hygiene food system along carbohydrates and vitamins.
- To learn the mode of mechanism for common diseases.

Course Outcomes (CO)

K1	CO1	Understanding on necessity and role of carbohydrates and vitamins for humans.
K2	CO2	Remember the phytochemical techniques -extraction, separation and purification.
K3	CO3	Implement the basic values and analyze the functions of food, food pyramid and hygiene food system.
K4	CO4	Evaluate the mechanism for biological function of carbohydrates and vitamins
K5	CO5	Analyze the mechanism and causes of common diseases

Unit I- Extraction strategies of drugs/natural products

Extraction Techniques - Cold and hot extraction methods, liquid-liquid extraction techniques, liquid-carbon dioxide extraction, concentration and evaporation techniques, lyophilisation, principles and technique of simple distillation -reduced pressure distillation-fractional distillation- steam distillation-rotary evaporation and centrifugation.

Unit II-Separation Techniques of drugs/natural products

Separation Techniques – Simple crystallization- experimental aspects – solvents for crystallization. Special methods– flavanoid, pigment extraction - GC-MS, LC-MS-identification of phytochemicals by NIST Library

Unit III- Purification Techniques of drugs/natural products

Purification Techniques – Preliminary methods of identification of extracts – Cermin chemical aspects-colour tests – TLC and fluorescent characteristics, proximate

methods.Theory of melting and freezing – melting point and vapour pressure., Biological assays- antibacterial, antifungal, antioxidant and invitro anticancer activities.

Unit IV- Health

Definition: - Food, Food Pyramid, Health, Hygiene, mal under over nutrition, their causes and remedies, sanitation.

Carbohydrates: Classification, biological functions,Vitamins: Classification, biological functions.

Unit V-Common diseases

Toxicants in food cancer, types and causes, common diseases- jaundice, vomiting, fever, rickets, scurvy, beriberi, pellagra, gout, goiter, diabetes anemia, night blindness, ulcer, their causes.

Web links:

https://www.youtube.com/watch?v=hf6nPZjOTXo
https://www.youtube.com/watch?v=gU2st5-T1Go
https://youtu.be/LcEmwSjnLZE
https://www.youtube.com/watch?v=_Z0OCjS5EZQ
https://www.youtube.com/watch?v=GJFb_ghEFB4

Text Books:

1. Harborne. J. B,(2008), *Phytochemical methods-A guide to modern techniques of Plant analysis*, 3rdedition,Springer publication.
2. Ahluwalia &Madhu Chopra. V.K, (2008), *Medicinal Chemistry*, Ane Books India.
3. Ashutoshkar, (2010), *Medicinal Chemistry*, 5th Edition, New Age international publishers.
4. Jayashree Ghosh, (1999), *A Textbook of Pharmaceutical Chemistry*, S. Chand and Co. Ltd.
5. Alex V Ramani, (2009),*Food Chemistry*, MJP Publishers, Chennai.
6. Satake M and Mido Y, (2003),*Chemistry for the Health Science*, Discovery Publishing House, New Delhi.

Reference Books:

1. Graham L. Patrick, (2009),*An Introduction to Medicinal Chemistry*, 4th Indian Edition, Oxford publishers,
2. Krishnaswamy. N. R, (2010), *Chemistry of Natural Products*, 2ndEdition,An Unified Approach –Unified Press.
3. Krishnaswamy. N. R, (2003), *Chemistry of Natural Products A Laboratory Handbook*,1st Edition, University press India Pvt. Ltd.

Mapping

PO / CO	PO1	PO2	PO3	PO4	PO5
CO1	3	3	2	3	3
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3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.V.Prabhu Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY415**	**Inorganic Chemistry Practical -II**	**Batch :**	2020-2022
			Semester	III &IV
Hrs/Week:	4&5	**Total Hrs: 117**	**Credits:**	3

Course Objective

- To know and apply the principle of complexometric titration.
- To get an idea about the quantitative analysis of mixture of cations using volumetric and gravimetric principles.
- To allow the students to know and practice the techniques in preparation of some inorganic complexes.

