Thiagarajar College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Re-Accredited with 'A' Grade by NAAC

Thirty Ninth Academic Council Meeting

Department of Chemistry

Dr. Rm. Murugappan
Dean – Curriculum Development

THIAGARAJAR COLLEGE, MADURAI – 9.
(Re-Accredited with "A" Grade by NAAC)
Curriculum Structure for

B.A. Tamil, English & Economics

B.Sc., Maths, Physics, Chemistry, Botany, Biotechnology, Zoology, Microbiology and Psychology

(For those who joined in 2020 and after)

Category	Course	No. of Courses / Paper	Credit Distribution	Hrs/ Week	Total Credits
Part I	Tamil	4	3	12+12	12
Part II	English	4	3	12+12	12
		Sub Total		**48**	**24**
Part III	Core			72 +12	74
	Elect–Core	2	5	10	10
	Elect–Generic	2+2	5	24	20
		Sub Total		**118**	**104**
Part IV	**AECC** I & II Sem	I Sem EVS II Sem VE	2 + 1	2 I & II Sem	03
	NME III & IV Sem	2	2	2 III & IV Sem	04
	SEC V & VI Sem	2	2	2 V & VI Sem	04
		Sub Total		**06**	**11**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality/WSC Circle/ Library/ SSL/ Nature Club/Value Education/ YRC**				**1**
	Grand Total				**140**

AECC – Ability Enhancement Compulsory Course
SEC – Skill Enhancement Course
NME – Non Major Elective

For Choice Based Credit System (CBCS)

- For NME every department offers two papers (one in each at III & IV Semester)
- For SEC every department offers two papers for each course (in Sem V &VI)
- For Major elective there may be an option for choice.

Semester	Courses
I	**EVS**
II	**VE**
III	**NME**
IV	**NME**
V	**SEC**
VI	**SEC**

B.Sc. Chemistry

Programme Code - UCH

(Aided & SF)

Programme outcome-PO (Aligned with Graduate Attributes)- Bachelor of Science (B.Sc.,)

Scientific Knowledge and Critical Thinking

Apply the knowledge of Life Science, Physical and Chemical Science, Mathematics, statistics, Computer science and humanities for the attainment of solutions to the problems that come across in our day-to-day life/activities.

Problem Solving

Identify and analyze the problem and formulate solutions for problems using the principles of mathematics, natural sciences with appropriate consideration for the public health, safety and environmental considerations.,

Communication and Computer Literacy

Communicate the fundamental and advanced concepts of their discipline in written and oral form. Able to make appropriate and effective use of information and information technology relevant to their discipline

Life-Long Learning

Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Ethical, Social and Professional Understanding

Commitment to principles, codes of conduct and social responsibility in order to behave consistently with personal respect. Acquire the responsibility to contribute for the personal development and for the development of the community. Respect the ethical values, social responsibilities and diversity.

Innovative, Leadership and Entrepreneur Skill Development

Function as an individual, and as a member or leader in diverse teams and in multidisciplinary settings. Become an entrepreneur by acquiring technical, communicative, problem solving, intellectual skills.

Department of Chemistry

Vision : To train our students as scientifically literate professionals with a sense of social responsibilities.

Mission: (i) To make our students to understand the advancement of chemistry in all of its branches through education and research.

(ii) To provide students with community need based research and outreach opportunities.

(iii) To strive for an ideal balance between creation and knowledge dissemination in the Chemical sciences.

(iv) To train our students to succeed in academic, professional and social life.

BACHELOR OF CHEMISTRY
(PROGRAMMING CODE: UCH)

Program Educational Objectives (PEOs)

The objectives of the B.Sc Chemistry programme is to prepare-equip the students.

PEO1	To pursue further studies and succeed in academic and research careers.
PEO2	To develop productive employees in chemical, petrochemical and allied industries.
PEO3	As all rounded professionals in terms of effective communication, skillful execution, good leadership qualities and teamwork.
PEO4	To provide solutions for societal issues such as environmental protection, occupational health and safety, resource management and appropriate business skills.
PEO5	To develop life-long learning skills and abilities.

Program Specific Outcomes (PSOs)
On the successful completion of B.Sc Chemistry program students will be able

PSO1	To get a firm foundation in the fundamentals and applications of chemical and scientific theories including environmental and biological Chemistry.
PSO2	To carry out scientific experiments with the help of laboratory and analytical instruments, as well as accurately record and analyze the results of such experiments.
PSO3	To develop skills in problem solving, critical thinking and analytical reasoning as applied to chemistry related problems.
PSO4	To find the solution for the ethical, historic, philosophical, economical and environmental dimensions of problems and issues facing chemists.
PSO5	To pursue post graduate program in higher educational institutions and also to get suitable employment opportunities in industries and academic institutions.

THIAGARAJAR COLLEGE, MADURAI- 9
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DEPARTMENT OF CHEMISTRY
(For those who join in 2020 and after)
B.Sc Chemistry- Programming Code: UCH

BACHELOR OF CHEMISTRY

Semester – I

Course	Code No	Subject	Hrs/ Week	Cred	Total Hrs	Max Mark	Max Marks	Total
Part I	U20P111	இக்கால இலக்கியம்	6	3	90	25	75	100
Part II	U20EN11	English for Comm. I	6	3	90	25	75	100
Core 1	UCH20C11	Fundamental Concepts in Organic Chemistry	3	3	45	25	75	100
Core 2	UCH20C12	Fundamental concepts in Inorganic & Physical Chemistry	3	3	45	25	75	100
Core Lab-I	UCH20CL11	Organic qualitative analysis	4	2	60	40	60	100
Generic Elective	UPH20GE11C	Physics I	4	4	60	25	75	100
Gen.ele. lab	UPH20GL21C	Physics practical –I	2	-	30	-	-	-
AECC(I)	U20ES11	Environmental Science	2	2	30	15	35	50
Total			30	20	450			

Semester – II

Course	**Code No**	**Subject**	**Hrs/ Week**	**Cred.**	**Total Hrs**	**Max Marks CA**	**Max Marks**	**Total**
Part I	U20P121	பக்தி இலக்கியமும் சிற்றிலக்கியமும்	6	3	90	25	75	100
Part II	U19EN22	English for Comm II	6	3	90	25	75	100
Core 3	UCH20C21	Basic concepts and Main group elements-I	3	3	45	25	75	100
Core 4	UCH20C22	Essential Concepts in Physical Chemistry	3	3	45	25	75	100
Core lab-II	UCH20CL21	Inorganic Qualitative Analysis	4	2	60	40	60	100
Generic elective.	UPH20GE21C	Ancillary Physics – II	4	4	30	25	75	100
Generic elective. Lab	UPH20GL21C	Ancillary physics practical	2	2	60	25	75	100
AECC (II)	U20VE21	Value Education	2	1	30	15	35	100
			30	**21**	450			

Semester – III

Course	Code No	Subject	Hrs/ Week	Credits	Total Hrs	Max Marks CA	Max Marks SE	Total
Part I	U20P131	Tamil	6	3	90	25	75	100
Part II	U20EN31	English for Comm. III	6	3	90	25	75	100
Core 5	UCH20C31	Main group elements-II, Acid-Base Concepts and Non-Aqueous solvents	3	3	45	25	75	100
Core 6	UCH20C32	Chemistry of Aliphatic compounds-I	3	3	45	25	75	100
Core lab-III	UCH20CL31	Inorganic volumetric analysis	4	2	60	40	60	100
Generic Elective	UMA20GE31C /UZO20 GE31C	Ancillary Maths /Zoology-I	6 4	5 4	60	25	75	100
Generic lab	UZO20 GL41C	Ancillary Zoology practical	2	-	30	-	-	-
Non-Major Elective	UCH20 NE31	Chemistry in day-to-day life	2	2	30	15	35	50
		Total	**30**	**20**	450		560	750

Semester – IV

Course	Code No	Subject	Hrs/ Week	Credits	Total Hrs	Max Marks CA	Max Marks	Total
Part I	U20P141	Tamil	6	3	90	25	75	100
Part II	U20EN41	English for Comm. IV	6	3	90	25	75	100
Core 7	UCH20C41	Chemistry of Aliphatic compounds-II	3	3	45	25	75	100
Core 8	UCH20C42	Thermodynamics and Equilibria	3	3	45	25	75	100
Core lab-IV	UCH20CL41	Estimation and Preparation of organic compounds	4	2	60	40	60	100
Generic elective	UMA20GE31C /UZO20 GE31C	Ancillary Maths/ Zoology -II	6 4	5 4	60	25	75	100
Generic ele.lab	UZO20 GL41C	Ancillary Zoology practical – I	2	2	30	40	60	100
Non-Major elective-II	UCH20NE41	Processing of consumer products –Lab	2	2	30	25	75	100
Total			30	22	450			

Semester – V

Course	Code	Subject	Hrs/ Week	Cre dits	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 9	UCH20C51	Solid state, Transition Elements and Co-ordination Chemistry	6	6	90	25	75	100
Core 10	UCH20C52	Chemistry of Aromatic compounds	6	6	90	25	75	100
Core11	UCH20C53	Wave Theory and Photo – Kinetics	6	6	90	25	75	100
Core lab-V	UCH20CL51	Inorganic Estimations and Preparations	4	2	60	40	60	100
Core elective. I	UCH20CE51 (A/B)	Group theory and Spectroscopy / Industrial Chemistry	6	6	90	25	75	100
SEC(I)	UCH20 SE51 (A/B/C)	Agricultural Chemistry/ Dairy Chemistry/Forensic Chemisty	2	2	30	15	35	50
Total			**30**	28	450			

Semester – VI

Course	Code	Subject	Hrs/ Week	Credits	Total Hrs	Max Marks	Max Marks SE	Total
Core 12	UCH20C61	Combinatorial Chemistry	6	6	90	25	75	100
Core 13	UCH20C62	Chemistry of Aliphatic compounds-II	6	6	90	25	75	100
Core 14	UCH20C63	Energetic and Surface chemistry	6	6	90	25	75	100
Core lab-VI	UCH20CL61	Experiments in Physical Chemistry	5	3 (1L:0T:2P)	75	40	60	100
Core. Elective II	UCH20CE61 (A/B)	Chemistry in Industry and Computer Applications(option A) Bioinorganic Chemistry (option B)	5	5	75	25	75	100
SEC (II)	UCH 20SE61 (A/B/C)	Water analysis-Lab (Option A) Food Chemistry (option B) Polymer(Option C)	2	2	30	15	35	50
Total			**30**	**28**	450			
Part V			-	1	-	-	-	-
Total (for semesters I to VI)			**180**	**140**	**2700**			

A) CONSOLIDATION OF CONTACT HOURS AND CREDITS: UG

Semester	Contact hours	Credits
I	30	21
II	30	21
III	30	21
IV	30	21
V	30	27
VI	30	28
Part - V	30	01
Total	**180**	**140**

B) Curriculum Credits: Part wise

Part I	Tamil	4 x 3	= 12 Credits
Part II	English	4 x 3	= 12 Credits
Part III	Core		= 61 Credits
	Core Lab	(2+2+2+2+2+3)	= 13 Credits
	Core electives	5+5	= 10 Credits
	Generic elective	(4 +4+4+4)	= 16 Credits
	Generic elective Lab	(1+1+1+1)	= 04 Credits
Part IV	AECC	2+1	= 03 Credits
	SEC	2+2	= 04 Credits
	NME	2+2	= 04 Credits
Part V		1	= 01 Credits
	Total		**= 140 Credits**

AECC : Ability Enhancement Compulsory Course.
SEC : Skill Enhancement Course

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Course Code	Course title	Category	L	T	P	Credit
UCH20C11	**Fundamental Concepts in Organic Chemistry**	Core-1	3	-	-	3

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

This course explains the nomenclature, structure and shape of organic molecules. The reaction mechanism, isomerism and stereochemistry of organic molecules are discussed in detailed manner. It also deliberates the laboratory methods of purification of organic compounds.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Apply basic rules of organic nomenclature to convert between structures and names; Identify the hybridisation and structure organic compounds and reaction intermediates; Correlate the electron displacement effect and physical effects such as stability and reactivity.	K1
CO2	Tell the types of cleavage, reagents and reactions in organic chemistry; and Draw the isomers of any organic compounds and identify the isomerism involved.	K1
CO3	Explain the conformations of cycloalkanes and the chemistry of alkanes.	K2
CO4	Draw the conformations of alkanes and interconversion of Sawhorse, Newmann and perspective representations and assign R/S and E/Z configuration.	K2
CO5	Do the laboratory purification methods of organic molecules such as Distillation, Crystallization, Sublimation and Chromatographic techniques.	K3

K1-Knowledge *K2-Understand* *K3-Apply*

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	**S**	**L**	-	**M**	**S**
CO2	M	**S**	**L**	-	**M**	**S**
CO3	M	**S**	**L**	M	**L**	**S**
CO4	M	**S**	**S**	**S**	**L**	**S**
CO5	L	**S**	**M**	-	**S**	-

S-Strong; M-Medium; L-Low

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	S	-	S
CO2	S	S	S	-	S
CO3	S	M	S	-	S
CO4	S	-	S	-	S
CO5	S	S	-	S	S

S-Strong; M-Medium; L-Low

Bloom's Taxonomy: Assessment pattern

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Course Title: Fundamental Concepts in Organic Chemistry

UNIT-I: 11 Hrs

IUPAC NOMENCLATURE, STRUCTURE AND PROPERTIES

Classification and nomenclature of organic compounds – IUPAC systems.

Structure and shape of organic molecules: Hybridization – Definition, sp^3 hybridization of carbon (methane) – sp^2 hybridization in alkenes (ethene) and sp hybridization in alkynes (ethyne).

Electronic Displacement Effects: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation.

Reactive Intermediates: Carbocations, Carbanions, free radicals, benzyne, carbenes and nitrenes (Structure and stability).

UNIT-II 7 Hrs

REACTION MECHANISM AND ISOMERISM

Cleavage of Bonds: Homolysis and Heterolysis.

Types of reagents: Electrophilic and Nucleophilic reagents –Definition and examples.

Types of organic reactions (substitution, addition, elimination, rearrangement, oxidation/reduction); another way of classification (thermal, photochemical) one example for each reaction; mechanism not required) – Energy profile of organic reactions. Isomerism (Definition and examples): Types of isomerism- structural isomerism – chain, position, functional – metamerism – tautomerism – stereo isomerism – Geometrical and optical isomerism.

UNIT-III **7 Hrs**

ALKANES AND CYCLOALKANES

Alkanes: Preparation (Catalytic hydrogenation, from alkyl halide, By Wurtz reaction, By Corey-House synthesis), Physical and chemical properties (free radical halogenations reaction).

Cycloalkanes: Definition, nomenclature, symbols of cycloalkanes

Stability: Baeyer's strain theory and its limitations, Sache-Mohr theory.

UNIT-IV **11 hrs**

STEREOCHEMISTRY

Conformations of ethane and butane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds. Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S (for only one chiral carbon atoms) and E / Z Nomenclature (for ethene). Conformations of cyclohexane.

UNIT-V **9 hrs**

PURIFICATION TECHNIQUES

Different methods of purification of organic substances – distillation: under reduced pressure - steam distillation - Soxhlet method – Crystallization – Sublimation -Fractional distillation. Chromatography - adsorption chromatography (column) - partition chromatography (paper) - Thin layer chromatography (TLC) – Gas chromatography (GC) – High Pressure Liquid Chromatography (HPLC).

Text books

1. Bhupinder Mehta, Manju Mehta, 2015, Organic Chemistry, Prentice Hall of India Pvt Ltd,. New Delhi.
2. B.S. Bahl and Arun Bahl, 1998, Advanced Organic Chemistry, 1st edition, S. Chand and Company Ltd, New Delhi.

Reference books

1. I.L.Finar, 2005, Organic chemistry Vol 1, 6th edition, Pearson Edition, Singapore.
2. R.T. Morrision and R.N. Boyd, 1997, Organic chemistry, 6th edition, Prentice Hall Private Limited, New Delhi.
3. P.L. Soni, 2005, Text Book of Organic Chemistry, Sultan Chand, New Delhi.
4. K.S. Tewari, N.K. Vishil and S.N. Mehotra. 2001, A textbook of Organic Chemistry, 1st edition, Vikas Publishing House Pvt Ltd, New Delhi.

Course designers

1. Dr. P. Tharmaraj Dr. P. Prakash Dr. R. Mahalakshmy Dr. A. Tamil Selvi

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Department of Chemistry
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Course Code	Course title	Category	L	T	P	Credit
UCH20C12	**Fundamental concepts in Inorganic & Physical Chemistry**	Core 2	3	-	-	3

L - Lecture T - Tutorial P - Practicals

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

The course explains the fundamental concepts in framing the structure of an atom, periodicity, metallurgical processes, Lab safety and Error analysis in the Lab and also enables the students to gain the knowledge on physical properties of gases and liquids.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Recall the atomic structure of an atom and explain related theories and concepts. Classify the elements and compare their periodic properties	K1
CO2	Demonstrate the various metallurgical processes involved in the extraction of metals and predict the feasibility of redox reactions	K2
CO3	Explain the laboratory safety methods include handling toxic and poisonous chemicals safely and provide knowledge about first-aid in case of small laboratory accidents. Point out the sources of errors and analyze the data statistically	K3
CO4	Find out the deviation of gases and to understand the physical behaviour of liquids.	K2
CO5	Tell and Apply the colligative properties of dilute solutions.	K1

K1-Knowledge *K2-Understand* *K3-Apply*

Mapping of COs with PSOs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	-	M	-	**S**	-
CO2	**S**	-	M	M	**S**	S
CO3	**S**	**S**	S	**S**	**S**	S
CO4	**S**	**S**	S	**S**	**S**	S
CO5	**S**	**S**	S	**S**	**S**	**S**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	M	-	**S**
CO2	**S**	-	M	-	**S**
CO3	**S**	**S**	S	**S**	**S**
CO4	**S**	**S**	S	**S**	**S**
CO5	**S**	**S**	S	**S**	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Course Title: Fundamental concepts in Inorganic & Physical Chemistry

Unit I: Atomic Structure and Periodic law (9 hrs)

Rutherford model of the atom- defects of Rutherford model - Discovery of neutron, Bohr model of an atom and derivations - merits and demerits- atomic spectrum of Hydrogen - Sommerfield modification- de Broglie's concept - dual nature, Heisenberg's uncertainty principle - quantum numbers- shapes of s, p, d atomic orbitals- The Schrodinger equation, significance of wave functions, normalization of wave function, radial and angular wave functions, Arrangement of electrons in atoms- Pauli exclusion principle - Hund's rule – Aufbau principle.

Periodic law and Cause of periodicity. Division of elements in to s, p, d and f blocks. Periodic Properties of atoms: Atomic properties - Ionisation Energy, Electron affinity, Effective Nuclear Charge- Slater's rule- Electronegativity and its importance. Covalent radius-van der Waals radius-Ionic radius and their periodic trends.

Unit II: Metallurgical Processes (9 hrs)

Definition for minerals and ores - ore dressing – gravity separation - froth flotation-magnetic separation - chemical separation- calcination and roasting- Thermodynamics of reduction processes - Ellinghem diagram.

Extraction of metal-chemical reduction-auto reduction-electrolytic reduction-metal displacement. Refining methods - distillation - fractional crystallization - van Arkel method - electrolytic refining - vapour phase refining-ion exchange method-muffle furnace. Metallurgy of Be, Au, Ni, Cr and Cu. Anamalous behaviour of mercury. Alloys of copper and Nickel.

