Thiagarajar College

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

Thirty Eighth Academic Council Meeting

Department of Chemistry

Dr. Rm. Murugappan

Dean – Curriculum Development

B.Sc. Chemistry

Programme Code-UCH

THIAGARAJAR COLLEGE, MADURAI – 9.

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

Curriculum structure for

B.Sc., CS, IT & BCA BBA & B.Com

(For those who joined in 2019 and after)

Catergory	Course	No.of Courses /paper	Credit Distribution	Hrs/ Week	Total Credits
Part I	Tamil	2	3	-	06
Part II	English	2	3	-	06
		Sub Total			**12**
Part III	Core	-	-	-	84
	Elective –Main	2	5	-	10
	Elective – Generic	2+2	5	-	20
		Sub Total			**114**
Part IV	**AECC** I &II Sem	I sem EVS II Sem .Prof.Skill Development	2	4	04
	NME III & V Sem Horizontal Migration **SEC** IV & VI Sem Vertical Migration	2 2	2	8	08
	Value Education V Sem	1	1	2	**01**
		Sub Total		**14**	**13**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality Circle/ Library/ SSL/ Nature Club/Value Education/ YRC/WSC**				**01**
	Grand Total				**140**
	Self-Study Paper (Optional)- -V Sem			**05**	**145**

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 &V semester)
- For SEC every department offer three papers for each course (Sem IV & VI)
- For Major elective there may be an option for choice.

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with ‘A’ Grade by NAAC)

Curriculum structure for

BA Tamil, English & Economics

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

(For those who joined in 2019 and after)

Catergory	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	72
	Elect –Main	2	5	10	10
	Elect – Generic	2+2	5	24	20
		Sub Total		**118**	**102**
Part IV	**AECC** I &II Sem	I sem EVS II Sem .Prof.Skill Development	2	4	04
	NME III & V Sem Horizontal Migration **SEC** IV & VI Sem Vertical Migration	2 2	2	8	08
	Value Education V Sem	1	1	2	**1**
		Sub Total		**14**	**13**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality/WSC Circle/ Library/ SSL/ Nature Club/Value Education/ YRC**				**1**
	Grand Total				**140**
	Self-Study Paper (Optional)- -V Sem			**05**	**145**

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 &V semester)
- For SEC every department offer three papers for each course (Sem IV & VI)
- For Major elective there may be an option for choice.

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 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.

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 an all rounded professionals in terms of effective communication, skillful execution, good leadership qualities and a teamwork.
PEO4	To provide solutions for societal issues such as environmental protection, occupational health and safety, resource management and appropriate business skills.
PEO5	To develope life-long learning skills and abilities.

Program Speciific 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 theoriesincluding environmental and biological Chemistry.
PSO2	Tocarry out scientific experiments with the help of laborataory 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
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who joined in 2019 and after)
Programme Code:UCH
BACHELOR OF CHEMISTRY
Semester – I

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I	U19TM11	Tamil	6	3	90	25	75	100
Part II	U19EN11	English	6	3	90	25	75	100
Core 1	UCH19C11	Fundamental concepts in organic chemistry	3	3	45	25	75	100
Core 2	UCH19C12	Fundamental concepts in Inorganic and Physical Chemistry	3	3	45	25	75	100
Core Lab –I	UCH19 CL11	Organic qualitative analysis	4	2	60	40	60	100
Generic elective.	UPH19GE11C	Physics I	4	4	60	25	75	100
Gen.ele. lab	UPH19GL21C	Physics practical –I	2	-	30	-	-	-
AECC (I)	U19ES11	Environmental Science	2	2	30	15	35	50
Total			**30**	**20**	**450**			

Semester – II

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Part I	U19T M21	Tamil	6	3	90	25	75	100
Part II	U19EN2 2	English	6	3	90	25	75	100
Core 3	UCH19 C21	Inorganic Chemistry - I	3	3	45	25	75	100
Core 4	UCH19 C22	Physical Chemistry - I	3	3	45	25	75	100
Core lab-II	UCH19 CL21	Inorganic qualitative analysis	4	2	60	40	60	100
Generic elective	UPH19G E21C	Basic Electronics	4	4	60	25	75	100
Gen.ele. lab	UPH19G L21C	Ancillary physics practical	2	2	30	0	60	100
AECC (II)	UCH19A E21	Personality Development	2	2	30	15	35	100
			30	**22**	450			

Semester – III

Course	Code No	Subject	Hrs/ Week	Credits	Total Hrs	Max Marsk CA	Max Marks SE	Total
Part I	U19TM31	Tamil	6	3	90	25	75	100
Part II	U19EN31	English	6	3	90	25	75	100
Core 5	UCH19 C31	Inorganic Chemistry – II	3	3	45	25	75	100
Core 6	UCH19 C32	Organic Chemistry-I	3	3	45	25	75	100
Core lab-III	UCH19 CL31	Inorganic volumetric analysis	4	2	60	40	60	100
Generic Eletive	UMA19/UMB19 GE31C	Allied Maths / Zoology -I	4	4	60	25	75	100
Generic lab	UMB19 GL41C	Allied Zoology practical	2	-	30	-	-	-
Non-Major Elective	UCH19 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 Mark CA	Max Marks SE	Total
Part I	U19TN41	Tamil	6	3	90	25	75	100
Part II	U19EN41	English	6	3	90	25	75	100
Core 7	UCH19 C41	Organic chemistry – II	3	3	45	25	75	100
Core 8	UCH19 C42	Physical Chemistry-II	3	3	45	25	75	100
Core lab-IV	UCH19 CL41	Estimation and Preparation of organic compounds	4	2	60	40	60	100
Generic elective	UMA19/UMB19 GE41C	Allied Maths / Zoology -II	4	4	60	25	75	100
Generic ele.lab	UMB19 GL41C	Allied Zoology practical – I	2	2	30	40	60	100
SEC(I)	UCH19 SE41	Agricultural Chemistry (option A) Dairy Chemistry(Option B) Forensic Chemisty(Option C)	2	2	30	15	35	50
Total			**30**	**22**	**450**			

Semester – V

Course	Code	Subject	Hrs/ Week	Credits	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 9	UCH19 C51	Inorganic Chemistry-III	6	6	90	25	75	100
Core 10	UCH19 C52	Organic Chemistry-III	6	6	90	25	75	100
Core11	UCH19 C53	Physical Chemistry – III	5	5	75	25	75	100
Core lab-V	UCH19 CL51	Inorganic Estimations and Preparations	4	2	60	40	60	100
Core ele. I	UCH19 CE51 (A/B)	Group theory and spectroscopy (Option-A) Industrial Chemistry (Option B)	5	5	75	25	75	100
Non-Major elective-II	UCH19 NE51	Processing of consumer products -Lab	2	2	30	25	75	100
Value Education	U19VE51	Value Education	2	1	30	15	35	50
Total			**30**	27	450			

Semester – VI

Course	Code	Subject	Hrs/ Week	Credits	Total Hrs	Max Marks	Max Marks SE	Tota l
Core 12	UCH19 C61	Inorganic Chemistry and Computer Applications	6	6	90	25	75	100
Core 13	UCH19 C62	Organic Chemistry-IV	6	6	90	25	75	100
Core 14	UCH19 C63	Physical Chemistry-IV	6	6	90	25	75	100
Core lab-VI	UCH19 CL61	Experiments in Physical Chemistry	5	3 (1L:0T:2P)	75	40	60	100
Core. Elective II	UCH19 CE61 (A/B)	Coordination Chemistry(option A) Bioinorganic Chemistry (option B)	5	5	75	25	75	100
SEC (II)	UCH19 SE61 (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	(6+6+6+6+17+18) = 59 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+2 = 04 Credits
	SEC	2+2 = 04 Credits
	Open elective	2+2 = 04 Credits
	Value Education	1 = 01 Credits
Part V		1 = 01 Credits
	Total	**= 140 Credits**

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

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Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2019)
Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19C11	Fundamental Concepts in Organic Chemistry	Core-1	3	-	-	3

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 thehybridisation and structure organic compounds and reaction intermediates; Correlate the electron displacement effect and physical effects such as stabilityand reactivity.	K1, K2, K3
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 methodsof organic molecules such as Distillation, Crystallisation, Sublimation and Chromatographic techniques.	K1, K3

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

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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

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, 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 (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 8 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.
Conformations of cyclohexane.

UNIT-IV 10 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).

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 text book of Organic Chemistry, 1st edition, Vikas Publishing House Pvt Ltd, New Delhi.

Course designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi

Course contents and lecture schedule

Unit	Topic	No. of lecture hrs
I	**IUPAC NOMENCLATURE, STRUCTURE, BONDING AND PROPERTIES**	**11**
1.1	Classification and nomenclature of organic compounds – IUPAC systems.	2
1.2	Structure and shape of organic molecules: Hybridization:Definition, sp^3 hybridization of carbon, Bonding in methane	1
1.3	sp^2 hybridization in alkenes (ethene).	1
1.4	sp hybridization in alkynes (ethyne).	1
1.5	Reactive Intermediates: Carbocations, Carbanions and free radicals, and carbenes (Structure and stability).	3
1.6	Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation.	2
	Revision	1
II	**FUNDAMENTALS OF REACTION MECHANISM AND ISOMERISM**	**7**
2.1	Cleavage of Bonds: Homolysis and Heterolysis.Types of reagents:Electrophilic and Nucleophilic reagents –Definition and examples.	1
2.2	Types of organic reactions	1
2.3	Isomerism:Definition, types of isomerism- structural isomerism – chain, position, functional isomers (explanation with examples)	2
2.4	metamerism – tautomerism (explanation with examples)	1

2.5	stereo isomerism – Geometrical or cis trans isomerism – Geometrical isomerism in alkenes with examples.	1
	Revision and test	1
III	**ALKANES AND CYCLOALKANES**	**8**
3.1	Alkanes: Preparation (Catalytic hydrogenation, from alkyl halide, By Wurtz reaction, By Corey-House synthesis).	1
3.2	Physical and chemical properties (free radical halogenations reaction).	1
3.3	Cycloalkanes: Definition, nomenclature, symbols.	1
3.4	Stability:Baeyer's strain theory and its limitations, Sache-Mohr theory.	2
3.5	Conformations of cyclohexane and its mono and disubstituted derivatives.	2
	Revision and test	1
IV	**STEREOCHEMISTRY**	**10**
4.1	Conformations with respect to ethane and butane.	1
4.2	Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations.	3
4.3	Concept of chirality (upto two carbon atoms).	1
4.4	Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L.	1
4.5	cis – trans nomenclature; E / Z Nomenclature (for alkenes)	1
4.6	CIP Rules: R/ S (one chiral carbon atoms)	2
	Revision and test	1
V	**PURIFICATION TECHNIQUES**	**9**
5.1	Different methods of purification of organic substances	1
5.2	Distillation: under reduced pressure - steam distillation	1
5.3	Soxhlet method	1
5.4	Crystallization – Sublimation – Fractional distillation.	1
5.5	Chromatography – adsorption chromatography (column) – partition chromatography (paper)- Thin layer chromatography (TLC).	2
5.6	Gas chromatography (GC)	1
5.7	High Pressure Liquid Chromatography (HPLC)	1
	Revision and test	1
	Total(11+7+8+10+9)	**45**

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Department of Chemistry
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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19C12	Fundamental concepts in Inorganic & Physical Chemistry	Core 2	3	-	-	3

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 and enable 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	Spell the atomic structure of atom and related theories and concepts.	K1
CO2	Classify the elements and compare their periodic properties.	K1, K2
CO3	Explain the metallurgical processes involved in the extraction of metals.	K2
CO4	Make use of the physical behaviour of gases and liquids.	K2, K3
CO5	Apply the colligative properties of dilute solutions.	K1, K2

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

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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Unit I: Atomic Structure **(9 hrs)**
Rutherford model of the atom- defects of Rutherford model - Discovery of neutron, Bohr model of an atom- merits and demerits- Hydrogen atom spectra - Sommerfield modification- de Broglie's concept- dual nature, 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: Periodicity and Periodic properties **(9 hrs)**
Periodic law and Cause of periodicity. Division of elements in to s, p, d and f blocks.
General Properties of atoms: Atomic properties- Elementary ideas of Covalent radius - van der Waals radius-Ionic radius and their periodic trends. Ionisation Energy, Electron affinity, Electronegativity-Pauling, Mulliken-Jaffe, Allred-Rochow definitions.

Unit III: 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.

Unit IV: States of Matter (Gas and Liquid) **(9 hrs)**
Gaseous State: Postulates and derivation of the kinetic gas equation - Kinds of velocities - mean, RMS, most probable velocities (definition only) – Collision frequency – mean free path - Deviation of real gas from ideal behaviour- Derivation of van der Waal‘s equation.
Liquid State: Physical properties of liquids – Vapour pressure – surface tension – coefficient of viscosity – Effect of temperature and pressure on viscosity – concentration terms – molarity (M), Normality (N), molality (m), formality, mole fraction, percentage concentration.

Unit V: Colligative Properties of Dilute Solution **(9 hrs)**
Colligative Properties: Relative lowering of vapour pressure – elevation of boiling point – depression in freezing point – osmotic pressure – Applications in calculating molar masses of normal solutes in solution.**Dilute Solution**: Lowering of vapour pressure – Raoult's and Henry's Law and their applications.

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.

Course designers
1. Dr.D.S. Bhuvaneshwari
2. Dr. T.Arumuganathan K. Selvakumar

Unit	Topic	No. of Lecture Hours
I	**Atomic Structure**	**9**
1.1	Rutherford model of the atom- defects of Rutherford model	1
1.2	Discovery of neutron	1
1.3	Bohr model of an atom- merits and demerits	1
1.4	Hydrogen atom spectra	1
1.5	Sommerfield modification	1
1.6	de Broglie's concept- dual nature	1
1.7	Quantum numbers	1
1.8	Shapes of s, p, d atomic orbitals	1
1.9	Arrangement of electrons in atoms- Hund's rule – Pauli exclusion principle- Heisenberg's uncertainty principle.	1
II	**Periodicity and Periodic properties**	**9**
2.1	Periodic law and Cause of periodicity	1
2.2	Division of elements in to s, p, d and f blocks.	2
2.3	General Properties of atoms: Atomic properties- Elementary ideas of Covalent radiusVanderwaals radius-Ionic radius and their periodic trends	3
2.4	Ionisation Energy, Electron affinity, Electronegativity-Pauling, Mulliken-Jaffe, Allred-Rochow definitions	3
III	**Metallurgical Processes**.	**9**
3.1	Definition for minerals and ores - ore dressing	1
3.2	Gravityseparation - froth flotation-magnetic separation - chemical separation	1
3.3	calcination and roasting	1
3.4	Extraction of metal-chemical reduction-auto reduction-electrolytic reduction-metal displacement	2
3.5	Refining methods - distillation - fractional crystallization - van Arkel method - electrolytic refining - vapour phase refining	2
3.6	Ion exchange method-muffle furnace	2
IV	**STATES OF MATTER (GAS AND LIQUID)**	**9**
4.1	**Gaseous State**: Postulates and derivation of the kinetic gas equation	2
4.2	Kinds of velocities - mean, rms, most probable velocities (definition only)	1
4.3	Collision frequency and mean free path	1
4.4	Deviation of real gas from ideal behaviour	1
4.5	Derivation of Vander Waal's equation	1
4.6	**Liquid State**: Physical properties of liquids – Vapour pressure –	2

	surface tension – coefficient of viscosity	
4.7	Effect of temperature and pressure on viscosity	1
V	**COLLIGATIVE PROPERTIES OF DILUTE SOLUTION**	**9**
5.1	Colligative Properties-Relative lowering of vapour pressure – elevation of boiling point	2
5.2	Colligative Properties - depression in freezing point – osmotic pressure	2
5.3	Applications of colligative properties in calculating molar masses of normal solutes in solution	3
5.4	Dilute Solution - Lowering of vapour pressure – Raoult's and Henry's Law and their applications.	2

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Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2019)
Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19CL11	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 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

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. Chloro and nitro aromatic compounds.
7. Aliphatic diamides.

Course designers

1. Dr. P. TharmarajDr. P. PrakashDr. R. MahalakshmyDr. A. TamilSelvi

THIAGARAJAR COLLEGE, MADURAI-625 009
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Course Code	Course Title	Category	L	T	P	Credit
	Environmental science	AECC (I)	2	-	-	2

Year	Semester	Int. Marks	Ext marks	Total
1	I	15	35	50

Preamble

The course outlines the structure of an ecosystem, environment, ecological resources, environmental degradation, methods for the conservation of our environment.

Course Outcomes

On the completion of the course the student will be able

	Course Outcomes	Knowledge level
CO1	Spell thecauses, effects of environmental pollution and scope of the environmental studies.	K1
CO2	Explain the structure of an ecosystem, food web, biodiversity and its value.	K2
CO3	Identify the E-waste and plastic waste and apply their disposal methods.	K3
CO4	Develop the methods to control air pollution, water pollution, noise pollution and radioactive pollution.	K3

K1 : Knowledge   K2 : Understand   K3: Apply

Mapping of COs with POs

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

S-Strong;   M-Medium;   L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

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Course Code	Course title	Category	L	T	P	Credit
UCH19C21	**Inorganic Chemistry – 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 and shape of covalent molecules, 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	Tell the formation of different types of chemical bonding and their significance.	K1
CO2	Predict the hybridization and geometry of molecules based on VB and VSEPR theories and explain the molecular orbital theory(MOT) of homo and heteronuclear diatomic molecules.	K1, K2, K3
CO3	Outline the general characteristics of s block elements and the preparation, properties and uses of their compounds.	K2, K3
CO4	Tellthe general characteristic of p-block elements especially Boron and preparation, properties and structure of their compounds.	K1
CO5	Comprehend the properties and structure of allotropes of carbon,silicates and oxides and chlories of carbon compounds.	K1

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

Mapping of COs with POs

	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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Unit I: Chemical Bonding **(9 hrs)**

Chemical bond - definition, types of chemical bonds.
Ionic or electrovalent bond - Definition, Illustration of the formation of ionic bond (Examples: NaCl, MgO, CaF_2, Al_2O_3 only), Condition for the formation of ionic compounds, Born Haber cycle.

Covalent bond: Definition, types of covalent bond (single, double and triple), Illustration of the formation of covalent bond (Example: HF, H_2O, NH_3, O_2, N_2 only), factors favouring the formation of covalent compounds.

Coordinate bond: Definition, Illustration of the formation of coordinate bond (Example: H_2O_2, SO_2, CO, NH_4^+, Al_2Cl_6 only), comparision between ionic, covalent and coordinate bond.
Hydrogen bond: Definition, properties, types and significance of hydrogen bonding.

Unit II : Hybridization and Shape of Covalent Molecules **(9 hrs)**

Hybridization –concept-VB theory-sp,sp^2,sp^3spd, spd^2-VSEPR theory-Geometry of $SnCl_2$ NH_3,H_2O. ClF_3,IF_5 . Formation of molecular orbitals from atomic orbitals.

Molecular Orbital Theory- Homonuclear (H_2, Li_2, N_2, O_2) and Heteronuclear (CO and NO) diatomic molecules.

Unit III:- s -Block Elements **(9 hrs)**

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, BeO, $BeCl_2$, calcium carbide, $CaCl_2$, super phosphate of lime, Plaster of Paris and lithopone- **Biological importance.**

Unit IV: 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, boric acid, borohydrides- Hydroboration- Ultramarine. **Anomalous behaviour of Aluminium, Inert pair effect of Thallium.**

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

Group 14 (carbon group): catenation and heterocatenation, allotropy of carbon- Structure of diamond, graphite and fullerenes; Metal carbides, Applications of carbides in industry.

Properties and structure of Silicates (ortho-, pyro-, cyclic-, chain-, sheet-, three dimensional silicates)- **oxides and chlorides of carbon(CO, CO_2, $COCl_2$, CCl_4), $SiCl_4$, bonding in $(SiH_3)_3N$, Pigments of Lead.**

Text Books:

1. Puri B.R, Sharma L.R, and Kalia K.C,2004, Principles of Inorganic Chemistry, 28^{th} edition, Vallabh Publication, NewDelhi.
2. Madan R.D,2002, Modern Inorganic Chemistry, Chand S.& Company, 2^{nd} 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, 4^{th} 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 5^{th} Ed.

Course designers

1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D.S. Bhuvaneswari
4. Dr. K. Selvakumar

Unit	Topic	Hours
I	**Chemical Bonding**	**9**
1.1	Chemical bond - definition, types of chemical bonds.	1
1.2	Ionic or electrovalent bond - Definition, Illustration of the formation of ionic bond (Examples: NaCl, MgO, CaF_2, Al_2O_3 only), Condition for the formation of ionic compounds, Born Haber cycle.	2
1.3	Covalent bond: Definition, types of covalent bond (single, double and triple), Illustration of the formation of covalent bond (Example: HF, H_2O, NH_3, O_2, N_2 only), factors favouring the formation of covalent compounds.	2
1.4	Coordinate bond: Definition, Illustration of the formation of coordinate bond (Example: H_2O_2, SO_2, CO, NH_4^+, Al_2Cl_6 only), comparision between ionic, covalent and coordinate bond.	2
1.5	Hydrogen bond: Definition, properties, types and significance of hydrogen bonding.	2
II	**Hybridization and Shape of Covalent Molecules**	**9**
2.1	Hybridization	1
2.2	Concept-VB theory	1
2.3	$sp, sp^2, sp^3 spd, spd^2$	1
2.4	VSEPR theory	1
2.5	Geometry of $SnCl_2$ NH_3,H_2O. ClF_3,IF_5	1
2.6	Formation of molecular orbitals from atomic orbitals	1
2.7	Molecular Orbital Theory- Homonuclear (H_2, Li_2, N_2, O_2)	1
2.8	Heteronuclear (CO and NO) diatomic molecules	2
III	**s-Block Elements**	**9**
3.1	General characteristics	1

3.2	Anomalous behaviour of lithium and beryllium	2
3.3	Diagonal relationships of lithium with magnesium and beryllium with aluminium	2
3.4	Preparation, properties and uses of lithium hydride, sodium peroxide, potassium iodide, BeO, $BeCl_2$, calcium carbide, $CaCl_2$, super phosphate of lime, Plaster of Paris and lithopone	4
IV	**p- Block Elements (Boron group)**	**9**
4.1	General Characteristics	1
4.2	Extraction of boron, Diagonal relationship of boron with silicon	1
4.3	Reaction of B with other elements, water, air, acids, alkali, metals and non-metals.	1
4.4	Preparation, Properties and structure of diborane	1
4.5	Structure of borazine, boric acid, borohydrides	2
4.6	Hydroboration	1
4.7	Ultramarine	1
V	**p-Block Elements (Carbon group)**	**9**
5.1	Catenation and heterocatenation	1
5.2	Allotropy of carbon- Structure of diamond, graphite and fullerenes	2
5.3	Metal carbides, Applications of carbides in industry	2
5.4	Properties and structure of Silicates (ortho-, pyro-, cyclic-, chain-, sheet-, three dimensional silicates)	2
5.5	Structure of aluminosilicates- mica, clay, zeolites, fullers earth.	1
5.6	Manufacture, Types and Uses of glasses	1

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Course Code	Course title	Category	L	T	P	Credit
UCH19C22	Physical Chemistry – I	Core 4	3	-	-	3

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

Preamble

The course enables the students to gain knowledge on nuclear, polymer, distribution law, catalysis and 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	Explain the basic concepts of nuclear chemistry.	K2
CO2	Analyze Nernst distribution law and its applications.	K3
CO3	Relatethe functions, types and reaction mechanism of catalysts.	K1, K2
CO4	Illustrate physical properties of molecules like distribution, polarization, magnestism etc.	K2, K3
CO5	Outline the chemistry of polymer.	K2

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

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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT I **(9 hrs)**

NUCLEAR CHEMISTRY: Composition of the nucleus - Nuclear forces, Mass defect -'Binding energy – Binding energy per nucleon (Problems related to this) Nuclear stability and Binding energy.

NATURAL RADIOACTIVITY: Types of radioactive rays, Detection and measurement of radioactivity - GM counter method and Wilson cloud chamber method, Fajan's - Russell - Soddy group displacement law – illustration, Laws of radioactive disintegration - derivation of radioactive disintegration constant, average life and half-life period (related simple problems).

UNIT II **(9 hrs)**

DISTRIBUTION LAW

Nernst Distribution law - thermodynamic derivation – limitations, 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

UNIT III **(9 hrs)**

CATALYSIS: Definition- different types of catalysts – homogenous and heterogeneous catalysis, acid-base catalysis, enzyme catalysis- Michaelis-Menton mechanism, auto catalysis- catalytic poisoning- promoters.

UNIT IV **(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 and molecular structure, Magnetic properties of molecules - Magnetic permeability - Magnetic susceptibility - Measurement of magnetic susceptibility, Diamagnetism, Paramagnetism, Ferro magnetism and Anti-Ferromagnetism.

UNIT V **(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, Moulding of polymers – injection and compression.

Text Books

1.Puri B.R., Sharma L.R. and Pathania M.S., 2007, Principles of Physical chemistry, 30thedition, 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 Designer:

1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan

UNIT	TOPIC	No. of Lecturehrs
I	**NULEAR CHEMIISTRY**	
1.1	**NUCLEAR CHEMISTRY**: Composition of the nucleus - Nuclear forces.	1
1.2	Mass defect -'Binding energy – Binding energy per nucleon (Problems related to this) Nuclear stability	2
1.3	**NATURAL RADIOACTIVITY:** Types of radioactive rays	1
1.4	Detection and measurement of radioactivity - GM counter method and Wilson cloud chamber method	2
1.5	Fajan's - Russell - Soddy group displacement law – illustration, Laws of radioactive disintegration	1
1.6	Derivation of radioactive disintegration constant	1
1.7	Average life and half-life period (Problems related to this).	1
	Total	**9**
II	**DISTRIBUTION LAW**	
2.1	Nernst Distribution law-Introduction	1
2.2	Thermodynamic derivation of Nernst distribution law – limitations	1
2.3	Association of solute in one of the solvents	1
2.4	Dissociation of solute in one of the solvents	2
2.5	Solute enters into chemical combination with one of the solvents	2
2.6	Applications of Nernst distribution law	2
	Total	**9**
III	**CATALYSIS**	
3.1	Definition- different types of catalysts	1
3.2	Homogenous catalysis	1
3.3	Heterogeneous catalysis	1
3.4	Acid-base catalysis	2
3.5	Enzyme catalysis- Michaelis - Menton mechanism	2
3.6	Auto catalysis	1
3.7	Catalytic poisoning- promoters.	1
	Total	**9**
IV	**MOLECULAR PROPERTIES AND STRUCTURE**	

4.1	Electrical properties of molecules	1
4.2	polarization of a molecule in an electric field	1
4.3	Derivation of Clausius - Mosotti equation	1
4.4	Dipole moments and molecular structure	1
4.5	Magnetic properties of molecules	1
4.6	Magnetic permeability - Magnetic susceptibility	1
4.7	Measurement of magnetic susceptibility	1
4.8	Diamagnetism – Paramagnetism	1
4.9	Ferro magnetism and Anti-Ferromagnetism	1
	Total	**9**
V	**POLYMER CHEMIISTRY**	
5.1	Classification of polymers	1
5.2	Functionality – Tacticity	1
5.3	Addition polymerization	1
5.4	Condensation polymerization	1
5.5	Thermoplastic resin and Thermosetting resin	1
5.6	Number average molecular weights	1
5.7	Weight average molecular weights	1
5.8	Moulding of polymers- injection	1
5.9	Moulding of polymers- compression.	1

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Course Code	Course title	Category	L	T	P	Credit
UCH19CL21	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 compound 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.
CO2	Eliminate the interfering acid radicals.
CO3	Identify the basic radical and its group.
CO4	Analyse the basic radical systematically.
CO5	Devleop their qualitative analysis skill of any given inorganic salt.

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					

S-Strong; M-Medium; L-Low

Analysis of simple salts
Acid radicals:
Simple: Nitrate, Sulphate, Bromide, Iodide and Carbonate
Interfering: Phosphate, Oxalate, Borate**, tartarate** and fluoride
Basic Radicals:
Lead, Copper, Cadmium, Iron, Nickel, Zinc, Calcium, Barium, Strantium, Magnesium, Ammonium.