Course Outcomes (CO)

K3	CO1	Recollect the preparation of coordination compounds.
K4	CO2	Understand the analysis of complexometric titration and mixture of cations using volumetric and gravimetric titration.
K4	CO3	Separate and estimate the metal ions in a mixture.
K5	CO4	Analyze the amount of individual cations present in a mixture using volumetric and gravimetric technique.
K5	CO5	Estimate the cations using complexometric titration and prepare coordination compounds by single stage preparation

A. Titrimetry:

Complexometric titration involving EDTA.

- Calcium
- Magnesium
- Nickel
- Zinc

B. Quantitative estimation:

Mixture of cations involving volumetric and gravimetric estimation

- Copper & Nickel
- Iron & Nickel
- Calcium & Copper
- Calcium &Barium.

Reference Books:

1. Venkateswaran, V. Veeraswamy. R and. Kulandaivelu, A.R (1997) *Principles of Practical Chemistry* 2nd Edition Sultan Chand & Sons.
2. Giri. S, Bajpai. D.N and Panday O.P (1997). *Practical Chemistry* Vol. I & II, S.Chand& Co.
3. Bassart J. Dennay. R.C. Jeffery G.H. and Mendham (2004). *Vogel's text Book of qualitative Inorganic Analysis,* 4thEdn. The ELBS & Longman.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	3	1	1
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Name and Signature	Name and Signature	CDC	COE
Name: R. Mini Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY416**	**Organic Chemistry Practical -II**	**Batch :**	2020-2022
			Semester	III &IV
Hrs/Week:	4&4	**Total Hrs: 104**	**Credits:**	3

Course Objective

- To attain knowledge in estimating organic compounds quantitatively.
- To learn and practice the methods of preparation of some organic compounds.
- To understand some chromatographic techniques.

Course Outcomes (CO)

K3	CO1	Remember aromatic substitution reactions and the basic principles of various chromatographic techniques.
K4	CO2	Understand the estimation of phenol, aniline, ketone and glucose and the extraction methods of natural product.
K5	CO3	Practice the preparation of organic compounds involving two stages,recrystallise and report.
K5	CO4	Estimate the amount of organic compounds present in the given solution
K5	CO5	Extract and estimate certain natural products and separate the compounds using chromatographic technique.

A. Quantitative estimations:

1. Estimation of phenol, aniline, ethyl methyl ketone, Glucose (iodimetry method and Bertrand's method).
2. Citric acid or ascorbic acid from a tablet or from a natural source

B. Two stage preparations:

1. Benzanilide from benzophenone
2. Acetyl salicylic acid from methyl salicylate
3. Preparation of m- nirtrobenzoic acid from methyl benzoate
4. Preparation of p- nitroaniline from acetanilide
5. Preparation of p-bromo acetanilide from aniline

C. Extraction: (Not for ESE examination**)**

1. Lactose from milk
2. Caffeine from tea
3. Curcumin from *Curcuma longa*
4. Nicotine from tobacco extract
5. Citric acid or ascorbic acid from a tablet or from a natural source.

D. Analysis of oil: (Not for ESE examination)

Reichart-Meisel value, saponification value and acetyl value.

E.Chromatography:
Column, Paper and thin layer.

Reference Books:

1. Day. B.B and Sitaram M.V and Govindachari T.R (1999). *Laboratory Manual of Organic Chemistry*, Allied Publishers Limited.
2. Gnanprakasam and Ramamurthy (2000). *Organic Chemistry Laboratory Manual* Ananda Book Depot, Chennai.
3. Jagmohan (2004). *Advanced Practical Organic Chemistry* Vol. I & II.

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Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
Course Code:	**20PCY417**	**Physical Chemistry Practical -II**	**Batch :**	2020-2022
			Semester	III &IV
Hrs/Week:	4&4	**Total Hrs: 104**	**Credits:**	4

Course Objective

- To arm the future chemist with the knowledge of electrical conductance measurement and conductometric titrations.
- To gain knowledge to make and record observations on conductometric titrations and chemical kinetics.