Unit III: Laboratory Safety, Volumetric and Error Analysis (9 hrs)

Laboratory Safety

Apparel in the laboratory-Safety symbols in laboratory-Material safety data sheet-(MSDS)-GHS-CAS-Global overview of chemical regulations in India.

First Aid- Important terms(carcinogenic, caustic, corrosive, irritant, poison)-First aid measures (cuts, burns, chemical spill, fire accidents, eye accidents, poison swallow, breathing chemical fumes, fainting, shock)- Materials in first aid kit (materials, tablets, creams)-safe handling and storage of chemicals (acids, bases, flammables, oxidizers, compressed gases).

Volumetric analysis

Vocabulary of volumetry-standardisation of solutions-concentrations terms-calculation of equivalent weights.

Error Analysis

Accuracy, precision, classification of errors, minimization of errors, significant figures, mean and standard deviation – method of least squares – student Q- Test, T-test. Linear Regression.

Unit IV: States of Matter (Gas and Liquid) (9 hrs)

Gaseous State: Gas laws - postulates and derivation of the kinetic gas equation; Types of velocities - mean, root mean square, most probable velocities (definition only); Collision

frequency – mean free path; Real gases - Deviation of real gas from ideal behavior - Derivation of vander Waal's equation and its significance.

Liquid State: concentration terms – molarity (M), Normality (N), molality (m), formality, mole fraction, ppm and percentage concentration and simple problems.

Physical properties of liquids – Vapour pressure – surface tension – viscosity coefficient (definition only)

Unit V: Colligative Properties of Dilute Solution (9 hrs)

Colligative Properties: Statement - Lowering of vapour pressure - Raoult's and Henry's Law - applications and its limitations; relative lowering of vapour pressure – elevation of boiling point – depression in freezing point – osmotic pressure – Applications in calculating molecular weight of normal solutes.

Text Books:

1. Puri, B.R . Sharma L.R and .Kalia.K.C.2004 Principles of Inorganic Chemistry, 28th edition,Vallabh Publication, NewDelhi.
2. Puri.B.R., Sharma L.R and Madan S.Pathania, 2007 Principles of Physical chemistry, 30th edition, Vishal publication, Jalandhar-Delhi.

Reference Books:

1. Madan R.D., 2004, Modern Inorganic Chemistry, S. Chand & Company, 2nd edition,, New Delhi.
2. Albert Cotton F.A, Kotz, 1998, Basic Inorganic Chemistry, Geofferey Wilkinson, Carlos, Murillo, Manfred Bochmann, John Wiley & Sons, Inc. New York.
3. Lee, J. D, 2002, A New Concise Inorganic Chemistry, Blackwell Science Ltd.,ELBS 5th Ed., London.
4. Bahl B.L, , Tuli G.D, and Arun Bahl,2004, Essential of Physical chemistry,S.Chand publications, Reprint , Ram nagar, New Delhi.

Web Resources:

https://www.khanacademy.org/science/chemistry/periodic-table/copy-of-periodic-table-of-elements/v/periodic-table-introduction

https://nptel.ac.in/courses/104/103/104103069/

Course designers

1. Dr. D.S. Bhuvaneshwari
2. Dr. T. Arumuganathan
3. Dr. K. Selvakumar
4. Dr. M. Sathiya
5. Dr. S. Pitchaimuthu
6. Dr. A. Baishnisha
7. Dr. A. Jeevika

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Course Code	Course title	Category	L	T	P	Credit
UCH20CL11	Organic qualitative analysis	Core Lab – I	-	-	4	2

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	40	60	100

Preamble

This lab course enables the students to acquire practical skill on qualitative analysis of simple organic compounds.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome
CO1	Explain the analytical procedure to identify the given organic compounds.
CO2	Analyze systematically and report the functional group present in the given organic compound.
CO3	Identify the saturation/unsaturation and aliphatic/aromatic nature of given organic compounds.
CO4	Analyze the elements (other than C, H and O) present in the given compound.
CO5	Prepare the derivatives for the functional groups.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	**S**	**S**	-	**S**	**S**
CO2	M	**S**	**S**	-	**S**	**S**
CO3	M	**S**	**S**	M	**S**	**S**
CO4	M	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	**S**	M	**S**	**S**

S-Strong; M-Medium; L-Low

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	S	-	**S**
CO2	**S**	**S**	S	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**S**	M	-	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Analysis of Organic compounds

1. Aromatic Organic Compounds like mono and dicarboxylic acids.
2. Aromatic primary and secondary amines.
3. Aromatic amides.
4. Aromatic aldehyde and ketones.
5. Phenols and naphthols.
6. Nitro aromatic compounds.
7. Aliphatic diamides.

Course designers

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Department of Chemistry
Programme Code: UCH
ENVIRONMENTAL STUDIES
(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2020)

Course Code	Course Title	Category	L	T	P	Credit
U20ES11	**Environmental Studies**	AECC1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	15	35	50

Preamble

Students acquire knowledge on the basic concepts, comonents and importance of environment.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Knowledge Level
CO1	Define the structure and functions of ecosystem	K1
CO2	Explain the benefits of biodiversity conservation	K2
CO3	Summaries the sources, effects and control measures of various types of Pollutant and pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3
CO5	Elaborate the impact of environmental problems on life systems	K3

K1: Knowledge K2: Understand K3: Apply

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**L**	**L**	**M**	**L**	**M**
CO2	**---**	**M**	**M**	**---**	**M**
CO3	**---**	**L**	**M**	**L**	**L**
CO4	**---**	**---**	**L**	**L**	**L**
CO5	**S**	**-**	**L**	**M**	**M**

Strong –S (+++) Medium-M (++) Low-L (+)

Mapping of Course Outcomes with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**S**	**L**	**S**	**S**	**-**
CO2	**S**	**M**	**L**	**M**	**L**	**L**
CO3	**S**	**S**	**L**	**S**	**M**	**L**
CO4	**S**	**S**	**L**	**M**	**S**	**S**
CO5	**S**	**M**	**-**	**S**	**S**	**S**

Strong –S (+++) Medium-M (++) Low-L (+)

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title: Environmental Studies

Unit I

Definition and Scope of Environmental Studies – Ecology and Ecosystem – Structure of an Ecosystem – Food chains, food webs and ecological pyramids – Causes of Biodiversity Loss – Benefit and Conservation of Biodiversity.

Unit II

Environmental problems and Management: Causes, effects and Control measures of : Air Pollution – Water Pollution – Noise pollution – Nuclear Hazards. Solid waste management and Waste Disposal methods. Climate change and Global Warming causes and Measures. Waste and Plastics. Urban environmental problems and measures. Environmental Legislations in India. Sustainable development and Inclusive growth.

Text Book

1. Kanagasabai, C.S. 2005.Environmental Studies. Rasee publishers. Madurai.

Reference Books

1. Yogendra, N. and Srivastava, N. 1998. Environmental Pollution, Ashish Publishing House. New Delhi.
2. Sapru R.K.2001. Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2020)
Programme Code: UCH

Course Code	Course title	Category	L	T	P	Credit
UCH20C21	**Basic concepts and Main group elements-I**	Core 3	3	-	-	3

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	25	75	100

Preamble

The course enables the students to gain knowledge on different types of chemical bonding, hybridization with shape of molecules, basic principles of inorganic qualitative analysis, redox reactions, periodicity of s & p-block elements and their applications.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Spell the formation of different types of chemical bonding and label their specific significance.	K1,
CO2	Define hybridization and geometry of molecules based on VB and VSEPR theories and illustrates the molecular orbital theory (MOT) of homo and heteronuclear diatomic molecules.	K3
CO3	Demonstrate the qualitative analysis of Group II and Group III cations and illustrates the analytical chemistry.	K2
CO4	Spell about the Hydrogen Explain the general characteristics of s block elements and the preparation, properties and uses of their compounds.	K3
CO5	Show the general characteristic of p-block elements especially Boron and preparation, properties and structure of their compounds. Tell the hydroboration- ultramarine. Anomalous behaviour of Aluminium, Inert pair effect of Thallium.	K2

K1-Knowledge *K2-Understand* *K3-Apply*

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	M	S
CO2	S	S	S	S	M	S
CO3	S	-	-	M	S	S
CO4	S	-	M	M	S	S
CO5	S	-	M	M	S	S

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	L	S	S
CO2	S	M	S	S	S
CO3	S	L	-	S	S
CO4	S	L	-	S	S
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	**CA**		**End of Semester**
	First	**Second**	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Course Title: Basic concepts and Main group elements-I

Unit I: Chemical Bonding (9 hrs)

Chemical bond - definition, types of chemical bonds.

Ionic or electrovalent bond - Definition, General characteristics of ionic compounds- sizes of ions, radius ratio rule and its limitation. Illustration of the formation of ionic bond (Examples: NaCl, MgO, CaF_2, Al_2O_3 only), Condition for the formation of ionic compounds, Lattice energy, Born-Haber cycle,

Covalent bond: Definition, General characteristics of covalent compounds, types of covalent bond (single, double and triple), Illustration of the formation of covalent bond (Example: HF, H_2O, NH_3, CH_4 O_2, N_2 only), factors favouring the formation of covalent compounds. Valence-Bond approach – postulates only- directional character of covalent bond. Limitations of VBT.

Coordinate bond: Definition, Illustration of the formation of coordinate bond (Example: H_2O_2, SO_2, CO, NH_4^+, Al_2Cl_6 only), comparison between ionic, covalent and coordinate bond.

Hydrogen bond: Definition, properties, types and significance of hydrogen bonding.

Non-Covelent interactions.

Unit II : Hybridization, VSEPR and Molecular Orbital Theory (9 hrs)

Hybridization-hybridization involving s-, p-, d- orbitals– Valence Shell Electron Pair Repulsion (VSEPR) postulates, shapes of simple molecules and ions of BeF_2, BF_3, SF_6 $SnCl_2$ NH_3, H_2O, ClF_3, IF_5 – Limitations. Molecular Orbital Theory- Postulates- Formation of molecular orbitals from atomic orbitals. Homonuclear (H_2, Li_2, N_2, O_2) and Heteronuclear (CO and NO) diatomic molecules- Calculation of bond order and magnetic properties. Bond moment and dipole moment, partial ionic character of covalent bonds, Fajan's rules.

Unit III: Principles of Inorganic qualitative analysis and estimations (9 hrs)

Formation of sublimates; principle of flame test, borax-bead test, cobalt nitrate test, fusion test, chromyl chloride test, analytical reactions for the detection of nitrate, nitrite, halides, phosphate, sulphide, sulphate, borate, boric acid. Analytical reactions for the detection of Cr^{3+}, Fe^{3+}, Ni^{2+}, Cu^{2+}, Mn^{2+}- Importance of common-ion effect in the separation of Group II cations and Group III cations (lead and zinc?)

Redox titrations, redox potentials, theory of redox indicators- principles involved in iodometric and iodimetric titrations- Complexometric titrations involving EDTA - indicators for Complexometric titrations.

Unit IV:- Hydrogen and s -Block Elements (9 hrs)

Hydrogen: Electronic structure, abundance, preparation and properties, isotopes, ortho- and para hydrogen, Hydrogen peroxide. Hydrides: ionic, covalent, metallic and intermediate hydrides. General characteristics - anomalous behaviour of lithium and beryllium - diagonal relationships of lithium with magnesium and beryllium with aluminium.

Preparation, properties and uses of lithium hydride, sodium peroxide, potassium iodide, KNO_3, BeO, $BeCl_2$, calcium carbide, $CaCl_2$, super phosphate of lime, Plaster of Paris and lithopone- Biological importance.

Unit V: p- Block Elements (Boron group) (9 hrs)

Group 13 (boron group): General Characteristics, extraction of boron, Anomalous behaviour of Boron, Diagonal relationship of boron with silicon, reaction of B with other elements, water, air, acids, alkali, metals and non-metals. Preparation, Properties and structure of diborane. Structure of borazine, structure and medicinal properties of boric acid, borohydrides- Hydroboration- Ultramarine. Anomalous behaviour of Aluminium, Inert pair effect of Thallium.

Text Books:

1. Puri B.R, Sharma L.R, and Kalia K.C, 2004, Principles of Inorganic Chemistry, 28th edition, Vallabh Publication, NewDelhi.
2. Madan R.D, 2002, Modern Inorganic Chemistry, Chand S.& Company, 2nd edition, New Delhi.

Reference Books:

1. Albert Cotton F.A, 1998, Advanced Inorganic Chemistry, Geofferey Wilkinson, Carlos, Murillo, Manfred Bochmann, John Wiley & Sons, Inc. New York.
2. Huheey J.E and Ellen Keiter A., Richard Keiter L.2004, Inorganic Chemistry, 4th edition, Pearson Education Pvt Ltd, Harper Collins College Publishers, Singapore.
3. Malik, Tuli, Madan, 2006, Selected Topics in Inorganic Chemistry, S. Chand & Co., New Delhi.
4. Lee, J. D, 2002, A New Concise Inorganic Chemistry, ELBS 5th Ed.
5. Arthur I .Vogel, Inorganic Chemistry, ELBS 4th & 5th Ed.

Web Source:

1. https://www.youtube.com/playlist?list=PLENI0YTeW7RDlpqCQl6fTNVHhYRIljht
2. https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry
3. https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
4. https://www.slideshare.net/KennethBarrientos4/lecture-notes-for-inorganic-chemistry

Course designers

1. Dr.DS.Bhuvaneswari
2. Dr.K.Selvakumar
3. Dr.S.Pitchaimuthu
4. Dr. A. Baishnisha
5. Dr. J. Tirupathi
6. Dr.N.Sudhan

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
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Programme Code UCH

Course Code	Course title	Category	L	T	P	Credit
UCH20C22	**Essential Concepts in Physical Chemistry**	Core 4	3	-	-	3

L - Lecture T - Tutorial P - Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	25	75	100

Preamble

The course enables the students to gain knowledge on catalysis, polymer, distribution law, nuclear, molecular properties and structure of molecules.

Course Outcomes

On the completion of the course the student will be able to

	Course outcome	Knowledge level
CO1	Relate the functions, types and reaction mechanism of catalysts.	K1
CO2	Outline the chemistry of polymer.	K2
CO3	Explain the basic concepts of nuclear chemistry.	K2
CO4	Analyze Nernst distribution law and its applications.	K3
CO5	Illustrate physical properties of molecules like distribution, polarization, magnestism etc.	K3

K1-Knowledge *K2-Understand* *K3-Apply*

Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	S	S	**M**
CO2	S	-	-	S	S	**S**
CO3	S	S	S	S	S	**S**
CO4	S	S	S	-	-	**-**
CO5	S	S	S	M	-	**-**

Mapping of COs and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	-	-	-	**S**
CO2	**S**	M	M	-	**S**
CO3	**S**	-	M	-	**S**
CO4	**S**	M	-	-	**S**
CO5	**S**	-	-	M	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Course Title: Essential Concepts in Physical Chemistry

UNIT I **(9 hrs)**

CATALYSIS: Definition – effect of catalyst – graphical illustration of exo and endo thermic catalysis; Types of catalysts – positive – negative - auto and induced catalyst; Types of catalysis – homogeneous and heterogeneous catalysis - acid-base catalysis; Enzyme catalysis- Michaelis-Menton mechanism; catalytic poisoning and promoters with simple examples.

UNIT II **(9 hrs)**

POLYMER CHEMISTRY

Classification of polymers – Functionality – Tacticity, addition and condensation polymerization, Thermoplastic resin and thermosetting resin, number average and weight average molecular weights of polymers, Moulding of polymers – injection and compression-Applications of polymer.

UNIT III **(9 hrs)**

DISTRIBUTION LAW

Nernst Distribution law - thermodynamic derivation association of solute in one of the solvent, dissociation of solute in one of the solvent, solute enters into chemical combination with one of the solvent - Applications of Nernst distribution law and limitations

UNIT IV **(9 hrs)**

NUCLEAR CHEMISTRY: Composition of the nucleus - Mass defect -'Binding energy – Binding energy per nucleon (Problems related to this) and Nuclear stability - magic numbers; **NATURAL RADIOACTIVITY:** Types and comparison of radioactive rays; Detection and measurement of radioactivity - GM counter method and Wilson cloud chamber method; Fajan's - Russell - Soddy group displacement law – derivation of radioactive disintegration constant, average life and half-life period (related simple problem only); Application of radioactive isotopes – carbon dating (related simple problem only)- radioactive waste disposal.

UNIT V **(9 hrs)**

MOLECULAR PROPERTIES AND STRUCTURE

Electrical properties of molecules - polarization of a molecule in an electric field, Derivation of Clausius - Mosotti equation; Dipole moments – concept and application in prediction of molecular structure of simple molecules – CO_2 and SO_2, BF_3 and NH_3.

Magnetism: Magnetic properties of molecules - permeability – susceptibility; Measurement of magnetic susceptibility – Guoy balance method; Types of magnetism- dia, para, ferric, Ferro and anti-ferromagnetism.

Text Books

1. Puri B.R., Sharma L.R. and Pathania M.S., 2007, Principles of Physical chemistry, 30th Edition, Vishal publication, 2007, Jalandhar-Delhi, India.

2. Billmeyer Jr., F.W, 1984, A text book of Polymer Chemistry, III edition, John Willey and Sons, UK.

Reference Books

1. Bahl B.S., Tuli G.D. and Arun Bahl, 2004, Essential of Physical chemistry, S.Chand publications, Ram nagar, New Delhi, India.

2. Arnikar H.J., 2005, Essentials of Nuclear Chemistry, IV Edn., New Age international (P) Ltd., New Delhi, India.

3. Gowarikar V., *et al*., 1986, Polymer Science, Willey Eastern Limited, New York, USA.

Course Designers

1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan
4. Dr. M. Sathiya
5. Dr. A. Jeevika
6. Dr. P. Senthilkumar

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2020)
Programme Code UCH

Course Code	Course title	Category	L	T	P	Credit
UCH20CL21	Inorganic Qualitative Analysis	Core Lab-II	-	-	4	2

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	40	60	100

Preamble

The lab course describes the systematic analysis of acid and basic radicals present in a given inorganic mixture and also develops the qualitative analysis skill of the students.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome
CO1	Analyse the acid radicals present in any given inorganic salt mixture.
CO2	Eliminate the interfering acid radicals.
CO3	Identify the basic radical and its group mixture of salt.
CO4	Analyse the basic radical systematically.
CO5	Develop their qualitative analysis skill of any given inorganic salt mixture.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5
CO1	S	**S**	**S**	-	**S**
CO2	M	**S**	**S**	-	**S**
CO3	M	**S**	**S**	M	**S**
CO4	M	**S**	**S**	**S**	**S**
CO5	**S**	**S**	M	**S**	**S**

S-Strong; M-Medium; L-Low

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	**S**	**S**	-	**S**
CO2	M	**S**	**S**	-	**S**
CO3	M	**S**	**S**	M	**S**
CO4	M	**S**	**S**	**S**	**S**
CO5	M	**S**	**S**	**S**	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Analysis of simple salts - mixture of salts
Acid radicals:
Simple: Nitrate, Sulphate, Bromide, Iodide and Carbonate
Interfering: Phosphate, Oxalate, Borate**,** and fluoride
Basic Radicals:
Lead, Copper, Cadmium, Iron, Nickel, Zinc, Calcium, Barium, Strantium, Magnesium, Ammonium.
Internal Marks = 40
External marks = 60
Total Marks = 100

Internal Marks Distribution:
Acid radical = 15
Basic radical = 15
Procedure = 05
Record = 05

Total = 40

Course Designers
1. Dr. A. Tamil Selvi
2. Dr. K. Selvakumar

Thiagarajar College (Autonomous) :: Madurai – 625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
PROGRAMME CODE: UCH

Course Code	Course Title	Category	L	T	P	Credit
U20VE51	**Value Education**	AECC	1	1	-	1

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	15	35	50

Preamble

Students realize that character building is equally important as career building , develops positive thinking to promote themselves and the society.