Internal Marks Distribution:	**Course Designers**
Acid radical = 15 Basic radical = 15 Procedure = 05 Record = 05	1. Dr. A. Elangovan 2. Dr.D.S.Bhuvaneshwari

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Course Code	Course Title	Category	L	T	P	Credit
UCH19AE21	Personality Development	AECC(II)	2	-	-	2

Year	Semester	Int. Marks	Ext marks	Total
1	II	15	35	50

Preamble

The course briefly outlines the life skill strategies such as effective communication, decision making, goal setting, problem solving, stress management, emotional intelligence and conflict management. Further it enables the students to develop their attitude, self awareness, leadership qualities.

Course Outcomes

On the completion of the course the student will be able

	Course Outcomes	Knowledge level
CO1	Show the life skill strategies, effective communication and decisions making.	K1
CO2	List the causes of a problem and the ways to solve it.	K1
CO3	Demonstrate their attitude, interpersonal skills and emotional intelligence to focus their achievements.	K2
CO4	Practiseleadership qualities and stress management.	K3

K1 : Knowledge K2 : Understand K3: Apply

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Unit I

Life skill strategies- Effective communication, Creative thinking, Decision making, Goal setting, Problem solving, Resume writing.

Unit II
Attitude, Interpersonal Skills, self awareness, SWOT, Emotional Intelligence, Leadership development- Team building, Time, Stress and Conflict Management.

Textbooks
1. N.Chockan 2011 Learn to understand others,Prodigy books, Chennai
2. R. Machakkalaiand L. Saraswathi 2005.Personality development a need. Mangai Publishers, Madurai.

Reference books
1. S.P.Sharma 2005. Youngsters guide for Personality development.Pustak Mahal, New Delhi
2. Sean Convey 1998. The 7 habits of highly effective teens.Fireside New York, USA.

Course designer
Dr. Rm. Murugappan

UNIT	TOPIC	No. of lecture hrs
I		
1.1	Life skill strategies- Effective communication,	3
1.2	Creative thinking, Decision making, Goal setting,	4
1.3	Problem solving	3
1.4	Resume writing.	2
II		
2.1	Attitude, Interpersonal Skills, self awareness,	4
2.2	SWOT,	2
2.3	Emotional Intelligence	2
2.4	Leadership development- Team building,	5
2.5	Time, Stress and Conflict Management.	5

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Course Code	Course title	Category	L	T	P	Credit
UCH19C31	Inorganic Chemistry – II	Core 5	3	-	-	3

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

Preamble

The course explainsthe chemistry of p-block elements, halogens, acids and bases. Also describes the laboratory safety and error analysis techniques.

Course Outcome

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

#	Course Outcome	Knowledge level
CO1	Acquire the knowledge on preparation, properties and uses of nitrogen group compounds.	K1
CO2	Spell the importance of oxygen, oxyhalides and oxyacids of sulphur and biologically important sulphur compounds.	K1
CO3	Compare and evaluate the properties and uses of halogens, oxy acids and noble gases.	K2
CO4	Apply the basic concepts and theories of acids and bases and their properties.	K2, K3
CO5	Develop the knowledge to identity and rectify the various errors occurred in experiments and also to adopt safety methods in laboratory.	K1, K3

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	-	-	S
CO2	S	M	-	S	S
CO3	S	M	S	-	S
CO4	S	M	M	-	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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Unit I : p-Block elements (Nitrogen group) (9 hrs)

Group 15 (nitrogen group): General Characteristics- difference between nitrogen and the rest of the family members. preparation, properties, structure and uses of hydrazine, hydrazoic acid hydroxyl amine. Preparation and structure of ammonia, dinitrogen trioxide, dinitrogen pentoxide, nitrogen dioxide, nitrous oxide, nitric acid, phosphinic acid, phosphonic acid, hypo phosphorus acid, ortho, pyro and meta phosphoric acid – **oxides and sulphides of phosphorus- Allotrophy of phosphorus, Arsenic, Antimony and Bismuth.** Preparation and uses of sodium bismuthate, As_2O_3, Scheele's green, tartaremetic. Preparation and uses of Urea, triple superphosphate, potassium nitrate.

Unit II:p-Block elements (Oxygen group) (9 hrs)

Group 16 (oxygen group): structure and allotropy of elements- preparation, properties and structure of ozone, oxides and oxyacids of Sulphur. Halides and **oxyhalides** of Sulphur, Thionic acids, **thionyl chloride,** permono and perdi sulphuric acid. Biologically important sulphur compounds – sulphur bridged Molybdenum V dimeric complexes.

Unit III: Halogens (9hrs)

Group 17 (halogens): General characteristics, comparison of oxidizing action of halogens. Nomenclature and structure of oxy acids of halogens. **Acid strength of HX**- Preparation, properties and structure of Interhalogen and Psuedohalogens compounds: xenon hexafluoride, xenon oxyfluoride and xenon trioxide, ClF, ICl; ClF_3, BrF_3; ClF_5, BrF_5, IF_5, IF_7, $HClO_4$, I_2O_5, Fluorocarbons- structure and properties. **Isolation of noble gases from the atmosphere-Uses of noble gases.**

Unit IV: A**cids and Bases (9hrs)** Arrehenius concept, proton transfer theory – concept of Lowry and Bronsted – Luxflood concept – the solvent system concept – Lewis concept – Classification of solvents. Relative strength of acids and bases – effect of solvent – leveling effect – effect of polarity and dielectric constant – effect of substituents – factors influencing relative strengths of acids and bases.

Unit V: Laboratory Safety and Error Analysis (9 hrs)

i. Laboratory Safety

Storage and handling of corrosive, toxic and poisonous chemicals-simple first aid procedure for acid and alkali in eye, acid and alkali burns, heat burns and cut by glasses.

ii. Error Analysis

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

Text Books:

1. Puri.B.R., Sharma.L.R., and Kalia.K.C 2004., Principles of Inorganic Chemistry, 28th edition, Vallabh Publication, NewDelhi.
2. Sharma.B.K.,1996, Instrumental methods of chemical analysis, 5th edition, Goel publication, Meerut.

Reference Books:

1. Madan.R.D.2002, Modern Inorganic Chemistry, S. Chand & Company, 2nd edition, New Delhi.
2. Albert.F.A., Cotton 1998, Advanced Inorganic Chemistry, Geofferey Wilkinson, Carlos, Murillo, Manfred Bochmann, John Wiley & Sons, Inc. New York.
3. Huheey J.E and Ellen Keiter A., Richard Keiter L.2004, Inorganic Chemistry, 4th edition, Pearson Education Pvt Ltd, Harper Collins College Publishers, Singapore.
4. Skoog D.A, James F. Hollar and .Niemans T.A,2004, Principles of industrial analysis, 5th edition, Thomson Books Cole, Singapore.

Course designers

1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D.S. Bhuvaneswari
4. Dr. K. Selvakumar

Unit	Topic	No. of Lecture Hours
I	**p-Block elements (Nitrogen group)**	**9**
1.1	General Characteristics- difference between nitrogen and the rest of the family members	1
1.2	Preparation, properties, structure and uses of hydrazine, hydrazoic acid hydroxyl amine	1
1.3	Allotrophy of phosphorus, Arsenic, Antimony and Bismuth	1
1.4	Preparation and structure of ammonia, dinitrogen trioxide, dinitrogen pentoxide, nitrogen dioxide, nitrous oxide, nitric acid, phosphinic acid, phosphonic acid, hypo phosphorus acid, ortho, pyro and meta phosphoric acid	3
1.5	Preparation and uses of sodium bismuthate, As_2O_3, Scheele’s green, tartaremetic.	2
1.6	Preparation and uses of Urea, triple superphosphate, potassium nitrate.	1
II	**p-Block elements (Oxygen group)**	**9**
2.1	Structure and allotropy of elements	1
2.2	Preparation, properties and structure of ozone	1
2.3	Oxides and oxyacids of Sulphur	2
2.4	Halides of Sulphur, Thionic acids, permono and perdi sulphuric acid	2
2.5	Biologically important sulphur compounds – sulphur bridged Molybdenum V dimeric complexes	3
III	**Halogens**	**9**
3.1	General characteristics	1
3.2	Comparison of oxidizing action of halogens	1
3.3	Nomenclature and structure of oxy acids of halogens	2

3.4	Preparation, properties and structure of Interhalogen and Psuedohalogens compounds: xenon hexafluoride, xenon oxyfluoride and xenon trioxide, ClF, ICl; ClF_3, BrF_3; ClF_5, BrF_5, IF_5, IF_7, $HClO_4$, I_2O_5	3
3.5	Fluorocarbons- structure and properties	2
IV	**Acids and Bases**	**9**
4.1	Arrehenius concept, proton transfer theory- concept of Lowry and Bronsted	1
4.2	Luxflood concept – the solvent system concept	1
4.3	Lewis concept	1
4.4	Classification of solvents	1
4.5	Relative strength of acids and bases – effect of solvent – leveling effect – effect of polarity and dielectric constant	2
4.6	Effect of substituents – factors influencing relative strengths of acids and bases	3
V	**Laboratory Safety and Error Analysis**	**9**
5.1	Storage and handling of corrosive, toxic and poisonous chemicals	1
5.2	Simple first aid procedure for acid and alkali in eye, acid and alkali burns, heat burns and cut by glasses	2
5.3	Accuracy, precision	1
5.4	Classification of errors, minimization of errors	1
5.5	Significant figures	1
5.6	Mean and standard deviation	1
5.7	Method of least squares – student T test and Q test	2

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2019)
Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19C32	Organic Chemistry - I	Core-6	3	-	-	3

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

Preamble

This course explains the nomenclature, preparation and chemical properties of organic compounds such as unsaturated hydrocarbons, alkyl halides, alcohols, ethers, thioethers, epoxides, aldehydes & ketones. It also explains the mechanism of addition, elimination and some naming reactions.

Course outcomes

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

#	Course Outcome	Knowledge level
CO1	Spell the chemistry of alkenes and alkynes.	K1
CO2	Explain the preparation and chemical properties of saturated and unsaturated alkyl halides.	K2
CO3	Comprehend the preparation, chemical properties and uses of monohydric, dyhydric and polyhydric alcohols.	K1,K2
CO4	Outline the preparation, chemical properties of ethers, thioethers and epoxides.	K1, K2
CO5	Apply the chemistry of aldehydes and ketones and able to write the mechanism of naming reactions related to this functional groups.	K3

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT-I **9 hrs**

UNSATURATED HYDROCARBONS

Alkenes: Methods of preparation (Catalytic hydrogenation, Birch reduction, Saytzeffs and Hofmann's rule) – addition reactions: Markonikov and anti-Markonikov mechanism of addition to conjugated dienes.

Alkynes: Preparation and Acidity of alkynes – chemical reaction (Nucleophilic and electrophilic addition reactions).

UNIT-II **9 hrs**

ALKYL HALIDES

Haloalkanes: Introduction – Methods of Preparation (from alkanes, alkenes, alcohols, Finkelstein reaction). Chemical properties: Substitution reactions (SN1, SN2 and SNi mechanism) – Elimination reactions (E1 and E2 mechanism).

Unsaturated alkyl halides: Vinyl and allyl chlorides

UNIT-III **9 hrs**

ALCOHOLS

Monohydric alcohols: Classification (1°, 2° and 3°) – Ethanol: preparation (from alkenes, alkanes, Grignard reagent) – Physical properties, acidic nature of alcohols, chemical reactions and uses.

Dihydric alcohol: Ethylene glycol: Preparation, chemical properties and uses.

Trihydric alcohol: Glycerol: Preparation, chemical properties and uses.

UNIT-IV **9 hrs**

ETHERS, THIOETHER AND EPOXIDES

Ethers: Nomenclature - General methods of preparation, Williamson's Synthesis - Properties - Estimation of number of alkoxy groups – Ziesel's method.

Thioethers**:** Nomenclature - General methods of preparation – properties - mustard gas.

Epoxides**:** Synthesis – reactions – acid and base-catalyzed ring opening of epoxides – (Symmetrical epoxides only).

UNIT-V **9 hrs**

ALDEHYDES AND KETONES

General methods of preparation of carbonyl compounds (by oxidation reactions, By heating calcium salts of carboxylic acids) – Reactivity of carbonyl compounds: Nucleophilic addition reactions (Reaction with HCN, Wittings reactiion, Reformsky reaction, Baeyer-Villiger rearrangement, Reactions with NH_3 and their derivatives) – Oxidation reactions, Reduction reactions (Meerwein-Ponndorf-Verley reduction, Wolf-Kishner reduction, Clemmensen reduction), Aldol Condensation reactions – Cannizaro reaction – Distinguishing aldehyde and ketones – Chemistry of acrolein and crotonaldehyde.

Text Book

- Bhupinder Mehta, Manju Mehta, 2015, Organic Chemistry, Prentice Hall of India Pvt Ltd,. New Delhi.
- 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, 1997, Organic chemistry, Vol 1, 6th edition, Pearson Edition, 2005, 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 text book of Organic Chemistry, 1st edition, Vikas Publishing House Pvt Ltd, New Delhi.

Course designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi

Course contents and lecture schedule

Unit	Topic	No. of lecture hrs
1	**UNSATURATED HYDROCARBONS**	**6**
1.1	**Alkenes:** Methods of preparation (Catalytic hydrogenation, Birch reduction, Saytzeffs and Hofmann's rule)	2
1.2	Addition reactions: Markonikov and anti-Markonikov mechanism of addition to conjugated dienes.	2
1.3	**Alkynes:** Preparation and chemical reaction– Acidity of alkynes	2
II	**ALKYL HALIDES**	**9**
2.1	Haloalkanes:Introduction – Methods of Preparation (from alkanes, alkenes, alcohols, Finkelstein reaction).	2
2.2	Chemical properties: Substitution reactions (SN1, SN2 and SNi mechanism)	3
2.3	Elimination reactions (E1 and E2 mechanism).	2
2.4	Unsaturated alkyl halides: Vinyl and allyl chlorides	2
III	**ALCOHOLS**	**9**
3.1	Monohydric alcohols: Classification (1°, 2° and 3°) – nomenclature	2
3.2	Preparation (from alkenes, alkanes, Grignard reagent) – Physical properties, acidic nature of alcohols, chemical reactions and uses.	2
3.3	Dihydric alcohol:Ethylene glycol: Preparation, chemical properties and uses.	2
3.4	Trihydric alcohol: Glycerol: Preparation, chemicalproperties and uses.	2
	Revision	1

IV	**ETHERS, THIOETHER AND EPOXIDES**	**8**
4.1	**Ethers**: Nomenclature-General methods of preparation, Williamson's Synthesis - Properties - Estimation of number of alkoxy groups – Ziesel's method.	3
4.2	**Thioethers:** Nomenclature - General methods of preparation – properties - mustard gas.	3
4.3	**Epoxides:** Synthesis – reactions – acid and base-catalyzed ring opening of epoxides (Symmetrical epoxides only).	2
V	**ALDEHYDES AND KETONES**	11
5.1	General methods of preparation of carbonyl compounds (by oxidation reactions, By heating calcium salts of carboxylic acids)	1
5.2	Reactivity of carbonyl compounds: Nucleophilic addition reactions (Reaction with HCN, Wittings reactiion, Reformsky reaction, Baeyer-Villiger rearrangement, Reactions with NH3 and their derivatives)	3
5.3	Oxidation reactions, Reduction reactions (Meerwein-Ponndorf-Verley reduction, Wolf-Kishner reduction, Clemmensen reduction),	2
5.4	Aldol Condensation reactions – Cannizaro reaction	1
5.5	Distinguishing aldehyde and ketones	1
5.6	Chemistry of acrolein and crotonaldehyde	2
	Revision and test	1
	Total (9+9+8+8+11)	45

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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19CL31	Inorganic Volumetric analysis	Core Lab -III	-	-	4	2

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

Preamble

This course describes the practical procedure for the quantitative estimation of inorganic compounds by volumetric method.

Course outcome

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	Utilize the dichrometric procedure for the estimation of ferrous ion and potassium dichromate.
CO4	Do the quantitative estimation Copper and Potassium dichromate iodometrically.
CO5	Apply various volumetric procedure for the estimation of any inorganic compounds.

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

VOLUMETRIC ANALYSIS
A. ACIDIMETRY - ALKALIMETRY
1. Estimation of Na_2CO_3
Na_2CO_3(Std)-HCl(link) - Na_2CO_3(unknown)
2. Estimation of NaOH
Na_2CO_3 (Std)-HCl(link)- NaOH(unknown)
3. Estimation of Oxalic acid
Oxalic acid(Std)–NaOH(link) –Oxalic acid(unknown)
B. PERMANGANOMETRY
4. Estimation of Oxalic acid
FAS (Std) - $KMnO_4$(link) –Oxalic acid (unknown)

5. Estimation of Ferrous ammonium sulphate

Oxalic acid(Std) - $KMnO_4$(link) –FAS (unknown)

6. Estimation of Ferrous ammonium sulphate

FAS(Std) - $KMnO_4$(link)–FAS(unknown)

C. DICHROMETRY

7. Estimation of ferrous ion

FAS(Std) - $K_2Cr_2O_7$(link) –FAS(unknown)

8.Estimation of potassium dichromate

$K_2Cr_2O_7$(Std) –$FeSO_4$(link) - $K_2Cr_2O_7$(unknown)

D. IODOMETRY

9. Estimation of Copper

$K_2Cr_2O_7$(Std) – Thio(link)- $CuSO_4$(unknown)

10. Estimation of potassium dichromate

$K_2Cr_2O_7$(Std) –Thio(link) - $K_2Cr_2O_7$(unknown)

(Any Eight estimations from the above mentioned volumetric estimations)

Course Designers

1. Dr.A. Elangovan
2. Dr.D.S.Bhuvaneshwari

THIAGARAJAR COLLEGE, MADURAI-625 009
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Programme Code:UCH

Course Code	Course Title	Category	L	T	P	Credit
UCH19NE31	Chemistry in Day-To-Day Life	Non-Major Elective(NME)	2	-	-	2

Year	Semester	Int. Marks	Ext marks	Total
II	III	15	35	50

Preamble

The course briefly outlines the various ingredients present in the consumer products such as tooth pastes, soap, face powder, deodorant, hair conditioners, perfumes, colorants and their preparations. In addition,it also explains the composition and uses of consumer products viz., safety matches, agarbattis *etc*.

Course Outcomes

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

	Course Outcomes	Knowledge level
CO1	Tell the various ingredients present in the consumer products.	K1
CO2	Explain the preparation of shampoos, colorants, tooth pastes, soap, face powder, deodorant, hair conditioners, perfumes, colorants.	K2
CO3	List the composition and uses of consumer products like safety matches, agarbattis etc.	K1
CO4	Develop the skill of making cosmetics and consumer products.	K3

K1 : Knowledge *K2 : Understand* *K3: Apply*

Mapping od COs and PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Unit I: Cosmetics **20 hrs**

Dental Preparations: Tooth pastes- ingredients, their characteristics and functions. Mouth washes (Composition only). Soap- Hard soap, Soft soap- types. Face powder (Composition only), Deodorants and antiperspirants-Distinction between astringents and deodorants, deodorant powders (Composition only), Hair care preparations: shampoo different types and formulations, hair conditioners and setting lotions.Hair colourants: Hair lighteners and bleaches, Temporary colourant, Semi-permanent colourants, permanent colourants – vegetable dyes. Moisturizing creams, Perfumes, Lip sticks, shaving creams, after shave preparations.

Unit II: Consumer Products **10hrs**

Composition and Uses of Safety Matches, Agarbattis, Naphthalene Balls, Wax candles, shoe polish, Gum, Ink, Chalk crayons.

Text Books:

1. Poucher, W.A. Perfumes, Cosmetics and soaps, Vol. III, Modern Cosmetics.
   Simons, J.V. Chemistry and the beauty business.
2. B.K.Sharma, Industrial Chemistry, Goel publishing House, Meerut, 2003, New Delhi.

Reference Books:

1. R.V.Shreve, Industrial Chemical Process, Tata McGraw Hill publishing company, 2005, Mumbai.
2. Mohan Malhotra, Latest Cottage Industries, 20th Edition Edn, Vishal publishers, 1980, Meerut.

Course Designer

Dr. D. Bhuvaneshwari

Unit	Topic	No. of Lecture Hours
I	**Cosmetics**	
1.1	Dental Preparations: Tooth pastes- ingredients, their characteristics and functions. Mouth washes (Composition only)	3
1.2	Soap- Hard soap, Soft soap- types.	2
1.3	Face powder (Composition only)	1
1.4	Deodorants and antiperspirants-Distinction between astringents and deodorants, deodorant powders (Composition only),	3
1.5	Hair care preparations: shampoo different types and formulations, hair conditioners and setting lotions.	3
1.6	Hair colourants: Hair lighteners and bleaches, Temporary colourant, Semi-permanent colourants, permanent colourants – vegetable dyes	4
1.7	Moisturizing creams, Perfumes, Lip sticks	2
1.8	Shaving creams, after shave preparations	2

II	**Consumer Products**	
2.1	Composition and Uses of Safety Matches	2
2.2	Agarbattis, Naphthalene Balls	2
2.3	Wax candles, shoe polish	2
2.4	Gum, Ink	2
2.5	Chalk crayons	2

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Department of Chemistry
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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19C41	Organic Chemistry - II	Core-7	3	-	-	3

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

Preamble

This course explains the preparation, properties and synthetic applications of carboxylic acids, aldehydic acids, ketonic acids, aliphatic nitrogen compounds, organometallic reagents. Also discusses about the chemistry of carbohydrates.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Tell the chemistry of saturated, unsaturated and substituted carboxylic acid.	K1
CO2	Comprehend the preparation, properties and synthetic applications of aldehydic and ketonic acid.	K1, K2
CO3	Explain the preparation and chemical properties of aliphatic nitrogen compounds	K1,K2
CO4	Develop their knowledge on the chemistry of organometallic reagents and their synthetic applications.	K3
CO5	Apply the chemistry of carbohydrates like glucose, fructose, sucrose, starch and cellulose.	K3

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

Mapping of COs with POs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT –I **9 hrs**

CARBOXYLIC ACID AND THER DERIVATIVES

Saturated Monocarboxylic acids: Resonance structure of the carboxyl group – relative strength of acidity of carboxylic acids (effect of substituent effect). Acid derivatives (preparation and chemical properties): acid chlorides, anhydrides, amides and esters.

Unsaturated monocarboxylic acids: Preparation and chemical reactions of acrylic and crotonic acids.

Hydroxyl acids – alpha and beta hydroxyl acids – preparation and reactions – action of heat – chemistry of lactic and tartaric acids.

UNIT –II **9 hrs**

ALDEHYDIC AND KETONIC ACIDS

Preparation and properties of glyoxalic acids, pyruvic and laevulic acid – Preparation and synthetic importance of acetoacetic ester.

Dicarboxylic acids: Preparation and properties of Oxalic acid, malonic acid, succinic acid, glutaric acids – reactions of reactive methylene group.

Unsaturated dicarboxylic acid: Prpearation and properties of fumaric and maleic acid

UNIT –III **9 hrs**

ALIPHATIC NITROGEN COMPOUNDS

Nitroalkanes: Preparation, properties, and structure of nitroalkanes – chemical reactions of nitroalkanes.

Alkyl cyanides and isocyanides: Preparation and chemical reactions – Distinction between ethylcyanide and ethylisocyanides.

Aliphatic amines: Classification – Nomenclature - General methods of preparation, primary amine preparation (Lossen rearrangement, Hofmann degradation of amides, Curtius reaction) – Properties and reaction - separation of mixture of amines (Hofmann's method) – Basicity of amines - distinction between primary, secondary and tertiary amine.

Aliphatic diazo compounds: Preparation and properties of diazomethane.

UNIT-IV **9 hrs**

ORGANOMETALLIC REAGENTS

Organo magnesium halides: preparation, reactions and synthetic uses of Grignard reagents and its limitations.

Organolithiums: General methods of preparation, reactions, and synthetic applications.

Lithium Dialkylcuprates (Gilman reagent): Preparation and synthetic uses.

Tetra ethyl lead (TEL): preparation, reactions and synthetic uses.

UNIT-V **9 hrs**

CARBHOYDRATES

Introduction and classification — glucose – mutarotation – Killiani-Fischer synthesis – Ruff degradation - structure elucidation of glucose – Fructose: Structure elucidation of fructose - methods of interconversion between aldose and ketose – Disaccharides – sucrose – structure elucidation – Polysachharides - starch and cellulose (classification and structure only).

Text Book:

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

References:

1. I.L.Finar, 2005, Organic chemistry Vol I, 6th edition, Pearson Edition, Singapore.
2. R.T. Morrision, and R.N. Boyd, Organic chemistry, 6th edition, Prentice Hall Private Limited, 1997, 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 text book of Organic Chemistry, 1st edition, Vikas Publishing House Pvt Ltd, New Delhi.
5. P.S. Kalsi, 2005, Stereo chemistry, Conformation and Mechanism, 4th edition, New Age International Publishers, New Delhi.

Course designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi

Unit	Topic	No. of lecture hrs
I	**CARBOXYLIC ACID AND THER DERIVATIVES**	**9**
1.1	Saturated Monocarboxylic acids: Resonance structure of the carboxyl group – relative strength of acidity of carboxylic acids (effect of substituent effect).	2
1.2	Acid derivatives (preparation and chemical properties):: acid chlorides, anhydrides, amides and esters.	2
1.3	Unsaturated monocarboxylic acids: Prearation chemical reactions of acrylic, and crotonic acids.	2
1.4	Hydroxyl acids – alpha and beta hydroxyl acids – preparation and reactions – action of heat	2
1.5	chemistry of lactic and tartaric acids.	1
II	**ALDEHYDIC AND KETONIC ACIDS**	**9**
2.1	Preparation and properties of glyoxalic acids, pyruvic and laevulic acid	2
2.2	Preparation and synthetic importance of acetoacetic ester.	1
2.3	Dicarboxylic acids: Preparation and properties of Oxalic acid, malonic acid, succinic acid, glutaric acids – reactions of reactive methylene group.	4
2.4	Unsaturated dicarboxylic acid: Prpearation and properties of fumaric and maleic acid	2
III	**ALIPHARTIC NITOGEN COMPOUNDS**	**9**

3.1	Nitroalkanes: Preparation, properties, and structure of nitroalkanes – chemical reactions of nitroalkanes	2
3.2	Alkyl cyanides and isocyanides: Preparation and chemical reactions – Distinction between ethylcyanide and ethylisocyanides.	2
3.3	Aliphatic amines: Classification – Nomenclature	1
3.4	Primary amine preparation (Lossen rearrangement, Hofmann degradation of amides, Curtius reaction)	1
3.5	Separation of mixture of amines (Hofmann's method)	1
3.6	Basicity of amines - distinction between primary, secondary and tertiary amine.	1
3.7	Aliphatic diazo compounds: Preparation and properties of diazomethane.	1
IV	**ORGANOMETALLIC REAGENTS**	**9**
4.1	Organo magnesium halides: preparation, reactions and synthetic uses of Grignard reagents – Limitations of Grignard reagents	2
4.2	Organolithiums: General methods of preparation, reactions, and synthetic applications.	2
4.3	Lithium Dialkylcuprates (Gilman's reagent): Preparation and synthetic uses.	1
4.4	Tetra ethyl lead, TEL: preparation, reactions and synthetic uses.	3
	Revision and test	1
V	**CARBHOYDRATES**	**9**
5.1	Introduction and classification	1
5.2	Glucose – mutarotation	1
5.3	Killiani-Fischer synthesis – Ruff degradation	1
5.4	Structure of glucose – Fructose: Structure of fructose	2
5.5	Methods of interconversion between aldose and ketose	1
5.6	Disaccharides – sucrose – structure elucidation	1
5.7	Polysachharides - starch and cellulose (classification and structure only).	1
	Revision and test	1
	Total (9+9+9++9+9)	**45**

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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19C42	Physical Chemistry-1I	Core-8	3	-	-	3

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

Preamble

The course enables the students to gain knowledge on three laws of the thermodynamics, their applications and equilibrium principle.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Understand the fundamentals of first law of thermodynamics.	K2
CO2	Gain knowledge on the second law of thermodynamics and its applications.	K1, K3
CO3	Acquire the concepts of third law of thermodynamics and its applications.	K2
CO4	Aware of the heat changes accompanying in chemical reactions.	K3
CO5	Understand the basic principles of chemical equilibrium.	K2

K1-Knowledge K2-Understand K3-Apply

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT – I **(9 hrs)**

FIRST LAW OF THERMODYNAMICS

Importance of thermodynamics- limitations of thermodynamics-concepts of a system and surrounding, state variable- extensive and intensive properties, state function and their differential (exact and Inexact), different types of processes- Isothermal, Adiabatic, Isobaric, isochoric, reversible, irreversible and cyclic.