Course Outcomes (CO)

K3	CO1	Recollect the concept of conductometric titration, fundamentals of adsorption and the acid hydrolysis of ester.
K4	CO2	Understand various laws of electrochemistry and applications of electrical conductance measurements and the applications of chemical kinetics.
K5	CO3	Determine the cell constant and verify the Debye-Huckel Onsager equation and Kohlrausch's law.
K5	CO4	Determine the relative strength of acids and rate of reaction.
K5	CO5	Estimate the amount of ions condutometrically and evaluate the amount of oxalic acid adsorbed using charcoal as adsorbent.

Electrical Conductance measurements

1. Determination of cell constant
2. Verification of Debye-Huckel Onsager equation
3. Ostwald's dilution law
4. Verification of Kohlrausch's law
5. Solubility Product of sparingly soluble salt

Conductometric Titrations: Acid-Base titrations

6. Strong Base Vs Weak Acid
7. Strong Base Vs Mixture of (weak and strong) Acids

Precipitation titrations

8. $AgNO_3$ Vs mixture of halides (KCl& KI)
9. $BaCl_2$ Vs $MgSO_4$
10. Buffer Vs Strong acid

Chemical Kinetics

11. Acid hydrolysis of an ester - Relative strength of acids
12. Reaction kinetics of KI and $K_2S_2O_8$
13. Iodination of acetone

Adsorption

14. Adsorption of oxalic acid on charcoal

Reference Books:

1. Palit S.R. and De S.K (2003). *Practical Physical Chemistry*, Science Book Agency, Calcutta.
2. Sharma P.C. and Agarwal (1998). *Practical Chemistry*,
3. Goel Publishing House, Meerut.
4. Venkateswaran and Kulaindaivelu (2005). *Practical Physical Chemistry* S. Chand & Co.

Mapping

PSO / CO	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	3	3	2	1	1
CO2	3	3	3	3	2
CO3	2	3	3	3	2
CO4	2	3	3	3	2
CO5	2	3	3	3	2

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name: Dr.K.Poonkodi Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name:Dr.Muthukumaran Signature:

Programme code:	M.Sc.	**Programme Title :**	Master of Chemistry	
			Batch	2020-2022
Course Code:	**20PCY418**	**Project Work & Viva-Voce**	**Semester**	IV
Hrs/Week:	3	**Total Hrs: 26**	**Credits:**	6

Course Objective

1. To design research oriented project on particular context.
2. To identify the topic with the consideration feasibility and search literature on selected research oriented project work.
3. To conduct experiment scientifically with safety and utilize the techniques learn earlier for the synthesis of bioactive molecules with the help of named reactions and rearrangements.
4. To characterize the prepared molecules by physical and spectral analysis like IR, ^{1}H NMR, ^{13}C NMR and Mass Spectroscopy.
5. To prepare a dissertation report with complete follow up of research methodology and develop the skill of communication in presentation by utilizing various software such as ChemDraw, Origin, MS-Office etc.

Course Outcomes (CO)

K3	CO1	Apply the various preliminary skills in laboratory
K4	CO2	Analyze the various sources of literature review
K5	CO3	Evaluate the various techniques from the previous studies
K5	CO4	Apply the suitable parameters in the project work.

Individual Project and Viva Voce

- Each faculty will be allotted 4/5 students.
- The topic/area of work will be finalized at the end of III semester, allowing scope for the students to gather relevant literature during the vacation.
- The research work can be carried out in the college or at any other organization approved by the College.
- Viva Voce/Power point presentation will be conducted by a panel comprising of HOD, internal / external examiners.