Course Outcomes

On the completion of the course the student will be able to

	Course outcomes	Knowledge Level
CO1	Define the types of values ,values for self development and family	K1
CO2	Develop good character and good relationships	K2
CO3	Summarise the areas of thinking and self empowerment	K1
CO4	Outline the symptoms and stages of stress	K3
CO5	Build self confidence and leadership qualities to lead a happy and successful life	K2&K3

Mapping of Course Outcomes with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	L	S	S	S
CO2	S	S	L	S	S	S
CO3	M	L	S	S	S	S
CO4	M	S	L	S	S	M
CO5	S	M	L	M	S	M

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	M	L	S
CO2	S	M	L	S	M
CO3	M	S	L	S	M
CO4	S	S	L	M	M
CO5	M	S	L	S	S

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Course Title: Value Education

Unit I

Self Development – Introduction - Definition and Types of Values – Self Assessment – Values needed for self development - Values needed for family life –Principles of happy living

Character development- Good character – Good relationships - Legendary people of highest character – The quest for character –Developing character -The key to good character.

Unit II:

Positive Thinking and Self Esteem - Types of thoughts - Areas of thinking - Developing thought pattern - External influences on Thoughts - Methods to keep outlook positive – Meaning of Self Esteem – Self empowerment.

Stress free living – Illusions and causes - Symptoms and stages of stress – Self confidence– Role models and leadership qualities – Critical thinking - Communication skills – Happy and successful life.

Reference

Study material / Course material

Values for Excellence in Life‖ Compiled by then Curriculum Development Cell Thiagarajar College, Madurai, in collaboration with the Education wing, Brahma Kumaris, Madurai.

GENERIC ELECTIVES

THIAGARAJAR COLLEGE (AUTONOMOUS) MADURAI-9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those joined B.Sc. Zoology / Microbiology /Botany
With effect from 2020-2021 Batches onwards)
Programme Code: UCH

Course Code	Course title	Category	L	T	P	Credit
UCH20GE11Z/ UCH20GE31B	**Chemistry for Life Sciences**	Generic Elective	4	-	-	4

L - Lecture T - Tutorial P – Practical

Year	Semester	Int. Marks	Ext. Marks	Total
I	I/III	25	75	100

Preamble

The course explains the basic concepts in biomolecules such as carbohydrates, proteins, enzymes and vitamins. The main focus of the course is to enhance the knowledge and skills required for treatment of soils, chemical fertilizers, petrochemicals etc.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Summarize the structures, reactions and functional group interconversion of carbohydrates.	K1
CO2	Explain the fundamentals of proteins and enzymes	K2
CO3	Outline the ion exchange and basic properties of soils treatment	K2
CO4	Identify the chemical processes involved in industries and agricultural applications.	K3
CO5	Outline the classification, characteristics and applications of Insectisides and pesticides.	K3

K1-Knowledge *K2-Understand* *K3-Apply*

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	-	L	S	S	-
CO2	S	S	S	S	S	-
CO3	S	L	-	S	S	-
CO4	S	L	-	S	S	M
CO5	S	S	S	S	S	M

S-Strong; M-Medium; L-Low

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	M	-	**S**
CO2	**S**	-	M	-	**S**
CO3	**S**	**S**	S	**S**	**S**
CO4	**S**	**S**	S	**S**	**S**
CO5	**S**	**S**	S	**S**	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	**CA**		**End of Semester**
	First	**Second**	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Course Title: Chemistry for Life Sciences

UNIT –I: CARBOHYDRATE CHEMISTRY (12hrs)

Classification- preparation and properties and uses of sucrose- muta rotation- conversion of aldopentose to aldohexone and vice versa. Conversion of glucose to fructose vice versa. Clinical tests for sugars.

UNIT – II: Proteins and enzymes (12hrs)

A. AMINOACIDS: Definition- general methods of preparation, properties and uses- Glycine, and alanine

B. PROTEINS: Definitions- Classification and general properties – colour reactions and the relation of amino acids to proteins. Some common proteins and their sources – examples- egg albumin, haemoglobin, insulin, casein and keratin, plasma.

C. ENZYMES: Definition- classification and the role of enzymes

D. VITAMINS: Definition- classification, sources and role of vitamins- A, B complex, C, D and K (structure and synthesis not expected)

Unit-III: Soil Chemistry (12hrs)

Physical properties of soil-soil texture and textural classification-pore space-bulk density, particle density-soil structure and soil colour-surface area-soil colloids-plasticity, shrinkage-floceulition and deflocculation-soil air, soil temperature, their importance in plant growth-soil reaction-ion exchange reaction-cation exchange-anion exchange-buffering capacity-factors affecting soil pH-soil degradation - causes. Inorganic minerals in plant growth.

Unit-IV: Fertilizers (12hrs)

Plant nutrients-micro and macro nutrients-their role in plant growth-sources-forms of nutrient absorbed by plants-factors affecting nutrient-deficiency symptoms in plants-corrective measures-chemicals used for correcting nutritional deficiencies-nutrient requirements of crops, their availability, fixation and release of nutrients-Fertilizers-Classifications- NPK, natural and synthetic fertilizers-straight, complex-liquid fertilizers-secondary and micro nutrient fertilizers-mixture fertilizer-principles of fertilizers use-biofertilizers-rhizobium, azospirillum, azotobacter-blue green, algae, azolla production and quality control of bio-fertilizers.

Soil analysis – analysis of NPK - Mixed fertilizer – Urea

Unit-V: Pesticides, Fungicides and Insecticides (12hrs)

Pest Control – Pesticides – insecticides – fungicides – (organo sulfur and phosphorous compounds – sulfur dust) – their bad effects – natural pesticides. Examples – neeta products. Method of using Pesticides – insecticides – fungicides, Impact on environment.

Course Designer:

Dr.A. Elangovan
Dr.R.Mahalakshmy
Dr.T.Arumuganathan
Dr. N. Sudhan
Dr. P. Senthil kumar

Text book:

1. Text book of organic chemistry – P. L. SONI

Reference Book:

1. G.T. Sustin, Shreve's Chemical Process Industries, 5th edition, Mc-Graw-Hill, 1984, New Delhi.
2. B.A. Yagodin (Ed), Agricultural Chemistry, 2 volumes, Mir Publishers, 1976, Moscow.
3. G. Mahapatra, Elements of Industrial Chemistry, Kalyani Publishers, 2001, New Delhi.
4. B.N. Chakravarthy, Industrial Chemistry, Oxford and IBH Publishing Co., 1998, New Delhi.

Web Soruces:

1. https://www.google.com/search?q=carbohydrates+slideshare+ncert&oq=carbohydrates+slideshare+nc&aqs=chrome.1.69i57j33.25400j0j7&sourceid=chrome&ie=UTF-8
2. https://www.slideshare.net/krishnaSethi1/fertilizer-and-its-classification
3. https://www.google.com/search?sxsrf=ALeKk03vba7YoQOqVXJKQGQc3TWCNQVCaA%3A1594827271629&ei=ByIPX9yNJo2O4-EP7eWKoA4&q=soil+treatment+ncert&oq=soil+treatment+ncer&gs_lcp=CgZwc3ktYWIQARgAMgcIIRAKEKABMgcIIRAKEKABMgcIIRAKEKABOgQIABBHOgIIADoGCAAQFhAeOgUIIRCgAVCnL1jWM2DjQGgAcAF4AIAB3gWIAdQTkgEFNS0zLjGYAQCgAQGqAQdnd3Mtd2l6&sclient=psy-ab
4. https://www.google.com/search?sxsrf=ALeKk01PfNtLe3uvuJzpyqeSp9r75DK1eQ%3A1594827336285&ei=SCIPX-v_EKeJ4-EPi5ez-AQ&q=biomolecules+slideshare&oq=biom+slideshare&gs_lcp=CgZwc3ktYWIQARgBMgYIABAHEB4yBggAEAcQHjIGCAAQBxAeMgYIABAHEB4yBggAEAcQHjIGCAAQBxAeMgYIABAHEB4yBggAEAcQHjIGCAAQBxAeMgYIABAHEB46BAgAEA06CAgAEA0QBRAeOggIABAIEA0QHlDEMFi1T2DqZmgCcAB4AIAB7AGIAdoJkgEFMC4zLjOYAQCgAQGqAQdnd3Mtd2l6&sclient=psy-ab

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined B.Sc. Zoology / Microbiology /Botany
With effect from 2020-2021 Batches onwards)
(Programme Code:UCH)

Course Code	Course title	Category	L	T	P	Credit
UCH20GE21Z/ UCH20GE41B	**Industrial Chemistry**	Generic Elective	4	-	-	4

Year	Semester	Int. Marks	Ext. Marks	Total
I/II	II/IV	25	75	100

Preamble

This course explains the basic concepts and theories of water analysis and fuels. The main focus of the course is to enhance the knowledge and skills required for preparation of basic chemicals and food adulterants.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Demonstrate purification of water.	K1
CO2	Outline the classification, characteristics and applications of fuels.	K2
CO3	Identify the chemical processes involved in industries for the preparation of some important compounds.	K2
CO4	Summarise the food additives.	K3
CO5	To apply the use of food additives and testing	K3

K1-Knowledge *K2-Understand* *K3-Apply*

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5
CO1	S	-	L	S	S
CO2	S	S	S	S	S
CO3	S	L	-	S	S
CO4	S	L	-	S	S
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**-**	**-**	**M**	**S**
CO2	**S**	**M**	**S**	**-**	**S**
CO3	**S**	**M**	**M**	**L**	**S**
CO4	**S**	**-**	**S**	**S**	**S**
CO5	**S**	**M**	**L**	**-**	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge(30%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (30%)	20%	20%	20%

Course Title: Industrial Chemistry

Unit-I: WATER TREATMENT **12 Hrs**

Introduction – Definition- Units of Hardness- Scales and Sludge – Sterilization and flocculation. Hardness of water – Treatment of water: Ion –exchange method and reverse Osmosis – Estimation of hardness by EDTA method

Unit-II: FUELS **12 Hrs**

Types of Fuels- Calorific value. Coal – proximate and Ultimate analysis, metallurigical coke-manufacture by Otto-Hoffmann method. Petroleum-Cracking, synthetic petrol-Bergius and Fischer Tropsch process, knocking-octane and cetane number. Water gas, producer gas, LPG.

Unit-III: IMPORTANT CHEMICALS-PREPARATION, PROPERTIES AND USES 12 Hrs

PVC - HDPE - LDPE - PET - Teflon –, Nylon6, Nylon 66- Natural Rubber – vulcanization – recycled plastics - plastics and their role as pollutants – Fields (Varnishes, artificial limbs – biopolymers in medicinal applications.

Compositions of Cosmetics – Talc – tooth powder/paste – shampoo-toilet soaps and sanitary and disinfectant items – detergents

Unit-IV: FOOD ADDITIVES **12 Hrs**

Introduction-The chemistry of Sweeteners-Intense sweeteners (Asparatame and saccharin) and Bulk sweeteners (Mannitol and Erythritol) - Chemistry of Food colours- Natural and synthetic colours- Limiting value of colouring agents and safety-Flavouring agents- Antioxidants and their uses (Ascorbic acid, Tocopherols, Butylated hydroxy anisole (BHA), Citric acid)-Emulsifiers (mono and di-glycerides)-Food stuff containing emulsifiers-Types and Manufacture of Emulsifiers (lecithin, mono and diglycerides of fatty acids)-Functions of emulsifiers in food-Acidulants- Acetic acid-Citric acid-Lactic acid- Malic acid-Phosphoric acid-Tartaric acid .

Unit-V: FOOD ADULTERATION AND TESTING **12 Hrs**

Inroduction-Legal aspects of food adulteration and prevention-Common food adulterants-Analysis of adulterants in Edible Oils, Ghee, Coffee powder, Chilly powder, Turmeric powder, Meat and Milk-Harmful effects of the adulterants-Food additives (Sweeteners, preservatives, flavours and colourants) - Pesticide contaminants (DDT, parathion and malathion) - Toxicants (Lead, fluorine, cyanogenic compounds and antivitamins).

Course Designer:

Dr.A. Elangovan
Dr.R. Mahalakshmi
Dr.T. Arumuganathan
Dr. N. Sudhan
Dr. P. Senthil kumar

Text Books:

1. Alex V Ramani, Food Chemistry, MJP publishers, 2009, Chennai.
2. Bamji MS, Rao NP, Reddy V. 1996, 5. Ed. Text Book of Human Nutrition. Oxford and 1BH publishing Co. Pvt. Ltd.

Reference Books:

1. B.K.Sharma, Industrial Chemistry, Goel publishing House, Meerut, 2003, New Delhi.
2. R.V.Shreve, Industrial Chemical Process, Tata McGraw Hill publishing company, 2005, Mumbai.
3. G. Mahapatra, Elements of Industrial Chemistry, Kalyani Publishers, 2001, New Delhi.
4. B.N. Chakravarthy, Industrial Chemistry, Oxford and IBH Publishing Co., 1998, New Delhi.
5. Jane Bowers. Food Theory and Applications. MacMillan Publishing Company, New Delhi.

Web source:

1.https://www.google.com/search?sxsrf=ALeKk03Uw3RS97vPm2VRLBhJs8KNOersZg%3A1594827924674&ei=lCQPX4_tKNyZ4-EPtaey4A0&q=water+treatment+slideshare&oq=water+treatment+slideshare&gs_lcp=CgZwc3ktYWIQAzIGCAAQBxAeMgYIABAHEB4yBggAEAcQHjICCAAyBggAEAcQHjIGCAAQBxAeMgYIABAHEB4yBggAEAcQHjIGCAAQBxAeMgYIABAHEB5Qw40CWIuhAmCIpgJoAHAAeACAAcQEiAHfIJIBCzAuNS4zLjEuMS4zmAEAoAEBqgEHZ3dzLXdpeg&sclient=psy-ab&ved=0ahUKEwiPh7b_zM_qAhXczDgGHbWTDNwQ4dUDCAw&uact=5

2.https://www.google.com/search?sxsrf=ALeKk004wdtiyYtR8Gro9P25lQPJXlshFQ%3A1594827914070&ei=iiQPX5X9A9OO4-EPktSguAQ&q=food+additives+and+food+adulteration+slideshare&oq=food+additives+and+food+adulteration+sl&gs_lcp=CgZwc3ktYWIQARgAMgUIIRCgAToECAAQRzoGCAAQFhAeUIs1WP83YORFaABwAXgAgAG9AogB1wWSAQcwLjEuMS4xmAEAoAEBqgEHZ3dzLXdpeg&sclient=psy-ab

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join B.Sc., Physics, Mathematics on or after June 2020)
(Programme Code:UCH)

Course Code	Course title	Category	L	T	P	Credit
UCH20GE11M/ UCH20GE31P	General Chemistry - I	Generic elective	4	-	-	4

Year	Semester	Int. Marks	Ext. Marks	Total
I/II	I / III	25	75	100

Preamble

The course explains the basic concepts and theories of atomic structure. The main focus of the course is to enhance the knowledge and skills required for chemical industries like fertilizers, petrochemicals etc.,

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Spell the basic concepts and theories of atomic structure.	K1
CO2	Demonstrate purification of water.	K2
CO3	Summarize the structures, reactions and functional group interconversion of carbohydrates.	K2
CO4	Outline the classification, characteristics and applications of fuels.	K2
CO5	Identify the chemical processes involved in industries and agricultural applications.	K3

K1-Knowledge *K2-Understand* *K3-Apply*

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	-	**L**
CO2	**S**	-	S	S	**S**
CO3	**S**	-	L	S	**M**
CO4	**S**	M	M	S	**S**
CO5	S	-	M	S	**S**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	-	-	-	**S**
CO2	**S**	**M**	-	-	**S**
CO3	**S**	L	M	-	**S**
CO4	**S**	M	M	M	**S**
CO5	S	M	M	M	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Course Title: General Chemistry - I

Unit-I: STRUCTURE OF ATOM **12 Hrs**

Rutherford model of the atom- defects of Rutherford model - Discovery of neutron, Bohr model of an atom (postulates only)- merits and demerits- de Broglie's concept of duality - quantum numbers- shapes of s, p, d atomic orbitals. Arrangement of electrons in atoms- Hund's rule – Pauli exclusion principle- Heisenberg's uncertainty principle.

Unit- II: WATER TREATMENT **12Hrs**

Introduction – Definition- Units of Hardness- Scales and Sludge – Sterilization and flocculation. Hardness of water – Treatment of water: Ion –exchange method and reverse Osmosis – Estimation of hardness by EDTA method – Mineral Water – packed drinking water- ISI specification of drinking water.

Unit-III: CARBOHYDRATE **12 Hrs**

Classification

Glucose: Preparation, properties and uses

Sucrose: industrial method of preparation and properties and uses - muta rotation

Conversion of aldopentose to aldohexose and vice versa. Conversion of glucose to fructose vice versa.

Cellulose and starch: Industrial preparation, applications

Unit-IV: INDUSTRIAL FUELS **12 Hrs**

Fuels – definition - Classification of Fuels - Calorific value- Characteristic of a good fuel- Comparison between solid-liquid and gaseous fuels- knocking- Gaseous fuels- preparation and uses of water gas-producer gas- compressed natural gas (CNG)- Liquefied petroleum gas (LPG)- biogas- biomass.

Unit-V: CHEMISTRY AND AGRICULTURE **12 Hrs**

Fertilizers: Preparation and uses of urea, super phosphate, triple super phosphate and potassium nitrate. Pesticides: Classification of pesticides with examples-Insecticides: stomach poisons, contact insecticides and uses of insecticides- DDT, BHC (gammexane: conformation of gamma isomer)- Herbicides- 2,4-D and 2,4,5-T- Fungicides definition and uses.

Text Books

1. Gopalan, R. Sundaram, S. 1993, Allied chemistry- Sulthan Chand & Son LTD.
2. Soni, P.L. and Chand S. 1998, Text book of Organic Chemistry, & Company, New Delhi.

Reference Books

1. Puri, B.R. Sharma, L.R. and Kalia, K.C. 2004, Principles of Inorganic Chemistry, 28th edn, Vallabh Publication, New Delhi.
2. Puri, B.R. Sharma, L. and Kalia-Shoban K.C., 1998, Principles of Inorganic Chemistry, Lal Nagin Chand & co.

Course designers

1. Dr. A. R. Ramesh
2. Dr. D.S.Bhuvaneshwari
3. Dr. K.S. Selvakumar

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join B.Sc., Physics, Mathematics on or after June 2020)
(Programme Code:UCH)

Course Code	Course title	Category	L	T	P	Credit
UCH20GE21M/ UCH20GE41P	General Chemistry - II	Generic elective	4	-	-	4

Year	Semester	Int. Marks	Ext. Marks	Total
I/II	II / IV	25	75	100

Preamble

The course explains the basic concepts and theories of electrochemistry and catalysis. It describes the importance of nuclear chemistry, nano and green chemistry. Also focuses the Importance of amino acids and vitamins.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Tell the basic concepts, theories and applications of electrolysis.	K1
CO2	Explain types of catalysts and reaction mechanism of catalysis.	K1
CO3	Outline the application of nuclear reactions.	K2
CO4	Utilize the chemistry of amino acids and vitamins.	K2
CO5	Make use of nano-chemistry and green chemistry.	K3

K1-Knowledge *K2-Understand* *K3-Apply*

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	-	-	L
CO2	S	-	S	S	M	S
CO3	M	-	L	-	S	M
CO4	M	-	L	S	M	M
CO5	M	-	S	S	S	S

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**L**	-	-	S
CO2	**S**	M	-	-	S
CO3	**S**	l	-	M	S
CO4	**S**	M	L	M	S
CO5	**S**	M	M	**S**	S

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

Course Title : General Chemistry - II

Unit- I: ELECTROCHEMISTRY **12 Hrs**

Arrehenius theory of electrolysis- strong electrolytes- weak electrolytes- Oswald's dilution law and its significance. *Conductance*: Specific, equivalent and molar conductance- measurements, Kohlraush's Law and applications- conductometric titrations. *pH*: Definition simple calculation of pH from molarity of acids - common ion effects and its applications - Buffer solution – definition- theory of buffer action and applications.