Statement, Mathematical expression-enthalpy and energy of a system-Heat capacity at constant P & V-Correlation between Cp and Cv - Joule Thomson effect – inversion temperature.

UNIT – II **(9 hrs)**

SECOND LAW OF THERMODYNAMICS

Need for second law- Different forms of second law, Carnot cycle-efficiency of Carnot engine and entropy a state function, Entropy changes in reversible and irreversible processes, calculation of entropy change of an ideal gas with change in P,V &T-Entropy of mixing, Physical significance of entropy- work function and free energy, variation of free energy change with temperature and pressure- Maxwell‘s relationships, The Gibbs-Helmholtz equation- Clausius Clapeyron equation-Application of Clausius- Clapeyron equation.

UNIT – III **(9 hrs)**

THIRD LAW OF THERMODYNAMICS

Nernst heat theorem-Statement of third law of thermodynamics, determination of Absolute entropy of solid, liquids & gases, experimental verification of third law, entropy changes in chemical reaction-residual entropy- exceptions to third law-definition of zeroth law of thermodynamics.

UNIT – IV **(9 hrs)**

THERMOCHEMISTRY

Enthalpy of combustion- Standard enthalpy of combustion, Bomb calorimeter- Enthalpy of formation- Standard enthalpy of formation – Bond energy and its applications, Enthalpy of neutralization, Hess‘s law of heat of summation and its application, Kirchoff’s equation, flame and explosion temperature.

UNIT – V **(9 hrs)**

CHEMICAL EQUILIBRIUM

The law of mass action- Thermodynamic treatment of law of mass action, Relationship between K_p and K_c, Application of Law of mass action to Homogeneous system- dissociation of PCl_5 and N_2O_4, application of Law of mass action to Heterogeneous system-Calcium carbonate - LeChatlier principle - LeChatlier principle and physical equilibria.

TEXT BOOKS

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

2.Jain P.C. and Jain M., 2005, Engineering chemistry, 15th edition, Dhanpat Rai publishing company, New Delhi, India.

REFERENCE BOOKS:

1. Atkins P., 2002, Physical Chemistry, VII Edition, Oxford University Press, UK
2. Bahl B.S., Tuli G.D. and Arun Bahl, 2004, Essential of Physical chemistry S.Chand publications, Ram nagar, New Delhi, India.
3. Van Samuel Glasstone D., 2002, Thermodynamics, 5th edition, Eastern Wiley Publication, London, UK.

Course Designers

1. Dr. R. Sayee Kannan2. Dr. A. R. Ramesh3. Dr. T. Arumuganathan

UNIT	TOPIC	No. of lecture hrs
I	**FIRST LAW OF THERMODYNAMICS**	
1.1	Importance of thermodynamics- limitations of thermodynamics	1
1.2	Concepts of a system and surrounding-state variable- extensive and intensive properties	2
1.3	State function and their differential (exact and Inexact)-different types of processes	1
1.4	Isothermal, Adiabatic, Isobaric, isochoric, reversible, irreversible and cyclic.	1
1.5	Statement, Mathematical expression-enthalpy and energy of a system.	1
1.6	Heat capacity at constant P &V-Correlation between C_p andCv-	1
1.7	Workdone in reversible isothermal compression- workdone in irreversible isothermal expansion and adiabatic expansion.	2
II	**SECOND LAW OF THERMODYNAMICS**	
2.1	Need for second law- Different forms of second law	1
2.2	Carnot cycle and entropy a state function- Entropy changes in reversible and irreversible processes	2
2.3	Calculation of entropy change of an ideal gas with change in P,V &T.	1
2.4	Entropy of mixing- Physical significance of entropy-	1
2.5	Work function and free energy- variation of free energy change with temperature and pressure- Maxwell's relationships-	1
2.6	Gibbs-Helmholtz equation	1
2.7	Clausius Clapeyron equation and Its Application	2
III	**THIRD LAW OF THERMODYNAMICS**	
3.1	Nernst heat theorem	1
3.2	Statement of third law of thermodynamics	1
3.3	Determination of Absolute entropy of solid, liquids & gases	2
3.4	Experimental verification of third law	2
3.5	Entropy changes in chemical reaction- residual entropy- exceptions to third law	2
3.6	Definition of zeroth law of thermodynamics	1
IV	**THERMOCHEMISTRY**	
4.1	Enthalpy of combustion- Standard enthalpy of combustion	1

4.2	Bomb calorimeter-	2
4.3	Enthalpy of formation- Standard enthalpy of formation	1
4.4	Bond energy and its applications	2
4.5	Enthalpy of neutralization- Hess's law of heat of summation and its application- Kirchoff's equation	2
4.6	Flame and explosion temperature.	1
V	**CHEMICAL EQUILIBRIUM**	
5.1	The law of mass action	1
5.2	Thermodynamic treatment of law of mass action	2
5.3	Relationship between Kp and Kc	1
5.4	Application of Law of mass action to homogeneous system- dissociation of PCl_5 and N_2O_4	2
5.5	Application of Law of mass action to heterogeneous system-$CaCO_3$	1
5.6	LeChatlier principle – LeChatlier principle and physical equilibria	2

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Course Code	Course title	Category	L	T	P	Credit
UCH19CL41	Estimation and preparation of Organic compounds.	Core Lab –IV	-	-	4	2

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

Preamble

This lab course describes the practical procedure for the quantitative estimation of organic compounds, determination of saponification value and iodine value of an oil. Also enhances the laboratory skill of preparing few organic compounds.

Course outcomes

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

#	Course Outcome
CO1	Do the quantitative estimation of organic compounds such as Phenol, aniline and glycine.
CO2	Apply volumetric procedure for the quantitative estimation of Ascorbic acid (Vit.C).
CO3	Determine the saponification value and iodine value of an oil.
CO4	Synthesize organic compounds.
CO5	Develop the practical skill of estimation and preparation of any given organic compounds.

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

ORGANIC ESTIMATIONS

1. Estimation of Phenol
2. Estimation of Aniline
3. Estimation of Glycine
4. Estimation of Ascorbic acid (Vitamin C)
5. Estimation of Saponification value of an oil
6. Determination of Iodine value

ORGANIC PREPARATIONS

Preparation of the following Organic Compounds:

1. Benzoic acid from Methyl benzoate
2. Salicylic acid from Methy or ethyl salicylate
3. Osazone from Glucose
4. Benzoic acid from Benzaldehyde

(Any three estimations from each of the above mentioned volumetric estimations and also any three preparations)

Course Designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash

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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19SE41(A)	**Agricultural Chemistry**	SEC(Option A)	2	-	-	2

Year	Semester	Int. Marks	Ext. Marks	Total
II	IV	15	35	50

Preamble

The course briefly outlines the composition of soil,soil acidity and the availability of nutrients to plants. It also explains the nature of different types of fertilizers, pesticides and their uses.

Course outcomes

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

	Course Outcomes	Knowledge Level
CO1	Name the organic and inorganic constituents present in the soil and availability of nutrients to plants.	K1
CO2	Classify the organic and chemical fertilizers.	K2
CO3	Classify the types of pesticides like insecticides, fungicides,herbicides and weedicides.	K2
CO4	Make use of Bioinsecticides and Biofertilizers.	K3

K1-Knowledge K2-Understand K3-Apply

Mapping of COs with POs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT 1: SOIL AND FERTILIZERS CHEMISTRY (15 hrs)

Soil analysis: Composition of soil: Organic and Inorganic constituents. Soil acidity : buffering capacity of soils. Limiting of soil. Absorption of cations and anions: availability of soil nutrients to plants.

Fertilizers: Peat and organic manures (composts). Role of humus. Effluent form gobar gas plants. Use of fertilizers: urea, DAP, Super phosphate, Gypsum, NPK-mixed fertiizers, Optimal addition of Fertilizers to obtain estimated yields.

UNIT II: PESTICIDES (15 hrs)

Insecticides: stomach and contact poisons. Plant derivatives : pyrethrine, Nicotine and rotenone Synthetic organic: carbophos, carbaryl, p-DCB, dimethoate, butachlor, Endrin, Aldrin (Chemical name and uses). Rodenticides. Fungicides: Inorganic (Bordeaux Mixture) and organic(dithiocarbamate). Industrial fungicides: creosote fractions. Herbicides and weedicides : Selective and non-selective, 2, 4-D and 2, 4, 5-t (structure and function) Intenerated pest management-**Bioinsecticides-Biofertilizers.**

Text books:

1. G.T. Austin : shreve's Chemical Process Industries, 5th edition, Mc-Graw-Hill, 1984

Reference books

1.B.A. Yagodin (Ed). Agricultural Chemistry, 2 Volumes, Mir Publishers (Moscow), 1976.

Course Designers

Dr. A. Suganthi

Dr. R.Mahalakshmy

Course contents and lecture schedule

Unit	**Topic**	**No. of lecture hrs**
I	**SOIL AND FERTILIZERS CHEMISTRY**	**15**
1.1	Soil analysis: Composition of soil: Organic and Inorganic constituents.	2
1.2	Soil acidity : buffering capacity of soils. Limiting of soil.	2
1.3	Absorption of cations and anions: availability of soil nutrients to plants.	2
1.4	FERTILIZERS: Peat and organic manures (composts).	3
1.5	Role of humus. Effluent form gobar gas plants.	1
1.6	Use of fertilizers: urea, DAP, Super phosphate, Gypsum, NPK-mixed fertiizers, Optimal addition of Fertilizers to obtain estimated yields.	4
	Revision	1
II	**PESTICIDES**	**15**
2.1	Plant derivatives : pyrethrine, Nicotine and rotenone	2
2.2	Synthetic organic: carbophos, carbaryl, p-DCB, dimethoate,	3

	butachlor, Endrin, Aldrin (Chemical name and uses).	
2.3	Rodenticdes. Fungicides: Inorganic (Bordeaux Mixture) and organic(dithiocarbamate).	3
2.4	Insecticides: stomach and contact poisons.	1
2.5	Industrial fungicides: creosote fractions.	2
2.6	Herbicides and weedicides : Selective and non-selective, 2, 4-D and 2, 4, 5-t (structure and function) Intenerated pest management.	3
2.7	Revision	1
	Total (15+15)	**30**

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Course Code	Course title	Category	L	T	P	Credit
UCH19SE41(B)	**Dairy Chemistry**	SEC(Option B)	2	-	-	2

Year	Semester	Int. Marks	Ext. Marks	Total
II	IV	15	35	50

Preamble

The course briefly outlines the composition, constituents and physical properties of milk, factors affecting the composition of milk and microbiology of milk. It also explains the composition and processing methods of major milk products such as butter, ghee and special milk.

Course outcomes

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

	Course Outcomes	KnowledgeLevel
CO1	Define milk and find composition and physical properties of milk.	K1
CO2	Explain the factors which affect the composition of milk anddestruction of micro-organism.	K2
CO3	Illustrate the physico-chemical changes in milk due to processing, boiling and pasteurization.	K3
CO4	List the milk products cream,butter and ghee its composition, estimation,adulterants added and their detection. Perceive about types of special milk and its nutritive value.	K1

K1-Knowledge K2-Understand K3-Apply

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom’s Taxonomy	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT-I: COMPOSITION AND PROCESSING OF MILK

Milk-definition-general composition of milk-constituents of milk-lipids, proteins, carbohydrates, vitamins and minerals-physical properties of milk-colour-odour-acidity-specific gravity-viscosity and conductivity - factors affecting the composition of milk-adulterants, preservative and neutralizer-Microbiology of milk-destruction of micro-organisms in milk-physico-chemical changes taking place in milk due to processing-boiling pasteurization-types of pasterurization-Bottle, batch and HTST (High Temperature Short Time)-Vacuum pasterurization-Ultra High Temperature Pasteurization.

UNIT – II MAJOR MILK PRODUCTS

Cream-composition-Chemistry of creaming process-gravitational and centrifugal methods of separating cream-estimation of fat in cream. Butter –composition-desibutter-salted butter-estimation of acidity and moisture content in butter. Ghee-major constituents-common adulterants added to ghee and their detection- rancidity-definition-prevention-antioxidants and synergists-natural and synthetic. Special milk- definition, composition and nutritive value of -flavoured milk-vitaminised milk-tonned milk-imitation milk-vegetable toned milk - condensed milk.

Reference book:

1. Robert Jenness and S. Patom, Principles of dairy chemistry, Wiley, New York.

Text book:

1. K.S. Rangappa and K.T Acharya, Indian Dairy products.

Course designer:

Dr. A. Suganthi

Course contents and lecture schedule

Unit	Topic	No. of lecture hrs
1	**COMPOSITION AND PROCESSING OF MILK**	**15**
1.1	Milk-definition-general composition of milk-constituents of milk-lipids, proteins, carbohydrates, vitamins and minerals	3
1.2	Physical properties of milk-colour-odour-acidity-specific gravity-viscosity and conductivity	3
1.3	Factors affecting the composition of milk-adulterants, preservative	2

	and neutralizer	
1.4	Microbiology of milk-destruction of micro-organisms in milk	1
1.5	Physico-chemical changes taking place in milk due to processing	1
1.6	boiling pasteurization-types of pasterurization	1
1.7	Bottle, batch and HTST (High Temperature Short Time)-Vacuum pasterurization-Ultra High Temperature Pasteurization.	3
	Revision	1
2	**MAJOR MILK PRODUCTS**	**15**
2.1	Cream-composition-Chemistry of creaming process-gravitational and centrifugal methods of separating cream-estimation of fat in cream.	3
2.2	Butter –composition-desibutter-salted butter-estimation of acidity and moisture content in butter.	3
2.3	Ghee-major constituents-common adulterants added to ghee and their detection	3
2.4	Rancidity-definition-prevention-antioxidants and synergists-natural and synthetic.	2
2.5	Special milk- definition, composition and nutritive value of -flavoured milk-vitaminised milk-tonned milk-imitation milk-vegetable toned milk - condensed milk.	3
	Revision	1
	Total (15+15)	30

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Course Code	Course title	Category	L	T	P	Credit
UCH19SE41(C)	**Forensic Chemistry**	SEC (Option C)	2	-	-	2

Year	Semester	Int. Marks	Ext. Marks	Total
II	IV	15	35	50

Preamble

The course briefly outlines the various adulterants in food stuffs and suitable methods to detect the adulterants and forgery.

Course outcomes

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

	Course Outcomes	KnowledgeLevel
CO1	Spell the various adulterants in food stuffs.	K1
CO2	Classify the types of food poisons and suggest the first aid and antidote for poisoned persons..	K2
CO3	Identify the forgery in bank cheques/drafts and educational records.	K3
CO4	Analyse the alloys in coins, silverline watermark in currency notes. And also able to detect the purity of gold and diamond.	K3

K1-Knowledge K2-Understand K3-Apply

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT I: FOOD ADULTRATION **(15 hrs)**

Contamination of wheat, rice, dhal, milk, butter, etc. With clay, sand, stone, water and toxic chemicals (e.g. Kasseri dhal with mentanil yellow).

Food poisons: natural poisons (alkaloids, nephrotoxins), pesticides (DDT, BHC, Follidol), Chemical poisons (KCN). First aid and Antidotes for poisoned persons.

Heavy metal (Hg, Pb,Cd) Contamination of Sea food. Use of neutron activation analysis in detecting poisoning (e.g.,As in human hair).

UNIT II: FORGERY AND COUNTERFEITING **(15 hrs)**

Detecting forgery in bank cheques / drafts and educational records (mark lists, certificates), using UV-light. Alloy analysis using AAS to detect counterfeit coins. Checking silverline water mark in currency notes. Jewellery: detection of gold purity in 22 carat ornaments, detecting gold plated jewels, authenticity of diamonds (natural, synthetic, glassy).

Text books

1. Javad I. Khan, Thomas J, Kennedy, Dobbell R, Christian Jr, 2011. Basic principles of Forensic Chemistry, Springer Science and Business media.

Reference Book

1. Jay Siegel, 2015, Forensic Chemistry: Fundamentals and applications, Wiley – Blackwell(ISBN:978-1-118-89772-0).

Course Designers

1. Dr. A. Suganthi
2. Dr. R. Mahalakshmy

Course contents and lecture schedule

Unit	Topic	No. of lecture hrs
I	**FOOD ADULTRATION**	**15**
1.1	Contamination of wheat, rice, dhal, milk, butter, etc.	2
1.2	With clay, sand, stone, water and toxic chemicals (e.g. Kasseri dhal with mentanil yellow).	2
1.3	Food poisons: natural poisons (alkaloids, nephrotoxins)	2
1.4	Pesticides (DDT, BHC, Follidol)	2
1.5	Chemical poisons (KCN). First aid and Antidotes for poisoned persons.	2
1.6	Heavy metal (Hg, Pb,Cd) Contamination of Sea food.	2
1.7	Use of neutron activation analysis in detecting poisoning (e.g.,As in human hair).	2
	Revision	1
II	**FORGERY and COUNTERFEITING**	**15**
2.1	Detecting forgery in bank cheques / drafts and educational records	3

	(mark lists, certificates), using UV-light.	
2.2	Alloy analysis using AAS to detect counterfeit coins.	3
2.3	Checking silverline wter mark in currency notes.	3
2.4	Jewellery : detection of gold purity in 22 carat ornaments, detecting gold plated jewels	3
2.5	Authenticity of diamonds (natural, synthetic, glassy)	3
	Revision	1
	Total (15+15)	**30**

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Course Code	Course title	Category	L	T	P	Credit
UCH19C51	Inorganic Chemistry – III	Core 9	5	1	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
III	V	25	75	100

Preamble

The course explains the structure and defects of solids, chemistry of d and f block elements, Also discusses about the biological and industrial importance of metal compounds.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Tell different types of solid and their properties with suitable examples.	K1
CO2	Explain types of crystals, crystal defects and their application in semiconductor, solar cell and super conductor materials.	K2
CO3	Outline the periodic properties of d-block elements, metallurgy, properties of common reagents and alloys of gold, chromium and nickel.	K2
CO4	Apply the catalytic and biological importance of metal compounds.	K3
CO5	Make use of the periodic trends, separation, uses of lanthanide and actinides.	K3

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Unit-I: SOLID STATE- I (15L Hrs + 3T Hrs)

Types of solids – Amorphous – crystalline – Seven Crystal systems – Unit cell & Space lattice, Symmetry elements – Simple cubic – bcc – fcc lattices –Miller indices – Bragg equation – Packing of atoms and ions – packing arrangements ccp and hcp – radius ratio – co ordination number 3, 4 and 6 – packing efficiency – simple cubic, bcc and fcc. Structures of Cesium chloride, Zinc blende, Wurtzite, Diamond and Graphite.

Unit-II: SOLID STATE- II (15L Hrs + 3T Hrs)

Crystal defects, schottky and frenkel defects – colour centres – point defects – plane defects – edge dislocation – non-stoichiometric defects – Semiconductors – Application of solar cell-Types of crystals Molecular , Covalent, Metallic and Ionic crystals-Free electron theory and band theory of solids – P-N junction – Transistors – super conductors.-High temperature and low temperature super conductors, Organic super conductors.

Unit -III: d-BLOCK ELEMENTS (15L Hrs + 3T Hrs)

General characteristics- electronic configuration, metallic character, ionization energy, variable valency, reducing property, colour, magnetic property, non-stoichiometric compounds, catalytic properties and tendency to form complexes.Metallurgy of Au, Ni and Cr. Preparation, properties and uses of potassium permanganate, V_2O_5, Ni $(DMG)_2$, CrO_3, potassium dichromate, potassium ferrocyanide-Nessler's reagent. Anamalous behaviour of mercury. Alloys of copper and Nickel.

Unit -IV: (15L Hrs + 3T Hrs)

A. BIO –INORGANIC CHEMISTRY

Essential and Trace elements in biological systems (Mg, Al, Si, P, Ca, V, Cr, Mn, Fe, Zn) – Structure and functions of Haemoglobin and Chlorophyll.

B. TRANSITION METAL COMPOUNDS AS CATALYSTS

Wilkinson catalyst (hydrogenation of olefins) – Zeigler-natta catalyst (propylene polymerization) – organo palladium catalyst – Walker's process (oxidation of olefins) – Mechanism of these processes.

C. ORGANOMETALLIC COMPOUNDS

Definition-Types- Alkene complexes—Zeise's Salt-Structural Features of Zeise's Salt-Iron-Butadiene Complex-Nomenclature of organometallic compounds, 16- and 18-electron rule, Ferrocene- structure and Bonding. Mansanto process-Hydroformylation-Mechanism of these processes.

UNIT -V: f- BLOCK ELEMENTS (15L Hrs + 3T Hrs)

General characteristics- electronic configuration- oxidation states- colour and magnetic properties. mplexes of lanthanides and actinides. Lanthanide and actinide contraction and their consequences- **Uses of Lanthanides as** Shift reagents. Separation methods-fractional crystallization, oxidation- reduction, ion-exchange method and chromatographic separation. Uranium-occurrence, metallurgy; Properties of Uranyl nitrate and Uranyl acetate.

Text Books:

1. Puri, B.R. Sharma, L.R. and Kalia, K.C. 2004, Principles of Inorganic Chemistry, 28th edn, Vallabh Publication, New Delhi.
2. Madan, R.D. 2005, Advanced Inorganic Chemistry, 2nd edn.S. Chand & Company, New Delhi.

Referance Books

1. Hannay, N. B. 1976, Solid State Chemistry, Prentic- Hall of India Pvt Ltd, New Delhi.
2. Anthony, B. West, R. 1989, Solid State Chemistry and its applications, John Wiley & Sons, Singapore.
3. Albert Cotton, F.A. 1998, Advanced Inorganic Chemistry, Geofferey Wilkinson, Carlos, Murillo, Manfred Bochmann, John Wiley & Sons, Inc. New York.
4. Huheey, J. E. Keiter, Ellen A. Keiter, Richard L. 2004, Inorganic Chemistry, 4th edn, Pearson Education Pvt Ltd, Harper Collins College Publishers, Singapore.

Course designers

1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D.S. Bhuvaneswari
4. Dr. K. Selvakumar

Unit	Topic	No. of lecture hrs.
I	**SOLID STATE- I**	**18**
1.1	Types of solids – Amorphous	2
1.2	Seven Crystal systems	2
1.3	Unit cell & Space lattice, Symmetry elements	1
1.4	Simple cubic – bcc – fcc lattices	2
1.5	Miller indices – Bragg equation – Packing of atoms and ions	1
1.6	Packing arrangements ccp and hcp	1
1.7	Radius ratio – co-ordination number 3, 4 and 6	1
1.8	Packing efficiency	1
1.9	Simple cubic, bcc and fcc.	1
1.10	Structures of Cesium chloride	1
1.11	Zinc blende, Wurtzite	1
1.12	Diamond and Graphite	1
	Tutorial	3
II	**SOLID STATE- II**	**18**
2.1	Crystal defects, schottky and frenkel	1
2.2	Colour centres – point defects	2
2.3	Plane defects – edge dislocation	2
2.4	Non-stoichiometric defects	1
2.5	Semiconductors – Application of solar cell	2
2.6	Types of crystals Molecular, Covalent,	1
2.7	Metallic and Ionic crystals	1
2.8	Free electron theory and band theory of solids	1
2.9	P-N junction – Transistors	1

2.10	Super conductors	1
2.11	High temperature and low temperature super conductors	2
2.12	Organic super conductors.	1
	Tutorial	3
III	**d-BLOCK ELEMENTS**	**18**
3.1	General characteristics- electronic configuration	1
3.2	Metallic character, ionization energy, variable valence	1
3.3	Reducing property, colour, magnetic property,	2
3.4	Non-stoichiometric compounds,	1
3.5	Catalytic properties and tendency to form complexes	1
3.6	Preparation, properties and uses of potassium permanganate,	1
3.7	Preparation, properties and uses of manganese dioxide	1
3.8	Preparation, properties and uses of $TiCl_4$	1
3.9	Preparation, properties and uses of V_2O_5, $V_2(SO_4)_3$	1
3.10	Preparation, properties and uses of CrO_3, Chromic acids	2
3.11	Preparation, properties and uses of potassium dichromate	1
3.12	Preparation, properties and uses of potassium ferrocyanide. Anomalous behavior of mercury.	2
	Tutorial	3
IV	**ORGANOMETALLIC COMPOUNDS**	**18**
4.1	Nomenclature of organometallic compounds, 16- and 18-electron rule.	2
4.2	Metal carbonyls- definition and classification-	1
4.3	General methods of preparation- effective atomic number rule	2
4.4	Structure and bonding of mononuclear carbonyls of nickel,	1
4.5	Structure and bonding of iron and chromium,	1
4.6	Structure and bonding of binuclear carbonyls of iron	2
4.7	Structure and bonding of cobalt and manganese	1
4.8	Structure and bonding of Tetra nuclear carbonyls of iridium.	2
4.9	Mechanism and process of Wilkinson catalyst (hydrogenation of olefins)	1
4.10	Mechanism and process of Zeigler-natta catalyst (propylene polymerization)-	2
	Tutorial	3
V	**f- BLOCK ELEMENTS**	**18**
5.1	General characteristics- electronic configuration	1
5.2	Oxidation states- colour and magnetic properties.	2
5.3	Complexes of lanthanides and actinides.	2
5.4	Lanthanide and actinide contraction and their consequences	1
5.5	Shift reagents	1
5.6	Separationmethods-fractional crystallization	2
5.7	Oxidation- reduction	1
5.8	Ion-exchangemethod and chromatographic separation.	2
5.9	Uranium-occurrence, metallurgy	1

5.10	Properties of Uranyl nitrate and Uranyl acetate.	2
	Tutorial	3

THIAGARAJAR COLLEGE, 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
UCH19C52	Organic Chemistry - III	Core-10	5	1	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
III	V	25	75	100

Preamble

The course explains the concept of aromaticity and chemical properties of aromatic carbonyl compounds, sulphonic acid and nitrogen containing compounds. It also explains the basic principles and applications of spectroscopic techniques which are used to analyse the given organic molecules.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Explain the aromaticity of organic molecules and predict the reactivity and orientation of electrophiles during the chemical reactions and identify the chemistry of polynuclear hydrocarbons.	K2, K3
CO2	Predict the reaction products of aldehydes and ketones with various reagents and propose the mechanism of rearrangement reactions.	K1, K3
CO3	Gain the knowledge on the chemistry of sulphonic acids, hydroxy compounds and aromatic acids.	K1
CO4	Explain the chemistry of sulphonic acids, hydroxy compounds and aromatic acids.	K1, K3
CO5	Gain awareness about the application of spectral techniques in analysing organic molecules.	K1

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT-I (15L Hrs + 3T)

AROMATIC COMPOUNDS AND AROMATIC SUBSTITUTION

Introduction – Aromaticity and Huckel's rule – non benzenoid aromatics - Isolation of aromatic compounds from coaltar. Structure of benzene-resonance- aromatic Electrophilic substitution – Mechanism of nitration, sulphonation and Friedel-craft reaction, Directing effects of substituents – electronic interpretation - Aromatic nucleophilic substitution – Benzyne mechanism.

Poly Nuclear Hydrocarbons: Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene and Anthracene

UNIT – II (15L Hrs + 3T Hrs)

AROMATIC ALDEHYDES AND KETONES

Aldehydes: General methods of preparation, and properties of aromatic aldehydes – benzaldehyde – Mechanism of benzoin condensation – perkin reaction, claisen reaction, Knovenagel reaction and cannizaro reaction.