Research Areas

Synthetic Organic Chemistry, Coordination Chemistry, Phytochemistry, Surface Chemistry and Nanochemistry, etc.,

Methodology

Each project should contain Introduction, Review of Literature, Materials and Methods**,** Results and Discussions – evidences in the form of figures, tables and photographs,Summary and Bibliography

Evaluation - Total - 100 Marks (Internal – 20 marks, External – 80 marks)

Internal **Total - 20 marks**

I Review – Selection of the field of study, Topic & Literature collection

II Review – Research Design and Data Collection

III Review – Analysis & Conclusion, Preparation of rough draft

- 20 marks

Paper Presentation in National / International Conference

(Or)

Paper Publication in UGC Care list Journals

External **Total – 80 marks**

Project	**Total – 60 marks**
Relevance of the topic to the academic / society	10 Marks
Objectives	10 Marks
Experimental design	20 Marks
Expression of results and discussion	20 Marks
Viva Voce	**Total – 20 marks**
Presentation	10 Marks
Discussion	10 Marks

Mapping

PO / CO	**PO1**	**PO2**	**PO3**	**PO4**	**PO5**
CO1	3	3	2	3	3
CO2	3	3	3	3	3
CO3	3	2	3	3	3
CO4	3	3	3	3	2
CO5	3	3	3	3	3

3-High; 2-Medium; 1-Low

Course Designed by	Verified by HoD	Checked by	Approved by
Name and Signature	Name and Signature	CDC	COE
Name:Dr.K.Poonkodi Dr.V.Prabhu Ms.K.Vimaladevi Ms. R.Mini Ms. M.Anusuya Signature:	Name:Dr.K.Poonkodi Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

VALUE ADDED COURSE SCHEME

SEM	Course Code	Title of the Paper	Total hours	Examination				Credits
				Hours	CIA	ESE	Total	
I	20PCV201	Cosmetics chemistry	30	2			50	Grade
I	20PCV301	Treatment of industrial waste water	30	2			50	Grade

20 PCV201-COSMETICS CHEMISTRY

SCOPE

- The students will be familiar with the physical and chemical properties and reactions of commonly used raw materials in cosmetics.
- Students will be familiar with chemistry (especially the reactivity and stability of an organic molecules based on structure and isomerism) of commonly used chemicals.
- They will know common natural raw materials in cosmetics, especially the basic functional group involved, their properties and applications.

Objectives

- This course is designed to provide foundation knowledge of cosmetic principles to address the needs of cosmetic industry.
- Provide practical skills in the area of biology, formulation science, cosmeceuticals (cosmetics with¬ skin, hair and oral care benefits) and personal care and hygiene products.
- Provide knowledge on cosmetics, and related sciences,
- Provide with knowledge on marketing approaches on studying consumer need, need gaps, managing competition and global markets.

Employability

- To provide worldwide opportunity to study cosmetic science
- Students have the opportunity to undertake an optional placement and enhance their entrepreneur skill by offering valuable experience.

Nature of Course

Value added certificate course

Advantages

Students will be familiar with the different exposure of chemicals used in the cosmetics and one can design and practice ecofriendly cosmetics of their own.

Course Outcomes

- Acquire basic information about the possibilities and limitations of cosmetic products, their importance and marketing.
- Knowing the prohibited, regulated and authorized ingredients for cosmetic products, their origin, chemical nature and importance.
- Familiar with the principles of production as well as composition of cosmetics and products.

UNIT-I **L P T**
20 10 30hrs

Cosmetics- Classification, significance, quality control and its importance, stability of product forms and its significance.Physical and chemical properties of agents and designing of different product forms. Review of current product forms in market.

UNIT-II

Basic raw materials, preparation and uses of Hair dye, Shampoo, Lipsticks, Handmade herbal Soap, Herbal tooth powder, Phenyl making, liquid soap and detergents.

UNIT-III

Essential oils and their importance in cosmetic industries with reference to Eugenol, Geraniol, sandalwood oil, eucalyptus, rose oil, Civetone and Muscone. Surfactants-Introduction, physical and chemical properties, its types, HLB scale and its application in cosmetics. Review of commercialized surfactants.