Unit- II: CATALYSIS **12Hrs**

Definition- different types of catalysts – homogenous and heterogeneous catalysis- acid-base catalysis- enzyme catalysis-mechanism. Mechanism of heterogeneous catalytic reactions - auto catalysis- catalytic poisoning- promoters.

Unit- III: NUCLEAR CHEMISTRY **12Hrs**

Introduction – Comparison of properties of alpha, beta and gamma rays- mass defect- binding energy- Nuclear fission – Nuclear Fusion – nuclear reactor - Nuclear reactor in India- advantage and disadvantage of reactors - nuclear waste and its disposal- Uses of radioactive isotopes as tracers.

Unit- IV: AMINOACIDS & VITAMINS **12 Hrs**

Amino acids: Definition- general methods of preparation, properties and uses- Glycine, and alanine. *Proteins*: Definitions- Classification and general properties – colour reactions and the relation of amino acids to proteins. Effect of toxic chemicals on enzymes. Lead, mercury and cyanide pollution and their biochemical effects. *Vitamins*: Definition- classification, sources and role of vitamins or deficiency symptoms - A, B complex, C, D and K (structure and synthesis not expected).

Unit- V: NANO AND GREEN CHEMISTRY **12 Hrs**

Definition of nanoscience - preparation methods of nanomaterials (simple example) - top down approach – bottom up approach - sol-gel synthesis – optical and magnetic properties of nanomaterials - applications - Green chemistry - basic postulates of green chemistry - Green solvents - microwave reaction principle - advantage of microwave synthesis.

Text Books:

1. Gopalan, R. Sundaram, S. 1993, Allied chemistry- Sulthan Chand & Son., LTD.
2. Soni, P.L. and Chand S. 1998, Text book of Organic Chemistry, & Company, New Delhi.
3. Kent, industrial chemistry

Reference Books

1. Puri, B.R. Sharma, L.R. and Kalia, K.C. 2004, Principles of Inorganic Chemistry, 28th end, Vallabh Publication, New Delhi.
2. Puri, B.R. Sharma, L. and Kalia-Shoban K.C., 1998, Principles of Inorganic Chemistry, Lal Nagin Chand & co.
3. Bahl B. S. and Arun Bhal, Text book of Organic Chemistry 2005 S. Chand Limited,
4. Jain and Jain 1976, Engineering Chemistry, 5th end, Dhanpat Rai Publishing Company (P) Ltd.,

Course designers

1. Dr. A. R. Ramesh
2. Dr. D.S.Bhuvaneshwari
3. Dr. K.S. Selvakumar

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join B.Sc., Physics, Mathematics on or after June 2020)
(Programme Code: UCH)

Course Code	Course title	Category	L	T	P	Credit
UCH20GL21M/ UCH20GL41P	Ancillary Chemistry Lab – Volumetric analysis	Generic elective	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
I/II	II/ IV	40	60	100

Preamble

This lab course enables the students to improve their practical skill to do the quantitative estimation of inorganic compounds by volumetric method.

Course outcomes

On the completion of the course the student will be able to

#	Course Outcome
CO1	Apply acidimetric and alkalimetric method for the quantitative volumetric estimation of acids and bases.
CO2	Estimate the amount of inorganic compounds permanganometrically.
CO3	Apply dichrometric procedure for the estimation of ferrous ion and potassium dichromate.
CO4	Do the quantitative estimation Copper and Potassium dichromate iodometrically.

Mapping of Cos and POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	-	M	S
CO2	S	S	M	M	M	**S**
CO3	S	S	M	M	M	S
CO4	S	S	S	-	M	**S**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	M	M	S
CO2	**M**	**S**	M	M	**S**
CO3	M	**S**	M	L	S
CO4	M	**S**	M	L	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

I ACIDIMETRY - ALKALIMETRY

1 Na_2CO_3 (STD)-HCl - Na_2CO_3
2 Na_2CO_3 (Std)-HCl - NaOH
3 HCl- Na_2CO_3 (Std)-HCl
4 NaOH-Oxalic acid - (Std)-NaOH

II PERMANGANIMETRY

1 Fe^{2+}- KMnO4-FAS
2 $KMnO_4$- Fe^{2+}- KMnO4
3 Oxalic acid - KMnO4-Oxalic acid
4 KMnO4-Oxalic acid - KMnO4

III DICHROMETRY

1 Fe^{2+}- $K_2Cr_2O_7$ -FAS
2 $K_2Cr_2O_7$ - Fe^{2+}- $K_2Cr_2O_7$

IV IODOMETRY

1 $K_2Cr_2O_7$-Thio- $K_2Cr_2O_7$
2 $KMnO_4$-Thio- $K_2Cr_2O_7$
3 $CuSO_4$-Thio- $K_2Cr_2O_7$
4 $CuSO_4$-Thio- $KMnO_4$

Course Designers

1. Dr. A.R. Ramesh
2. Dr. K.Selvakumar

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join B.Sc., Microbiology and Botany on or after June 2020)
(Programme Code:UCH)
Exclusively for Life Sciences I B.Sc Microbiology and II B.Sc Botany

Course Code	Course title	Category	L	T	P	Credit
UCH20GL21Z / UCH20GL41B	Biochemical methods-Lab	Generic elective	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
I/II	II/ IV	40	60	100

Preamble

This lab course enables the students to improve their practical skill to do the quantitative estimation/ extraction of organic/ inorganic compounds present in the naturally occurring materials and its synthetic identical by volumetric method.

Course outcomes

On the completion of the course the student will be able to

#	Course Outcome
CO1	Analysis of important compounds in milk, fruit, leaf other plant parts
CO2	Estimate the amount of organic/inorganic compounds in beverages, soap and water.
CO3	Extraction of Pure/ Mixture of organic compounds from flowers and fruits
CO4	Determination of pure compounds from turmeric & in mild beverages like tea, coffee.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	S	S	S	M	S	**S**
CO3	S	S	S	S	S	S
CO4	S	S	S	M	S	**S**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	M	M	S
CO2	**M**	**S**	M	M	**S**
CO3	M	**S**	M	L	S
CO4	M	**S**	M	L	**S**

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge (40%)	40%	40%	40%
Understand(40%)	40%	40%	40%
Apply (20%)	20%	20%	20%

I**. Estimations** (any five)

The students will get exposed to analysis of milk, fruit, leaf, beverages, soap and water.

1. Analysis of milk: Estimation of Caseine.
2. Analysis of fruit: Estimation of Oxalate in Guava fruit.
3. Analysis of fruit: Estimation of Vitamin 'C' in orange.
4. Analysis of leaf: Estimation of chlorophylls.
5. Analysis of food: Determination of adulterants in food stuffs.
6. Analysis of amino acid: Estimation of Glycine.
7. Analysis of soap: Determination of foaming capacity.
8. Analysis of water: Estimation of chloride by Mohr's method.
9. Analysis of water: Estimation of total hardness.
11. Estimation of Saponification value of an Oil
12. Determination of Iodine value

II. Extractions: (Any two)

1. Extraction of Caffeine from coffee/tea powder
2. Extraction of Curcumin from turmeric
3. Extraction of essential oils from Jasmine
4. Extraction of pectin from orange peel
5. Solvent Extraction of Mixture of organic compounds
6. Extraction of Lactic acid from Milk.

Course Designers

1. Dr. A.Elangovan
2. Dr. T. Arumuganathan

M.Sc. Chemistry

(Programme Code-PCH)

THIAGARAJAR COLLEGE, MADURAI – 9.
(Re-Accredited with 'A' Grade by NAAC)
Curriculum Structure for PG

Semester	Category	No. of Courses	Credit Distribution
I	Core	---	18
	Elective	1	5
II	Core	---	18
	Elective	1	5
III	Core	---	18
	Elective	1	5
IV	Core	---	18
	Project	1	3
Total Credits			90

For Choice Based Credit System (CBCS)

- **Choices should be offered for Elective Courses**
- **Total Credits for Core Courses 72**
  Total Credits for Elective Courses 18 (3 Electives + 1 Project)

Programme outcome-PO (Aligned with Graduate Attributes)-Master of Science (M.Sc.,)

Knowledge

Acquire an overview of concepts, fundamentals and advancements of science across a range of fields, with in-depth knowledge in at least one area of study. Develop focused field knowledge and amalgamate knowledge across different disciplines.

Complementary skills

Students will be able to engage in critical investigation through principle approaches or methods and through effective information search and evaluation strategies. Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies;

Applied learning

Students will be able to apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and practice. Recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation or scholarly debate;

Communication

Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Able to comprehend and write reports, documents, make effective presentations by oral and/or written form.

Problem solving

Investigate, design and apply appropriate methods to solve problems in science, mathematics, technology and/or engineering.

Environment and sustainability

Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

Teamwork, collaborative and management skills

Recognise the opportunities and contribute positively in collaborative scientific research. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues

Department of Chemistry

Vision : To train our students as scientifically literate professionals with a sense of social Responsibilities.

Mission: (i) To make the students to understand the advancement of chemistry in all of its Branches through education and research.
(ii)To provide students with community need based research and outreach Opportunities.
(iii)To strive for an ideal balance between creation and knowledge dissemination in the Chemical sciences.
(iv)To train our students to succeed in academic, professional and social life.

Program Educational Objectives (PEOs)
The objectives of the M.Sc Chemistry programme is to prepare/equip the students

PEO1	To pursue Ph.D programme at national /global level research institute with CSIR-NET/ TOEFL/GRE qualification.
PEO2	To have successful professional careers in the chemical industry, government, academia and national/international research institute as innovative scientists.
PEO3	To get suitable employment in government sectors after qualifying specific competitive exams conducted by the service commission.
PEO4	To develop leadership, contemporary and also global outlook.
PEO5	To recognize the importance of utilizing their knowledge, skills, and initiative for the benefit of society.

Program Specific Outcomes (PSOs)
On the successful completion of M.Sc Chemistry program students will be able

PSO1	To get in-depth knowledge on advanced concepts in Inorganic, Organic, Physical, Analytical, Biological, environmental and industrial applications of chemistry.
PSO2	To get basic analytical and technical skills to work effectively in the various fields of chemistry.
PSO3	To synthesize, purify and characterize compounds using published protocols, with the help of standard and modern instrumentation techniques and to find their applications in various fields.
PSO4	To use online search tools for literature survey of the topic of research, manuscript preparation and online submission for publication.
PSO5	To qualify State, National and International eligibility exams to do research at National/International institutes and to get suitable employment.

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with "A" Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2020 and after)
MASTER OF CHEMISTRY
Semester – I

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks	Total
Core 1	PCH20C11	Aromaticity and reaction mechanism	5	5	75	25	75	100
Core 2	PCH20C12	Advanced Inorganic Chemistry - I	5	5	75	25	75	100
Core 3	PCH20C13	Wave Theory and Physicochemical Properties	5	5	75	25	75	100
Core 1-Lab	PCH20CL21	Preparation and qualitative analysis of Organic compounds	5	*	75	-	-	-
Core 2 – Lab	PCH20CL22	Inorganic Chemistry-Lab	5	*	75	-	-	-
Core 3 - Lab	PCH20CL23	Physical Chemistry-Lab	5	*	75	-	-	-
Total			**30**	**15**	**450**	**75**	**225**	**300**

- **For core practical credits will be given at the end of II semester (Year wise practical)**

Semester – II

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks	Total
Core 4	PCH20C21	Spectroscopy and Stereochemistry	4	4	60	25	75	100
Core 5	PCH20C22	Coordination, Bioinorganic and Nuclear Chemistry	4	4	60	25	75	100
Core 6	PCH20C23	Electrochemistry and Statistical Equilibria	4	4	60	25	75	100
Core elective-II	PCH20CE21(A)	C-Programming and Computer Applications in Chemistry (Option A)	5	5	75	25	75	100
	PCH20 CE21(B)	Medicinal Chemistry(Option B)						
*Core 1-Lab	PCH20CL21	Preparation and Qualitative analysis of Organic compounds	5	5	75	40	60	100
*Core 2 – Lab	PCH20CL22	Inorganic Chemistry-Lab	4	4	60	40	60	100
*Core 3 - Lab	PCH20CL23	Physical Chemistry-Lab	4	4	60	40	60	100
Total			**30**	**30**	**450**	**220**	**480**	**700**

Semester – III

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 7	PCH20C31	Organic synthesis, photochemistry and pericyclic reactions	5	5	75	25	75	100
Core 8	PCH20C32	Organometallics, Spectroscopy and Inorganic rings and cages	5	5	75	25	75	100
Core 9	PCH20C33	Physical Chemistry -III	5	5	75	25	75	100
Core elective-III	PCH20CE31 (A)	Comprehensive Chemistry (Option A)	5	5	75	25	75	100
	PCH20CE31 (B)	Advanced Organic Synthesis (Option B)						
*Core 7-Lab	PCH20CL41	Estimation and preparation of Organic compounds	5*	-	75	-	-	-
*Core 8 – Lab	PCH20CL42	Inorganic Chemistry Lab-II	5*	-	75	-	-	-
Total			**30**	**20**	**450**	**100**	**300**	**400**

- **For core practical credits will be given at the end of IV semester (Year wise practical)**

Semester – IV

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 10	PCH20C41	Chemistry of heterocyclic compounds, natural products and greener methodologies	5	4	75	25	75	100
Core 11	PCH20C42	Combinatorial Chemistry	5	4	75	25	75	100
Core 12	PCH20C43	Physical Chemistry - IV	4	4	60	25	75	100
*Core 10- Lab	PCH20CL41	Organic Chemistry-Lab	5	5	75	40	60	100
*Core 11 –Lab	PCH20CL42	Inorganic Chemistry-Lab	5	5	75	40	60	100
PJ	PCH20PJ41	Project	6	3	90	40	60	100
Total			**30**	**25**	**450**	**195**	**405**	**600**

A) CONSOLIDATION OF CONTACT HOURS AND CREDITS: PG

Semester	Contact hours	Credits
I	30	15
II	30	30
III	30	20
IV	30	25
Total	**120**	**90**

B) Curriculum Credits

Core	(15+12+15+12) =	49 Credits
Core Lab	(13+10) =	23 Credits
Core electives	5+5+5 =	15 Credits
Project	=	03 Credits
Total	**=**	**90 Credits**

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Course Code	Course title	Category	L	T	P	Credit
PCH20C11	**AromaticityReaction Mechanisms**	Core-1	4	1	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

The course has been framed with an objective of instilling maximum knowledge on various chemical reaction mechanisms viz., substitution, elimination and addition.

Prerequisites

Students with the minimum knowledge on fundamentals of reaction mechanism of addition, elimination and substitution reaction at undergraduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Comprehend the concept of chemical delocalization, aromaticity and intermediates in the chemical reaction.	K1
CO2	Explain the reaction mechanism for all types of chemical reaction.	K2
CO3	Analyze the reaction mechanism in relation to nucleophilic substitution reactions.	K3
CO4	Determine the mechanism for elimination reactions.	K4
CO5	Apply reaction mechanisms to various addition reactions.	K5

K1-Knowledge; K2-Understand; K3-Apply; K4- Analyze; K5-Evaluate

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**M**	**S**	**S**	**L**	**L**	**L**
CO2	**S**	**M**	**S**	**S**	**L**	**L**	**L**
CO3	**S**	**S**	**S**	**S**	**L**	**L**	**L**
CO4	**S**	**M**	**S**	**S**	**L**	**L**	**L**
CO5	**S**	**S**	**S**	**S**	**L**	**L**	**L**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**M**	**L**	**S**
CO2	**S**	**M**	**M**	**-**	**S**
CO3	**S**	**M**	**M**	**-**	**S**
CO4	**S**	**M**	**M**	**-**	**S**
CO5	**S**	**M**	**M**	**-**	**S**

S-Strong; M-Medium; L-Low

Blooms Taxonomy	CA		End of Semester (Marks)
	First (Marks)	Second(Marks)	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
Total Marks	**60**	**60**	**150**

UNIT-I Delocalized chemical bonding, Aromaticity and Reactive intermediates (15 hrs)
Electron displacement – Steric effect – Tautomerism
Concept of aromaticity – Benzenoid and non-benzenoid compounds – Huckel's rule - Non aromatic and antiaromaticity - Homoaromaticity - Alternant and non-alternant hydrocarbons - aromaticity of cyclopentadienyl anion and Tropylium cation – Azulene and annulenes.
Generation , structure, stability, reactivity and reactions of carbocations, carbanions, free radicals (reactions include Pinacol coupling, McMurray reactions, acyloin reaction). Carbenes: Stability - Structure – Generation – Types – Reactions (including Simmon-Smith reaction and Wolf rearrangement). Nitrenes: Generation and reactions.

UNIT - II Reaction mechanism-I (Basics) (15 hrs)
Guidelines for proposing reasonable mechanism – Energetics and energy profile diagrams – transition state – Intermediate – Hammond's postulate – principle of microscopic reversibility - kinetic and thermodynamic controls – kinetic and non-kinetic methods of determining organic reaction mechanism – primary and secondary kinetic isotope effects – Effect of structure on reactivity: Resonance and field effects – Quantitative treatments – Hammett and Taft equation.

UNIT - III Reaction mechanism-II (Substitution Reactions) **(18 Hrs)**
Aliphatic Nucleophilic Substitution Reactions - Mechanism – S_N1 and S_N2, mixed S_N1 & S_N2, S_Ni, SET, Neighboring group participation by σ and π bonds – Reactivity at an allylic, aliphatic trigonal and vinylic carbon – Effect of substrate structure, attacking nucleophile, leaving group and reaction medium on reactivity – Ambident nucleophiles.
Aromatic Nucleophilic Substitution Reactions – Unimolecular, Bimolecular, $S_{RN}1$ and Benzyne mechanism – Effect of substrate, leaving group and attacking nucleophile.
Electrophilic substitution reactions:
Aliphatic: Bimolecular mechanism SE2 and SE1 – Aromatic: Arenium ion mechanism – Orientation and reactivity: Ortho and Para ratio, partial rate factor

UNIT-IV Reaction Mechanism III (Elimination reactions) **(12 hrs)**
E_1, E_2 and E_1CB mechanism- Competition between substitution and elimination – orientation of double bonds (Bredt's rule and Hofmann and Saytzeff rules) – Effect of substrate structure, attacking nucleophile, leaving group and nature of reaction medium on reactivity – Mechanism and orientation in pyrolytic eliminations - Cope and Chugaev reaction (cis-elimination)

UNIT-V Reaction Mechanism IV (Addition to carbon-carbon multiple bonds) **(15 hrs)**
Electrophilic, Nucleophilic & free radical addition – Mechanism, Orientation and reactivity and reactions - addition to conjugated systems- addition to α,β-unsaturated carbonyl and nitrile systems - Michael addition – addition of Grignard reagents-Diels Alder reaction- Enamine reaction - Mechanism of Reformatsky reaction- Darzen reaction- Mannich reaction - Wittig reaction - Stobbe and Dieckmann condensation.