Unsaturated aldehyde – cinnamaldehyde

Ketones: Preparation and properties of acetophenone, benzophenone – Houben Hoesech synthesis.

Rearrangement: Mechanism of the following rearrangements: Pinacol – Pinacolone, Hoffmann, Benzilic acid, Claisen, and Fries rearrangement

UNIT – III (15L Hrs + 3T rs)

Aromatic Sulphonic Acids: Methods of sulphonation – preparation and reaction of benzene sulphonic acid, sulphanilic acid – saccharin, and chloramine – T.

Aromatic hydroxy compounds: General methods of preparation and reaction of phenol – acid strength of phenol – General methods of preparation and reaction of phenolic ether (anisole).

Aromatic acids: Monocarboxylic acids – general methods of preparation, properties and reactions - benzoic acid – anthranilic acid – salicylic acid – cinnamic acid.

Dicarboxylic acid: phthalic acid and terephalic acid.

UNIT – IV (15L Hrs + 3T Hrs)

AROMATIC COMPOUNDS CONTAINING NITROGEN

Nitro benzene – reduction products of nitrobenzene – T.N.T – picric acid - difference between nitro toluenes and phenylnitromethane.

Aniline – Preparation and reactions - basicity of aromatic amines – effect of substituents – phenylene diamine – Toludines – benzyl amine.

Diazonium compounds: Diazotization – mechanism - benzenediazoniumchloride – structure and reactions - synthetic applications – Mechanism of diazo coupling reaction.

UNIT – V (15L Hrs + 3T Hrs)

ORGANIC SPECTROSCOPY

UV-Visible spectroscopy - Types of electronic transitions – chromophore – auxochrome – bathochromic shift – hypsochromic shift – hyperchromic shift – applications of UV spectroscopy.

IR spectroscopy – Molecular vibrations – number of fundamental vibrations – factors affecting vibrational frequency – hydrogen bonding – applications of IR spectroscopy.

NMR spectroscopy – Introduction – relaxation process – number of signals - chemical shift – shielding and deshielding – splitting of signals – spin - spin coupling – coupling constants – Applications of NMR spectroscopy.

Text Book

1. P.L. Soni, 1991.Text Book of Organic chemistry, Sultans chand, New Delhi,

Reference books:

2. I.L.Finar,2005. Organic chemistry Vol 1, 6th edition, Pearson Edition, Singapore.
3. K.S. Tewari, N.K. Vishil, S.N. Mehotra 2001– A text book of org. chem – 1st edition, Vikas Publishing House Pvt Ltd., New Delhi.
4. Y.R. Sharma, O.P. Vig,1997. Elementary organic absorption spectroscopy – 1st edition, Goel Pulishers, India.

Course designers Dr. P. Tharmaraj Dr. P. Prakash Dr. R. MahalakshmyDr. A. Tamil Selvi

Units	Topic	No. of lecture hrs
I	**AROMATIC COMPOUNDS AND AROMATIC SUBSTITUTION**	**18**
1.1	Introduction – Aromaticity and Huckel’s rule – non benzenoid aromatics	4
1.2	Isolation of aromatic compounds from coaltar. Structure of benzene-resonance-	2
1.3	aromatic Electrophilic substitution – Mechanism of nitration, sulphonation and Friedel-craft reaction, Directing effects of substituents – electronic interpretation	5
1.4	Aromatic nucleophilic substitution – Benzyne mechanism.	1
1.5	**Poly Nuclear Hydrocarbons:** Properties of the following compounds with reference to electrophilic and nucleophilic substitution: Naphthalene and Anthracene	4
	Tutorial	3
II	**Aromatic aldehydes and ketones**	**18**
2.1	**Aldehydes:** General methods of preparation, and properties of aromatic aldehydes – benzaldehyde – Mechanism of benzoin condensation – perkin reaction, claisen reaction, Knovenagel reaction and cannizaro reaction.	6
2.2	Unsaturated aldehyde – Cinnamaldehyde	2
2.3	**Ketones:** Preparation and properties of acetophenone, benzophenone – Houben Hoesech synthesis.	4
2.4	**Rearrangement:** Mechanism of the following rearrangements: Pinacol – Pinacolone, Hoffmann, Benzilic acid, Claisen, and Fries	3

	rearrangement	
	Tutorial	3
III	**Aromatic acids and hydroxyl compounds**	**18**
3.1	**Aromatic Sulphonic Acids:** Methods of sulphonation – preparation and reaction of benzene sulphonic acid, sulphanilic acid – saccharin, and chloramine – T.	5
3.2	**Aromatic hydroxy compounds:** General methods of preparation and reaction of phenol – acid strength of phenol –	3
3.3	General methods of preparation and reaction of phenolic ether (anisole).	2
3.4	**Aromatic acids:** Monocarboxylic acids – general methods of preparation, properties and reactions - benzoic acid – anthranilic acid – salicylic acid – cinnamic acid.	3
3.5	Dicarboxylic acid: phthalic acid and terephalic acid.	2
	Tutorial	3
IV	**AROMATIC COMPOUNDS CONTAINING NITROGEN**	**18**
4.1	Aromatic Nitro Compounds:Nitro benzene – reduction products of nitrobenzene	3
4.2	T.N.T – picric acid - difference between nitro toluenes and phenylnitromethane.	3
4.3	Aromatic amino compounds: Aniline – Preparation and reactions - basicity of aromatic amines – effect of substituents – phenylene diamine – Toludines – benzyl amine.	4
4.4	Diazonium compounds: Diazotization – mechanism - benzenediazoniumchloride – structure and reactions	2
4.5	Synthetic applications – Mechanism of diazo coupling reaction	3
	Tutorial	3
V	**ORGANIC SPECTROSCOPY**	**18**
5.1	UV-Visible spectroscopy - Types of electronic transitions – chromophore – auxochrome – bathochromic shift – hypsochromic shift – hyperchromic shift – applications of UV spectroscopy.	5
5.2	IR spectroscopy – Molecular vibrations – number of fundamental vibrations – factors affecting vibrational frequency – hydrogen bonding – applications of IR spectroscopy.	5
5.3	NMR spectroscopy – Introduction – relaxation process – number of signals - chemical shift – shielding and deshielding – splitting of signals – spin - spin coupling – coupling constants – Applications of NMR spectroscopy.	5
5.4	Tutorial	3

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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19C53	**Physical Chemistry-1II**	Core-11	3	-	-	3

Year	Semester	Int. Marks	Ext. Marks	Total
III	V	25	75	100

Preamble

Thiscourse enables the students to gain knowledge on fundamental concepts and theories of nano chemistry, phase rule, chemical kinetics, atomic structure and quantum chemistry.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Spellthe basics of nanoscience and its technological applications.	K1
CO2	Apply the concepts of phase rule.	K3
CO3	Explain the theories of chemical kinetics.	K2
CO4	Summarise the fundamentals of quantum theory.	K2
CO5	Make use of the applications of quantum chemistry.	K3

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT – I **(15 hrs)**

NANO TECHNOLOGY

Definition of nanoscience, top down and bottom up approach, Sol-gel mehod, electron microscopes – Scanning electron microscope (SEM) - transmission electron microscope (TEM), application of nano materials – insulation materials, machine tools, phosphors, batteries and solar energy.

UNIT-II **(15 hrs)**

PHASE RULE

Statement and thermodynamic derivations, application of phase rule – one component system (Water and Sulphur only) – Two component systems – simple eutectic (Lead – Silver only) – Compound formation – congruent melting point (Zn – Mg only) – Incongruent melting point (Na – K only)

UNIT – III **(15 hrs)**

CHEMICAL KINETICS

Rate constant, order and molecularity – Integrated rate expression - I order, II order (reactants same and different) and zero order reaction – derivation, Half life period - zero, I, II order reactions, methods of determining order of the reaction-use of differential rate expression-use of integral rate expression-half-life method- isolation method, Arrhenius equation – significance of energy of activation.

UNIT – IV **(15 hrs)**

ATOMIC STRUCTURE AND WAVE MECHANICS

Black body radiation- Quantum theory of radiation -Planck‗s theory (no derivation required) ,Bohr‗s theory of hydrogen atom – spectrum of hydrogen atom, Derivation of Ritz combination principle, Photoelectric effect-Einstein photoelectric equation, Compton effect, de Broglie‗s wave equation, Heisenberg's uncertainty principle, Hund‗s rule and Pauli's exclusion principle.

UNIT – V **(15 hrs)**

QUANTUM CHEMISTRY

Postulates of quantum mechanics, derivation of Schrödinger wave equation, wave function and its significance, probability of finding electrons, operators - differential and integral operators only, application of Schrödinger wave equation - particle in one dimensional box.

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.

Reference Books

1.Laidler K.J., 2005, Chemical Kinetics, 2nd edition, TaTa Mc Graw – Hill, UK.

2.Chandra A.K., 1994, Introductory quantum chemistry, 4th edition, TaTa McGraw – Hill publishing company limited, UK.

3.Wilson M., Geolf Smith K.K., Simmons M., Raguse B., 2005, Nanotechnology, Overseas press, New Delhi, India.

Course Designers

1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan

Course contents and lecture schedule

UNIT	TOPIC	No. OF LECTURE Hrs
I	**NANO TECHNOLOGY**	
1.1	Definition of nanoscience	1
1.2	Top down and bottom up approach	3
1.3	Sol-gel mehod	2
1.4	Electron microscopes-Scanning electron microscope (SEM)	3
1.5	Transmission Electron Microscope (TEM)	3
1.6	Application of nano materials – insulation materials, machine tools, phosphors, batteries and solar energy.	3
II	**PHASE RULE**	
2.1	Statement and thermodynamic derivations	1
2.2	Application of phase rule – one component system - Water	3
2.3	Application of phase rule – one component system - Sulphur	3
2.4	Application of phase rule –two component system - Lead and Silver	3
2.5	Compound formation – congruent melting point (Zn – Mg only)	3
2.6	Incongruent melting point (Na – K only)	2
III	**CHEMICAL KINETICS**	
3.1	Rate constant, order and molecularity	1
3.2	Derivation of Integrated rate expression for I order	2
3.3	Derivation of Integrated rate expression for II order (reactants same& different)	2
3.4	Derivation of Integrated rate expression for zero order	1
3.5	Derivations of equations for rate constants - II order (concentration same and different)	3
3.6	Half life period -zero, I, II order reactions	1
3.7	Methods of determining order of the reaction- use of differential rate expression-use of integral rate expression	2
3.8	Methods of determining order of the reaction- half-life & isolation method	2
3.9	Arrhenius equation – significance of energy of activation	1
IV	**ATOMIC STRUCTURE AND WAVE MECHANICS**	
4.1	Black body radiation	1
4.2	Quantum theory of radiation	2
4.3	Planck‘s theory (no derivation required)	1

4.4	Bohr's theory of hydrogen atom- spectrum of hydrogen atom	3
4.5	Derivation of Ritz combination principle	2
4.6	Photoelectric effect - Einstein photoelectric equation	2
4.7	Compton effect	1
4.8	de Broglie's wave equation – uncertainty principle - Hund's rule – Pauli exclusion principle.	3
V	**QUANTUM CHEMISTRY**	
5.1	Postulates of quantum mechanics	2
5.2	Derivation of Schrödinger wave equation	2
5.3	Wave function and its significance	1
5.4	Probability of finding electrons	2
5.5	Operators – differential and integral operators	2
5.6	Application of Schrödinger wave equation - particle in one dimensional box	3
5.7	Application of Schrödinger wave equation - particle in three dimensional box	3

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Department of Chemistry
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Programme Code:UCH

Course Code	Course Title	Category	L	T	P	Credit
UCH19CL51	**Inorganic Estimation and Preparation**	Core Lab - V	-	-	4	2

Year	Semester	Int. Marks	Ext. Marks	Total
III	V	40	60	100

Preamble

This lab course enables the students to acquire practical knowledge on quantitative estimation of inorganic metal ions by gravimetric and colorimetric methods. Also enhances the laboratory skill of preparing simple inorganic complexes.

Course Outcomes

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

#	Course Outcome
CO1	Estimate inorganic metal ions such as lead, nickel and magnesium by gravimetric estimation.
CO2	Determine iron or copper by colorimetric method.
CO3	Prepare potassium cupricsulphate and Potassium trioxalatoaluminate complexes.
CO4	Prepare coordination complexes such as Hexathioureaplumbusnitrate, Tetrammine copper(II)sulphate and Ferrous/Ferric oxalate in the laboratory.
CO5	Explain the principle and application of chromatorgraphy and UV-Vis specrophotometric techniques.

Mapping of COs with PSOs

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

I. Gravimetric Analysis: (Any TWO)
a) Estimation of lead as lead chromate
b) Estimation of Nickel as Ni-DMG
c) Estimation of Magnesium as Magnesium oxinate

III. Preparation: (Any FOUR)

a) Potassium cupricsulphate
b) Potassium trioxalatoaluminate
c) Hexathioureaplumbusnitrate
d) Tetrammine copper(II)sulphate
e) Ferrous/Ferric oxalate

III. Colorimetry: (Any ONE)
a) Estimation of Iron (III)
b) Estimation of Copper (II)

IV. Chromatography (Demo only NOT for the Exam)
a) Paper Chromatography: Chromatographic separation of a mixture of Co, Mn, Ni and Zn
b) Column Chromatography: Chromatographic separation of potassium permanganate and dichromate**.**

V. UV-Visible spectrophotometer (Demo only NOT for the Exam)
Estimation of concentration of an inorganic compound using UV-Visible spectrophotometer.

Course Designers
1. Dr. A. Suganthi
2. Dr. D.S. Bhuvaneshwari

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Course Code	Course title	Category	L	T	P	Credit
UCH19CE51(A)	**Group theory and Spectroscopy**	Core elective -1 (Option A)	5	-	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
III	V	25	75	100

Preamble

This course enables the students to gain knowledge on fundamentals of group theory and spectroscopy.

Course Outcomes

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

	Course outcome	Knowledge level
CO1	Tell the theory of symmetry behavior of simple molecules.	K1
CO2	Summarize the theory and applications microwave and electronic spectroscopy.	K2
CO3	Explain theworking principle and applications of IR spectroscopy.	K2
CO4	Compare IR and Raman spectroscopy and their applications.	K2
CO5	Apply theory and applications of NMR and ESR spectroscopy.	K3

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

Mapping of Cos with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT – I

GROUP THEORY-I **15 hrs**

(i) Introduction - Symmetry elements and symmetry operations - Definition of mathematical group – four cardinal properties of a group – closure, associative, idendity and inverse rule – cyclic group – Abelian group (H_2O only) and non-abelian group (NH_3 only) – Group multiplication table- C_2v and C_3v; subgroup – similarity transformation – class of group –Point group – Assignment of point group of simple molecules – H_2O, NH_3, HCl and H_2.

(i) Matrix-introduction - matrix representation of the symmetry operations – idendity (E), Proper axis of rotation (C_n), Vertical reflection (σ_v), Improper axis of rotation (S_n) and Inverse (i); Representation definition – reducible and irreducible representation of a group.

UNIT-II **15 hrs**

MOLECULAR SPECTROSCOPY

Electromegnetic Spectrum –different regions in electromagnetic spectrum-Molecular spectra-Types of molecular spectra.

Microwave spectra –Classification of molecules –Rotational spectra of diatomic molecules –Rigid rotator-Selection rules-Relative intensities of spectral lines –effect of isotopic substitution – Application of microwave spectroscopy – Determination of bond distances in diatomic molecules.

Electronic spectra –electronic spectra of diatomic molecules – Franck Cotton principle – vibronic transitions and vibrational progression – group frequencies and factors affecting band position and intensities.

UNIT-III **15 hrs**

INFRA-RED SPECTROSCOPY

IR spectra - range - theory of IR spectroscopy- selection rule-Instrumentation - diatomic molecule as a harmonic oscillator - Diatomic molecule as anharmonic oscillator - Analysis of IR spectra on the basis of modes of vibrations of CO_2, H_2O - Finger print region and Characteristic frequencies – Overtones- Finger print region.

UNIT-IV

RAMAN SPECTROSCOPY **15 hrs**

Introduction – Difference between IR and Raman spectra –polarization of light –Raman effect – Strokes and antistrokes- Rayleigh-–Application of Raman effects to chemistry –Mutual exclusion principle –Instrumentation -advantages and limitations of Raman spectroscopy.

UNIT-V **15 hrs**

RESONANCE SPECTROSCOPY

NMR: Introduction – Nuclear spin and magnetic moment - origin of NMR spectra - theory of NMR spectroscopy-Basic instrumentation – factor affecting chemical shift-spin-spin splitting, NMR spectrum of ethanol, acetone - coupling constant.

ESR: ESR introduction –factors affecting the g value- difference between ESR and NMR-basic instrumentation-Hyperfine interactions –Applications of ESR-hydrogen radical and methyl radical.

Text Books:

1. Puri B. R., Sharma L.R. 2003, Physical chemistry, 33rd edition, Vishal Puplications, New Delhi, India.
2. Cotton F.A., 1971, Chemical applications of group theory, 3rd edition, Wiley eastern Ltd., UK.
3. Banwell C. M., 2005, Fundamentals of Molecular spectroscopy, 4th edition, TMH company limited, 2005.

Reference Books:

1. Gurudeep Chatwal R., Anand S. K., 2002, Spectroscopy, 5th edition, Himalaya Puplications, NewDelhi , India.

2. Raman K.V., 1990, Group theory, 1st edition, Tata McGraw Hill Publishing Limited, NewDelhi, India.

Course designer:

1. Dr. A. Suganthi
2. Dr. T. Arumuganathan

UNIT	TOPIC	No. of lecture hrs
I	**GROUP THEORY-I**	
1.1	Introduction - Symmetry elements and symmetry operations	1
1.2	Definition of mathematical group – four cardinal properties of a group – closure, associative, idendity and inverse rule – cyclic group	2
1.3	Abelian group (H_2O only) and non-abelian group (NH_3 only)	2
1.4	Group multiplication table- C_2v and C_3v	2
1.5	Subgroup – similarity transformation – class of group	2
1.6	Point group – Assignment of point group of simple molecules	2
1.7	Matrix-introduction - matrix representation of the symmetry operations – idendity (E), Proper axis of rotation (C_n), Vertical reflection (σ_v), Improper axis of rotation (S_n) and Inverse (i)	2
1.8	Representation definition – reducible and irreducible representation of a group	2
II	**GROUP THEORY-II**	
2.1	The great orthogonality theorem (GOT) – rules for writing (properties of) irreducible representations	2
2.2	Projection operator (definition only) – character table definition construction of character table C_{2V}, C_{3V} and C_{2h} point group	3
2.3	Application of group theory – determination of hybridization in BF_3 and CH_4	3
2.4	Normal mode analysis – H_2O and NH_3	3
2.5	Selection rule of IR and Raman activity of normal modes of H_2O, N_2F_2, NH_3	2
2.6	Direct product representation - – selection rules to predict allowed and forbidden transition in UV-Visible electronic transition for example formaldehyde (HCHO)	2
III	**MOLECULAR SPECTROSCOPY**	
3.1	Electromegnetic Spectrum –different regions in electromagnetic spectrum-Molecular spectra-Types of molecular spectra.	1
3.2	**Microwave spectra** –Classification of molecules	2
3.3	Rotational spectra of diatomic molecules –Rigid rotator	2
3.4	Selection rules-Relative intensities of spectral lines- effect of isotopic substitution	2

3.5	Application of microwave spectroscopy – Determination of bond distances in diatomic molecules	3
3.6	**Electronic spectra** –electronic spectra of diatomic molecules	2
3.7	Franck Cotton principle – vibronic transitions and vibrational progression – group frequencies and factors affecting band position and intensities	3
IV	**INFRA-RED AND RAMAN SPECTROSCOPY**	
4.1	**Infra-red:** IR spectra - range - theory of IR spectroscopy- selection rule-Instrumentation	3
4.2	Diatomic molecule as a harmonic oscillator and a rigid rotator - Diatomic molecule as anharmonic oscillator and a non-rigid rotator -	2
4.3	Analysis of IR spectra on the basis of modes of vibrations of polyatomic molecules CO_2, H_2O -	2
4.4	Finger print region and Characteristic frequencies – Fermi resonance.	1
4.6	**Raman spectra:** Introduction – Difference between IR and Raman spectra –	2
4.7	Pure rotational Raman spectra – polarization of light –Raman effect –	2
4.8	Application of Raman effects to chemistry, –Mutual exclusion principle, –Instrumentatio-advantages and limitations of Raman spectroscopy.	3
V	**RESONANCE SPECTROSCOPY**	
5.1	**NMR:** Introduction – Nuclear spin and magnetic moment - origin of NMR spectra –	2
5.2	Theory of NMR spectroscopy-Basic instrumentation	2
5.3	Factor affecting chemical shift-spin-spin splitting,	2
5.4	NMR spectrum of ethanol, acetone, acetaldedehyde, toluene	2
5.5	Coupling constant - applications of NMR spectroscopy.	2
5.6	**ESR:** ESR introduction –factors affecting the g value	2
5.7	Difference between ESR and NMR-basic instrumentation	2
5.8	Hyperfine interactions –Applications of ESR.	1

THIAGARAJAR COLLEGE, MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2019)
Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19CE51(B)	**Industrial Chemistry**	Core elective -2 (Option B)	5	-	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
III	V	25	75	100

Preamble

This course enables the students to gain knowledge on concepts of chemistry and its significant impacst on industries.

Course Outcomes

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

	Course outcome	Knowledge level
CO1	Tell the properties and uses of solid, liquid and gaseous industrial fuels.	K1
CO2	Explain the chemical properties and their usage in fertilizer, pesticide and sugar industries.	K2
CO3	Measure the hardness of water by EDTA method.	K3
CO4	Explain about air, water pollution, toxicity of chemicals and their biochemical effect.	K2
CO5	Apply their knowledge to prepare simple cottage industrial compounds such as candle, ink etc.,	K3

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT-1: Industrial fuels (15 h)

Energy Sources: non-renewable, classification of fuels: solid, liquid and gaseous. Calorific value of fuels and its determination.

Solid fuels Coal: types – properties and uses – lignite, sub-bituminous coal, bituminous coal and anthracite. Coking and non-coking coal.

Liquid fuels: Refining of crude petroleum and uses of fractions. Hydrodesulphurisation. Cracking: thermal and catalytic (fixed bed and fluidised bed cataylsis). Octane number. Production and uses of tetraethyl lead, ETBE and MTBE.

Gaseous fuels: Natural gas and gobar gas: production, composition and uses, Gobar electric cell.

UNIT-2: Chemistry and agriculture (15 h)

Fertilizers: NPK, representation,superphosphate, triple superphosphate, uses of mixed fertilizers. Micronutrients and their role, biofertilizers, plant growth harmones.

Pesticides: Classification of pesticides with examples. Insectides; stomach poisons, contact insecticides, fumigants. Manufacture and uses of insecticides. DDT, BHC (gammaxane: Conformation of gamma isomer) pyrethrin. Mention of aldrin, dieldrin, endrin and pentachlorophenel (and its Na salts) and **Biopesticides**: Herbicides: Manufacture of 2,4-D and 2,4,5-T Fungicides: Preparation of Bordeaux mixture. Mention of lime-sulphur, creosote oil and formula.

Sugar industry: Double sulphitation process. Refining and grading of sugar. Saccharin: synthesis and use as a sugar substitute - aspartame. Ethanol: manufacture from molasses by fermentation.

UNIT-3: Water treatment (15 h)

Introduction to sources of water. Hardness of water-temporary or carbonate hardness, permanent hardness or non-carbonate hardness. Units of hardness, disadvantages of hard water – In domestic, in industry and in steam generation in boilers. Effect of iron and manganese in water. Estimation of hardness – EDTA method – Estimation of total hardness – O. Hehner's method or alkali titration method.

Water softening methods Industrial purpose Lime – soda process, Zeolite process; Ion-exchange - Demineralisation - deionisation process. Mixed – bed deionisation. Domestic purpose Removal of suspended impurities. Removal of microorganism – Chlorination . Break point chlorination. Reverse osmosis. Desalination.

UNIT- 4: Pollution and chemical toxicology (15 h)

Pollution: Air pollution - Acid rain. Green house effect (global warming), ozone layer depletion - photochemical oxidants. Control of air pollution. Water pollution – organic pollutants, Chemical oxygen demand (COD), Biological oxygen demand (BOD), total organic carbon. International standards for water and air quality and regulations

Chemical toxicology: Effect of toxic chemicals on enzymes. Lead, mercury and cyanide pollution and their biochemical effects. Carbon monoxide, sulfur dioxide, oxides of nitrogen, ozone – biochemical effects.

UNIT-5: Small scale units (15 h)

Safety matches, agarbatties, naphthalene balls, wax candle, shoe polish, gum paste, writing/ fountain pen ink, chalk/crayons, plaster of paris, silicon carbide crucibles, how to remove stains.

Text book:

1. B.K. Sharma, Industrial Chemistry, Goel publishing house, sixteenth edition 2011.

Reference book:

2. O.P. Veramani, A.K. Narula, Industrial Chemistry, Galgotia publication Pvt. Limited, 2004.

Course designer:

1. Dr. A. Suganthi
2. Dr. R. Mahalakshmy

Course content and lecture schedule

Unit	Topic	No. of lecture hours
I	**Industrial fuels**	
1.1	**Energy Sources:** non-renewable, classification of fuels: solid, liquid and gaseous. Calorific value of fuels and its determination.	4
1.2	**Solid fuels Coal:** types – properties and uses – lignite, sub-bituminous coal, bituminous coal and anthracite. Coking and non-coking coal.	3
1.3	**Liquid fuels:** Refining of crude petroleum and uses of fractions. Hydrodesulphurisation. Cracking: thermal and catalytic (fixed bed and fluidised bed cataylsis). Octane number. Production and uses of tetraethyl lead, ETBE and MTBE.	5
1.4	**Gaseous fuels**: Natural gas and gobar gas: production, composition and uses, Gobar electric cell.	3
II	**Chemistry and agriculture**	
2.1	**Fertilizers**: NPK, representation,superphosphate, triple superphosphate, uses of mixed fertilizers. Micronutrients and their role, biofertilizers, plant growth harmones.	2
2.2	**Pesticides:** Classification of pesticides with examples. Insectides; stomach poisons, contact insecticides, fumigants. Manufacture and uses of insecticides. DDT, BHC (gammaxane: Conformation of gamma isomer) pyrethrin. Mention of aldrin, dieldrin, endrin and pentachlorophenel (and its Na salts)	4
2.3	**Biopesticides**: Herbicides: Manufacture of 2,4-D and 2,4,5-T Fungicides: Preparation of Bordeaux mixture. Mention of lime-sulphur, creosote oil and formula.	4
2.4	**Sugar industry:** Double sulphitation process. Refining and grading of sugar. Saccharin: synthesis and use as a sugar substitute - aspartame. Ethanol: manufacture from molasses by fermentation.	5
III	**Water treatment**	

3.1	Introduction to sources of water. Hardness of water-temporary or carbonate hardness, permanent hardness or non-carbonate hardness. Units of hardness, disadvantages of hard water	3
3.2	In domestic, in industry and in steam generation in boilers.	1
3.3	Effect of iron and manganese in water. Estimation of hardness – EDTA method – Estimation of total hardness – O. Hehner's method or alkali titration method.	4
3.4	Water softening methods Industrial purpose Lime – soda process, Zeolite process; Ion-exchange - Demineralisation - deionisation process. Mixed – bed deionisation. Domestic purpose Removal of suspended impurities.	5
3.5	Removal of microorganism – Chlorination.	1
3.6	Break point chlorination. Reverse osmosis. Desalination.	1
IV	**Pollution and chemical toxicology**	
4.1	Pollution: Air pollution - Acid rain. Green house effect (global warming), ozone layer depletion - photochemical oxidants. Control of air pollution.	5
4.2	Water pollution – organic pollutants, Chemical oxygen demand (COD), Biological oxygen demand (BOD), total organic carbon. International standards for water and air quality and regulations	5
4.3	Chemical toxicology: Effect of toxic chemicals on enzymes. Lead, mercury and cyanide pollution and their biochemical effects. Carbon monoxide, sulfur dioxide, oxides of nitrogen, ozone – biochemical effects.	5
V	**Small scale units**	
5.1	Safety matches, agarbatties,	3
5.2	Naphthalene balls, wax candle, shoe polish, gum paste	4
5.3	Writing/ fountain pen ink, chalk/crayons,	4
5.4	Plaster of paris, silicon carbide crucibles, how to remove stains.	4

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Department of Chemistry
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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19NE51	Processing of consumer products (Lab)	Non major elective	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
III	V	15	35	50

Preamble

This lab course enables the students to prepare consumer products which are useful in day- to-day life on their own.