Text Books:

*1.*Gaurav Kumar Sharma, JayeshGadiya and MeenakshiDhanawat, (2018),Textbook *of Cosmetic*
Formulations,.
2.Perry Romanowski Randy Schueller,(1973), Beginning Cosmetic Chemistry, 3rd Edition
,

Reference Books:

1. E. Stocchi: *Industrial Chemistry*, Vol -I, Ellis Horwood Ltd. UK. •

2. P.C. Jain, M. Jain: *Engineering Chemistry*, Dhanpat Rai & Sons, Delhi.

3. B.K. Sharma: *Industrial Chemistry*, Goel Publishing House, Meerut.

4. D.F. Williams,*Chemistry and Technology of the Cosmetics and Toiletries Industries*
Springer
International Edition.

5. Robert D. Hisrion and Michael P. Peters, *Entrepreneurship* 5th Edition.

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20PCV-301- TREATMENT OF INDUSTRIAL WASTE WATER

SCOPE

- This course will train participants with the knowledge, skills and competencies required for success in the practical operation of water treatment plants.
- This course is designed to expertise regulations governing industrial wastes, sources of wastes, methods for preventing and minimizing wastes at the source, and industrial waste monitoring.

Objectives

Upon completion, the participant should be able to:

- To teach the students the essential role of water in industries
- To study the various methods involved in analytical techniques
- To learn about about the characteristics of water, water pollution and how to manage and prevent water pollution.

Employability

- Graduates will be qualified to work in Wastewater Treatment Plants as operators to the expected industry standard.
- Students have the opportunity to undertake an optional placement and enhance their entrepreneur skill by offering valuable experience.

Nature of Course

- Value added

Advantages

- To reduce, recycle and reuse water for different purposes

Course Outcomes

- Define and implement cleaner production activities, industrial water management strategies for pollution and toxicity prevention.
- To Select the most appropriate treatment technology and design a wastewater treatment methods to treat an industrial effluent stream for a selected industry.
- Integrate cleaner production, industrial water management, wastewater treatment processes, and disposal in the design on an industrial waste treatment process for a selected industry.
- Learn the physico chemical properties of water, different wastewater treatment processes and water management strategies

L P T

UNIT-I

20 10 30 hrs

Characteristics of Water **10 Hrs**

Introduction – sources of water – Characteristics of water, Water Analysis- study of water samples - acidity, alkalinity, Hardness, free chlorine, chlorine demand, calcium, magnesium, iron, manganese, zinc, ammonia, nitrate, sulphate and fluoride, DOC, BOD, CODand their importance- Disadvantages of hard water – Scale and sludge formation in boiler – Boiler Corrosion - Softening methods –desalination of Brackish water: Distillation, Electro dialysis and reverse osmosis.

UNIT-II

Water Pollution **10 Hrs**

Introduction –water Pollutants – physical and chemical pollution of water – ground water pollution – harmful effects of ground water pollution – surface water. River water and sea water pollution, Oil pollution of water. Effects oil pollution in marine water – Radioactive materials in water- Role of pollution control boards.

UNIT-III

Physico chemical Examination of water **10 Hrs**

Collection of samples – colour – odour Turbidity pH – temperature – Soilds: Total Solids, Dissolved solids, suspended solids, settable solids – Acidity — Alkalinity – Hardness – calcium, Magnesium, Sodium - Potassium - Iron–*Dissolved Oxygen, BOD, COD,* biological and chemical treatments.

Text books:

1.Mark C. M. van Loosdrecht, Per Halkjaer Nielsen, C. M. Lopez-Vazquez, DamirBrdjanovic, (2016). Experimental methods in waste water treatment**,** IWA Publishing.

Vivek V. Ranade, Vinay M. (2014).Industrial Wastewater Treatment, Recycling and Reuse. Bhandari Butterworth-Heinemann Publications,

Reference Books:

1. Mukhlyonov. I(1979) *Chemical Technology*, Moscow, 3rd Edition. Mir publication
2. Norris Shreve. R &. Brink, J.A (1977) *Chemical Process Industries.*4th Edition. McGraw Hill
Tokyo.
3. Agarwal. S.K. (2005) *Water Pollution,* APH Publishing.
4. Chakrabarty, B.N. (1981) *Industrial Chemistry*, Oxford & IBH Publishing Co., New Delhi.
5. Singh, P.P. Joseph, T.M. Dhavale, R.G (1983) *College Industrial Chemistry*, Himalaya Publishing House, Bombay, 4th Edition
6. De. A.K. (1989) *Environmental Chemistry*, 11th Edition, Wiley Eastern Ltd. Meerut.

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