Text books:

1. Jerry March, 2006. Advanced Organic Chemistry, Reaction mechanism and structure, John Wiley and sons, 6th Edition, New York.
2. R.O.C. Norman, J.M. Coxon, 2017. Principles of organic synthesis, 3rd Edition Nelson Thorines, Hong Kong.
3. P.J. Garrat, 1991. Aromaticity, Mc Graw Hill, India
4. F.A. Carey and R.J. Sundberg, 2001. Advanced Organic Chemistry, Part A and B, Plenum Press, 4th Edition.
5. G.M. Badger, 2001 Aromatic character and Aromaticity, Cambridge, USA.

Reference Books

1. Clayden, Greeves, Warren and Wothers, 2007.Organic Chemistry, Oxford Uni Press, UK.
2. E.S. Gould, 1960. Mechanism and structure in Organic Chemistry, Holtoo INC.
3. T. W. G. Solomon, Graham Solomons, Craig B. Fryhle, Scott A. Snyder, 2020. Organic Chemistry, John Wiley and sons INC, 12th Edition.
4. Michael B. Smith, 2017 Organic synthesis, Academic Press, 4th edition.
5. Peter sykes, 2003. A Guidebook to Mechanism in Organic Chemistry, Longman, 6th Edition.

Course designer

1. Dr. P. Tharmaraj
2. Dr. P.Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamilselvi
5. Mrs. P. Rajam

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Course Code	Course Title	Category	L	T	P	Credit
PCH20C12	**Advanced Inorganic Chemistry I**	Core-2	4	1	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

The course gives in-depth knowledge on electronic structure of atoms, bonding and its applications, solid state and acid-base concepts.

Prerequisites

Students with the minimum knowledge on basic models of structure of atoms, chemical bonding, solid state, and various definitions of acid-base concepts at undergraduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Comprehend the electronic structure of atoms and periodic properties of elements.	K1
CO2	Explain and compare the concepts of chemical bonding.	K2
CO3	Apply the concepts of VB, MO and VSEPR theory to determine the structure of molecules.	K3
CO4	Analyze the structure and defects of solids.	K4
CO5	Illustrate acid-base concepts, its measures and to evaluate various effects on acid base strength.	K5

K1-Knowledge; K2-Understand; K3-Apply; K4-Analyze; K5- Evaluate

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**S**	**S**	**S**	**S**	**S**	-
CO2	**S**	**M**	**L**	**L**	-	**M**	-
CO3	**S**	**S**	**M**	**L**	-	**M**	-
CO4	**S**	**M**	**M**	**S**	**L**	**S**	-
CO5	**S**	**S**	**S**	**S**	**S**	**S**	-

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	-	L	S
CO2	S	L	-	M	S
CO3	S	S	M	M	S
CO4	S	M	M	L	S
CO5	S	S	S	M	S

S-Strong; M-Medium; L-Low

Blooms Taxonomy	CA		End of Semester (Marks)
	First (Marks)	Second(Marks)	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
Total Marks	**60**	**60**	**150**

Course Title: Advanced Inorganic Chemistry

UNIT – I: STRUCTURE OF ATOM and PERIODIC PROPERTIES 15 Hrs

Structure of atom- Discussion of Heisenberg uncertainty principle- Wave mechanical description of electron and orbitals, radial density functions and orbital energies, angular functions and orbital shapes. Quantum numbers- Theories of quantum numbers– Aufbau principle – Zeeman Effect - Stability of half-filled and completely filled orbitals–Electronic configuration - Electron Angular momentum in atoms. Effective nuclear charge- Slater's rule and limitations

Periodic properties - Ionisation potential, Ionic radii and covalent radii, Electron affinity, Electronegativity (Pauling, Mulliken, Allred-Rochows scale and calculation) and their trends in the periodic table.

UNIT – II: NATURE OF THE CHEMICAL BOND 15Hrs

Ionic bond – Lattice energy and its determination by Born-Haber cycle and Born-Lande Equation – Hardness, electrical conductivity and solubility of ionic compounds – ionic radii. Gold-Schmidth's radius ratio. Calculation of ionic radius – Pauling's method and Linde's method. Covalent bond – qualitative treatment of valence bond theory – Heitler-London theory – Pauling theory and Molecular orbital theory - LCAO theory – Partial ionic character of covalent bonds - Fajan's Rule –Effects of polarization-Hybridization involving of s, p and d orbitals- resonance.

UNIT – III: BONDING APPLICATION 15 Hrs

Application of VB and MO theories to the structure of homonuclear (H_2, B_2, C_2, N_2 and O_2) and- Walsh diagram - heteronuclear (CO, NO, HCl, HF) diatomic and selective polyatomic molecules (CO_3^{2-}, NO_2, BeH_2, CO_2) comparison of VB and MO theories. Bond properties, bond order, bond energy, bond length and bond polarity. VSEPR theory and its applications to ICl_2^-, IF_5 IF_7, ClO_4^- ions and xenon compounds like xenon halides and oxy halides.

UNIT IV SOLID-STATE CHEMISTRY 15 Hrs

Packing of atoms and ions - close packing arrangements – HCP and CCP lattice.

Radius ratio rules- Limiting radius ratio.

Structure of typical lattices such as calcite, cesium chloride, nickel arsenide, Fluorite, Antifluorite, Cadmium iodide, Perovskite, Spinels (normal and inverse). Miller Indices - Bragg's equation-problems involving Bragg's equation. Crystal structure determination - X-ray, electron and neutron diffraction studies.

Crystal defects- stoichiometric compounds - non-stoichiometric compounds-point - Schottky and Frenkel defects - line and plane defects - colour centers- experimental methods of study of non-stoichiometry- effect of imperfections and non- stoichiometry on physical properties-types of solids-electronic structure of solids- free electron and band theories.

UNIT – V: ACID-BASE SYSTEMS AND NON-AQUEOUS SOLVENTS 15Hrs

A generalized acid base concepts – steric effects and solvation effects – proton sponges- Measures of Acid-Base strength –Factors affecting the strength of acids and bases- Common ion effect and Henderson's equation- Hard and Soft acids and bases – symbiosis – theoretical basis of hardness and softness. Classification, properties and uses of solvents – protic, aprotic, superacids, molten salts as solvents, ionic liquids (gel effects)

properties of ionizing solvents. Typical reactions in non–aqueous solvents- liquid HF, liquid SO_2, liquid NH_3, and Sulphuric acid.

TEXT BOOKS:

1. Clyde Day, M. Jr & Joel Selbin, Theoretical Inorganic Chemistry, Chapman & Hall Ltd., London, 5th Reprint, 1967.
2. Chandra, A. K. Introductory Quantum Chemistry, Tata McGraw Hill, New Delhi, 3rd End., 1988.
3. Lee, J. D. Concise Inorganic Chemistry, Blackwell Science Ltd., V Edn., London. 2002.
4. Durrant P. J. and Durrant, B. Introduction to advanced inorganic chemistry, Longman Group Ltd, London, 1970.
5. Keer, H.V. 1993.Principles of the Solid State, Wiley Eastern Ltd..

REFERENCE BOOKS:

1. Huheey, J. E. Ellen A. Keiter, Richard L. Keiter, Inorganic Chemistry, IV Edn., Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2004.
2. Madan, R. D. Modern Inorganic Chemistry, S. Chand & Company Ltd., New Delhi, 2004.
3. Wahid U. Malik, G. D. Tuli and R. D. Madan, Selected Topics in Inorganic Chemistry, S. Chand & Co. Ltd., New Delhi, 2006.
4. Gary L. Miessler and Donald A. Tarr, Inorganic Chemistry, Pearson Education, Inc., 3rd Edn., New Delhi, 2004.
5. William W. Porterfield, Inorganic Chemistry, II Edn., Elsevier, New Delhi, 2005.
6. Sharpe, A.G. Inorganic Chemistry, III Edn., Addition – Wesley Longman, UK, 2004.
7. Shriver D. F. and Atkins, P.W. Inorganic Chemistry, Oxford University Press, London, 1999.
8. K. Chakrabarthy,2005 Solid State Chemistry, New Age International Publishers, (P) Ltd.,
9. Azaroff, 2004.Introduction to Solids, Tata McGraw hill, New Delhi.

Web Resources:

https://www.unf.edu/~michael.lufaso/chem2045/Chapter6.pdf
https://universe.bits-pilani.ac.in/uploads/Dubai/rusalraj/Chemical%20Bonding.pdf
https://www.lamar.edu/arts-sciences/_files/documents/chemistry-biochemistry/dorris/chapter8.pdf
http://ncert.nic.in/ncerts/l/lech101.pdf
http://nsdl.niscair.res.in/bitstream/123456789/547/1/revised%20acid%20bases.pdf
https://nou.edu.ng/sites/default/files/2018-09/Reviewed%20CHM424%20Non%20Aqueous%20Solvents%20%20Edited%20by%20prof%20Ayi%20%282%29.pdf

Course Designers:

1. Dr. A. Elangovan
2. Dr. D.S. Bhuvaneshwari
3. Dr. K. Selvakumar
4. Dr. S. Pitchaimuthu
5. Dr. A. Baishnisha
6. Dr. J. Thiruppathi
7. Dr. N. Sudhan

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Course Code	Course Title	Category	L	T	P	Credit
PCH20C13	**Wave Theory and Physicochemical Properties**	Core 3	4	1	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	25	75	100

Preamble

The course enables the students to gain knowledge on quantum chemistry, properties of gases, bio-physicochemical behavior of molecules.

Prerequisites

Basic knowledge on fundamentals concepts of quantum chemistry, gases and liquids and physico chemical behavior of molecules at undergraduate level.

Course Outcomes

On the completion of the course the student will be able to

	Course Outcome	Knowledge level
CO1	Apply the concepts and fundamentals of quantum chemistry.	K1
CO2	Evaluate the quantum chemistry concepts and their applications.	K2
CO3	Examine the applications of SWE to many electron system	K3
CO4	Explain the properties of gases, liquid crystals, theory of thermodynamic equilibrium and non-equilibrium.	K4
CO5	Develop their knowledge in physical features of biochemistry.	K5

K1-Knowledge; K2-Understand; K3-Apply; K4-Analyze; K5- Evaluate

Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	S	M	L	L
CO2	S	M	M	S	M	L	L
CO3	S	S	S	S	S	L	L
CO4	S	S	S	S	M	L	L
CO5	S	S	S	S	S	L	L

Mapping of COs and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	-	-	-	**S**
CO2	**S**	L	-	-	**S**
CO3	**S**	L	M	M	**S**
CO4	**S**	M	M	M	**S**
CO5	**S**	S	S	-	**S**

S-Strong; M-Medium; L-Low

Blooms Taxanomy	CA		End of Semester (Marks)
	First (Marks)	Second(Marks)	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
Total Marks	**60**	**60**	**150**

Course Title: Wave Theory and Physicochemical Properties

UNIT - I

QUANTUM CHEMISTRY-I **(15 HRS)**

Black body radiation - Heisenberg's uncertainty principle- de Broglie wave particle duality- Experimental verification of matter waves - Compton effect - Postulates of quantum mechanics - operators – linear and non-linear operators - commutative and non-commutative operators- Hermitian properties of operators- Eigen function, Eigen values and degeneracy- Orthogonality and normalization of wave functions- Derivation of Schrodinger's wave equation and its significance.

UNIT- II

QUANTUM CHEMISTRY-II **(15 HRS)**

Application of quantum mechanics to simple system-Application of SWE to free particle moving in one dimension- particle moving in a one dimension box - particle moving in 3D cubical and rectangular box- Quantum Mechanical tunneling - particle in a ring- rigid rotor- Simple harmonic oscillator - hydrogen atom- angular momentum spin momentum- ladder operator.

UNIT –III **(15 Hrs)**

QUANTUM CHEMISTRY-III

Necessity for approximation methods- Variation methods for the hydrogen and hydrogen like atoms – Perturbation (first order) method to Helium atom - Slater and secular determinants of wave functions– Hartree-Fock self consistent field method to Helium atom – HMO bi-electron theory of ethylene and butadiene.

UNIT-IV

PROPERTIES OF GASES AND LIQUID CRYSTALS **(15 HRS)**

Equations of states - molecular speeds- Maxwell's distribution of molecular velocities - one, two and three dimensions; Energy distribution-Maxwell's – Boltzmann distribution law- Rotation, vibrations and translational degree of freedom- principle of equipartition of energy and heat capacity; Molecular collisions- collision diameter, cross-section, number, frequency, mean free path (definition only); Transport phenomena in gases - Viscosity of gases – viscosity in terms of momentum transfer, thermal conductivity and diffusion.

Liquid crystals- Nematic (*p*-methoxycinnamic acid), cholesteric (cholesteryl benzoate), smectic (ethyl-*p*-azoxybenzoate)- theory and its application in liquid crystals display.

UNIT-V

PHYSICO-CHEMICAL PRINCIPLES AND BIOLOGICAL REACTIONS (15 HRS)

(i) Studies on biochemical equilibria: Buffer system of intracellular fluids – H_2CO_3 / HCO_3^- HPO_4^{2-} / $H_2PO_4^-$ - Application of Henderson-Hasselbach's equation; Ion channels– membrane

and static potentials - Role of Na^+ / K^+ ions in neural communications –Na^+ / K^+ ion pump; allosterism and oxygen saturation curves for hameoglobin and myoglobin – derivation of Hill's equation.

(ii) Thermodynamics in biology-Exergonic and endergonic reactions – energy conversion in biological cells – ATP; properties of ATP and its central role in bioenergetics; biochemical reactivity of O_2 and N_2.

Course Designed by

1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan
4. Dr. M.Sathiya
5. Dr. A. Jeevika
6. Dr. P. Senthilkumar

Text Books:

1. Glasstone S. A., 1999, Text book of Physical Chemistry, McMillan India Ltd.,
2. Alberty R. A. and Daniels F., 1978, Physical Chemistry, John Wiley & Sons, New York.
3. Castellan G. W., 1986, Physical chemistry, 3rd edition, Wesley Publishing Company, UK.
4. Atkins P, 2002, Physical Chemistry, VII Edition, Oxford University Press, UK.
5. Atkins P. W., 1986, Molecular Quantum Mechanics, II Edition, Oxford University Press, UK.
6. Hanna H. W., 1983, Quantum Mechanics in Chemistry, Benjamin- Cummiza London Publishing Company, UK.
7. Chandra A.K., 1988, Introductory quantum chemistry, 3rd edition, Tata McGrow- Hill
8. Publishing Co Ltd., New Delhi, India.
9. Gareth Morris J. 1974, Biologists physical chemistry, Edward Arnold, UK.
10. Barrow G. M., 1994, physical chemistry for the life sciences, McGraw Hill Kogakusha Ltd., New York.
11. Prasad R.K., 2004, Quantum Chemistry, 4th revised edition. (ISBN:8122424082/9788122424089)
12. Mc Quarie D.A., 1983, Quantum Mechanics, Oxford University press, Oxford,UK.

Reference Books:

1. Glasstone S., 1999, A text book of Physical Chemistry, McMillan India Ltd., Alasca.
2. Walter J. Moore, 2006, Physical Chemistry, 6th edition, Orient Longman, New York.
3. Levine, 2006, Quantum Chemistry, 6th edition, Prentice-Hall, New Delhi.
4. Mcquarrie D. A., 2003, Quantum Chemistry,Viva Books Pvt. Ltd., New Delhi.
5. Levine, 2003, Quantum Chemistry, 5th edition, Prentice-Hall, UK.
6. Raymond Chang, 2002, Physical Chemistry with application to biochemical system, Mc Millan Publishing Company. Inc., New Delhi.
7. Graham L Patrick, An Introduction to Medicinal Chemistry, Oxford University Press.
8. H.W. Hanna, 1993, Quantum Mechanics in Chemistry-Benjamin –Cummiza London Publishing Company, New Delhi, India.

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Course Code	Course title	Category	L	T	P	Credit
PCH20C21	**Organic Spectroscopy and Stereochemistry**	Core-4	5	-	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	25	75	100

Preamble

The research in chemistry does require the knowledge on various spectroscopic techniques. This course fulfills the said requirements.

Prerequisites

Basic knowledge on fundamentals and working principle of spectroscopic techniques.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Explain the fundamentals of UV-Vis and IR spectroscopy.	K1
CO2	Make use of the basic principles underlying NMR spectroscopy and its application in structural elucidation.	K2
CO3	Apply the concept of mass spectroscopy, ORD and CD in analyzing and determining the structure of organic molecules.	K3
CO4	Examine organic stereochemistry vis-à-vis optical and geometrical isomerism.	K4
CO5	Determine the conformational analysis of cyclic, acyclic and heterocyclic system.	K5

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**S**	**S**	**S**	**M**	**L**	**M**
CO2	**S**	**S**	**S**	**S**	**M**	**L**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**L**	**M**
CO4	**S**	**S**	**S**	**S**	**S**	**L**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**L**	**M**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**L**	**M**	**S**
CO2	**S**	**S**	**L**	**M**	**S**
CO3	**S**	**S**	**M**	**M**	**S**
CO4	**S**	**M**	**M**	**M**	**S**
CO5	**S**	**M**	**M**	**M**	**S**

S-Strong; M-Medium; L-Low

Blooms Taxanomy	**CA**		**End of Semester (Marks)**
	First (Marks)	**Second(Marks)**	
Knowledge -K1	15% (9)	15% (9)	20% (30)
Understand -K2	15% (9)	15% (9)	20% (30)
Apply-K3	30% (18)	30% (18)	20% (30)
Analyze-K4	20% (12)	20% (12)	20% (30)
Evaluate-K5	20% (12)	20% (12)	20% (30)
Total Marks	**60**	**60**	**150**

K1-Knowledge: K2-Understand; K3-Apply; K4-Analyze; K5- Evaluate

Course Title: Organic Spectroscopy and Stereochemistry

Unit-I: UV-Visible and IR Spectroscopy (12 Hrs)

UV-Visible spectroscopy – basic principle –the absorption laws - instrumentation – types of electronic transitions – Selection rules - Effect of solvent, hybridisation and hydrogen bonding on λ_{max} values - Woodward rules to calculate λ_{max} values of conjugated dienes, conjugated polyenes, and carbonyl compounds

Infrared spectroscopy – basic principle – Selection rules - Molecular Vibrations – instrumentation – Sampling techniques – characteristic IR absorption of different functional groups – Fingerprint region – factors influencing the vibrational frequencies

Unit-II: NMR spectroscopy (12 Hrs)

^{1}H NMR spectroscopy: Basic principles – number of signals – chemical shift –factors influencing chemical shift – spin-spin coupling – coupling constant and factors influencing coupling constant. Simplification of complex spectra – shift reagents, deuterium substitution and spin decoupling.

^{13}C NMR spectroscopy: Basic principle – comparison with ^{1}H NMR – noise decoupling – off-resonance decoupling – factors affecting the C-13 chemical shifts.

Advanced NMR Spectroscopy - Introduction to 2D-NMR - Classification of Multi-pulse techniques and 2D experiments – DEPT experiments – HOMO and HETERO nuclear correlation – J resolved correlation. Correlation Spectroscopy (COSY) – HOMO-COSY, HETERO-COSY, 1D- and 2D- INADEQUATE and NOESY.