Course Outcomes

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

#	Course Outcome
CO1	Identify the various ingredients present in the consumer products.
CO2	Gain theoretical knowledge on the preparation of consumer products.
CO3	Prepare consumer products like detergent powder, cleaning powder, tooth powder, etc., on their own.
CO4	Become an entrepreneur in making consumer products.

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Training in the laboratory preparation of the following products:

(i) Tooth powder
(ii) Detergent powder
(iii) Cleaning powder
(iv) Phenoyl
(v) Shampoo
(vi) Pain Balm
(vii) Face powder
(viii) Candle
(ix) Chalk
(x) Soap oil

Text Books:

1. Poucher, W.A. Perfumes, Cosmetics and soaps, Vol. III, Modern Cosmetics;
2. Simons, J.V. Chemistry and the beauty business.
3. B.K.Sharma, Industrial Chemistry, Goel publishing House, Meerut, 2003, New Delhi.

Reference Books:

1. R.V.Shreve, Industrial Chemical Process, Tata McGraw Hill publishing company, 2005, Mumbai.
2. Mohan Malhotra, Latest Cottage Industries, 20th Edition Edn, Vishal publishers, 1980, Meerut.

Course Designer:

Dr. D. S. Bhuvaneshwari

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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19C61	**Inorganic Chemistry and Computer Applications**	Core 12	5	1	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
III	VI	25	75	100

Preamble

The course explains the basic concepts of analytical chemistry, inorganic polymers and computer applications.It also gives introduction about computers and programming in 'C' language.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	List various titration techniques, principle and applications of colorimetric and spectrophotometric analysis techniques.	K1
CO2	Explain the principle, instrumentation and applications of electrochemical and thermal techniques.	K2
CO3	Summarise the preparation, general properties and application of various inorganic polymers.	K2
CO4	Demonstrate the history and development of computer, operating systems, input and output devices.	K2
CO5	Solve the problems in chemistry using C programming language.	K3

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	-	-	S
CO2	S	M	S	-	S
CO3	S	M	-	M	S
CO4	S	S	-	L	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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Unit I: ANALYTICAL CHEMISTRY -I (15L Hrs + 3T Hrs)

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

ii. Colorimetric and Spectrophotometric analysis-Beer's - Lambert's law and problems involving concentrations using Beer's-Lambert's law, working of double beam UV-visible spectrophotometer-determination of Nickel (II) and iron(III).

Unit II: ANALYTICAL CHEMISTRY-II (15L Hrs + 3T Hrs)

i. Principle, instrumentation and aplication of Cyclic voltammetry, amphrometric titration, Electrogravimetric methods (with out potential control) and Coulumetric methods.

ii. Principles and instrumentation TGA and DTA- glass transition temperature of polymer-applications of calcium oxalate monohydrate, Copper sulphate pentahydrate and mixture of polymers.

Unit-III: **INORGANIC POLYMERS** (15L Hrs + 3T Hrs)

Inorganic polymers-General properties- Glass transition temperature-phosphorous based polymers- chain polymers, Maddrell's salts- kuroll's salts-phosphorous based network polymers-Sulphur based polymers- Switching phenomenon in chalcogenide glass- Boron based polymers-Polymeric boron nitride-comparision of polymer of boron nitride and graphite -Silicon polymers-linear polymer- cross linking polymer- copolymer-**coordination polymers.**

Unit-IV: INTRODUCTION OF COMPUTERS (15L Hrs + 3T Hrs)

Importance of Computers-history and development-hardware and software-structure of a computer - operating systems - DOS and UNIX – Low level and High level languages- Interpreter and compiler-Types of Computers - various input and output devices.

Unit-V: PROGRAMMING IN `C' LANGUAGE (15L Hrs + 3T Hrs)

i. Advantages - types-style of the language - Structure of C-program- keywords -variables – constants-data types-operators-arithmetic expressions--input and output functions- Running of C program -control-statements-Looping statements- arrays.

ii. Application Of C Program in Chemistry-Formula Translations.

Calculation of RMS and average velocities of O_2 - Mean activity coefficient of an electrolyte - Calculation of pH of the given solution - Use of braces in if-else ladder to obtain the lines of Lyman series-Applying C-programming to simple physical chemistry practicals like Rast method and Ester hydrolysis - Calculation of Normality, Molarity and molality of the given solution - Conversion of Celsius to Kelvin temperature and vice versa.

Text Books:

1. Sharma, B. K. 2000. Instrumental Methods of Chemical Analysis, 5th edn. Goel publication, New Delhi.
2. Balaguruswamy, 1. E. 2005. Programming in ANSI C, 3rd edn, Tata McGraw-Hill publishing Company Ltd., New Delhi.

Reference Books:

1. Yaswant Kanitkar, 1998. Let us C, BPB Publications, New Delhi.
2. Puri, B.R. and Sharma, L.R. and Kalia, K. C. 2004. Principles of Inorganic Chemistry, 28th edn, Vallabh publication, New Delhi.
3. Skoog. and West. 2004. Principles of instrumental analysis, 5th edn. Thomson Brooks Cole, Singapore.

Course designers Dr. A. SuganthiDr. A. ElangovanDr. D.S. Bhuvaneswari

1. Dr. K. Selvakumar

Unit	Topic	No. of lecture hrs.
I	**ANALYTICAL CHEMISTRY -I**	**18**
1.1	Redox titrations	1
1.2	Redox potentials, theory of redox indicators	2
1.3	Principals involved in iodometric and iodimetric titrations	2
1.4	Complexometric titrations involving EDTA	1
1.5	Indicators for Complexometric titrations.	1
1.6	Colorimetric and Spectrophotometric analysis	1
1.7	Beer's - Lambert's law	1
1.8	Problems involving concentrations using Beer's-Lambert's law,	2
1.9	Working of double beam UV-visible spectrophotometer	2
1.10	Determination of Nickel (II) and iron(III).	1
1.11	Determination of iron(III).	1
	Tutorial	3
II	**ANALYTICAL CHEMISTRY-II**	**18**
2.1	Principle, instrumentation of Cyclic voltammetry	2
2.2	Application of Cyclic voltammetry	1
2.3	Principle, instrumentation of amphrometric titration	2
2.4	Application of amphrometric titration	1
2.5	Electrogravimetric methods (without potential control)	2
2.6	Principle, instrumentation and Application of Coulumetric method.	1
2.7	Principles and instrumentation TGA	1
2.8	Principles and instrumentation DTA	1
2.9	Glass transition temperature of polymer	1
2.10	Applications of calcium oxalate monohydrate	1
2.11	Copper sulphate pentahydrate	1
2.12	Mixture of polymers.	1
	Tutorial	3
III	**INORGANIC POLYMERS**	**18**
3.1	Inorganic polymers-General properties	2
3.2	Glass transition temperature	1
3.3	Phosphorous based polymers- chain polymers	2
3.4	Maddrell's salts- kuroll's salts	1
3.5	Phosphorous based network polymers	2

3.6	Sulphur based polymers	1
3.7	Switching phenomenon in chalcogenide glass	1
3.8	Boron based polymers- Polymeric boron nitride	2
3.9	Comparision of polymer of boron nitride and graphite	1
3.10	Silicon polymers-linear polymer	1
3.11	Cross linking polymer- copolymer.	1
	Tutorial	3
IV	**INTRODUCTION OF COMPUTERS**	**18**
4.1	Importance of Computers	1
4.2	History and development	1
4.3	Hardware and software	1
4.4	Structure of a computer	1
4.5	Operating systems - DOS	2
4.6	Operating systems - UNIX	2
4.7	Low level and High level languages	3
4.8	Interpreter and compiler	1
4.9	Types of Computers	1
4.10	Various input and output devices.	2
	Tutorial	3
V	**PROGRAMMING IN `C' LANGUAGE**	**18**
5.1	Advantages - types-style of the language	1
5.2	Structure of C-program- keywords -variables datas	1
5.3	Constants-datatypes-operators-arithmetic expressions- input and output functions	1
5.4	Running of C program -control-statements-Looping statements-arrays.	2
5.5	Application of C Program In Chemistry-Formula Translations.	1
5.6	Calculation of RMS and average velocities of O_2 - Mean activity coefficient of an electrolyte.	2
5.7	Calculation of pH of the given solution - Use of braces in if-else ladder to obtain the lines of Lyman series.	1
5.8	Applying C-programming to simple physical chemistry practicals like Rast method and Ester hydrolysis.	2
5.9	Calculation of Normality, Molarity and molality of the given solution.	2
5.10	Conversion of Celsius to Kelvin temperature and vice versa.	1
	Tutorial	3

THIAGARAJAR COLLEGE, 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
UCH19C62	Organic Chemistry - IV	Core-13	5	1	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
III	VI	25	75	100

Preamble

The course explains the chemistry of heterocyclic compounds, dyes, natural products, amino acids, peptides, proteins and enzymes. It describes the mechanism of photochemical reactions.The basic principles and applications of green chemistry are also discussed in this course.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Recall the chemistry of heterocyclics and their applications in dye industry.	K1
CO2	Explain the role of heterocyclics in natural product chemistry.	K2
CO3	Compare thermal and photochemical reactions.	K2
CO4	Utilize the chemical properties of amino acids, proteins and enzymes.	K3
CO5	Outline the principles and importance of green chemistry and make use of it in day today life.	K2, K3

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT – I **(15L Hrs + 3T Hrs)**

HETROCYCLIC COMPOUNDS AND DYES

Introduction to heterocyclic compounds, Nomenclature – preparation and reactions of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole.

Introduction to dyes – colour and constitution - Classification based on structure and application – preparation and applications of the following dyes – methylorange, congored, malachite green, flourescein, phenolphthalene and indigo.

UNIT –II

CHEMISTRY OF NATURAL PRODUCTS **(15L Hrs + 3T Hrs)**

Alkaloids

Introduction - general characteristics - classification – Hofmann Exhaustive methylation - structure and synthesis of the following alkaloids – piperine, nicotine, and atropine.

Terpenoids

Introduction and classification - isoprene rule – gem dialkyl rule - structure, synthesis and stereochemistry of the following terpenoids – citral, menthol and camphor.

UNIT – III

PHOTOCHEMISTRY **(15L Hrs + 3T Hrs)**

Difference between photochemical and thermal reaction – Jablonski diagram - introduction to photochemical reaction - photochemical reactions of carbonyl compounds: Norrish type I and II reactions, photo elimination - photo reductions - photo oxidations - Cis -trans isomerisation – rearrangements – Cyclisation (Diel's Alder reaction) – Woodward – Hofmann rules for cyclo additions.

UNIT – IV **(15L Hrs + 3T Hrs)**

AMINO ACIDS, PEPTIDES, PROTEINS AND ENZYMES:

Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis – Protection of –COOH group and –NH2 group – ninhydrin test.

Enzymes – specificity – Prosthetic group – co-enzyme, apoenzyme, holoenzyme, co-factor – nomenclature and classification of enzyme – application of enzymes.

UNIT – V **(15L Hrs + 3T Hrs)**

GREEN CHEMISTRY

Definition – Basic principles- Solid state and solvent free organic reactions (using supported reagents)- Microwave radiation- Characteristics of microwave heating- Difference between microwave heating and conventional heating.

Microwave assisted reactions in aqueous media, organic solvents, Supercritical CO_2 and ionic liquids.

Text Books:

1. Bhupinder Mehta, Manju Mehta, 2015, "Organic Chemistry", Prentice Hall of India Pvt Ltd,. New Delhi.
2. Bahl, A. and Bahl, B.S. 2009, A Text Book of Organic Chemistry, S. Chand & Company Limited, New Delhi.

Reference books

- I.L.Finar, 2005, Organic chemistry Vol 1, 6th edition, Pearson Edition Singapore.
- I.L. Finar, 2005, Organic Chemistry, Vol. II, V Edition, ELBS, UK.
- K.S.Tewari, N.K.Vishil and S.N.Mehotra. 2001, A text book of Organic Chemistry, 1st edition, Vikas Publishing House Pvt Ltd, New Delhi.
- R.T. Morrision and R.N. Boyd, 1997, Organic chemistry, 6th edition, Prentice Hall Private Limited, New Delhi.
- Hermann Dugus, 2004, Bioorganic Chemistry, Springer International, III Edition, New Delhi.
- K. R. Desai, 2005, Green Chemistry, Himalaya Publishing House, Mumbai.

Course designer

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi

Units	Topic	No. of lecture hrs
I	**HETROCYCLIC COMPOUNDS AND DYES**	**18**
1.1	Introduction to heterocyclic compounds, Nomenclature	2
1.2	Chemistry of furan, thiophene, pyrrole, pyridine, quinoline, isoquinoline and indole.	6
1.3	Introduction to dyes – colour and constitution - Classification based on structure and application –	2
1.4	Preparation and applications of – methylorange, congored, malachite green, flourescein, phenolphthalene and indigo	5
	Tutorial	3
II	**CHEMISTRY OF NATURAL PRODUCTS**	**18**
2.1	Alkaloids:Introduction-generalcharacteristics- classification –Hofmann Exhaustive methylation	3
2.2	Structure and synthesis of alkaloids – piperine, nicotine, and atropine.	3
2.3	Terpenoids:Introduction and classification - isoprene rule – gem dialkyl rule.	3
2.4	structure, synthesis and stereochemistry of the following terpenoids – citral, menthol and camphor.	6
	Tutorial	3
III	**CHEMISTRY OF NATURAL PRODUCTS**	**18**
3.1	Introduction to photochemical reaction -Difference between photochemical and thermal reaction – Jablonski diagram	4
3.2	Photochemical reactions of carbonyl compounds: Norrish type I and II reactions.	2
3.3	Photo elimination, photo reductions, photo oxidations	4
3.4	Cis -trans isomerisation, rearrangements – Cyclisation (Diel's Alder reaction)	3
3.5	Woodward – Hofmann rules for cyclo additions	2
	Tutorial	3
IV	**AMINO ACIDS, PEPTIDES, PROTEINS AND ENZYMES**	**18**

4.1	*Preparation of Amino Acids:* Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis.	5
4.2	*Reactions of Amino acids*: ester of –COOH group, acetylation of $–NH_2$ group, complexation with Cu^{2+} ions, ninhydrin test.	3
4.3	Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins	3
4.4	Nomenclature and classification of enzyme –	1
4.5	–Enzymes specificity – Prosthetic group – co-enzyme, apoenzyme, holoenzyme, co-factor, Applications of enzymes	3
	Tutorial	3
V	**GREEN CHEMISTRY**	**18**
5.1	Definition, Requirements- Basic principles	4
5.2	Solid state and solvent free organic reactions (using supported reagents)	2
5.3	Microwave radiation- Characteristics of microwave heating, requirements of microwave reactions	3
5.4	Differences between microwave heating and conventional heating.	1
5.5	Microwave reactions in aqueous media, organic solvents, Supercritical CO_2 and ionic liquids.	5
	Tutorial	3

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Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2019)
Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19C63	Physical Chemistry-1V	Core-14	5	1	-	6

Year	Semester	Int. Marks	Ext. Marks	Total
III	VI	25	75	100

Preamble

To course explains the fundamental concepts, theories and applications of electro chemistry and Colloids. Also explains various photochemical processes and surface chemistry concepts.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Explain the fundamental concepts of electrochemistry.	K2
CO2	Tell the theories and applications of electrochemistry.	K1
CO3	Explain various photochemical processes.	K2
CO4	Identify the preparation, properties and applications of colloids.	K3
CO5	Recall their knowledge on surface chemistry concepts.	K1

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

UNIT – I

ELECTRO CHEMISTRY – I (15L+ 3T + 0P- hrs)

(i) Conductance: Electrical conductance in solution – Ohm‘s law and Faraday‘s law, specific, equivalent and molar conductance, variation of conductance with dilution – Oswald‘s dilution law, Kohlrausch‘s law and its application, conductometric titrations (Strong acid and strong base, weak acid and weak base)

(ii) Ionic equilibria: Ionic product of water, Ionization constant of weak acids and bases, pH, pOH and pKa, buffer solutions – Henderson-Haselbach equation, common ion effect (definition only).

UNIT – II

ELECTROCHEMISTRY – II (15L+3T +0P - hrs)

Electrochemical cells – Galvanic cells and Emf, electrode reaction and electrode potential – thermodynamics of cells -concentration cells, measurement of Emf (Poggendrof‘s method) and it‘s applications, Nernst‘s equation - standard electrode potential –representation of cells- Electrochemical ells, dry cell – Leglanche’s cell, lead storage battery, potentiometric titration (FAS Vs $K_2Cr_2O_7$ only), fuel cells – hydrogen-oxygen fuel cell.

UNIT – III PHOTOCHEMISTRY (15L+3T +0P - hrs)

Introduction-definition-Absorption of photochemical reactions, Absorption of radiation – Laws of photochemistry – quantum efficiency, thermal and photochemical reactions, Jablonski diagram – fluorescence and phosphorescence – photosensitization – chemluminescence – bioluminescence - Hydrogen – bromine reaction, Hydrogen -chlorine reaction.

UNIT – IV COLLOIDS (15L+3T +0P hrs)

Definition-Differene between true solution, colloidal solution and suspension – classification of colloids, difference between lyophilic and lyophobic colloids, preparation and properties of colloids-electrical double layer- zeta potential – coagulation, Hardy Schulze law, Hofmeister series protective effects – protective colloids - gold number – gels, thixotrophy, synerisis and imbibition –applications of colloids (purification of drinking water, pollution control, sewage disposal, medicine and detergent)

UNIT – V SURFACE CHEMISTRY (15L+3T +0P - hrs)

Definition-Adsorption, adsorbent, adsorbate, occlusion - types of adsorption- -Differences between physisorption and chemisorption-Langmuir‘s and Freundlich adsorption isotherms, positive and negative adsorption, application of adsorption (gas masks, chromatography, preserving vacuum, cleaning of sugar, paint industry and catalysis).

Text Books

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

Reference Books

1. Bokris J. O. M. and Reddy A. K. N., 1998, Modern Electrochemistry, Vol I and Vol II, Plenum Press, New York, USA.
2. Van Samuel Glasstone D., 2002, Thermodynamics, 5th edition, Eastern Wiley Publication, London,
3. Rahatgi Mukherjee, 1994, Fundamentals of Photochemistry, Willey Eastern Ltd., New York, USA.

Course designers Dr. P. Sayee KannanDr. A. R. RameshDr. T. Arumuganathan

UNITS	TOPIC	No. OF LECTURE Hrs
I	**ELECTRO CHEMISTRY – I**	
1.1	Electrical conductance in solution	1
1.2	Ohm's law and Faraday's law – specific, equivalent and molar conductance	2
1.3	Variation of conductance with dilution- Oswald's dilution law	2
1.4	Kohlrausch's law and its application	2
1.5	Conductometric titrations -Strong acid and strong base -weak acid and weak base	2
1.6	Ionic equilibria: Ionic product of water - Ionisation constant of weak acids and bases	2
1.7	pH, pOH and pKa	1
1.8	Buffer solutions – Henderson equation	2
1.9	Common ion effect	1
II	**ELECTROCHEMISTRY – II**	
2.1	Electrochemical cells – Galvanic cells and Emf- electrode reaction and electrode potential	2
2.2	Thermodynamics of cells	1
2.3	Concentration cells	1
2.4	Measurement of Emf (Poggendrof's method) and it's applications	2
2.5	Nernst's equation	1
2.6	Standard electrode potential – Electrochemical ells	1
2.7	Dry cell-Leglanche's cell	1
2.8	Lead storage battery	2
2.9	Potentiometric titration (FAS Vs $K_2Cr_2O_7$ only)	2
2.10	Fuel cells - Hydrogen – Oxygen fuel cell.	2
III	**PHOTOCHEMISTRY**	
3.1	Absorption of potochemical reactions	2
3.2	Hydrogen – bromine reaction	2
3.3	Hydrogen chlorine reaction	2
3.4	Absorption of radiation – Laws of photochemistry	3
3.5	Quantum efficiency – thermal and photochemical reactions	3
3.6	Jablonski diagram – fluorescence and phosphorescence	3

	photosensitization – chemluminescence – bioluminescence	
IV	**COLLOIDS**	
4.1	Differences between true solution, colloidal solution and suspension - clasification of colloids	3
4.2	Differences between lyophilic and lyophobic colloids	1
4.3	Preparation and properties of colloids- zeta potential – coagulation	2
4.4	Hardy Schulze law	2
4.5	Hofmeister series protective effects- protective colloids - gold number	2
4.6	Gels – thixotrophy, synerisis and imbibitions	2
4.7	Applications of colloids (purification of drinking water, pollution control, sewage disposal, medicine and detergent)	3
V	**UNIT –V** **SURFACE CHEMISTRY**	
5.1	Adsorption -Differences between absorption and adsorption	2
5.2	Types of adsorption- physical adsorption, chemical adsorption	3
5.3	Occlusion	1
5.4	Langmuir‘s adsorption isotherms	2
5.5	Freundlich adsorption isotherms	2
5.6	Positive and negative adsorption	2
5.7	Application of adsorption (gas masks, chromatography, preserving vacuum, cleaning of sugar, paint industry and catalysis)	3

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Department of Chemistry
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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19CL61	Experiments in Physical chemistry	Core Lab - VI	1	-	4	3

Year	Semester	Int. Marks	Ext. Marks	Total
III	VI	40	60	100

Preamble

This lab course develops the skill of doing potentiometric, conductometric, kinetics, phase rule and colligative properties related experiments.

Course Outcomes

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

#	Course Outcome
CO1	Do the potentiometric and conductometric titrations.
CO2	Determinethe molecular weight of a solute.
CO3	Apply phase phase rule to simple systems.
CO4	Do experiment with CST of phenol – water system.
CO5	Determine the kinetics of ester hydrolysis reaction.

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

1. Potentiometric Titrations (Redox titration).
2. Conductometric Titrations (Strong acid Vs Strong base).
3. Molecular weight determination by Rast Micro Method.
4. Simple Eutectic system (Phase diagram).
5. Compound formation (Phase diagram).
6. Ester hydrolysis using acid HCl or H_2SO_4
7. Critical Solution Temperature (CST) of Phenol-water system and effect of impurity on CST.

Course designers Dr. P. PrakashDr. R. MahalakshmyDr. T. Arumuganathan

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Course Code	Course title	Category	L	T	P	Credit
UCH19CE61(A)	Coordination Chemistry	Core elective -3 (Option A)	5	-	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
III	VI	25	75	100

Preamble

The course explains the theories, mechanism and applications of coordination compounds. Also gives detailed information about the classification, preparation, structure, properties and uses of metal carbonyls.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Name the basic terms and isomerism involved in coordination compounds.	K1
CO2	Explain the theories of coordination compounds.	K2
CO3	Illustrate the reaction mechanism of coordination complexes.	K2
CO4	Outline the preparation, structure, properties and uses of metal carbonyls.	K2
CO5	Apply coordination compounds in various fields such as analytical, qualitative analysis, colorimetry, gravimetry, therapy, industries and in biological systems.	K3

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	-	-	-	**S**
CO2	**S**	-	-	-	**S**
CO3	**S**	-	M	-	**S**
CO4	**S**	M	-	-	**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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT – I: Introduction to coordination Chemistry (15 hrs)
Introduction to the transition elements – electronic configuration – variable valency – double salts and coordination compounds – coordination number and geometries, nomenclature –physical methods in the study of complexes – Werner‘s theory – stability of complexes – determination of stability constants – jobs method – stepwise stability constant – overall stability constant – factors affecting stability of coordination compounds – charge of central metal ion – size of central metal ion – chelate ring size – steric effects. Isomerism in coordination compounds.

UNIT – II: Theories of Coordination Chemistry (15 hrs)
Theories – Valence bond theory - application to octahedral and square planar complexes – crystal field theory – magnetic properties of metal complexes – factors influencing the magnitude of crystal field splitting – colour of transition metal complexes Jahn Teller distortion – Electronic spectra – Orgel diagram – d1 and d9 systems – MO theory applied to sigma bonding only.

UNIT – III: Reaction mechanism of coordination complexes (15 hrs)
Reactions of metal complexes. Labile and Inert complexes VBT, Taube‘s explanation of lability and inertness – ligand substitution reactions applied to Octahedral complexes SN1, SN2 reactions. Electron transfer reactions, inner sphere and outer sphere mechanism.

UNIT – IV: Metal Carbonyls (15 hrs)
Complexes of Pi acceptor ligands – metal carbonyls and **its types**– EAN rule – classification preparation – properties – uses of metal carbonyls – bonding in metal carbonyls – IR spectra of metal complexes in cis – trans isomerism – determination of bond order of CO – differentiating terminal and bridging CO – structures of some common binary metal carbonyls – Preparation, properties, structure and bonding of mononuclear carbonyls of nickel, iron and chromium, binuclear carbonyls of iron, cobalt and manganese and trinuclear carbonyls of iron and osmium. Tetra nuclear carbonyls of iridium-Vibrational spectroscopy in the study of **carbonyls.**

UNIT – V:Application of coordination compounds **(15 hrs)**
Application of coordination compounds- metal complexes in analytical chemistry – Inorganic qualitative analysis – complexometric titrations – complexes in colourimetry, gravimetry - metal complexes in therapy – metal complexes in industries –Metal Complexes in Biological system.

Text books:

1. W. U. Malik, G.D. Tuli, R.D. Madan,2003.Selected topics in Inorganic Chemistry, 7th edition, S. Chand & Company Ltd, New Delhi.
2. R. Gopalan, V. Ramalingam,2001.Concise coordination chemistry –Vikas publishing House, PVT LTD, New Delhi.

Reference books:

1. J.E. Huheey, Ellen A.Keiter, Richard L.Keiter,2004. Inorganic Chemistry, IV Edn., Pearson Education (Singapore) Pvt. Ltd., New Delhi..
2. J.D. Lee, 2002.Concise Inorganic Chemistry, Blackwell Science Ltd., V Edn., London.

Course Designer: Dr. A. SuganthiDr. P. Tharmaraj

Units	Topic	No. of lecture hrs
I	**Introduction to coordinationChemistry**	**15**
1.1	Introduction to the transition elements – electronic configuration	2
1.2	Variable valency – double salts and coordination compounds – coordination number and geometries, nomenclature	3

1.3	Physical methods in the study of complexes – Werner‘s theory	1
1.4	Stability of complexes – determination of stability constants – jobs method – stepwise stability constant – overall stability constant	3
1.5	Factors affecting stability of coordination compounds – charge of central metal ion – size of central metal ion – chelate ring size – steric effects.	3
1.6	Isomerism in coordination compounds.	3
II	**Theories of Coordination Chemistry**	15
2.1	Theories – Valence bond theory	2
2.2	Application to octahedral and square planar complexes	1
2.3	crystal field theory – magnetic properties of metal complexes	2
2.4	Factors influencing the magnitude of crystal field splitting	2
2.5	Colour of transition metal complexes Jahn Teller distortion	3
2.6	Electronic spectra – Orgel diagram – d1 and d9 systems	3
2.7	MO theory applied to sigma bonding only.	2
III	**Reaction mechanism of coordination complexes**	15
3.1	Reactions of metal complexes. Labile and Inert complexes VBT	3
3.2	Taube‘s explanation of lability and inertness	2
3.3	Ligand substitution reactions applied to Octahedral complexes SN1, SN2 reactions	5
3.4	Electron transfer reactions, inner sphere and outer sphere mechanism.	5
IV	**Metal Carbonyls**	15
4.1	Complexes of Pi acceptor ligands – metal carbonyls – EAN rule	2
4.2	Classification preparation – properties – uses of metal carbonyls	2
4.3	Bonding in metal carbonyls – IR spectra of metal complexes in cis – trans isomerism	3
4.4	Determination of bond order of CO – differentiating terminal and bridging CO	4
4.5	Structures of some common binary metal carbonyls – carbonyls of Ni, Fe, Co.	4
V	**Application of coordination compounds**	15
5.1	Application of coordination compounds- metal complexes in analytical chemistry – Inorganic qualitative analysis	6
5.2	Complexometric titrations – complexes in colourimetry, gravimetry	2
5.3	metal complexes in therapy – metal complexes in industries –Metal Complexes in Biological system.	7

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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19CE61(B)	Bioinorganic Chemistry	Core elective-4 (Option B)	5	-	-	5

Year	Semester	Int. Marks	Ext. Marks	Total
III	VI	25	75	100

Preamble

our

The course explains the role of metal ions in biology and medicine. Also explains the structure and properties of metallo enzymes and metallo proteins.