UNIT-III: Mass Spectroscopy, ORD and CD (12 hrs)

Basic instrumentation of Mass spectrometer - types of ions – molecular, isotopic, metastable and fragmentation ions – Tests for molecular ion peak – General fragmentation modes – Retro Diels - Alder reactions – Mc Lafferty rearrangement – Fragmentation pattern of simple organic molecules. Application – Accurate Molecular weight, Molecular formula

(Nitrogen rule) – Determination of structures of organic molecules. Introduction to ESI, MALDI and FAB mass spectrometer.

Optical rotatory dispersion (ORD) and Circular Dichroism (CD): Circularly polarized light – Circular birefringence and CD – plain curves and their applications – Cotton effects curves – applications to structural elucidation – axial haloketone rule, octant rule and their applications.

Solving problems based on UV, IR, NMR and Mass data.

UNIT IV - Organic Stereochemistry (12 hrs)

Optical isomerism

Symmetry elements – the concept of chirality – chirality about a center – specification by Cahn-Ingold-Prelog notations – compounds with more than one chiral center – erythro, threo and meso nomenclature – concept of prochirality – homotopic, enantiotopic and diastereotopic ligands and faces – Asymmetric synthesis – Cram's rule and Prelog's rule. Optical activity in biphenyls, allenes and spiranes – Stereochemistry of nitrogen compounds.

Geometrical isomerism

E and Z notation – Determination of configuration of geometrical isomers by simple techniques like hydroxylation, hydroboration and methods based on physical properties – Stereoisomerism in cyclic compounds – 3, 4 and 5-membered ring systems.

UNIT V – Conformational Analysis (12 hrs)

Configuration and conformation – definition – conformational free energy- atropisomers- conformational analysis of acyclic, cyclic, heterocyclic systems – conformational analysis of cyclohexane system: stability and isomerism in mono and disubstituted cyclohexanes – conformation and reactivity of cyclohexane derivatives - conformational analysis of fused ring system - decalins, and perhydrophenanthrene.

Text Books:

1. D. Nasipuri, 2005. Stereochemistry of Organic compounds 2nd edition, New Age International, New Delhi .
2. William Kemp, 1994. Organic Spectroscopy, 4th Edition, ELBS, UK.
3. R.M. Silverstein, G.C. Bassler and T.C. Morrill, Spectrometric Identification of organic compounds, 6th Edition, John Wiley, New York, 2005.

Reference Books:

1. E.L. Eliel and S.H.Wiley, 2003. Stereochemistry of carbon compounds. John Wiley & Son, Inc
2. V.M.Potapov, 1999. Stereochemistry, MIR Publisher, Moscow.
3. H.Kagan, 2001.Organic Stereochemistry, Edward Arnold, London.
4. E.L. Eliel, N.L. Allinger, S.J. Angyal and G.A. Morrison, 2004. Conformational Analysis, Interscience, New York.
5. P. Wetirli Marchand, 1987. Interpretation of ^{13}C NMR Spectra, VCH Weinheim, UK.
6. Atta-ur Rahman,1990. Nuclear Magnetic Resonance, Springer Verlog, New York.

Course designer

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamilselvi
5. Mrs. P. Rajam

THIAGARAJAR COLLEGE, MADURAI-625 009
(Re-Accredited with „A‟ Grade by NAAC)
Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 201 9)
Programme Code: PCH

Course Code	Course Title	Category	L	T	P	Credit
PCH20C22	**Coordination, Bioinorganic and Nuclear Chemistry**	Core-5	4	-	-	4

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	25	75	100

Preamble

The course explains the various theories and reaction mechanisms of coordination compounds. It also gives information on the role of metal ions in biological systems, description of various inorganic physical methods, concepts of nuclear chemistry.

Prerequisite

Basic knowledge on coordination compounds, spectral techniques, bioinorganic Chemistry and nuclear chemistry at undergraduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level
CO1	Explain various theories and properties of coordination compounds.	K1
CO2	Examine the mechanism of coordination compounds.	K2
CO3	Outline the principles of various spectral techniques like IR, Raman, NMR and Orgel and Tanabe-Sugano diagram.	K3
CO4	Classify the essential and trace elements in biological systems to understand the functionality of various bio-inorganic molecules and application of metal complexes in chelate and chemotherapy.	K4
CO5	Experiment with different types of nuclear reactions, nuclear reactors and to list various nuclear waste disposal and safety measures.	K5

K1 - Knowledge K2 - Understand K3 - Apply K4 - Analyze K5 - Evaluate

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**M**	**M**	**S**	**M**	**L**	**M**
CO2	**S**	**S**	**M**	**S**	**M**	**L**	**M**
CO3	**M**	**S**	**S**	**S**	**S**	**L**	**S**
CO4	**M**	**S**	**S**	**M**	**M**	**M**	**M**
CO5	**S**	**M**	**S**	**M**	**S**	**M**	**L**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	M	S
CO2	S	S	S	S	S
CO3	S	S	S	S	S
CO4	S	S	M	M	S
CO5	S	S	L	M	S

Strong(S), Medium(M), Low(L)

Blooms Taxanomy	CA		End of Semester (Marks)
	First (Marks)	Second (Marks)	
Knowledge K1	15% (9)	15% (9)	20% (30)
Understand K2	15% (9)	15% (9)	20% (30)
Apply K3	30% (18)	30% (18)	20% (30)
Analyze K4	20% (12)	20% (12)	20% (30)
Evaluate K5	20% (12)	20% (12)	20% (30)
Total Marks	**60**	**60**	**150**

Course Title: Coordination, Bioinorganic and Nuclear Chemistry

UNIT I COORDINATION CHEMISTRY-1 15 Hrs

Nomenclature of coordination complexes-Stereochemistry of coordination compounds: Geometrical isomerism- optical isomerism of complexes having C.N. 4, 6- stability constants of complexes - stepwise and overall stability constant- their determination - Jobs' continuous variation method - Chelate effect

CFT-Inadequacy of VB theory- pi bonding-Influence of ligands on crystal field splitting- Octahedral and Tetrahedral splitting of "d" orbitals, CFSE. Spectrochemical series- Nephelauxetic effect– John Teller effect (static and dynamic) - site preferences.

MO theory- Types of pi-bonds-MO energy level diagrams of σ and π bonding in Oh complexes, nature of metal-ligand π bonds, π-back bonding, π acceptor series.

UNIT-II COORDINATION CHEMISTRY-II 15 Hrs

Magnetic properties- spin-orbit contribution-Para, Dia, ferromagnetism and antiferromagnetism- Curie's law-spin isomerism-Determination of magnetic properties – Gouy's method

Substitution reactions- lability-inertness- square planar substitution reactions- Factors affecting reactivity of square planar complexes- Trans effect- Theories of Trans effect- Stereochemistry of substitution in octahedral complexes.(SN^1, SN^2, SNiCB)- Reactions of coordinated ligands- Acid hydrolysis- anation reactions and base hydrolysis.

Mechanism of electron transfer reactions- Outer sphere, inner sphere electron transfer reactions- Marcus Theory and its applications. Synthesis of coordination compounds using electron transfer and substitution reaction.

UNIT-III PHYSICAL METHODS IN INORGANIC CHEMISTRY-I 15 Hrs

Electronic spectra: selection rules – polarization – splitting of spectral terms – L.S Coupling scheme- Russel- Saunders method- Term Symbols -Orgel and Tanabe-Sugano diagram. – Evaluation of 10 Dq and beta $\mathbf{d^2}$, $\mathbf{d^3}$, $\mathbf{d^7}$, $\mathbf{d^8}$ systems

IR and Raman spectra: Selection rules - Applications of IR and Raman to structure determination. IR spectral studies of inorganic complexes (Except metal carbonyls and nitrosyl).

Nuclear magnetic resonance: Application of chemical shift and spin coupling to structure determination using multiple NMR (H, P & F) chemical exchange, dynamic processes in inorganic and organometallic compounds- Fluxional NMR of metal carbonyls and allyl complexes – paramagnetic NMR and contact and pseudo contact shifts.

UNIT –IV BIO-INORGANIC CHEMISTRY 15Hrs

Essential and trace elements in biological systems –ion pump- metalloporphyrins – the porphyrine ring system – chlorophyll – photosystem(PS) I and II - Electron transport sequence – biological electron transfer – electron transfer agents – cytochromes – Haemoglobin – myoglobin – and synthetic oxygen carriers – nitrogen fixation – in vivo and in vitro – copper proteins – Enzymes: superoxide dismutase, carboxypeptidase A- (structure and functions), Biomineralization of iron.

Metal complexes in medicine – Chelate therapy - Metals used for diagnosis and chemotherapy - metal-nucleic acid interactions.

UNIT – V: NUCLEAR CHEMISTRY 15Hrs

Radioactive decay and equilibrium- Different types of nuclear reactions – spallation – fission and fusion. Theories of fission. Fissile and fertile isotopes.-Nuclear fusion – stellar energy - Nuclear forces: Liquid drop model, shell model - Calculation of Q-values – Cross section. Detectors: Scintillation counter, Gas Ionisation chamber. Proportional Counter, Cerenkov Counter - Accelerators: Cyclotron, Synchrocyclotron, Betatron. Radioisotopes and their Applications: Activation analysis, Isotopic dilution technique - radiometric titration.

Nuclear reactors: Types (Thermo nuclear and breeder reactors) feed materials production. Reprocessing of nuclear materials - waste disposal - Atomic power projects in India - Hazardous of radioactive materials and Safety measures.

Text Books:

1. Gurdeep R. Chatwal & M. S. Yadav, 1993 Coordination Chemistry, Himalaya Publishing House, I Edn..
2. Figgis, B.N, 1964.Introduction to Ligand Fields, Wiley Interscience, Eartern Ltd., I Edn., New Delhi.
3. Banerjea, D, 1993. Coordination Chemistry, Tata McGraw- Hill Publishing Co. Ltd.,
4. Huheey, J. E. Ellen A. Keiter, Richard L. Keiter, Inorganic Chemistry, IV Edn., Pearson Education (Singapore) Pvt. Ltd., New Delhi, 2004.
5. Gary L. Miessler and Donald A. Tarr, Inorganic Chemistry, Pearson Education, Inc., 3rd Edn., New Delhi, 2004.
6. Drago, R. S. Van Nostrand and Reinhold, 1976. Physical Methods in Chemistry.
7. Nakamoto, Kazuo, 1986. Infrared and Raman Spectra of Inorganic and coordination compounds, IV edition, John Wiley and Sons, New Yark.
8. Raymond Chang, 1971.Basic principles of Spectroscopy, Mc Graw Hill, New Delhi.
9. K. Hussain Reddy, Bioinorganic Chemistry New Age Internation (p) limited, New Delhi-2003.

10. Glasstone, S. 1967.Source Book of Atomic Energy, Van Nostrand, III Edn, East West Press (P) Ltd., New Delhi.
11. Friedlander, G. Kennedy J.S and Millodr, M. M. 1984.Nuclear and radiochemistry, John Wiley & Sons, New York.

References:

1) Purcell, K. F. Kotz, J.C. Holt Saunders, 1977. Inorganic Chemistry, Philedelphia,USA
2) Straughan B. P. and Walker S. 1976. Spectroscopy Vol.3, Chapman and Hall, New Delhi.
3) Bertini I.G., Bio-Inorganic Chemistry, Viva books private Limited, 1998.
4) Lippard S.T., and Berg T.M., Principles of Bio-inorganic Chemistry, Panima Publishing Company, New York, 1997.
5) Arnikar, H. J.2005 Essentials of Nuclear Chemistry, IV Edn., New Age international (P) Ltd., New Delhi.

Web Resources:

1. https://nptel.ac.in/courses/104105033/
2. https://nptel.ac.in/courses/103106101/

Course Designers:

1. Dr. A. Elangovan
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THIAGARAJAR COLLEGE, MADURAI-625 009
(Re-Accredited with "A" Grade by NAAC)
Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 2020)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20C23	**Electrochemistry and Statistical Equilibria**	Core-6	4	-	-	4

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	25	75	100

Preamble

The course enables the students to gain knowledge on electrochemistry, statistical thermodynamics and thermodynamic equilibrium.

Prerequisites

Basic knowledge on fundamental concepts and theories of electrochemistry, statistical thermodynamics and thermodynamics equilibrium concepts at undergraduate level.

Course outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Summarise the fundamental concepts and theories of electrochemistry.	K1
CO2	Make use of the applications of electrochemistry.	K3
CO3	Identify the need and fundamental derivation of statistical thermodynamics.	K3
CO4	Examine the applications of statistical thermodynamics.	K4
CO5	Measure their knowledge on thermo dynamical equilibrium and non equilibrium concepts	K5

K1-Knowledge; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	L	W	S	L	L	M
CO2	S	S	S	S	S	L	M
CO3	S	L	M	S	S	L	M
CO4	S	L	S	S	S	L	M
CO5	S	L	M	S	S	L	M

Mapping of COs with PSOs

	PO1	PO2	PO3	PO4	PO5
CO1	S	L	-	-	S
CO2	S	M	M	M	S
CO3	S	M	M	M	S
CO4	S	M	M	M	S
CO5	S	M	L	M	S

S-Strong; M-Medium; L-Low

Blooms Taxanomy	CA		End of Semester (Marks)
	First (Marks)	Second (Marks)	
Knowledge K1	15% (9)	15% (9)	20% (30)
Understand K2	15% (9)	15% (9)	20% (30)
Apply K3	30% (18)	30% (18)	20% (30)
Analyze K4	20% (12)	20% (12)	20% (30)
Evaluate K5	20% (12)	20% (12)	20% (30)
Total Marks	**60**	**60**	**150**

Course Title: Electrochemistry and Statistical Equilibria

UNIT-I

ELECTROCHEMISTRY-I

Theory of strong electrolytes – Inter-ionic attraction theory – Debye-Huckel theory of strong electrolytes - Debye-Huckel model of ionic atmosphere – Debye-Huckel Onsager equation-derivation, verification and modifications- Debye – Falkenhagen's effect and Wien's effect; Electrical double layers – formation – Structure of electrified interfaces – Stern model. Debye-Huckel limiting law- extension- Huckel-Bronsted equation - Determination of activity coefficients using Bronsted equation – Applications of conductivity measurements; Nernst equation and its significance – reversible and irreversible cells - electrodes – SHE – Calomel – Glass electrode – Platinum electrode – Glassy carbon electrode – ion selective electrode and measurement of pH.

UNIT-II **(12 Hrs)**

ELECTROCHEMISTRY-II

Over voltage – theories of over voltage- applications of over voltage-hydrogen and oxygen overvoltage; Butler-Volmer equation- Tafel equation; Corrosion- principles of electrochemical corrosion – dry and wet corrosion and its mechanism – Pilling-Bedworth's rule. Types of corrosion- galvanic, aeration, stress, pitting corrosion and passivity – factors influencing corrosion – corrosion control method- cathodic protection - corrosion inhibitors.

Principles of polarography - Cyclic voltametry –quasi – reversible – irreversible systems; basic principles of electrochemical impedance spectroscopy - electrochemical energy conversions-Nickel Cadmium, lead acid battery; Fuel cells – H_2 - O_2 and methyl alcohol fuel cell-membrane cell electrode.

UNIT-III **(12 Hrs)**

STATISTICAL THERMODYNAMICS-I

Need for statistical mechanics or thermodynamics-basic terminology used in statistical thermodynamics- probability, thermodynamic probability and partition function; Classical statistics -Derivation of Maxwell Boltzmann classical distribution law in term of degeneracy; Partition function (Q) – derivation of relation between partition function and the following thermodynamic functions – internal energy (E), Helmholtz free energy (A), Pressure (P), Enthalpy (H), Gibbs free energy (G), chemical potential (μ_i), heat capacity (Cv) and entropy (S); Derivation of translational, rotational, vibrational, electronic partition function and related simple problems only-Translational entropy of monoatomic ideal gas - Derivation of Sackur-Tetrode equation.

UNIT-IV **(12 Hrs)**

STATISTICAL THERMODYNAMICS-II

Quantum statistics- Ensemble- types of ensemble - micro canonical - canonical and grand canonical ensemble (definition only); Phase space- microstates- probability and distribution (definition only); Derivation-Bose-Einstein Statistics and Fermi-Dirac statistics - Comparison of Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics; Application of Bose-Einstein statistics for a photon gas (elementary basis only) – Planck‘s radiation formula-Derivation of Rayleigh-Jeans law-Stefan Boltzman equation; Application of Fermi-Dirac statistics to electron gas in metals (elementary basis only);

Population inversion-negative absolute temperature - Einstein‘s theory and Debye‘s theory of heat capacities of monoatomic crystals– Statistical thermodynamics of ortho and para hydrogen nuclear states.

UNIT-V

EQUILIBRIUM AND NON-EQUILIBRIUM **(15 HRS)**

A general review of enthalpy, entropy and free energy concepts: Nernst heat theorem- Genesis of third law and its limitations - derivation of third law and their application to real gases-calculation of $(\delta H/dP)T$, $(\delta E/dV)T$ and $\mu j.T$ for gases-

Thermodynamics of open systems - partial molar properties- internal energy, molar enthalpy, molar entropy, molar volume, free energy (chemical potential) – determination of partial molar properties; Chemical potential- relationship between partial molal quantities - Gibbs - Duhem equation- Duhem Margules equation; thermodynamic properties of real gases- Fugacity concept-Determination of Fugacity of real gases.

Electrolytes and Non-Electrolytes- Equilibrium thermodynamics- Gibbs phase rule and its application to three component systems- quantitative treatment of Le Chatlier’s principle-equilibria respond to pressure and temperature; Non-Equlibrium Thermodynamics -Basic concepts - Principle of microscopic reversibility and the Onsager reciprocal relations.

Text Books:

1. Bokris J. O. M., Reddy A. K. N., 1978, Modern Electrochemistry, Vol I, Plenum Press, New York.
2. Crow Dr., 1988, Principles and Applications of Electrochemistry, Chapman Hall, UK.
3. Venkataraman R., Rengarajan K., Raghavan P. S., 2007, Electrochemistry, First edition
4. Glasstone S., 2002, Thermodynamics for Chemists, Eastern Wiley Publication.
5. Lee, Sears, Tercotte, 1973, Statistical Thermodynamics, Addision Wesley Publishing Co., London – I Edition.