Course outcomes

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

#	Course Outcome	Knowledge level
CO1	Understand the role of metal ions in biological systems.	K1
CO2	Explain the fundamentals of proteins and enzymes.	K2
CO3	Gain knowledge on structure and functions of hemoglobin and myoglobin.	K2, K3
CO4	Acquire knowledge on copper enzymes and nitrogenase.	K2, K3
CO5	Comprehend the applications of metal ions in medicine.	K3

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	-	M	M	S
CO2	S	-	-	-	S
CO3	S	M	M	-	S
CO4	S	-	L	-	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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

UNIT I: ROLE OF METALS IN BIOLOGY **(15 hrs)**

Introduction – Essential Chemical Elements – Metals in Biological Systems – Biological Metal Ion Complexation – Electronic and Geometric Structures of Metals –Metals in Biological Systems – Metals containing proteins and enzymes.

UNIT II: BIOCHEMISTRY FUNDAMENTALS **(15 hrs)**

Proteins – Amino Acid Building Blocks – Protein Structure – Protein Sequencing and Proteomics – Protein Function, Enzymes, Classification of enzymes – Enzyme Kinetics – Enzyme Inhibition

Unit III: IRON-CONTAINING OXYGEN CARRIERS **(15 hrs)**

Myoglobin and Hemoglobin: Structure of the Prosthetic Group – Mechanism for Reversible Binding of Dioxygen and Cooperativity of Oxygen Binding – Behavior of Dioxygen Bound to Metals – Structure of the Active Site in Myoglobin and Hemoglobin – Binding of CO to Myoglobin, Hemoglobin.

UNIT IV:COPPER ENZYMES AND NITROGENASE **(15 hrs)**

Copper Enzymes: Occurrence – Structure – Function – Discussion of Specific Enzymes: Superoxide Dismutase – Hemocyanin.

Enzyme Nitrogenase: Iron–Sulfur Clusters – Fe–Protein Structure – Detailed Mechanistic Studies.

UNIT V: METALS IN MEDICINE **(15 hrs)**

Inorganic Medicinal Chemistry - Metal Toxicity and Homeostasis – Anti-cancer agents: Cis-platin and related compounds - Chelation therapy – Cancer treatment – Anti-arthritis drugs – Gadolinium MRI Imaging Agents.

Text Books

1. K. Hussain Reddy,2003 Bioinorganic Chemistry New Age Internation (P) limited, New Delhi.
2. W. U. Malik, G.D. Tuli, R.D. Madan 2003. Selected topics in Inorganic Chemistry, 7th edition, S. Chand & Company Ltd, New Delhi.

Reference books

1. Rosette M. Roat-Malone, 2002, Bioinorganic Chemistry: A short course, Wiley—Interscience, John Wiley & Sons, Inc.
2. G.L. Miessler & Donald A. Tarr 2002: Inorganic Chemistry, Pearson Publication.
3. James E. Huheey, Ellen Keiter & Richard Keiter: Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Publication.
4. Lippard S.T., and Berg T.M., Principles of Bio-inorganic Chemistry, Panima Publishing Company, New York,1997.
5. J. E. Huheey, Inorganic Chemistry, 3rd ed., Harper & Row Publishers, Singapore.

Course Designers

1. Dr. R. Mahalakshmy
2. Dr. A. Tamil Selvi

Units	Topic	No. of lecture hrs
I	**ROLE OF METALS IN BIOLOGY**	**15**
1.1	Introduction – Essential Chemical Elements	3

1.2	Metals in Biological Systems – Biological Metal Ion Complexation	4
1.3	Electronic and Geometric Structures of Metals	4
1.4	Metals in Biological Systems – Metals containing proteins and enzymes.	4
II	**BIOCHEMISTRY FUNDAMENTALS**	15
	Proteins – Amino Acid Building Blocks	4
	Protein Structure – Protein Sequencing and Proteomics	3
	Protein Function, Enzymes, Classification of enzymes	5
	Enzyme Kinetics – Enzyme Inhibition	3
III	**IRON-CONTAINING OXYGEN CARRIERS**	15
3.1	Myoglobin and Hemoglobin: Structure of the Prosthetic Group–	3
3.2	Mechanism for Reversible Binding of Dioxygen and Cooperativity of Oxygen Binding	5
3.3	— Behavior of Dioxygen Bound to Metals – Structure of the Active Site in Myoglobin and Hemoglobin	5
3.4	Binding of CO to Myoglobin, Hemoglobin.	2
IV	**COPPER ENZYMES AND NITROGENASE**	15
4.1	**Copper Enzymes**: Occurrence – Structure – Function	4
4.2	Discussion of Specific Enzymes: Superoxide Dismutase – Hemocyanin.	4
4.3	**Enzyme Nitrogenase**: Iron–Sulfur Clusters	3
4.4	Fe–Protein Structure – Detailed Mechanistic Studies.	4
V	**METALS IN MEDICINE**	15
5.1	Inorganic Medicinal Chemistry - Metal Toxicity and Homeostasis	4
5.2	Anti-cancer agents: Cis-platin and related compounds	4
5.3	Chelation therapy – Cancer treatment	3
5.4	Anti-arthritis drugs – Gadolinium MRI Imaging Agents.	4

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Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19SE61(A)	**Water Analysis Lab**	SEC(Option A)	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
III	VI	15	35	50

Preamble

This lab course enhances the practical skill of analyzing the hardness of water, determination of COD and BOD of water samples.

Course Outcomes

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

#	Course Outcomes
CO1	Analyze the TDS and hardness of any water samples.
CO2	Check the alkalinity levels, pH levels, turbidity levels, fluoride level and sulphate level of water samples.
CO3	Detect Na by Flame photometric estimation.
CO4	Determine the COD and BOD of water samples.

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Experiments
1. Estimation of temporary and permanent hardness.
2. Estimation of calcium and magnesium hardness.
3. Estimation of chloride by Mohr's method.
4. Estimation of sulphate.
5. Spectro photometric estimation of fluoride.
6. Estimation of dissolved oxygen (DO).
7. Estimation of TDS.
8. Determination of Biological Oxygen Demand (BOD).
9. Determination of Chemical Oxygen Demand (COD).
10. Flame photometric estimation of sodium.

Course designer

Dr. P. Prakash

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Programme Code:UCH

Course Code	Course Title	Category	L	T	P	Credit
UCH19SE61(B)	**Food Chemistry**	SEC (Option B)	2	-	-	2

Year	Semester	Int. Marks	Ext marks	Total
III	VI	15	35	50

Preamble

The course briefly outlines the basic knowledge in Food and Milk Chemistry and learn the practical knowledge in food analysis.

Course Outcomes

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

	Course Outcomes	Knowledge level
CO1	Tell the functions of food group and its relation to health.	K1
CO2	Explain the composition and effectiveness of nutrition and balanced diet.	K2
CO3	Summarize the calorific value of food stuffs and factors affecting the basal metabolic rate (BMR).	K2
CO4	Make use of the nutritional value of proteins and carbohydrates.	K3

K1 : Knowledge K2 : Understand K3: Apply

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

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

UNIT I: Introduction (10 hours)

Food: source, functions of food – food groups – food guide – basic five food groups, usage of the food guide – food in relation to health – objectives of cooking.

Milk: Composition and effectiveness as a diet. Fat content in milk, whole and skimmed. Effect of cooking and heat processing of milk – pasteurization. Preservation of milk. Deep freeze preservation, dairy products – cheese, butter, ghee and kova. Spray drying technique – milk powder, infant food preparation. Lactose intolerance Milk substitutes – vegetable milk. Toned milk.

UNIT 2: Nutrition and Balanced Diet (10 hours)

Nutrition – calorific value of food stuff – RQ of food (Respiratory quotient of food) – basal metabolic rate – factors influencing BMR, specific dynamic action (SDA) of food. Thermogenic effect – energy requirements of individuals – diet and its components – the protein requirements – biological value of proteins, supplementary value of proteins. Diseases associated with protein malnutrition. Nutritional value of carbohydrates. – Fibers in the diet, dietary sugars – nutritional aspects of lipids.

Text books:

1.S.A. Iqbal, Y.Mido, Food Chemistry, Discovery Publishing House, Delhi, 2005.

Reference Book

1. M. Swaminathan, Food and Nutrition, Bappio publication, 1989.

Course Designer: Dr. A. Suganthi

Unit	**Topic**	**No. of lecture hrs**
I	Introduction	**15**
1.1	Food: source, functions of food – food groups – food guide – basic five food groups, usage of the food guide – food in relation to health – objectives of cooking.	4
1.2	Milk: Composition and effectiveness as a diet. Fat content in milk, whole and skimmed. Effect of cooking and heat processing of milk – pasteurization.	4
1.3	Preservation of milk. Deep freeze preservation, dairy products – cheese, butter, ghee and kova. Spray drying technique – milk powder, infant food preparation. Lactose intolerance Milk substitutes – vegetable milk. Toned milk.	5
	Revision	2
II	**Nutrition and Balanced Diet**	**15**
2.1	Nutrition – calorific value of food stuff – RQ of food (Respiratory quotient of food) – basal metabolic rate – factors influencing BMR, specific dynamic action (SDA) of food.	7
2.2	Thermogenic effect – energy requirements of individuals – diet and its components – the protein requirements – biological value of proteins, supplementary value of proteins. Diseases associated with protein malnutrition. Nutritional value of carbohydrates. – Fibers in the diet, dietary sugars – nutritional aspects of lipids.	7
	Revision	1
	Total (15+15)	30

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Course Code	Course Title	Category	L	T	P	Credit
UCH19SE61(C)	Polymer Chemistry	SEC (Option C)	2	-	-	2

Year	Semester	Int. Marks	Ext marks	Total
III	VI	15	35	50

Preamble

The course briefly outline the classification of polymers, types of polymerization and plastics. It also explains the chemistry of commercial polymers viz., PVC, polystyrene etc.,

COURSE OUTCOMES

	COURSE OUTCOMES	KNOWLEDGE level
CO 1	Classify different types of polymers and polymerization techniques.	K2
CO 2	Distinguish between thermo and thermosetting plastics.	K2
CO 3	Tell the knowledge on preparation, properties and uses of commercial polymers such as Polythene, PVC, polystyrene and PAN.	K1
CO 4	Apply the chemistry of polymers viz., Teflon, polyurethanes, phenol-formaldehyde composites etc.	K3

K1 : Knowledge K2 : Understand K3: Apply

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

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

UNIT-I

INTRODUCTION TO POLYMERS (15 hrs)

Introduction - polymers- monomers and polymers-degree of polymerization- definition-Classification of polymers- Homo, Hetero and copolymers- Block – Graft polymers- functionality – tacticity-Addition, co-polymerisation and Condensation polymers - Thermosetting & Thermoplastics.

UNIT-II

CHEMISTRY OF COMMERCIAL POLYMERS (15 hrs)

General methods of preparation, properties and uses of the following polymers: Polyethylene (LDPE & HDPE), PVC, Polystyrene, PAN, Teflon, Polyurethanes, phenol-folmaldehydes- composites- ABS.

Text Book:

1. V.R.Gowariker, N.V. Viswanathan and J.Sreedhar, 2000, Polymer Science, Wiley Eastern Ltd., New Delhi.

Reference Book:

1. B.K.Sharma, 2002, Polymer Chemistry, Goel publishing House, Meerut.

Course Designer

Dr. R. Sayeekannan

Unit	Topic	No. of lecture hrs
I	**INTRODUCTION TO POLYMERS**	**15**
1.1	Introduction - polymers- monomers and polymers	3
1.2	degree of polymerization- definition-Classification of polymers	3
1.3	Homo, Hetero and copolymers- Block – Graft polymers-functionality – tacticity	3
1.4	Addition, co-polymerisation and Condensation polymers - Thermosetting & Thermoplastics	5
	Revision	1
II	**CHEMISTRY OF COMMERCIAL POLYMERS**	**15**
2.1	General methods of preparation, properties and uses of the following polymers: Polyethylene (LDPE & HDPE), PVC,	7
2.2	Polystyrene, PAN, Teflon, Polyurethanes, phenol-folmaldehydes-composites- ABS.	7
	Revision	1
	Total (15+15)	30

GENERIC ELECTIVES

THIAGARAJAR COLLEGE, MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined B.Sc Physics / Mathematics/ Zoology/ Botany on or after June 2019)
Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19GE11(M / Z) /UCH19GE31 (P /B)	General Chemistry - I	Generic elective	4	-	-	4

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

Preamble

The course explains the basic concepts and theories of atomic structure. The main focus of the course isto 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.	K1. 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 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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

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 durality - 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 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 – Mineral Water – packed drinking water- ISI specification of drinking water.

Unit-III: CARBOHYDRATE 12 Hrs

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.

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. Ramesh2. Dr. D.S.Bhuvaneshwari3. Dr. K.S. Selvakumar

Unit	Topic	lecture hrs.
I	**STRUCTURE OF ATOM**	
1.1	Rutherford model of the atom- defects of Rutherford model	2
1.2	Discovery of neutron, Bohr model of an atom- merits and demerits	3
1.3	de Broglie‘s concept of durality	1
1.4	Quantum numbers- shapes of s, p, d atomic orbitals.	2
1.5	Arrangement of electrons in atoms- Hund‘s rule	2
1.6	Pauli exclusion principle- Heisenberg‘s uncertainty principle.	2
II	**WATER**	
2.1	Introduction – Definition- Units of Hardness	2
2.2	Scales and Sludge	1
2.3	Sterilization and flocculation.	2
2.4	Hardness of water – Treatment of water	2
2.5	Ion –exchange method and reverse Osmosis	2
2.6	Estimation of hardness by EDTA method	1
2.7	Mineral Water – packed drinking water-	1
2.8	ISI specification of drinking water	1
III	**CARBOHYDRATE**	
3.1	Classification- preparation of sucrose	4
3.2	Properties and uses of sucrose	1
3.3	Muta rotation- conversion of aldopentose to aldohexone and vice versa.	5
3.4	Conversion of glucose to fructose vice versa	2
IV	**INDUSTRIAL FUELS**	
4.1	Fuels- definition- Classification of Fuels-	2
4.2	Calorific value- Characteristic of a good fuel	3
4.3	Knocking- Gaseous fuels-	1
4.4	Preparation and uses of water gas	2
4.5	Producer gas- compressed natural gas (CNG)-	2
4.6	Liquefied petroleum gas (LPG)- biogas- biomass.	2
V	**CHEMISTRY AND AGRICULTURE**	
5.1	Fertilizers: Preparation and uses of urea	2
5.2	Super phosphate, triple super phosphate and potassium nitrate.	2
5.3	Pesticides: Classification of pesticides with examples	2
5.4	Insecticides: stomach poisons, contact insecticides and uses of	2
5.6	Insecticides- DDT, BHC (gammexane: conformation of gamma isomer)	2
5.7	Herbicides- 2,4-D and 2,4,5-T	1
5.8	Fungicides definition and uses.	1

THIAGARAJAR COLLEGE, MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined B.Sc Mathematics / Zoology / Botany on or after June 2019)
Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19GE21(M / Z) /UCH19GE41 (P/B)	General Chemistry - II	Generic elective	4	-	-	4

Year	Semester	Int. Marks	Ext. Marks	Total
I	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 focusses 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, K2
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 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%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

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 nuclear reactor-hydrogen bomb- nuclear waste and its disposal- Uses of radioactive isotopes as tracers.

Unit- IV: AMINOACIDS & VITAMINES 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- top down approach – bottom up approach- sol-gel synthesis- application- Green chemistry-basic postulates of green chemistry- Green solvents-

Bloom's Taxonomy	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

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.

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.
3. Bahl B. S. and Arun Bhal, Text book of Organic Chemistry 2005 S. Chand Limited,
4. Jain and Jain 1976, Engineering Chemistry, 5th edn, Dhanpat Rai Publishing Company (P) Ltd.,

Course designers Dr. A. R. Ramesh2. Dr. D.S.Bhuvaneshwari. Dr. K.S. Selvakumar

Unit	Topic	Lecture Hrs
I	**ELECTROCHEMISTRY**	
1.1	Arrehenius theory of electrolysis- strong electrolytes	2
1.2	Weak electrolytes- Oswald‘s dilution law and its significance	3
1.3	*Conductance*: Specific, equivalent and molar conductance-	1
1.4	Measurements, Kohlraush‘s Law and applications-	1
1.5	Conductometric titrations. *pH*: Definition simple calculation of pH from molarity of acids -	3
1.6	Common ion effects and its applications - Buffer solution	1
1.7	Definition- theory of buffer action and applications.	1
II	**CATALYSIS**	
2.1	Definition- different types of catalysts	2
2.2	Homogenous and heterogeneous catalysis	2
2.3	Acid-base catalysis- enzyme catalysis-mechanism.	3
2.4	Mechanism of heterogeneous catalytic reactions -	3
2.5	Auto catalysis- catalytic poisoning- promoters.	2
III	**NUCLEAR CHEMISTRY**	
3.1	Introduction – mass defect- binding energy-	2
3.2	Comparison of properties of alpha, beta and gamma rays	2
3.3	Nuclear fission – Nuclear Fusion – nuclear reactor	3
3.4	Nuclear reactor in India- advantage and disadvantage of nuclear reactor-	3
3.5	Hydrogen bomb- nuclear waste and its disposal-	1
3.6	Uses of radioactive isotopes as tracers.	1
IV	**AMINOACIDS & VITAMINS**	
4.1	*Amino* acids: Definition- general methods of preparation, properties and uses- Glycine, and alanine.	3
4.2	*Proteins*: Definitions- Classification and general properties –	2

4.3	Colour reactions and the relation of amino acids to proteins.	2
4.4	Effect of toxic chemicals on enzymes. Lead, mercury and cyanide pollution and their biochemical effects.	2
4.5	*Vitamins*: Definition- classification, sources and role of vitamins or deficiency symptoms - A, B complex,	2
4.6	Definition- classification, sources and role of vitamins or deficiency symptoms C, D and K.	1
V	**NANO AND GREEN CHEMISTRY**	
5.1	Definition of nanoscience-preparation methods	2
5.2	Top down approach –	1
5.3	Bottom up approach- sol-gel synthesis-	2
5.4	Sol-gel synthesis- applications	1
5.5	Green chemistry-	1
5.6	Basic postulates of green chemistry-	1
5.7	Green solvents- microwave reaction principle-	2
5.8	Advantage of microwave synthesis.	2

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined B.Sc Mathematics / Zoology / Botany on or after June 2019)
Programme Code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH19GL21(M / Z) /UCH19GL41(P / B)	Ancillary Chemistry Lab	Generic elective	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
I	II or 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 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

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

ENVIRONMENTAL STUDIES

(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19EVS11	**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, components 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	Summarise the sources, effects and control measures of various types of Pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

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

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 PSOllution – Water PSOllution – Noise PSOllution – Nuclear Hazards. Solid waste management and Waste DisPSOsal 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 PSOllution, Ashish Publishing House. New Delhi.

Sapru R.K.2001. Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.

THIAGARAJAR COLLEGE, MADURAI – 9.

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

VALUE EDUCATION

(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19VE51	**Value Education**	AECC1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	15	35	50

Preamble

Students acquire knowledge on the basic concepts, components 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	Summarise the sources, effects and control measures of various types of Pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

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

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.

விழுமியக் கல்வி

கூறு - 1

சுய முன்னேற்றம்

அறிமுகம் - விழுமியங்களின் விளக்கம் மற்றும் வகைகள் - சுயமதிப்பீடு - சுய முன்னேற்றத்திற்கு விழுமியங்களின் தேவை - குடும்ப வாழ்க்கைக்கு விழுமியங்களின் தேவை - மகிழ்ச்சியான வாழ்க்கைக்கான கொள்கைகள்

பண்பு வளர்ச்சி

நற்பண்பு - நல்லுறவு - உயரிய பண்புகளால் உயர்ந்த பெருமக்களாதல் - பண்புகளைத் தேடல் - பண்புகளை வளர்த்தல் - நற்பண்புகளுக்கான திறவுகோல்.

கூறு - 2

சுயமரியாதையும் நேர்மறைச் சிந்தனையும்

சிந்தனையின் வகைகள் - சிந்தனைப் பகுதிகள் - சிந்தனையை வளர்க்கும் முறை - சிந்தனையில் புறத்தாக்கங்கள் - நேர்மறைப் பண்பை வெளித்தோற்றத்தில் காட்டும்முறை - சுயமரியாதையின் பொருள் - சுய அதிகாரமளித்தல்

அழுத்தமில்லா வாழ்க்கை

பிரமைகளும் காரணங்களும் - அழுத்த நிலைகளுக்கான அறிகுறிகள் - தன்னம்பிக்கை - தலைமைப் பண்பில் முன்னுதாரணங்கள் - விமர்சனச் சிந்தனை - தொடர்புத் திறன்கள் - மகிழ்ச்சி மற்றும் வெற்றிகரமான வாழ்க்கை

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

Self Study Paper

Thiagarajar College (Autonomous) :: Madurai – 625 009
SELF STUDY PAPER
(For those joined UG on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19SS51	**Soft Skills**	Self Study Paper	-	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	----	100	100

*** Carries Extra 5 credits that do not form part mandatory credits (140) required for completion of the course. Optional paper not compulsory for all UG students.**

Preamble

Prepare the students to develop skills, provide training to face interview .prepare themselves with the right skill-sets and attitude

Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Possess a basic idea on the understanding of nature, cause, effect and ways to deal with critical challenges in everyday life	K1,K2
CO2	Overcome the aspects such as Communication barriers, Stress management, Emotions.	K3
CO3	Gain insights into high-in-demand soft skills and prepare themselves with the right skill-sets and attitude	K1,K2
CO4	Develop or take part inteam work, Thinking skills, Creativity and time management.	K3
CO5	Prepare themselves to face different levels of interviews. Develop skills to manage an organization	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

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

Unit - 1

Self Awareness (Concept of Self-esteem, Positive and Negative self esteem) Motivation (Nature and types, Factors enhancing and affecting Motivation, Needs and Drives) (Creativity

Introduction, Nature of Creativity, Stages of Creativity, Enhancing Creativity, Verbal and Non Verbal Creativity) Values and Ethics (Nature and Significance, Values, Ethics, Work Ethics, Character building, Manners and Ethics)

Self Management (Self management skills and Social Competency, Social Competency Behaviour, Value Orientation, Life goals)

Unit 2

Communication and Thinking Communication (Definition, Types, Styles, Culture and Communication); Thinking (Nature, Types, Problem Solving, Proactive thinking, Positive Thinking, Assertiveness)

Unit 3

Emotions (Nature of emotions, Emotional Intelligence and its strategies, Attachment, Love, Happiness, Introduction to Anger – Causes, Types, Functions and Consequences, Anger management)

Stress (Nature of stress, Relation between Demands and Coping, Types and Causes, Effects and Indicators, Management of Stress, Time management and Stress reduction) Empathy (Definition, Nature and Factors enhancing empathy)

Unit4

Excelling through a placement process(Resume writing; Taking a written test; Group discussion – Need, Types, Tips and techniques; Interview handling – Tips and Techniques)

Unit 5

Being effective in an organisation

50 rules of work, Professional Etiquettes and Mannerism, Building relationship within an organisation, Communication skills, Working in teams, Managing conflicts, Effective negotiation skills, Problem solving using creativity.

Text book

1. Life Skills for Success – AlkaWadkar – 2016 Edition SAGE | TEXTS Sagepublishing.com
2. Campus to Corporate – Roadmap to Employability – Gangadhar Joshi – 2015 Edition SAGE | TEXTS Sagepublishing.com

Reference textbook

1 ACE of Soft skills – Gopalaswamy Ramesh and Mahadevan Ramesh, Pearson Publication

2 Bridging the soft skills gap – Bruce Tulgan – 2015 Edition – Wiley Publication

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Fundamental concepts in organic chemistry	15	08	12	03	15
Fundamental concepts in Inorganic and Physical Chemistry	15	09	13	09	15
Organic qualitative analysis	15	15	14	09	15
Inorganic Chemistry - I	15	07	07	15	15
Physical Chemistry - I	15	04	04	02	15
Inorganic qualitative analysis	09	12	12	05	12
Inorganic Chemistry –II	15	11	08	06	15
Organic Chemistry-I	15	08	03	03	15
Inorganic volumetric analysis	15	15	10	11	15
Organic chemistry – II	15	10	03	04	15
Physical Chemistry-II	15	11	12	02	15
Estimation and Preparation of organic compounds	15	15	10	04	15
Inorganic Chemistry-III	15	06	12	08	15
Organic Chemistry-III	15	08	06	0	15
Physical Chemistry –III	15	04	04	02	15
Inorganic Estimations and Preparations	11	15	02	06	15
Group theory and spectroscopy	15	08	07	0	15
Industrial Chemistry	15	10	07	06	15
Inorganic Chemistry and Computer Applications	15	12	06	06	15
Organic Chemistry-IV	15	08	12	10	15
Physical Chemistry-IV	15	04	04	0	15
Experiments in Physical Chemistry	15	15	08	02	15
Coordination Chemistry	15	05	05	03	15
Bioinorganic Chemistry	15	02	07	04	15

NME / SBE papers

Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Environmental Studies	12	10	12	12	12
Personality Development	05	04	06	11	12
Chemistry in day-to-day life	12	08	08	02	12
Agricultural Chemistry	12	09	04	12	12
Dairy Chemistry	12	06	05	05	12
Forensic Chemisty	12	05	06	12	12
Processing of consumer products -Lab	09	12	05	02	12
Value Education					
Water analysis-Lab	09	12	09	09	12
Food Chemistry	12	08	07	10	12
Polymer	12	04	04	04	12

Allied / Ancillary papers

Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
Ancillary Chemistry **General Chemistry-I (AC11/AC31)**	**15**	**07**	**06**	**04**	**15**
Ancillary Chemistry **General Chemistry – II(AC21/AC41)**	**15**	**08**	**03**	**07**	**15**
Ancillary Chemistry practical **(ACL21/ACL41)**	**09**	**12**	**08**	**10**	**12**
Ancillary Physics I					
Ancillary Physics practical –I					
Ancillary physics-II					
Ancillary physics practical					
Ancillary Maths/Zoology-I					
Ancillary Zoology practical					
Ancillary Maths/Zoology -II					
Ancillary Zollogy practical – I					

M.Sc. Chemistry

(Programme Code-PCH)

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 presentation 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 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.Sc Chemistry programme is toprepare/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 chemical industry, government, academia and national/international research institute as innovative scientists.
PEO3	Toget suitable employment in government sectors after qualifying specific competitive exams conducted by 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 onadvanced 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 literatue 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 2019 and after)

MASTER OF CHEMISTRY

Semester – I

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 1	PCH19 C11	Organic chemistry-I	5	5	75	25	75	100
Core 2	PCH19 C12	Inorganic Chemistry-I	5	5	75	25	75	100
Core 3	PCH19 C13	Physical Chemistry –I	5	5	75	25	75	100
Core lab -1	PCH19 CL21	Organic Chemistry-Lab I	5	*	75	-	-	-
Core lab -2	PCH19 CL22	Inorganic Chemistry-Lab I	5	*	75	-	-	-
Core lab- 3	PCH19 CL23	Physical Chemistry-Lab I	5	*	75	-	-	-
Total			**30**	**15**	**450**	**75**	**225**	**300**

Semester – II

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 4	PCH19 C21	Organic chemistry-II	4	4	60	25	75	100
Core 5	PCH19 C22	Inorganic Chemistry-II	4	4	60	25	75	100
Core 6	PCH19 C23	Physical Chemistry-II	4	4	60	25	75	100
Core elective-1	PCH19CE21(A)	C-Programming Fundamentals & Applications in Chemistry	5	5	75	25	75	100
	PCH19 CE21(B)	Medicinal Chemistry						
Core lab-1	PCH19 CL21	Organic Chemistry-Lab	5	5	75	40	60	100
Core lab -2	PCH19 CL22	Inorganic Chemistry-Lab I	4	4	60	40	60	100
Core lab -3	PCH19 CL23	Physical Chemistry –Lab I	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	PCH19 C31	Organic chemistry-III	5	5	75	25	75	100
Core 8	PCH19 C32	Inorganic Chemistry-III	5	5	75	25	75	100
Core 9	PCH19 C33	Physical Chemistry – III	5	5	75	25	75	100
Core elective -2	PCH19 CE31 (A)	Computer Applications in Chemistry (Option A)	5	5	75	25	75	100
	PCH19 CE31(B)	Advanced Organic synthesis **(Option B)**						
Core lab - 4	PCH19 CL41	Organic Chemistry-Lab 2	5*	-	75	-	-	-
Core lab -5	PCH19 CL42	Inorganic Chemistry-Lab 2	5*	-	75	-	-	-
Total			**30**	**20**	**450**	**220**	**480**	**400**

Semester – IV

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 10	PCH19C41	Organic chemistry-IV	5	4	75	25	75	100
Core 11	PCH19C42	Inorganic Chemistry-IV	5	4	75	25	75	100
Core 12	PCH19C43	Physical Chemistry –IV	4	4	60	25	75	100
Core lab -4	PCH19CL41	Organic Chemistry-Lab 2	5	5	75	40	60	100
Core Lab - 5	PCH19CL42	Inorganic Chemistry-Lab 2	5	5	75	40	60	100
PJ	PCH19PJ41	Project	6	3	90	40	60	100
Total			**30**	**25**	**450**	**225**	**405**	**600**

- **For core practical (Year wise practical) credits will be given at the end of II semester (For I M.Sc) and IV semester(for II M.Sc).**

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 12 papers	(15+12+15+12) = 54 Credits
Core Lab 11	(13+10) = 23 Credits
Core electives	5+5 = 10 Credits
Project	= 03 Credits
Total	**= 90 Credits**

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19C11	**Organic Chemistry - I**	Core-1	5	-	-	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 reactionmechanism viz.,substitution, elimination and addition.