Reference Books:

1. Antropov L., 1999, Theoretical electrochemistry, MIR Publications, New Delhi.
2. Glasstone S., 2002, An Introduction to Electrochemistry, Von Nostrand Co. Inc., Toronto.
3. Gupta M. C., 1993, Statistical Thermodynamics, Wiley Eastern limited, New Delhi.
4. Kuriakose J. C., Rajaram, J. 1999, Thermodynamics, III edition, Shoban lal Nagin Chand, New Delhi, India.
5. Klotz, M., Rosenberg, R. M., 1996, Chemical thermodynamics, 4th edition Benjamin, New York.
6. Glasstone, S., 2002, Thermodynamics for Chemists, 5th edition, Eastern Wiley publications. A.J. Bard- Electrochemistry

7. Kent and Riegl's hand book of industrial chemistry, 1992, 11th edition.

Course Designed by

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2. Dr. A. R. Ramesh
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THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined M.Sc Chemistry on or after June 2020)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CE21 (A)	C-Programming and Computer Applications in Chemistry	Core elective -1 (Option A)	5	-	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	25	75	100

Preamble

The course explains the importance of C-programming and various terms used in C. It also explains the applications of C in solving problems in chemistry. And also it explains the computer applications in Chemistry

Prerequisites

Basic knowledge to operate computer.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Recall and explain the basics of C Programming; especially the operators, functions and expressions and build a program using proper data input and output logics and decision making looping logics	K1
CO2	Develop programs using the arrays and functions. Applying C-Program to solve some Chemical formula/equations	K2
CO3	Apply the knowledge of diffraction techniques to the study of structural chemistry; and understand the applications of SHELX and PLATON software in crystallography.	K3
CO4	Analyze the chemical structures using CHEM Office in scientific manner and get the mass and NMR simulations; and also get an idea about computational chemistry.	K4
CO5	Evaluate the application of RASMOL and MATLAB in chemistry.	K5

K1-Knowledge; K2-Understand; K3-Apply; K4- Analyze; K5-Evaluate

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**S**	**S**	**S**	**S**	**L**	**S**
CO2	**S**	**S**	**S**	**S**	**S**	**L**	**S**
CO3	**S**	**S**	**S**	**S**	**S**	**L**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**L**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**L**	**S**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**L**	**S**	**S**
CO2	**S**	**S**	**L**	**S**	**S**
CO3	**S**	**S**	**L**	**S**	**S**
CO4	**S**	**S**	**M**	**S**	**S**
CO5	**S**	**S**	**M**	**S**	**S**

S-Strong; M-Medium; L-Low

Blooms Taxanomy	CA		End of Semester (Marks)
	First (Marks)	Second(Marks)	
Knowledge -K1	15% (9)	15% (9)	15% (20)
Understand -K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze-K4	20% (12)	20% (12)	20% (25)
Evaluate-K5	20% (12)	20% (12)	20% (25)
Total Marks	**60**	**60**	**130**

Course Title: C-Programming and Computer Applications in Chemistry

UNIT-I INTRODUCTION AND OVERVIEW OF C (T:9 HRS + P:6 HRS)

Introduction – Importance of C-structure of C-programs- Simple programs-style of the language.
Characters–Keywords, Variables and parameters-Data types-Constants-Declaration of and assignments of values to variables.
Operators-Arithmetic, Relational, Logical, assignment, Increment and Decrement, Conditional and bitwise operators-Special operators.
Formatted input and output data-the gets, puts, getchar, putchar functions - Scanf and printf - - preparing and running a complete program.
Decision making and branching: Decision making with IF statement –simple IF statement-the IF…ELSE statement- Nesting of IF…Else statements – The ELSE IF ladder –The Switch statement – The ?: operator – the GOTO statement.
Decision making and Looping: The WHILE statement – The DO statement-The FOR statement – Jumps in loops.

Unit-II ARRAYS, FUNCTIONS AND APPLICATIONS OF C IN CHEMISTRY
(T: 7 HRS + P: 8 HRS)

Arrays: One dimensional array –Two dimensional arrays –Initializing two dimensional arrays-Multidimensional arrays.
User defined functions: Need for user–defined functions – A multifunction program – The form of C functions -Return values and their types- Calling a function –Category of function- No arguments and no return values –Nesting functions- Recursions- The scope and life time of variables in function.

Applications of C in Chemistry

Explanation of the formulae, equations and programs to solve the following problems in chemistry:

1. Calculation of Molecular weight and empirical formula of Organic Compounds.
2. Determination on First Order rate constant and half life for the given reaction

3. Evaluation of lattice energy using
   i). Born- Haber Cycle
   ii). Born –Lande equation
4. Computing ionic radii- Lande's method and Paulings method
5. Calculation of pH, Normality, Molarity and Molality of a given solution
6. Determination of enthalpy of a given solution
7. Calculation of energy of Hydrogen atom spectral lines.
8. Calculation of RMS, average and MPV of gases.
9. Solving Quadratic equation to evaluate the Equilibrium constant for the reaction
   $H_2 + I_2 \rightleftharpoons 2HI$
10. Calculation of Cell constant and Mean activity coefficient of an Electrolyte (KCl)

UNIT-III APPLICATIONS OF CRYSTALLOGRAPHIC SOFTWARES IN CHEMISTRY
T: 10 + P: 5 Hrs

Basics of crystal structures: Definition of the crystal lattice and unit cell - Lattices, lattice parameters - The seven crystal systems - Conventional and primitive lattices - The 14 Bravais lattices - Crystallization techniques

X-ray Diffraction Analysis: Symmetry and operations - Deduction of Space group –X-Ray Diffractometers - X-ray data - Structure solution and refinement using SHELX - Structure building using PLATON

Visualization of the crystal structures ORTEP - CIF file.

UNIT-IV APPLICATIONS OF CHEMDRAW AND CHEM 3D SOFTWARES IN CHEMISTRY T: 8 + P: 7 Hrs

ChemDraw: Introduction- Tool Pallets - Construction of the molecule using ChemDraw tools- Analyzing a molecule - Getting the details about the elemental analysis and Mass report - NMR simulation and interpretation - Naming IUPAC - Structure from Name and Name from Structure

Chem3D: Model display- Display type- Structure displays- Molecular Surface display - Computational Concepts: - Computational methods: Conformational analysis – geometry Optimizations property (calculations) - Potential energy surface - Molecular Dynamics – Animations - Difference between Chemdraw and Chem 3D.

UNIT-V: APPLICATIONS OF RASMOL and MATLAB IN CHEMISTRY T : 8 + P: 7 Hrs

RASMOL: - Introduction- User commands– Identification of disulfide-bridges and visualization of :- hydrophobic and polar residues, the distribution of polar and non polar amino acids, side chain of carboxylate and amine , the different structural motives like α-helix, β-sheet and β - turn, the amino acids bound to Zn, active site of carboxypeptidase A, the environment of the active center.

MATLAB: - Introduction-advantages- getting started- windows for workspace, command interpretation, command history and current history- Addition- Use of sine and Cosine of angles(pi)- variable 'ans'- order of operations- significant decimals- Representation of matrix- getting transpose of a matrix- display of images- saving images-solving linear equations(case m=n only).

TEXT BOOK

1. E. Balagurusamy, 2005. Programming in ANSI C, Tata McGraw- Hill Publishing Company Ltd., New Delhi, 3rd Edn., 10th Reprint.

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1. Brian W. Kernighan & Dennis M. Ritchie, 2001 The C Programming Language, Prentice Hall of India Private Limited, New Delhi, 2nd Edn.,.
2. Byron S. Gottfried,2001. Programming with C, Tata McGraw- Hill Publishing Company

Ltd., New Delhi, 2nd Edn.,
3. R. Rajaram,1999. C Programming Made Easy, Scitech Publications, Chennai.
4. Yeshavant Kanitkar, 1999. Let Us C, BPB Publications, New Delhi, 3rd Edn..
5. Yeshavant Kanitkar, C 1998- Projects, BPB Publications, New Delhi,.
6. K. V. Raman, 1993 Computers in Chemistry, Tata McGraw- Hill Publishing Company Ltd., New Delhi, 3rd Edn.
7. Chem Draw & Chem 3D –Manual
8. Shelx, Rasmol and MATLAB- Manuals.

REFERENCES in the NET

1. http://www.umass.eud/microbio/rasmol/
2. http://www. Mdli.com/cgi/dynamic/welcome.html/ (for CHIME similar to Rasmol)

Course designers

1. Dr. A. Elangovan
2. Dr. R. Mahalakshmy
3. Dr. A. Tamil Selvi
4. Dr. M. Sathiya

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined M.Sc Chemistry on or after June 2020)
Programme Code: PCH

ourse Code	Course title	Category	L	T	P	Credit
PCH19CE21 (B)	Medicinal Chemistry	Core elective -1 (Option B)	5	-	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	25	75	100

Preamble

The course gives introduction about drug discovery, quantitative structural activity relationship(QSAR) and synthesize of few important drugs.

Prerequisites

Basic knowledge about medicinal chemistry at under graduate level.

Course outcomes

#	Course Outcome	Knowledge level
CO1	Tell the properties of Adsorption, Distribution, Metabolism, Elimination(ADME)and usage of pharmacokinetics in drug design.	K1
CO2	Explain drug discovery by design and compare the structural activity relationship properties.	K2
CO3	Apply the basic concepts of quantitative structural activity relationship(QSAR) and combinatorial chemistry.	K3
CO4	Classify the drugs such as Antineoplastic Agents, Psychoactive drugs, (The chemotherapy of Mind), Cardiovascular drugs and Local Antiinfective drugs.	K4
CO5	Synthesis drugs such as Antineoplastic agents, cardiovascular drugsand Phychoactive drugs in the laboratory scale.	K5

K1-Knowledge; K2-Understand; K3-Apply; K4- Analyze; K5-Evaluate

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO2	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO3	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**M**
CO5	**S**	**S**	**S**	**S**	**S**	**M**	**M**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**L**	**S**	**S**	**S**
CO2	**S**	**M**	**M**	**S**	**S**
CO3	**S**	**S**	**L**	**S**	**S**
CO4	**S**	**M**	**M**	**S**	**S**
CO5	**S**	**M**	**S**	**S**	**S**

Blooms Taxanomy	**CA**		**End of Semester (Marks)**
	First (Marks)	**Second(Marks)**	
Knowledge -K1	15% (9)	15% (9)	15% (20)
Understand -K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze-K4	20% (12)	20% (12)	20% (25)
Evaluate-K5	20% (12)	20% (12)	20% (25)
Total Marks	**60**	**60**	**130**

Course Title: Medicinal Chemistry

Unit – I : Introduction to Drug Design **15 hrs**

a) ADME Properties The pharmacokinetics phase-Adsorption-Distribution, Metabolism-Elimination-Bioavailability of drug. pharmacokinetics models, Intravascular and Extravascular administration. The use of pharmacokinetics in Drug design**.**

b) Pharmacodynamics - Stereoelectronic structure.

Unit - II Drug Discovery by Design **15 hrs**

a) Streochemistry and Drug Design Structurally rigid Groups –procaine, Acetylcholine. Conformation-Syn and Anti Acetylcholine, Phenyl ethanoate methiodides. Configuration-Variations in the biological activities of stereoisomers

b) Strutural –Activity –Relationship (SAR) Changing the size and shape.Changing th degree of unsaturation. Introduction or removal of ring system. Introduction of new substituents-methyl group, Halogens, hydroxyl groups, Basic groups, carboxylic and sulphonic acid groups. Changing the excisting substituents of leadisosteres,bioisoteres.

Unit III

a)Quantitative-structural Activity-Relationship (QSAR) **15 hrs**

Partition parameters-partition coefficients(p), Lipophilic subtituents constants () Electronicπ parameters-The Hammett constants-Steric parameters-The Taft Steric parameters (Es), Molar refractivity (MR), Hansch analysis-craig plots, The toplss decision tree. Computer –aided drug designModelling Drug-Receptor Interaction.

b) Combinatorial Chemistry Basic concepts- the design of combinatorial syntheses. The general technique used in combinatorial synthesis i) Solid support mthod-parrllel synthesis –Furka_s mix and splt techniques-sequential chemical tagging methods-Still‘s binary code Tag systemcomputerised tagging. ii) Combinaterial synthesis in solution iii) Screening and deconvolution

Unit – IV

a) Antineoplastic Agents: **15 hrs**

Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer

b) Psychoactive drugs – The chemotherapy of Mind: Introduction, neutotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, neurochemistry of mental diseases

c) Cardiovascular Drugs and Local Antiinfective Drugs:

Introduction, Cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output.

Unit V Synthesis of Drugs **15 hrs**

a) Synthesis of Antineoplastic agents Mechlorethamine, Cyclophosphamide uracil, mustards and 6-mercaptopurine

b) Synthesis of cardiovascular drugs Amyl-nitrate, sorbitrate, Verapamil.

c) Synthesis of Phychoactive drugs Synthesis of Diazepam, Chlorazepam, oxazepam, Alprazolam, Phenyltocin or Diphenylhydantoin, Barbitol, Phenobarbital.

Text Books:

1.Gringuage, 2004.Introduction to Medical Chemistry, Wiley – VCH,.
2. Robert F.Dorge2003 Wilson and Gisvold‘s Text Book of Organic Medicinal and Pharmaceutical Chemistry,
3. S.S.Pandeya and J.R.Dimmock,2006. An Introduction to Drug Design, New Age International.
4. M.E. Wolff, 2005. Burger_s Medicinal Chemistry and Drug Discovery, Vol-1 (Chapter-9 and Ch-14) John Wiley publications.
5. Goodman and Gilman_s Pharmacological Basis of Therapeutics, McGraw-Hill, 2006.
6. R.B.Silverman, 2006. The Organic Chemistry of Drug Design and Drug Action, Academic Press.

Reference Books:

1. D. Lednicer, Strategies for Organic Drug Synthesis and Design, John Wiley.
2. Gareth Thomas, 2004. Medicinal Chemistry, An introduction, John wiley& sons,Ltd.,
3. M.L Gangwal 2007. Medicinal chemistry Lectures on Drug design and Synthetic Drugs, Student publishing House.

Course Designer: 1. Dr. P. Tharmaraj
2. Dr. P. Prakash

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CL21	**Preparation and qualitative analysis of Organic compounds**	Core Lab -1	-	-	5	5

Year	Semester	Int. Marks	Ext. Marks	Total
I	I & II	40	60	100

Preamble

This lab course enhances the laboratory skill of analyzing the functional groups present in a mixture of organic compounds qualitatively and preparing organic compounds.

Prerequisites

Basic theoretical and practical knowledge on qualitative analysis of simple organic compounds at under graduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome
CO1	Apply the analytic procedure to identify the organic molecules.
CO2	Separate the organic mixture by chemical methods.
CO3	Detect the elements (other than C, H, and O) present in a given organic compound.
CO4	Identify the functional groups in a given organic compound.
CO5	Prepare the derivatives for the given organic compound.

Mapping of COs with PSOs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	M	S
CO2	S	S	S	S	S	M	S
CO3	S	S	S	S	S	M	S
CO4	S	S	S	S	S	M	S
CO5	S	S	S	S	S	M	S

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	S	S
CO3	M	S	S	S	S
CO4	M	S	S	S	S
CO5	M	S	S	S	S

S-Strong; M-Medium; L-Low

Analysis

Analysis of Organic mixtures: Two component Systems (Maximum of **SIX** Mixtures)

Preparation of organic compounds

1. Dibenzal acetone
2. Dimethyl pyrazole
3. Diphenylchalcone
4. p - Nitroacetanilide
5. Salicylaldoxime

Course Designers

1. Dr. P. Tharmaraj
2. Dr. A. Tamilselvi

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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CL22	**Inorganic Chemistry Lab - I**	Core Lab - 2	-	-	4	4

Year	Semester	Int. Marks	Ext. Marks	Total
I	I & II	40	60	100

Preamble

This lab course enables the students to acquire laboratory skill on quantitative estimation of inorganic metal ions by complexometric technique using EDTA and qualitative analysis of inorganic cations present in the mixture of salts.

Prerequisites

Basic theoretical and practical knowledge on volumetric titration and quantitative analyses of inorganic metal ions at undergraduate level.

Course outcomes

On the completion of the course the student will be able to

#	Course Outcome
CO1	Estimate the amount of metal ions susch as like Zinc, Magnesium and Copper present in the given solution by EDTA volumetric method.
CO2	Calculate the amount of Nickel ions present in the given solution by direct and indirect EDTA volumetric methods.
CO3	Analyze the familiar cations present in the given mixture of salts.
CO4	Analyze the less familiar cations present in the given salt mixture
CO5	Develop the laboratory skill of quantitative as well as qualitative analysis of metal ions.

Mapping of COs and POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	M	M	S	M	L	M
CO2	S	S	M	S	M	L	M
CO3	M	S	S	S	S	L	S
CO4	M	S	S	M	M	M	M
CO5	S	M	S	M	S	M	L

Mapping of COs and PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**M**	**S**	**M**
CO2	**S**	**S**	**M**	**S**	**M**
CO3	**M**	**S**	**S**	**S**	**S**
CO4	**M**	**S**	**S**	**M**	**M**
CO5	**S**	**M**	**S**	**M**	**S**

S-Strong; M-Medium; L-Low

I. COMPLEXOMETRIC TITRATIONS WITH EDTA

1. Estimation of ZINC
2. Estimation of MAGNESIUM
3. Estimation of COPPER
4. Estimation of NICKEL: a) By Direct Method; b) By Indirect Method

II. **SEMI MICRO QUALITATIVE ANALYSIS** Semi micro analysis of inorganic mixture containing two familiar cations and two less familiar cations – Maximum of **five** samples.

Course Designers 1. Dr. A. Elangovan
2. Dr. T. Arumuganathan

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CL23	Physical Chemistry practical	Core lab 3	-	-	4	4

Year	Semester	Int. Marks	Ext. Marks	Total
I	I & II	40	60	100

Preamble

This lab course enables the students to acquire practical knowledge on physical chemistry experiments such as electrochemical, kinetics, surface chemistry and colorimetric estimations.

Prerequisites

Fundamental theoretical and practical knowledge on simple electrochemical and kinetic experiments at undergraduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome
CO1	Carryout the various types of conductometric titrations.
CO2	Do the various types of potentiometric titrations.
CO3	Develop analytical skill on adsorption experiments.
CO4	Apply colorimetric estimation techniques.
CO5	Identify various types of conductometric titrations.

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO2	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO3	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO4	**S**	**S**	**S**	**S**	**S**	**M**	**S**
CO5	**S**	**S**	**S**	**S**	**S**	**M**	**S**

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**M**	**S**
CO2	**S**	**S**	**S**	**M**	S
CO3	**S**	**S**	**S**	**-**	S
CO4	**S**	**S**	**S**	**-**	S
CO5	**S**	**S**	**S**	**L**	S

S-Strong; M-Medium; L-Low

S. **No**.	**EXPERIMENTS**
1	Kinetics of Acid hydrolysis of an ester
2	Estimation of strong acid by conductometry
3	Estimation of mixture of acids by conductometry
4	Estimation of NH_4Cl by conductometry
5	Estimation of CH_3COONa by conductometry
6	Estimation of $BaCl_2$ by conductometry
7	Estimation of Fe(II) using $K_2Cr_2O_7$ by potentiometry
8	Estimation of Fe(II) using ceric ammonium sulphate by potentiometry
9	Estimation of KI with $KMnO_4$ by potentiometry
10	Estimation of Cu(II) by spectrocolorimetry
11	Determination of the adsorption parameters of oxalic acid on charcoal
12	Determination of the adsorption parameters of acetic acid on to activated charcoal
13	Estimation of thiocyanate using Fe(III) by spectrocolorimetry
14	Determination of Fe(III) ion content by photometric method based on complex formation
15	Cyclic voltammetry– Demo only- Not for Exam.

Course Designer

1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh

M.Phil., Chemistry

Programme Code:MCH

Programme outcome-PO (Aligned with Graduate Attributes)- Master of Philosophy (M.Phil.,)

Knowledge and critical thinking

Acquire, analyse, evaluate and interpret data using appropriate techniques. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Problem solving

Critically evaluate information and ideas from multiple perspectives. Employ conceptual, analytical, quantitative and technical skills in solving the problems and are adept with a range of technologies

Complementary Skills

Recognize the need for information, effectively search for, retrieve, evaluate and apply that information gathered in support of scientific investigation or scholarly debate.

Communication efficiency

Communicate and disseminate clearly and convincingly the research findings effectively in the academic community and to stakeholders of their discipline in written and or oral form. Elaborate on the ideas, findings and contributions in their field of interest to expert and non-expert audiences.

Environment, Ethical and Social relevance

Apply ethical principles for societal development on environment context. Demonstrate the knowledge of and need for sustainable development.

Life-Long Learning

Recognize the need, and have the ability, to engage in continuous reflective learning in the context of technological advancement.

Team work

Work effectively in teams, both collaboratively and independently to meet a shared goal with people whose disciplinary and cultural backgrounds differ from their own. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues

Department of Chemistry

Vision: To train our students as scientifically literate professionals with a sense of social responsibilities.

Mission: (i) To train our students to succeed in competitive examinations.
(ii)To encourage the advancement of chemistry in all of its branches through education, research and service opportunities.
(iii) To provide students with community need based research and outreach opportunities.
(iv) To strive for an ideal balance between creation and knowledge dissemination in the chemical sciences.

Program Educational Objectives (PEOs)

The objectives of the M.Phil Chemistry programme is to prepare-equip the students

PEO1	To pursue Doctoral programme at national/global level research institutewith sponsored fellowship.
PEO2	To get successful professional careers in academia as Assistant Professor, team leader in research and development company, scientist in higher education research institute like DRDO, BARC etc.
PEO3	To get suitable employment in government sectors after qualifying specific competitive exams conducted by service commission or will become a successful entrepreneur.
PEO4	To demonstrate adherence to personal and professional ethics.
PEO5	To be active members and ready to serve the society locally and internationally.

Program Specific Outcomes (PSOs)

On the successful completion of M.Phil Chemistry program students will be able

PSO1	To gain in depth knowledge in specific area of chemical sciences.
PSO2	To represent data in the form of figures and tables and able to give logical explanation with evidences.
PSO3	To get a comprehensive understanding of experimental and analytical techniques, and a thorough knowledge of the literature, applicable to their own research.
PSO4	To show abilities in the critical evaluation of current research, research techniques and methodologies.
PSO5	To get jobs in various sectors ranging from energy to environment, teaching to research, pharmaceutical to medical sciences.

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

DEPARTMENT OF CHEMISTRY

(For those joined M.Phil Chemistryon or after June 2020)

M. Phil., PROGRAMME IN CHEMISTRY (SELF FINANCE)

Course Structure

Semester - I

Course	Code No	Subject	Hrs/ Week	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 1	MCH20C11	Research methodology	6	90	100	100	200
Core 2	MCH20C12	Course work	6	90	100	100	200
Core 3	MCH20C13	In depth study	6	90	100	100	200
			18	270	300	300	600

Semester-II

Course	Code No	Subject	Hrs/ Week	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 4	MCH20PJ21	Project	6	90	*a(50+50)	*b100	200
		Total					

*b. Thesis evaluation by external examiner :100
*a Viva-voce (Project guide) : 50
*a Viva-voce (external examiner) : 50

Total : 200

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)

DEPARTMENT OF CHEMISTRY

(For those joined M.Phil Chemistry on or after June 2020)

Course Code	Course title	Category	L	T	P	Credit
MCH20C11	**Research methodology**	Core-1	6	-	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	100	100	200

Preamble

Research in chemistry requires the knowledge on literature, chemistry softwares, laboratory skill, analytical skill and writing skill. This course fulfills the said requirements.

Prerequisites

Students with minimum the knowledge on chemistry software, literature, analytical and laboratory skill at postgraduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Explain the purpose of a literature survey.i.e.to place each work in the context of its contribution to understand the research problem being studied and identify the ways to interpret prior research.	K1
CO2	Illustrate the properties, structure and bonding in molecules/compounds using chem office, SHELX and molecular modeling softwares.	K2
CO3	Make use ofthe working principle and applications of analytical instruments, such as AAS, TGA, SEM, TEM, HPLC, GC-MS and cyclic voltammetry.	K3
CO4	Demonstrate the safety measures in chemistry laboratory. Also to prepare and purify reagents and solvents.	K4
CO5	Write their research findings report effectively.	K6

K1-Knowledge; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6- Create

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**S**	**S**	**S**
CO2	**S**	**S**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**M**	**S**
CO5	**S**	**S**	**S**	**M**	**S**

S-Strong; M-Medium; L-Low

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**-**	-	**-**	-	-	**-**	**-**
CO2	-	-	**-**	-	-	**-**	**-**
CO3	-	-	**-**	-	-	**-**	**-**
CO4	-	-	**-**	-	-	**-**	**-**
CO5	-	-	**-**	**-**	-	**-**	**-**

Blooms Taxanomy	**CA**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge -K1	20	20	--
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total Marks	**120**	**120**	**200**

Course Title: Research methodology

Unit I - Literature Survey: (18 hrs)

Searching the chemical literature, primary sources & secondary sources of literature survey – Importance of journals and patents, impact factor, h-index, i-index, ISSN, ISBN –Science Citation Index - chemistry journal index - choosing a problem - Computers in literature search using Internet websites- ACS-pubs, Royal Society, Springer link, science direct, Wiley - Interscience, search engines-Google, Yahoo, Alta Vista, etc., and Chemical Abstract Online.

Unit II - Computers in Chemistry: (18 hrs)

Desk-top chemical software: **Chemoffice:** Chemdraw, Chem 3D & Chem finder, Linear regression, Multi regression. MS Excel: Graph drawing and calculations -Origin.

Rasmol: Visualization of Protein molecules – highlighting amino acids, helices, beta sheets, non-hydrogen, hydrogen and sulphur bonds, identification of metal atoms and active sites.

Kinemages **:** Construction and visualization of one's own protein molecules

SHELX **:** Structure solving and refinement using Shelxs and Shelxl.

Molecular modeling:

Coordinate systems - Cartesian and internal coordinate systems-wire frame, ball and stick, space filling and surface models - potential energy surfaces – force fields in molecular mechanics and potential energy calculation. Optimization of small molecules using Gaussian software.

Unit III- Instrumental Methods of Chemical Analysis: (18 hrs)

Principle, instrumentation and applications of spectroscopic techniques - Flame Emission spectroscopy - Atomic absorption spectroscopy (AAS). Thermal analysis-Thermo Gravimetry (TGA), Differential Thermal Analysis (DTA) & Differential scanning calorimetry (DSC)- Scanning Electron Microscopy(SEM), Transmission Electron Microscopy (TEM), Atomic Force Microscopy (AFM) and Scanning Tunneling Microscope (STM).

Principle, instrumentation and applications- HPLC, GC-MS and cyclic voltammetry- Spectrofluorimetry.

Unit IV- Laboratory techniques: (18 hrs)

Safety in chemical lab - explosion and fire hazards - hazards due to toxic chemicals - electrical safety - UV radiation - first aids for various kinds of accidents including toxic chemicals - preparation and purification of reagents - precipitation- filtration - evaporation- preparation of deionised water - choice of solvents and liquids - purification - distillation - steam and fractional distillation - solvents and reagents.

Unit V-Effective thesis writing: (18 hrs)

Thesis layout - preliminaries - title page - certificates - declaration- abstracts - preface - acknowledgements - table of contents - list of tables - figures and symbols - text of the thesis - chapter division - subdivision - heading - subheadings - pagination - margins - paragraph - format and conventions - use of tables and figures - numbering - captions - referencing- Reference Systems - documenting –appendices - use of appendix and its format - puntuation and mechanics - presenting a scientific seminar - art of writing a thesis- publication of research paper.

References:

1. Barbara Kasser, Using the internet, IV Edn., EE edition, New Delhi, 1998.
2. Jerry March, Advanced Organic Chemistry, John Wiley & Sons Ltd., IV Edn., New York, 2004.
3. Geffery, G. H., Basselt, J., Mendhan, J. and Denney, R. C., Vogel's Text book of Quantitative Chemical Analysis, V Edn., Longman Scientific and Industrial, UK, 1989.
4. D.A. Skoog, D.M. West & F.J. Holler, Fundamentals of Analytical Chemistry, VII Edn., Saunders College Publishing, New York, 1996.
5. Hobart H. Willard, Lynne L. Merritt,Jr., John A. Dean, Frank A. Settle,Jr, Instrumental Methods of Analysis, VII edition, CBS publishers and distributors, New Delhi, 1986.
6. R.M. Silverstein, G.C. Bassler & T.C. Morril, Spectrometric Identification of Organic Compounds, John Wiley & Sons, V Edn., New York, 2001.
7. R.S Drago, Physical Methods in Chemistry, Saunders College Publishing, Philadelphia, 1977.
8. Andrew R. Leach, Molecular Modeling Principles and Applications, II Edn., Dorset publishers, Dorchester, 2001.
9. J. Anderson, B.H. Durston and M. Poole, Thesis and Assigment Writing, Wiley Eastern Ltd., New Delhi,1997.
10. F.Abdul Rahim - Thesis Writing - A Manual Researcher, New age International Ltd., New Delhi,1996.
11. Bradley J. Holliday & Chad A. Mirkin, Strategies for the Construction of Supramolecular Compounds through Coordination Chemistry- Reviews, Angew. Chem. Int. Ltd., Ed., 2001, 40, 2022-2043., ~CHEMIE@WILEY-VCH
12. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons & Burkhard Raguse, Nanotechnology, Ist Indian Edition, New Delhi, 2005.

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Department of Chemistry
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Course Code	Course title	Category	L	T	P	Credit
MCH20C12	**Course work**	Core-2	6	-	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	100	100	200

Preamble

The course has been framed with an objective of instilling maximum knowledge on organic synthesis, spectroscopy, polymer, nano, green and bio-inorganic chemistry.

Prerequisites

Students with knowledge onorganic synthesis, spectroscopy, polymer, nano, green and bio-inorganic chemistry at postgraduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Explain the guidelines of synthesizing complex organic molecules.	K1, K2
CO2	Synthesize nanoparticles bytop-down and bottom-up process and to investigate their chemical and biological applications.	K3, K4
CO3	Summarisethorough knowledge on the structure and functions of metalloproteins, metalloenzymes and DNA.	K2,K3
CO4	Develop knowledge onpreparation of synthetic Polymer, composites and biopolymers and also to isolate the key design features of products and its mechanism.	K3, K4, K6
CO5	Make use of the instrumentation and applications of NMR,EPR spectroscopic techniques and also able to interpret these spectroscopic data.	K3, K5, K6

K1-Knowledge; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6- Create

Mapping of COs with PSO

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**-**	**M**	**S**	**S**
CO2	**S**	**-**	**M**	**S**	**S**
CO3	**S**	**L**	**M**	**S**	**S**
CO4	**S**	**L**	**S**	**S**	**S**
CO5	**S**	**M**	**S**	**S**	**S**

S-Strong; M-Medium; L-Low

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	-	-	-	-	-	-	-
CO2	-	-	-	-	-	-	-
CO3	-	-	-	-	-	-	-
CO4	-	-	-	-	-	-	-
CO5	-	-	-	-	-	-	-

Blooms Taxanomy	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20	20	--
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total Marks	**120**	**120**	**200**

UNIT I: Advanced Organic synthesis:

Importance of organic synthesis - Key intermediates – Synthon, Retron- synthetic equivalent-starting materials - Retro synthetic analysis- Guideline for best disconnection-synthesis involving functional group interconversion -chemo selectivity, regioselecitivity, stereo selectivity- two group C-X disconnection and synthetic strategies 1,2-1,3-1,4-1,5-1,6 difunctionalised disconnection- use of inclusion compounds such as cyclodextrin, calixarene- carbon-carbon bond forming reaction-suzuki coupling, Heck reaction, sharpless epoxidation.

UNIT II: Nano / Green Chemistry:

Nanoparticles and Carbon nanotubes (singlewalled and multiwalled carbon nanotubes) - Introduction - Methods of preparations – CVD, Laser ablation method – Uses – zinc Oxide, Cadmium sulphide, Titanium dioxide – Synthesis and characterization - Application of nanoparticles: Phosphors, Batteries - Information storage - Solar cells .

Need for Green Chemistry - Solvent free reactions - Microwave assisted synthesis - Role of ionic liquids in green chemistry - Cleaner technology with super critical fluids - Catalytic approach to green chemistry (use of Zeolites, clays, mesoporous materials).

UNIT III: Bio-Inorganic Chemistry:

Metalloproteins: Transport and storage protein: e.g Fe-S protein, Blue-copper protein, Ferritin, Transferritin, Hemocyanin and Heme erythrin. Metalloenzymes: Hydrolases (e.g. Carboxy peptidases and amino peptidases), Oxido reductases (e.g. Superoxide dismutase), Isomerases and Synthatases – (e.g. Vit B_{12})- Nickel containing enzymes - Structure of DNA - types of Nucleic acid interactions - Coordination, intercalation and hydrogen bonding - Interactions of metal ion with Nucleic acid, Redox Chemistry, Hydrolytic Chemistry.

UNIT IV: Polymer Chemistry:

Polymer-Intoduction-Classification-Tactictity-Polymerization- Addition, Co-polymerisation and condensation – Mechanism of polymerization – Free radical mechanism, Ionic mechanism, Zeigler-Nata polymerization- Stucture-Property relationships in polymer-Classification

of plastics- Thermosetting and Thermoplastic resins- Additives-Compounding of plastic-Fabrication-Compression moulding, Injection moulding, Extrusion moulding and Blow moulding- Molecular weight determination-Light scattering, viscosity, osmometry methods- Number average and Average number weight polymer.

Preparation, properties and uses of some important polymeric resins-PE (LDPE and HDPE), Phenol-formaldehyde resins, Silicon resins- composite-ABS, Cellulose-Bio-degradable plolymer.

UNIT V-Spectroscopy:

NMR Spectroscopy - Proton and ^{13}C- fluxional NMR, 2-dimensional NMR - uses of Shift reagents.

ESR spectroscopy - Hyperfine splitting -factors affecting 'g' value - anisotropy of 'g' and 'A' tensors - Zero field splitting - Krammer's degernacy - EPR spectra of Cu (II) Complexes. Jahn - Teller distortion in Cu(II) complexes. Evaluation of bonding parameters.

Analysis and Interpretation of Spectra of simple Aliphatic and Aromatic compounds using IR, UV, NMR, MASS, XRD techniques.

References:

1) Jerry March, Advanced Organic Chemistry, (Appendix A), IV edition, John Wiley and Sons, NewDelhi, 2000.
2) S. Warren, Organic Synthesis, The disconnection approach, John Wiley and Sons, U.K , 2004.
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4) R. K. Mackie and D. M. Smith, Guide book to Organic Synthesis, Longman, Newyork, 1999.
5) V.R. Gowarikar, etal., Polymer Science I Edn., Wiley Eastern Ltd., New York,1986.
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7) Fred. W. Billmeyer, JR, Text book of Polymer Science III Edition, John Wiley and Sons, NewYork.
8) James E. Huheey, Eller A. Keiter and Richard L. Keiter, Inorganic Chemistry, IV Edn., Harper Collins College Publishers, New York,1993.
9) Bertini I.G.,Bio-Inorganic Chemistry, Viva books private Limited,1998.
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15) C.N.R Rao, A. Muller and A.K. Cheethar, The Chemistry of Nanomaterials-Synthesis, Properties and Applications Vol. 1 and 2, Wiley –VCH – Verlag GmoH & Co., Wilhelm, 2004.
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17) Charles P. Poole, Jr, Frank J. Owens, Introduction to NanoTechnology, John Wiley and Sons, Inc., New York , 2003.
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Course designer

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Dr. A. R. Ramesh

THIAGARAJAR COLLEGE(Autonomous), MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined M.Phil Chemistry on or after June 2020)

Course Code	Course title	Category	L	T	P	Credit
MCH20C13	**In-Depth study**	Core-3	6	-	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
I	I	100	100	200

Preamble

This course gives in-depth knowledge in specific area of chemical sciences.

Prerequisites

Students with a comprehensive understanding of research methodologies, techniques, thorough knowledgeof the literature and have the ability to do the critical evaluation of current research.

Course outcomes

On the completion of the course the student will be able to

#	Course Outcome	Knowledge level
CO1	Show thorough knowledge of the literature, applicable to their own research.	K1, K2
CO2	Develop a comprehensive understanding of experimental and analytical techniques.	K3
CO3	Design their research problem independently.	K6
CO4	Analyze and give logical explanation to their research findings with valid experimental evidences.	K3, K4
CO5	Do critical evaluation of current research, research techniques and methodologies.	K5, K6

K1-Knowledge; K2-Understand; K3-Apply; K4-Analyze; K5-Evaluate; K6- Create

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**S**	**M**	**S**
CO2	**S**	M	**S**	**S**	**S**
CO3	**S**	S	**S**	**M**	**S**
CO4	**S**	**S**	**S**	**S**	**S**
CO5	**S**	**M**	**S**	**S**	**S**

S-Strong; M-Medium; L-Low

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**-**	-	**-**	-	-	**-**	**-**
CO2	-	-	**-**	-	-	**-**	**-**
CO3	-	-	**-**	-	-	**-**	**-**
CO4	-	-	**-**	-	-	**-**	**-**
CO5	-	-	**-**	**-**	-	**-**	**-**

Blooms Taxanomy	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20	20	--
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total Marks	**120**	**120**	**200**

This paper is based on the project work proposed by the guide for each student. Guide shall give **10-research articles** related to the project work from reputed international and other journals. For internal evaluation, a written test will be conducted for 2-**hours and will be evaluated by the guide**. The students are expected to give a seminar and assignment. The summative examination question papers will be set by the guide and one examiner will evaluate all the answer scripts.

Internal = 100 (Internal test: 60; Seminar:25; Assignment: 15)
External = 100

Total = 200

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Course Code	Course title	Category	L	T	P	Credit
MCH20PJ21	**Project**	-	6	-	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
I	II	100	100	200

Preamble

The research in chemistry requires the knowledge on laboratory synthesis, analysis, analytical data interpretation and able to communicate the laboratory scientific results both in oral, written and electronic format to both chemists and non-chemists. This course fulfills the said requirements.

Prerequisites

Students with minimum knowledge on preparation, characterization and analytical data interpretation at postgraduate level.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome
CO1	Get skills on developing novel materials through new synthetic routes.
CO2	Characterize the materials using various analytical techniques.
CO3	Interpret the analytical data and able to correlate theoretical and experimental results.
CO4	Communicate the laboratory scientific results both in oral, written and electronic format to both chemists and non-chemists.
CO5	Learn research methodologies along with literature survey.

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**S**	**M**	**S**
CO2	**S**	**M**	**S**	**S**	**S**
CO3	**S**	**S**	**S**	**S**	**S**
CO4	**S**	**S**	**S**	**M**	**S**
CO5	**S**	**M**	**S**	**M**	**S**

S-Strong; M-Medium; L-Low

Mapping of COs with POs

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	**-**	-	**-**	-	-	**-**	**-**
CO2	-	-	**-**	-	-	**-**	**-**
CO3	-	-	**-**	-	-	**-**	**-**
CO4	-	-	**-**	-	-	**-**	**-**
CO5	-	-		**-**	-	**-**	**-**

Dissertation work is a Two Semesters Sequential Course:

After the successful completion of the theory courses, students should carry out the project selected in the first semester supplemented by experimental investigations.

Progress Report:

The first progress report should be presented to the Department before the 60th working day of the second semester.

Preview of dissertation:

The student will present the preview of the dissertation by the 75th working day of the semester to the Department.

Submission of dissertation:

The student has to submit four typed copies of dissertation by the 85th working day of the second semester to the department. A copy of this dissertation will be sent to the external examiner for review.

Evaluation of dissertation:

The Head of the PG department will be the chairman and the convener of the research committee. Internal valuation will be done by the guide. A public viva-voce examination will be conducted by a panel of examiners consisting of an external examiner who valued the dissertation and the guide.

Marks:

Thesis evaluation by external examiner	: 100
Viva-voce (Project guide)	: 50
Viva-voce (external examiner)	: 50

	200