Prerequisites

Students with the minimum knowledge on fundamentals of reaction mechanism of addition,elimination and substitution reaction at under graduate 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, K2
CO2	Explain the reaction mechanism for all types of chemical reaction.	K5
CO3	Analyze the reaction mechanism in relation to nucleophilic substitution reactions.	K4
CO4	Determine the mechanism for elimination reactions.	K3, K5
CO5	Apply reaction mechanism to various addition reactions.	K3

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

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 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**

UNIT-I Delocalized chemical bonding, Aromaticity and Reaction intermediate (15 hrs)
Electron displacement – Steric effect – Tautomerism
Concept of aromaticity – Benzenoid and non-benzenoid compounds – Huckel's rule - Non aromatic and anti aromaticity - Alternant and non alternant hydrocarbons - aromaticity of cyclopentadienyl anion and Tropylium cation – Azulenes and annulenes.
Generation , structure, stability, reactivity and reactions of carbocations, carbanions, free radicals (reactions include Pinacol coupling, McMurray reactions, acyloin reaction, selective radical bromination). Carbenes: Stability - Structure – Generation – Types – Reactions. 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 nuleophiles.
Aromatic Nucleophilic Substitution Reactions – Unimolecular, Bimolecular 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-IVReaction 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-VReaction Mechanism IV (Addition to carbon-Carbon multiplebonds) **(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 Dieckman condensation.

Text books:

1. Jerry March, 1992. Advanced Organic Chemistry, Reaction mechanism and structure, John Wiley and sons, 4th Edition, New york.
2. R.O.C. Norman, 2001. 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, 1990. Advanced Organic Chemistry, Part A and B, Plenum Press, 3rd 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. G. Solomon, 1992. Organic Chemistry, John Wiley and sons INC, 5th Edition,.
4. R.K. Mackie and D.M. Smith, 1993 Guide Book to Organic synthesis, Longman, UK.
5. Peter sykes, 2003. A Guidebook to Mechanism in Organic Chemistry, Longman, 6th Edition.

Course designer

1 Dr. P. TharmarajDr. P. PrakashDr. R. MahalakshmyDr. A. Tamil Selvi

Course contents and lecture schedule

Unit	Topic	No. of lecture hrs
I	**Delocalized chemical bonding, Aromaticity and Reaction intermediate**	
1.1	Electron displacement – Steric effect – Tautomerism	1
1.2	Concept of aromaticity – Benzenoid and non-benzenoid compounds – Huckel's rule - Non aromatic and anti aromaticity	3
1.3	Alternant and non alternant hydrocarbons - aromaticity of cyclopentadienyl anion and Tropylium cation – Azulenes and annulenes.	2
1.4	Synthesis, structure, stability, reactivity and reactions of carbocations, carbanions	3
1.5	Synthesis, structure, stability, reactivity and reactions of free radicals (reactions include Pinacol coupling, McMurray reactions, acyloin reaction, selective radical bromination).	3
1.6	Carbenes: Stability - Structure – Generation – Types – Reactions. Nitrenes: Generation and reactions.	2
	Revision	1
II	**Reaction mechanism-I**	15
2.1	Guidelines for proposing reasonable mechanism – Energetics and energy profile diagrams – transition state – Intermediate	2
2.2	Hammond's postulate – principle of microscopic reversibility - kinetic and thermodynamic controls	3
2.3	Kinetic and non-kinetic methods of determining organic reaction mechanism	3
2.4	Primary and secondary kinetic isotope effects – Effect of structure on reactivity: Resonance and field effects	3
2.5	Quantitative treatments – Hammett and Taft equation.	3
	Revision	1
III	**Reaction mechanism-II**	**15**
3.1	**Substitution Reactions:**Aliphatic Nucleophilic Substitution Reactions - Mechanism – S_N1 and S_N2, mixed S_N1& S_N2, S_Ni, SET,	4

3.2	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 nuleophiles.	5
3.3	Aromatic Nucleophilic Substitution Reactions – Unimolecular, Bimolecular and Benzyne mechanism – Effect of substrate, leaving group and attacking nucleophile.	4
3.4	Electrophilic substitution reactions: Aliphatic: Bimolecular mechanism SE2 and SE1 – Aromatic: Arenium ion mechanism – Orientation and reactivity: Ortho and Para ratio, partial rate factor	4
	Revision	1
IV	**Reaction Mechanism III Total**	**18**
4.1	Elimination reactionsE_1, E_2 and E_1CB mechanism	2
4.2	Competition between substitution and elimination – orientation of double bonds (Bredt's rule and Hofmann and saytzeff rules)	3
4.3	Effect of substrate structure, attacking nucleophile, leaving group and nature of reaction medium on reactivity	3
4.4	Mechanism and orientation in pyrolytic eliminations - Cope and Chugaev reaction (cis-elimination)	3
	Revision	1
V	**Reaction Mechanism IV**	**12**
5.1	Addition to carbon – carbon multiple bonds:Electrophilic, Nucleophilic & free radical addition	2
5.2	Mechanism, Orientation and reactivity and reactions - addition to conjugated systems	3
5.3	Addition to α,β-unsaturated carbonyl and nitrile systems- Michael addition –	3
5.4	Addition of Grignard reagents-Diels Alder reaction- Enamine reaction	3
5.5	Mechanism of Reformatsky reaction- Darzen reaction- Mannich reaction - Wittig reaction - Stobbe and Dieckman condensation	3
5.6	Revision and test	1
	Total	**15**

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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19C12	**Inorganic Chemistry - I**	Core-2	5	-	-	5

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

Preamble

The course gives in-depth knowledge onelectronic structure of atom, bonding and its applications, acid-base concepts and nuclear chemistry.

Prerequisites

Students with the minimum knowledge on fundamentals of electronic structure of atom, chemical bonding, acid-base concepts 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	Comprehend the electronic structure of atom and periodic properties of elements.	K1, K2
CO2	Explain and compare the concepts of chemical bonding.	K2, K4
CO3	Apply the concepts of VB, MO and VSEPR theory to determine the structure of molecules.	K3, K5
CO4	Illustrateacid-base concepts, its measures and to evaluate various effects on acid base strength.	K2, K5
CO5	Experiment with different types of nuclear reactions, nuclear reactors and to list various nuclear waste disposal and safety measures.	K3,K4

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

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		S
CO5	S	S	S	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**

UNIT – I: ELECTRONIC STRUCTURE OF ATOM 15 Hrs

Modern views on atomic structure: Wave mechanical description of electron and orbitals, radial density functions and orbital energies, angular functions and orbital shapes-term symbol.

Modern periodic table: Periodic properties-Ionisation potential, Ionic radii and covalent radii, Electron affinity, Electronegativity and their trend in the periodic table- Comparison of transition metals of 3d, 4d and 5d series.

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. Goldschmidths radius ratio- packing of atoms and ions in solids. Calculation of ionic radius – Pauling's method and Linde's method. Effective nuclear charge-Slater's rule.

Covalent bond – qualitative treatment of valence bond theory – Heitler-London theory – Pauling theory and Molecular orbital theory LCAO theory – Hybridisation and 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 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. Partial ionic character of covalent bonds-Fajan's Rule –Effects of polarization. VSEPR theory and its applications to H_2O, NH_3, ICl_2^-, IF_5 IF_7, ClO_4^- ions. VSEPR applied to Xenon compounds like Xenon halides and xenon oxides.

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

A generalized acid base concepts – steric effects and solvation effects – 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 of solvents – properties of ionizing solvents. Typical reactions in non–aqueous solvents- liquid HF, liquid SO_2, liquid NH_3, and Sulphuric acid.

UNIT – V: NUCLEAR CHEMISTRY 15Hrs

Radioactive decay and equilibrium- Different types of nuclear reaction – 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. Radio isotopes 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. 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 Edn., 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. Glasstone, S. Source Book of Atomic Energy, Van Nostrand, III Edn, East West Press (P) Ltd., New Delhi.1967
6. Friedlander, G. Kennedy J.S and Millodr, M. M. Nuclear and radiochemistry, John Wiley & Sons, New York.1984.

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

Course designer

1 Dr.A.Suganthi
2 Dr.A. Elangovan
3 Dr.D.S. Bhuvaneshwari
4 Dr.K.Selvakumar

Course content and lecture schedule

Unit	Topic	Lecture Hours
I	**Electronic Structure of atom**	**15**
1.1	Modern views on atomic structure: Wave mechanical description of electron.	3
1.2	Radial density functions	2
1.3	Orbitals, and orbital energies	2
1.4	Angular functions and orbital shapes	2
1.5	Radii of atoms and ions	2
1.6	Modern periodic table: Periodic properties-Ionisation potential, Ionic radii and covalent radii, Electron affinity, Electro negativity- their trend in the periodic table.	4
II	**Nature of the Chemical bond**	**15**
2.1	Ionic bond – Lattice energy and its determination by Born-Haber cycle and Born Lande Equation	2

2.2	Hardness, electrical conductivity and solubility of ionic compounds – ionic radii.	2
2.3	Goldschmidths radius ratio-packing of atoms and ions in solids	2
2.4	Calculation of ionic radius –Pauling's method and Linde's method	2
2.4	Effective nuclear charge-Slater's rule.	2
2.5	Covalent bond – qualitative treatment of valence bond theory – Heitler-London theory –	2
2.6	Pauling theory and Molecular orbital theory LCAO theory	3
2.7	Hybridisation and resonance.	2
III	**Bonding Application**	**15**
3.1	Application of VB and MO theories to the structure of homonuclear (H_2, B_2, C_2, N_2).	2
3.2	Heteronuclear (CO,NO,HCl,HF) diatomic and selective polyatomic molecules (CO_3^{2-}, NO_2, BeH_2, CO_2)	2
3.3	comparison of VB and MO theories	2
3.4	Bond properties, bond order, bond energy, bond length and bond polarity	2
3.5	Partial ionic character of covalent bonds-Fajan's Rule	2
3.6	VSEPR theory and its applications to H_2O, NH_3, , IF_5 IF_7, ClO_4^- ions	2
3.7	VSEPR applied to Xenon compounds like Xenon halides and xenon oxides	3
IV	**ACID-BASE SYSTEMS AND NON-AQUEOUS SOLVENTS**	**15**
4.1	A generalized acid base concepts	2
4.2	Steric effects and solvation effects	2
4.3	Measures of Acid-Base strength –Factors affecting the strength of acids and bases	2
4.4	Common ion effect and Henderson's equation	2
4.5	Hard and Soft acids and bases – symbiosis – theoretical basis of hardness and softness	2
4.6	Classification of solvents – properties of ionizing solvents. Typical reactions in non–aqueous solvents- liquid HF, Hydrogen cyanide	3
4.7	Sulphuric acid and acetic acid.	2
V	**Nuclear Chemistry**	**15**
5.1	Radioactive decay and equilibrium	1
5.2	Different types of nuclear reaction – spallation – fission and fusion	1
5.3	Theories of fission. Fissile and Fertile isotopes.	1
5.4	Radio isotopes and their applications.	1
5.5	Nuclear fusion – stellar energy	1
5.6	Nuclear forces: Liquid drop model, shell model	1
5.7	Detectors: Scintillation counter, Gas Ionisation chamber. Proportional Counter, Cerenkov Counter Accelerators: Cyclotron, Synchrocyclotron, Betatron.	2
5.8	Calculation of Q-values – Cross section	1
5.9	Applications: Activation analysis, Isotopic dilution technique-radiometric titration	2
5.10	Nuclear reactors: Types (Thermo nuclear and breeder reactors) feed materials production. Reprocessing of nuclear materials waste disposal.	2
5.11	Atomic power projects in India. Hazardous of radioactive materials and Safety measures.	2

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 2019)
Programme Code: PCH

Course Code	Course Title	Category	L	T	P	Credit
PCH19C13	**Physical Chemistry – I**	Core 3	5	-	-	5

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

Preamble

The course enables the students to gain knowledge on properties of gases, thermodynamic equilibrium and bio-physicochemical behavior of molecules.

Prerequisites

Basic knowledge on fundamentals concepts of gases and liquids, thermodynamics and quantum chemistry at undergraduate level.

Course Outcomes

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

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

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

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**

UNIT-I

PROPERTIES OF GASES AND LIQUID CRYSTAL (15 HRS)

Equations of states - molecular speeds- Maxwell distribution of molecular velocities - one, two and three dimensions; Energy distribution-Maxwell – 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 (cholestryl benzoate), smectic (ethyl-p-azoxybenzoate)- theory and its application in liquid crystals display.

UNIT-II

THERMODYNAMICS – 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 principle- equilibria respond to pressure and temperature; Non Equlibrim Thermodynamics -Basic concepts - Principle of microscopic reversibility and the Onsager reciprocal relations.

UNIT –III

QUANTUM CHEMISTRY-I (15 HRS)

Black Body radiation- Heisenberg‘s uncertainity principle- de Broglie wave particle duality- Experimental verification of matter waves- Compton effect- The Schrodinger equation and the postulates of quantum mechanics- operators –linear and non-linear operators- commutative and non-commutative operators- Hermitian operators- Eigen function, Eigen values and degeneracy-

Orthogonality and Normalization of wave functions- Derivation of Schrodinger'swaveequation.

UNIT- IV

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-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 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 – derivationof Hill equation. (ii)Medicinal Chemistry – QSAR; Partition parameters – Partition Coefficients (P) – hydrophobicity or lipophilicity constant (π); Electronic Parameters – Hammett constant (σ); Steric parameters – Taft Steric paramerter (Es); Hansch equation; Craig Plot – Topliss Scheme; ΔG criteria for biological reactions – ATP and ADP conversion.

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. Glasstone S., 2002, Thermodynamics for Chemists, Eastern Wiley publications.
5. Atkins P, 2002, Physical Chemistry, VII Edition, Oxford University Press, UK.
6. Atkins P. W., 1986, Molecular Quantum Mechanics, II Edition, Oxford University Press, UK.
7. Hanna H. W., 1983, Quantum Mechanics in Chemistry, Benjamin- Cummiza London Publishing company, UK.
8. Chandra A.K., 1988, Introductory quantum chemistry, 3rd edition, Tata McGrow- Hill
9. Publishing Co Ltd., New Delhi, India.
10. Gareth Morris J. 1974, Biologists physical chemistry, Edward Arnold, UK.
11. Barrow G. M., 1994, physical chemistry for the life sciences, McGraw Hill Kogakusha Ltd., New York.
12. Prasad R.K., 2004, Quantum Chemistry, 4th revised edition. (ISBN:8122424082/9788122424089)

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. Klotz, M., Rosenberg, R. M., 1996, Chemical thermodynamics, 4th edition, Benjamin, New York.
4. Glasstone, S., 2002, Thermodynamics for Chemists, 5th edition, Eastern Wiley publications.
5. Rajaram J., Kuriakose J. C., 1999, Thermodynamics, 3rd edition, S. N. Chand, New Delhi.
6. Levine, 2006, Quantum Chemistry, 6th edition, Prentice-Hall, New Delhi.

7. Mcquarrie D. A., 2003, Quantum Chemistry,Viva Books Pvt. Ltd., New Delhi.
8. Levine, 2003, Quantum Chemistry, 5th edition, Prentice-Hall, UK.
9.Raymond Chang, 2002, Physical Chemistry with application to biochemical system, Mc Millan Publishing Company. Inc., New Delhi.
10. Graham L Patrick, An Introduction to Medicinal Chemistry, Oxford University Press.

Course Designed by
1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan

UNIT	TOPIC	No. OF LECTURE Hrs
I	**PROPERTIES OF GASES AND LIQUID CRYSTAL**	
1.1	Equations of states - molecular speeds- Maxwell distribution of molecular velocities - one, two and three dimensions	3
1.2	Energy distribution-Maxwell – Boltzmann distribution law- Rotation, vibrations and translational degree of freedom- principle of equipartition of energy and heat capacity.	3
1.3	Molecular collisions- collision diameter, cross-section, number, frequency, mean free path (definition only).	2
1.4	Transport phenomena in gases - Viscosity of gases – viscosity in terms of momentum transfer, thermal conductivity, and diffusion.	3
1.5	Liquid crystals- Nematic (p-methoxycinnamic acid), cholesteric (cholestryl benzoate), smectic (ethyl-p-azoxybenzoate)	2
1.6	Liquid crystals theory and its application in liquid crystals display.	2
II	**THERMODYNAMICS – EQUILIBRIUM AND NON-EQUILIBRIUM**	
2.1	A general review of enthalpy, entropy and free energy concepts: Nernst heat theorem- Genesis of third law and its limitations.	2
2.2	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.	2
2.3	Thermodynamics of open systems - partial molar properties- internal energy, molar enthalpy, molar entropy, molar volume, free energy (chemical potential).	2
2.4	Determination of partial molar properties; Chemical potential- relationship between partial molal quantities - Gibbs - Duhem equation- Duhem Margules equation.	3
2.5	Thermodynamic properties of real gases- Fugacity concept- Determination of Fugacity of real gases.	2
III	**QUANTUM CHEMISTRY-I**	
3.1	Black Body radiation- de Broglie wave particle duality- Heisenberg‘s uncertainity principle	3
3.2	Experimental verification of matter waves- Compton effect	2
3.3	The Schrodinger equation and the postulates of quantum mechanics	2
3.4	Operators –linear and non-linear operators- commutative and non-commutative operators- Hermitian operators-	3
3.5	Eigen function, Eigen values and degeneracy; Orthogonality and Normalization of wave functions	3
3.6	Derivation of Schrodinger‘s wave equation	2
IV	**QUANTUM CHEMISTRY-II**	

4.1	Application of quantum mechanics to simple system.	2
4.2	Application of Schrodinger wave equation (SWE) to free particle moving in one dimension	2
4.3	Particle moving in a one dimension box	2
4.4	Particle moving in 3D cubical and rectangular box	3
4.5	Quantum Mechanical tunneling - particle in a ring- rigid rotor- Simple Harmonic oscillator	3
4.6	Hydrogen atom- angular momentum spin momentum- ladder operator	3
V	**PHYSICO-CHEMICAL PRINCIPLES AND BIOLOGICAL REACTIONS**	
5.1	(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 equation.	2
5.2	Ion channels – membrane and static potentials - Role of Na+ / K+ ions in neural communications –Na^+ / K^+ ion pump;	2
5.3	Allosterism and oxygen saturation curves for hameoglobin and myoglobin – derivation of Hill equation	3
5.4	(ii) Medicinal Chemistry – QSAR;	2
5.5	Partition parameters – Partition Coefficients (P) – hydrophobicity or lipophilicity constant (π); Electronic Parameters – Hammett constant (σ); Steric parameters – Taft Steric paramerter (Es)	3
5.6	Hansch equation	1
5.7	Craig Plot – Topliss Scheme	2

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Course Code	Course title	Category	L	T	P	Credit
PCH19C21	**Organic Chemistry – I**	Core-1	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, K2
CO2	Make use of the basic principles underlying NMR spectroscopy and its application in structural elucidation.	K3
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

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

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**

Unit-I UV and IR Spectrsocopy (12 Hrs)

Ultraviolet spectroscopy – basic principle – instrumentation – the absorption laws, types of electronic transitions – Effect of solvent 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 – Molecular Vibrations – instrumentation – characteristic IR absorption of different functional groups – factors influencing the vibrational frequencies

Unit-II ^{1}H NMR and ^{13}C 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 2D experiments – HOMO and HETERO nuclear correlation – J resolved correlation. Correlation Spectroscopy (COSY): Pulse sequence – 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 – structural applications – 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 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,2004. 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 andS.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. Tamil Selv

Course contents and lecture schedule

Unit	Topic	No. of lecture hrs
I	**UV and IR Spectrsocopy**	12
1.1	Ultraviolet spectroscopy – basic principle – instrumentation – the	2

	absorption laws, types of electronic transitions – Effect of solvent and hydrogen bonding on λ_{max} values.	
1.2	Effect of solvent and hydrogen bonding on λ_{max} values	1
1.3	Woodward rules to calculate λ_{max} values of conjugated dienes, conjugated polyenes, and carbonyl compounds.	2
1.4	Infrared spectroscopy – basic principle – Molecular Vibrations – instrumentation.	3
1.5	characteristic IR absorption of different functional groups.	1
1.6	factors influencing the vibrational frequencies.	2
1.7	Revision and test	1
II	**^{1}H NMR and ^{13}C NMR spectroscopy**	12
2.1	**^{1}H NMR spectroscopy**: Basic principles – number of signals – chemical shift	1
2.2	Chemical shift –factors influencing chemical shift – spin-spin coupling – coupling constant and factors influencing coupling constant.	3
2.3	Simplification of complex spectra – shift reagents, deuterium substitution and spin decoupling.	1
2.4	**^{13}C NMR spectroscopy**: Basic principle – comparison with ^{1}H NMR – noise decoupling – off resonance decoupling – factors affecting the C-13 chemical shifts.	2
2.5	**Advanced NMR Spectroscopy -**Introduction to 2D-NMR -Classification of 2D experiments – HOMO and HETERO nuclear correlation – J resolved correlation.	2
2.6	Correlation Spectroscopy (COSY): Pulse sequence – HOMO-COSY, HETERO-COSY, 1D- and 2D- INADEQUATE and NOESY.	2
	Revision and test	1
III	**Mass Spectroscopy, ORD and CD**	12
3.1	Basic instrumentation of Mass spectrometer - types of ions – molecular, isotopic, metastable and fragmentation ions – Tests for molecular ion peak.	3
3.2	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.	4
3.3	Optical rotatory dispersion (ORD) and Circular Dichroism (CD): Circularly polarized light – Circular birefringence and CD – plain curves and their applications – Cotton effects curves – structural applications – axial haloketone rule, octant rule and their applications.Solving problems based on UV, IR, NMR and Mass data.	4
	Revision and test	1
IV	**Organic Stereochemistry**	12
4.1	**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	6

	nomenclature – concept of prochirality – homotopic, enantiotopic and diastereotopic ligands and faces – Asymmetric synthesis – Cram's rule and Prelog's rule. Optical activity in allenes and spiranes – StereoChemistry of nitrogen compounds.	
4.2	**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.	5
	Revision and test	1
V	**Conformational Analysis**	12
5.1	Configuration and conformation – definition – conformational free energy- atropisomers- conformational analysis of acyclic, cyclic, heterocyclic systems	4
5.2	Conformational analysis of cyclohexane system: stability and isomerism in mono and disubstituted cyclohexanes	2
5.3	Conformation and reactivity of cyclohexane derivatives - conformational analysis of fused ring system - decalins, and perhydrophenanthrene.	5
	Revision and test	1

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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19C22	**Inorganic Chemistry – II**	Core-5	4			4

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

Preambe

The course gives detailed information about supramolecular chemistry, solid state chemistry, inorganic rings, cages clusters and polymers, It also explains the principle and applications of various analytical techniques.

Prerequisites

Basic knowledge on supramolecular chemistry, solid state chemistry and analytical techniques at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Describe supramolecular chemistry of transition metal compounds, structure and their application in various fields.	K1, K2, K3
CO2	Analyze the structure and defects of solids.	K4
CO3	Compare and solve the structures of Borone, S-N, P-N of inorganic rings, cages, clusters and polymers.	K3, K5
CO4	Categorize the given S-N, P-N, silicone, P-O compounds and deduce their structure.	K4, K5
CO5	Apply suitable analytical techniques to examine and estimate the inorganic compounds.	K3

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

Mapping of COs with PSOs

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

UNIT I SUPRAMOLECULAR CHEMISTRY (12 Hrs)

Definition, Nature of supramolecular interactions- Non- Covalent interactions, Host - guest interaction, complexing involving crowns and cryptands-cyclodextrine - Inclusion compounds-Clatharates-intercalation compounds -Molecular recognition, Types of recognition, Self-assembly. General properties of Supra molecular complexes- Molecular Library- Transition metal mediated supramolecules- Directional bond approach- Molecular triangles (Pd and Pt)- Molecular squares (Pd, Pt and Re)- Molecular rectangles-(Pd, Pt, Cu and Re) Molecular Cages (Pd, Pt and Re) and their applications.

UNIT II SOLID-STATE CHEMISTRY (12 Hrs)

Packing of atoms and ions- close packing arrangements-HCP, CCP and BCC 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). Bragg's equation- problems involving Bragg's equation. Crystal structure determination- X-ray diffraction study, Electron and Neutron diffractions
Crystal defects- point – Schotky and Frenkel defect - line and plane defects- colour centers- non-stoichiometric Compounds- 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-III Inorganic Rings, Cages, Clusters and Polymers- I (12 Hrs)

Electron deficient compounds: Borane and carboranes- Synthesis, structure and bonding (VBT and MO approach) –topological treatment-wades rule –styx numbers-structural studies by NMR-metallocarboranes-other heteroatom boron derivatives,borates-boroxines-B-P and B-As heterocycles. Synthesis, structure and bonding in Binary sulphur nitrils, S-N cations and anions, cyclic S-N compounds, S-N halogen compounds-bonds and electron counting in S-N heterocycles-polythiazyls. Structure of aluminosilicates- mica, clay, zeolites, fullers earth.Manufacture, Types and Uses of glasses.

UNIT- IV Inorganic Rings, Cages, Clusters and Polymers- II (12 Hrs)

P-N Heterocyclics- Phosphonitrilic compounds: Synthesis, Structure and bonding-phosphazene oligomers-high polymers-polymeric phosphorus nitrides-hydrolysis of phosphazenes- reactions of halo phosphazenes- aminolysis-metathetical reactions-reaction with organometallic reagents-Friedel-Crafts substitutions-rearrangements-theories of bonding-electronic structure and aromaticity-posphazene oligomers-high polymers-polymeric phosphorus nitrides. High, low nuclearcity carbonyl clusters-halide clusters. Isolobal analogy-Synthesis, structure and bonding in Poly anions and isopoly anions of phosphorous, vanadium, chromium, Nolybdenum and tugston. Hetero poly anions of molybdenum and tungsten. Structural prediction by Wade's rule-Cappit rule

UNIT-V ANALYTICAL CHEMISTRY-1 (12 Hrs)

Principles and practice of complexometric estimations/- Spectro analytical methods:-Principles and applications of colorimetry and spectro photometry, fluorimetry, nephelometry and turbidimetry-emission and atomic absorption spectroscopy (AAS) and atomic fluorescence spectroscopy.

ANALYTICAL CHEMISTRY-II

Principles, Instrumentation and applications of Cyclic Voltametry, Thermogravimetry, Differential thermal analysis and differential scanning colorimetry, Chromatography: GC, HPLC and Ion Exchange Chromatographic techniques.

Text book:

1. 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
2. Katsuhiko Ariga, Toyoki Kunitaka, Supramolecular Chemistry-Fundamentals and Applications: Advanced Textbook, Springer Science & Business Media, 2006.
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4. Lee, J. D. Concise Inorganic Chemistry, Blackwell Science Ltd., V Edn., London. 2002.
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6. H. G.Heal, the Inorganic Heterocyclic Chemistry of Sulphur, Nitrogen and Phosphorus, Academic press, New York, 1980.
7. J. D. Woolings, Non Metal Rings, Cages and Clusters, John Wiley and sons, New York, 1989.
8. P.J. Durrant and B. Durrant, Introduction to advanced inorganic chemistry, Longman Group Ltd, London,1970.
9. Purcell K.F. and Kotz J.C., Saunders, Inorganic Chemistry, Philadelphia, 1977.
10. D. A. Skoog and D. M. West, Fundamentals of Analytical Chemistry, Holler Saunders college publishing, USA.VI Edn., 1998.
11. F.A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, Wiley-Interscience publications, John Wiley & Sons, V Edn., New Delhi, 1988.
12. Walter E. Harris and Byron Kratochvil, An Introduction to Chemical Analysis, Saunders Golden Sunburst Series, Philadelphia,1982.
13. Galen W. Ewing, Instrumental Methods of Chemical Analysis, Mc Graw Hill International Editions, V Edn., New Delhi, 1987.
14. K. Sharma, Instrumental Methods of Chemical Analysis, GOEL Publishing House, 12th Reprint, New Delhi, 1993.

Reference books:

1. J. E. Huheey, Ellen A. Keiter, Richard L. Keiter, Inorganic Chemistry, Pearson Education (Singapore) Pte. Ltd., IV Edn., Delhi, 2004.
2. I. Azaroff, Introduction to Solids, Tata McGraw hill, New Delhi, 2004.

3. K. Chakrabarthy, Solid State Chemistry, New Age International Publishers, (P) Ltd., 2005.
4. D. F. Shriver and P.W. Atkins, Inorganic Chemistry, Oxford University Press, London, 1999.
5. Wahid U. Malik, G.D. Tuli and R. D. Madan, Selected Topics in Inorganic Chemistry, S. Chand & Co. Ltd., New Delhi, 2006.
6. William W. Porterfield, Inorganic Chemistry, II Edn., Elsevier, New Delhi, 2005.
7. A.G. Sharpe, Inorganic Chemistry, III Edn., Addition – Wesley Longman, UK 2004.
8. A. I. Vogel, Textbook of Quantitative Chemical Analysis, ELBS Longman Singapore Publisher (P) Ltd., Singapore. V Edn., 2002.

Course designer

1 Dr.A.Suganthi
2 Dr.A. Elangovan
3 Dr.D.S. Bhuvaneshwari
4 Dr.K.Selvakumar

Course Contents and Lecture Schedule

Unit	Topic	No. of Lecture Hours
I	**Supramolecular Chemistry**	**12**
1.1	Definition, Nature of supramolecular interactions- Non-Covalent interactions.	2
1.2	Host - guest interaction	1
1.3	Complexing involving crowns and cryptands-cyclodextrine	1
1.4	Molecular recognition, Types of recognition	2
1.5	Self- assembly	2
1.6	General properties of Supra molecular complexes-	1
1.7	Molecular Library- Transition metal mediated supramolecules-Directional bond approach	1
1.8	Molecular triangles (Pd and Pt)- Molecular squares (Pd, Pt and Re)- Molecular rectangles-(Pd, Pt, Cu and Re) Molecular Cages (Pd, Pt and Re) and their applications	1
1.9	Inclusion compounds-Clatharates-intercalation compounds	1
II	**Solidstate Chemistry**	**12**
2.1	Packing of atoms and ions- close packing arrangements-HCP,CCP and BCC lattice.	2
2.2	Radius ratio rules- Limiting radius ratio.	1
2.3	Structure of typical lattices such as calcite, cesium chloride, Nickel arsenide, Fluorite, Antifluorite, Cadmium iodide, Perovskite, Spinels (normal and inverse).	2
2.4	Bragg's equation- problems involving Bragg's equation.	1
2.4	Crystal structure determination- X-ray diffraction study, Electron and Neutron diffractions.	1
2.5	Crystal defects- point – Schotky and Frenkel defect - line and planedefects-colour centers – non-stoichiometric Compounds-experimental methods of study of non-stoichiometry	2
2.6	Effect of imperfections and non- stoichiometry on physical properties	1
2.7	Ttypes of solids-electronic structure of solids- free electron and band theories.	2
III	**CAGES AND METAL CLUSTERS- POLYMERIC INORGANIC COMPOUNDS**	**12**
3.1	Electron deficient compounds: Borane and carboranes -	2
3.2	Synthesis, structure and bonding (VBT and MO approach)	1
3.3	topological treatment-wades rule –styx numbers	1
3.4	Structural studies by NMR-metallocarboranes-other heteroatom boron derivatives-borates-boroxines-B-P and B-As heterocycles	2
3.5	P-N HETEROCYCLICS- Phosphonitrilic compounds: Synthesis, Structure and bonding-phosphazene oligomers-high polymers-	2

	polymericphosphorus nitrides.	
3.6	**S-N HETEROCYCLICS**: Synthesis, structure and bonding in Binary sulphur nitrils, S-N cations and anions, cyclic S-N compounds, S-N halogen compounds	2
3.7	bonds and electron counting in S-N heterocycles-polythiazyls.	2
IV	**Si-O, P-O, P-S SYSTEMS**	**12**
4.1	Synthesis of P-N-skeleton.	1
4.2	Hydrolysis of phosphazenes- reactions of halo phosphazenes-aminolysis-metathetical reactions	2
4.3	Reaction with organometallic reagents	1
4.4	Friedel-Crafts substitutions-rearrangements	2
4.5	Theories of bonding-electronic structure and aromaticity	2
4.6	Phosphazene oligomers-high polymers-polymeric phosphorus nitrides.	2
4.7	METAL CLUSTERS:Synthesis, structure and bonding in Poly anions and isopoly anions of phosphorous,vanadium, chromium,Nolybdenum and tugston. Hetero poly anions of molybdenum and tungsten	2
V	**Analytical Chemistry**	**12**
5.1	Principles and practice of complexometric titrations	1
5.2	Spectro analytical methods	1
5.3	Estimations,Principles and applications of colorimetry and spectro photometry, fluorimetry, nephelometry and turbidimetry	2
5.4	Emission and atomic absorption spectroscopy (AAS) and atomic fluorescence spectroscopy	2
5.5	Instrumentation and applications of Cyclic Voltametry	2
5.6	Thermogravimetry, Differential thermal analysis and differential scanning colorimetry	2
5.7	Chromatography: GC, HPLC and Ion Exchange Chromatographic techniques.	2

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19C23	**Physical Chemistry-II**	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 quantum chemistry.

Prerequisites

Basic knowledge on fundamental concepts and theories of electrochemistry, statistical thermodynamics and quantum chemistryat 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, K2
CO2	Make use of the applications of electrochemistry.	K3
CO3	Identify the need and fundamental derivation of statistical thermodynamics.	K3
CO4	Examinethe applicationsof statistical thermodynamics.	K4
CO5	Measure their knowledge on advanced quantum chemistry.	K5

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
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**

UNIT-I **(12 Hrs)**

ELECTROCHEMISTRY-I

Theory of strong electrolytes – Interionic attraction theory – Debye-Huckel theory of strong electrolytes - Debye-Huckel model of ionic atmosphere–Debye-Huckel Onsager equation-derivation, verification and modifications- Debye – Falkenhagen effect and Wien 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 rule. Types of corrosion-galvanic, aeration, stress, pitting corrosion and passivity – factor influencing corrosion – corrosion control- cathodic production - corrosion inhibitors.

Principles of Polorography - Cyclic Voltametry –quasi – reversible – irreversible voltamogram; electrochemical energy conversions-Nickel Cadmium, lead acid battery; Fuel cells – H_2 - O_2 Fuel cell – methyl alcohol fuel cell.

UNIT-III **(12 Hrs)**

STATISTICAL THERMODYNAMICS-I

Need for statistical mechanics or thermodynamics-Ensemble- types of ensemble – micro canonical - canonical and grand canonical ensemble; Phase space- microstates- probability and distribution-Maxwell Boltzmann classical distribution law- derivation in term of degeneracy; Partition function (Q) – 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 Sackur-Tetrode equation-thermodynamic properties of monoatomic gases.

UNIT-IV **(12 Hrs)**

STATISTICAL THERMODYNAMICS-II

Quantum statistics- Bose-Einstein Statistics derivation- application of Bose-Einstein statistics for a photon gas – Planck's radiation formula-Derivation of Rayleigh-Jeans law-Stefan Boltzman equation. Fermi-Dirac statistics derivation -Application of Fermi-Dirac statistics to electron gas in metals; Population inversion-negative absolute temperature -heat capacity of diatomic gases-Einstein's theory and Debye's theory of heat capacities of solids- third law of thermodynamics and statistical entropy - hydrogen ortho and para nuclear states.

UNIT –V **(12 Hrs)**

Approximation methods, application of SWE to many electron systems.

Necessity for approximation methods- Variation methods for the Hydrogen atom – Perturbation (first order) method to Helium atom - Slater determinant wave function- secular determinant – Hartree – Fock self consistent field method to Helium atom – HMO bielectron theory of Ethylene and Butadiene.

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.
6. Chandra A. K., 1988, Introductory Quantum Chemistry, 3rd edition, Tata McGraw-Hill Publishing Co, New Delhi, India.
7. Mc Quarie D.A., 1983, Quantum Mechanics, Oxford University press, Oxford,UK.

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. Levine, 2006, Quantum Chemistry, 6th Edition, Prentice-Hall, New Delhi, 2006.
6. H.W. Hanna, 1993, Quantum Mechanics in Chemistry-Benjamin –Cummiza London Publishing Company, New Delhi, India.

Course Designed by

1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan

Course contents and lecture schedule

UNIT	TOPIC	No. OF LECTURE Hrs
I	**ELECTROCHEMISTRY-I**	

1.1	Theory of strong electrolytes -Interionic attraction theory- Debye – Huckel theory of strong electrolytes - Debye-Huckel model of ionic atmosphere.	2
1.2	Debye–Huckel Onsager equation-derivation, verification and modifications- Debye – Falkenhagen effect and Wien effect.	2
1.3	Electrical double layers – formation – Structure of electrified interfaces – Stern model. Debye Huckel limiting law- extension.	2
1.4	Huckel Bronsted equation - Determination of activity coefficients using Bronsted equation.	2
1.5	Applications of conductivity measurements – Nernst equation and its significance.	2
1.6	Reversible and irreversible cells - Electrodes – SHE – Calomel – Glass electrode – Platinum electrode – Glassy carbon electrode – ion selective electrode and measurement of pH.	2
II	**ELECTROCHEMISTRY-II**	
2.1	Over voltage- Theories of over voltage- applications of over voltage	1
2.2	electrode processes - Kinetics of electrode processes - Butler-Volmer equation- Tafel equation-	2
2.3	Corrosion- principles of electrochemical corrosion – dry and wet corrosion and its mechanism – Pilling-Bedworth rule.	2
2.4	Types of corrosion- galvanic, aeration, stress, pitting corrosion and passivity – factor influencing corrosion – corrosion control- cathodic production - corrosion inhibitors.	2
2.5	Principles of Polorography - Cyclic Voltametry –quasi – reversible – irreversible voltamogram	2
2.6	Electrochemical energy conversions-Nickel Cadmium, lead acid battery.	2
2.7	Fuel cells – H_2 - O_2 Fuel cell – methyl alcohol fuel cell.	1
III	**STATISTICAL THERMODYNAMICS-I**	
3.1	Need for statistical mechanics or thermodynamics-Ensemble- types of ensemble – micro canonical - canonical and grand canonical ensemble;	2
3.2	Phase space- microstates- probability and distribution- Maxwell Boltzmann classical distribution law- derivation in term of degeneracy;	3
3.3	Partition function (Q) – 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);	5
3.4	Derivation of Sackur-Tetrode equation-thermodynamic properties of monoatomic gases.	2
IV	**STATISTICAL THERMODYNAMICS-II**	
4.1	Quantum statistics- Bose-Einstein Statistics derivation- application of	3

	Bose-Einstein statistics for a photon gas	
4.2	Planck's radiation formula-Derivation of Rayleigh-Jeans law-Stefan Boltzman equation	2
4.3	Fermi-Dirac statistics derivation -Application of Fermi-Dirac statistics to electron gas in metal	2
4.4	Population inversion-negative absolute temperature -heat capacity of diatomic gases-Einstein's theory and Debye's theory of heat capacities of solids-	3
4.5	Third law of thermodynamics and statistical entropy - hydrogen ortho and para nuclear states.	2
V	**Approximation methods, application of SWE to many electron systems.**	
5.1	Necessity for approximation methods - Variation methods for the Hydrogen atom	2
5.2	Perturbation (first order) method to Helium atom	2
5.3	Slater determinant wave function- secular determinant	3
5.4	Hartree – Fock self consistent field method to Helium atom	2
5.5	HMO bielectron theory of Ethylene and Butadiene.	3

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Department of Chemistry
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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19CE21 (A)	C-Programming: Fundamentals And 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.

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.	K1, K2
CO2	Build a program using proper data input and output logics.	K3
CO3	Developa programs using the decision making looping logics.	K3
CO4	Construct the C Programs for solving the problems by chemical formula translation.	K4
CO5	Evaluate C programs to compute the output for chemical formula in organic, inorganic and physical chemistry.	K5

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

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)	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 Introduction and overview of C (15 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.

Expressions- Arithmetic - Evaluation of expression- Procedure of arithmetic operators- Library functions.

UNIT-II Data input and Output (T: 7 HRS + P: 8 HRS)

Character input- The getchar function – Character output- The putchar function – Entering input data- the Scanf function-Writing output data- The printf function- Formatted input and output data-the gets and puts functions-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.

UNIT-III (T: 10 HRS + P: 5 HRS)

Decision making and Looping: The WHILE statement – The DO statement-The FOR statement – Jumps in loops.

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.

UNIT-IV Applications of C in Chemistry-I (T: 5 HRS + P: 10 HRS)

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

1. Calculation of Molecular weight of Organic Compounds.
2. Calculation of pH.
3. Determination on First Order rate constant for the given reaction
4. Evaluation of lattice energy using
   i). Born- Haber Cycle
   ii). Born –Lande equation

5. Computing ionic radii- Lande's method and Paulings method
6. Calculation of Normality, Molarity and Molality of a given solution
7. Converting Kelvin to Celsius temperature and vice versa.
8. Determination of enthalpy of a given solution
9. Evaluation of Cell constant
10. Calculation of energy of Hydrogen atom spectral lines.

UNIT-V: Applications of C in Chemistry-II (T: 5 HRS + P: 10 HRS)

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

Organic Chemistry:

1. Use of Recursive functions to calculate the number of π Resonance structures for an organic conjugated system using

   res - str = n! / ((n/2)! * ((n/2) + 1)!)
2. Empirical formula of Hydrocarbons and other Organic compounds.

Inorganic Chemistry:

1. Array manipulation to balance the chemical equations.
2. Half life and average life periods of radioactive nuclei.
3. Binding energy of nucleus.
4. Program to get output as First ten elements of Periodic Table with their Name, Symbol, Atomic number and Atomic Weight.

Physical chemistry:

1. Calculation of RMS, average and MPV of gases.
2. Solving Quadratic equation to evaluate the Equilibrium constant for the reaction

   $H_2 + I_2$ 2HI
3. Illustrate use of Loop to calculate the NMR frequency for a nucleus with Spin ½
4. Mean activity coefficient of an Electrolyte (KCl)

TEXT BOOK

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

REFERENCES:

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.

Course designer

1. Dr. A. Elangovan
2. Dr. R. Mahalakshmy
3. Dr. A. Tamilselvi

Course contents and lecture schedule

Units	Topic	No. of lecture hrs (T+P)
I	**Introduction and overview of C**	15

1.1	Introduction – Importance of C-structure of C-programs- Simple programs-style of the language.	3
1.2	Characters–Keywords, Variables and parameters-Data types-Constants-Declaration of and assignments of values to variables.	4
1.3	Operators-Arithmetic, Relational, Logical, assignment, Increment and Decrement, Conditional and bitwise operators-Special operators.	4
1.4	Expressions- Arithmetic - Evaluation of expression- Procedure of arithmetic operators- Library functions.	3
1.5	Revision	1
II	**Data input and Output**	**15**
2.1	Character input- The getchar function – Character output- The putchar function – Entering input data- the Scanf function-Writing output data- The printf function- Formatted input and output data- the gets and puts functions-preparing and running a complete program.	7
2.2	**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.	7
2.3	Revision and test	1
III	**Unit III**	15
3.1	**Decision making and Looping:** The WHILE statement – The DO statement-The FOR statement – Jumps in loops.	5
3.2	**Arrays:** One dimensional array –Two dimensional arrays – Initializing two dimensional arrays- Multidimensional arrays.	4
3.3	**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.	5
2.3	Revision and test	1
IV	**Applications of C in Chemistry-I**	5+10
4.1	**E**xplanation of the formulae, equations and programs to solve the following problems in chemistry: 1. Calculation of Molecular weight of Organic Compounds. 2. Calculation of pH. 3. Determination on First Order rate constant for the given reaction 4. Evaluation of lattice energy using i). Born- Haber Cycle ii). Born –Lande equation 5. Computing ionic radii- Lande's method and Paulings method 6. Calculation of Normality, Molarity and Molality of a given solution 7. Converting Kelvin to Celsius temperature and vice versa.	5T+10P

	8. Determination of enthalpy of a given solution 9. Evaluation of Cell constant 10. Calculation of energy of Hydrogen atom spectral lines.	
V	**Applications of C in Chemistry-II**	
5.1	Explanation of the formulae, equations and programs to solve the following problems in chemistry: **Organic Chemistry:** 1. Use of Recursive functions to calculate the number of π Resonance structures for an organic conjugated system using res - str = n! / ((n/2)! * ((n/2) + 1)!) 2. Empirical formula of Hydrocarbons and other Organic compounds. **Inorganic Chemistry:** 1. Array manipulation to balance the chemical equations. 2. Half life and average life periods of radioactive nuclei. 3. Binding energy of nucleus. 4. Program to get output as First ten elements of Periodic Table with their Name, Symbol, Atomic number and Atomic Weight. **Physical chemistry:** 1. Calculation of RMS, average and MPV of gases. 2. Solving Quadratic equation to evaluate the Equilibrium constant for the reaction $H_2 + I_2 \qquad 2HI$ 3. Illustrate use of Loop to calculate the NMR frequency for a nucleus with Spin ½ 4. Mean activity coefficient of an Electrolyte (KCl)	5T+10P

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Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 2019)
Programme Code: PCH

Course 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

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

#	Course Outcome	Knowledge level
CO1	Tell the properties of Adsorption, Distribution, Metabolism, Elimination(ADME)and usage of pharmacokinetics in drug design.	K1, K2
CO2	Explain drug discovery by design andcompare the structural activity relationship properties.	K4, K5
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.	K3

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

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)	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**

S-Strong; M-Medium; L-Low

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 lead-isosteres,bioisoteres.

Unit III a)Quantitative-structural Activity-Relationship (QSAR) 15 hrs

Partition parameters-partition coefficients(p), Lipophilic subtituents constants (□) Electronic parameters-The Hammett constants-Steric parameters-The Taft Steric parameters (Es), Molar refractivity (MR), Hansch analysis-craig plots, The toplss decision tree. Compute –aided drug design-Modelling 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 Gangwal2007. Medicinal chemistry Lectures on Drug design and Synthetic Drugs, Student publishing House.

Course Designer1. Dr. P. Tharmaraj2. Dr. P. Prakash

Units	**Topic**	**No. of lecture hrs**
I	**Introduction to Drug Design:**	
1.1	**a) ADME Properties** The pharmacokinetics phase-Adsorption-Distribution, Metabolism-Elimination-Bioavailability of drug. pharmacokinetics models,	8
1.2	Intravascular and Extravascular administration. The use of pharmacokinetics in Drug dsign**.**	4
1.3	**b) Pharmacodynamics** - Stereoelectronic structure	3
II	**Drug Discovery by Design**	
2.1	**a) Streochemistry and Drug Design** Structurally rigid Groups –procaine, Acetylcholine. Conformation-Syn and Anti Acetylcholine, Phenyl ethanoate methiodides.	**6**

	Configuration-Variations in the biological activities of stereoisomers	
2.2	**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 lead-isosteres,bioisoteres.	**9**
III		
3.1	**Quantitative-structural Activity-Relationship**	
	Partition parameters-partition coefficients(p), Lipophilic subtituents constants ( ) Electronic parameters-The Hammett constants-Steric parameters-The Taft Steric parameters (Es), Molar refractivity (MR), Hansch analysis-craig plots, The toplss decision tree.	7
3.2	Computer –aided drug design- Modelling Drug-Receptor Interaction.	2
3.3	**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	6
IV		
4.4	**a) Antineoplastic Agents: 15 hrs** Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer	5
4.2	**b) Psychoactive drugs – The chemotherapy of Mind:** Introduction, neutotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, neurochemistry of mental diseases	5
4.3	**c) Cardiovascular Drugs and Local Antiinfective Drugs:** Introduction, Cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output.	5
V	**Synthesis of Drugs**	
5.1	**a) Synthesis of Antineoplastic agents** Mechlorethamine, Cyclophosphamide uracil, mustards and 6-mercaptopurine	5
5.2	**b) Synthesis of cardiovascular drugs** Amyl-nitrate, sorbitrate, , Verapamil.	4
5.3	**c) Synthesis of Phychoactive drugs** Synthesis of Diazepam, Chlorazepam, oxazepam, Alprazolam, Phenyltocin or Diphenylhydantoin, Barbitol, Phenobarbital.	6

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19CL21	**Organic qualitative analysis**	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 presnt 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	Identifythe functional groups in a given organic compound.
CO5	Preparethe derivatives for the given organic compound.

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 Designers1. Dr. P. Tharmaraj2. Dr. A. Tamilselvi

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Course Code	Course Title	Category	L	T	P	Credit
PCH19CL22	**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	Analyse the familiar cations present in the given mixture of salts.
CO4	Analyse 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 PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	S
CO2	M	S	S	S	S
CO3	M	S	S	S	S
CO4	M	S	S	S	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 NICKELa) By Direct Methodb) By Indirect Method

II. **SEMI MICRO ANALYSIS**

Semi micro analysis of samples containing two Familiar Cations and two Less Familiar Cations. – Maximum of Five samples.

Course Designers1. Dr. A. Elangovan2. Dr. T. Arumuganathan

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Course Code	Course title	Category	L	T	P	Credit
PCH19CL23	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 aknowledge 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	Deveop analytical skill on adsorption experiments.
CO4	Apply colorimetric estimation techniques.
CO5	Identify various types of conductometric titrations.

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 conductometrically**
3	**Estimation of mixture of acids conductometrically**

4	**Estimation of NH_4Cl by Conductometrically**
5	**Estimation of CH_3COONa by conductometrically**
6	**Estimation of $BaCl_2$ by conductometrically**
7	**Estimation of Fe(II) using $K_2Cr_2O_7$ by Potentiometry**
8	**Estimation of Fe(II) using CAS by Potentiometry**
9	**Estimation of KI with $KMnO_4$ by Potentiometry**
10	**Estimation of Copper (II) by Spectrocolorimetry**
11	**Determination of the Adsorption Parameters of Oxalic acid on Charcoal**
12	**Adsorption of acetic acid on to activated charcoal**
13	**Estimation of thiocyanate using iron (III) by spectrocolorimetry**
14	**Determination of Iron ion content by photometric method based on complex formation**

Course Designer

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

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Course Code	Course title	Category	L	T	P	Credit
PCH19C31	**Organic Chemistry - III**	Core-7	5	-	-	5

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

Preamble

The course explains the application of various reagents in organic synthesis. It imparts laboratory skill to the students. It gives in-depth knowledge on the mechanism of pericyclic, photochemical and molecular rearrangement reaction.

Prerequisites

Basic knowledge about reagents, organic synthesis, thermal, photochemical and molecular rearrangement reactions at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Make use of chemical reagents in various organic transformation such as oxidation, reduction, catalysis etc.,	K3
CO2	Outline synthetic route for complex organic molecules which find medicinal, industries of commercial importance.	K1, K2
CO3	Evaluate various methods to synthesizeoptically active compounds.	K5
CO4	Analyze the concepts and mechanism of photochemical and thermal reactions of carbonyl, alkenes and conjugated pi electrons compounds.	K4
CO5	Apply their knowledge in writing the mechanism of molecular rearrangement reaction.	K3

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

Mapping of COs with PSOs

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

Unit-I: Reagents in Organic Synthesis (15 Hrs)

Use of the following reagents in organic syntheses and functional group transformations – complex metal hydrides, Gilman‘s reagent, lithium dimethyl cuprate – lithium diisopropylamide (LDA) –– trimethyl silyliodide – tri-n-butyl tin hydride – Jones reagent – pyridinium chloro chromate – SeO_2 – peracids – DMSO – $Pb(OAc)_4$ – HIO_4 – Prevost and Woodward hydroxylation – Etard‘s reagent – Waker‘s reagent – RuO_4 – $Hg(OAc)_2$ – Oppenauer oxidation – DDQ – $LiAlH_4$, $NaBH_4$, Lawesson‘s reagent – Crown ethers – Thallium nitrate – Phase transfer catalysts – Birch reduction.

Unit-II Advanced Organic Synthesis I (Retro-synthesis) (15 hrs) Disconnection Approach: Importance of organic synthesis-Planning synthesis – Synthons and types – synthetic equivalents – latent functionality Guideliness for best disconnection approach, Reactions involving functional group interconversions – Reterosynthetic analysis – concept of umpolung – two group C-X disconnections and synthetic strategies 1,2-, 1,3-, 1,4-, 1,5- and 1,6- difunctionalised disconnection. Steroselective and stereospecific reactions-Chemoselectivity–Stereoselectivity- Regioselectivity.

Unit-III Advanced Organic Synthesis II (Asymmetric synthesis) (15hrs)

Definition of enantiomeric, disatereomeric excess – analytical methods to determine ee and de – strategy and classification of methods of asymmetric synthesis – chiral substrates – Chiral auxiliaries – chiral reagents – chiral catalysts.

Chiral catalysts and chiral reagents: BINAP-ruthenium (II) Mc Murray‘s reagent – $Ti(i\text{-}PrO)_4$, and $K_2Os_2(OH)_4$ – Sharpless asymmetric epoxidation, – Heck reactions – Suzuki Coupling – Sonogashira coupling.

Unit-IV Photochemistry and Pericyclic reactions (15 hrs)

General principles – orbital symmetry considerations related to photochemical reactions, thermal versus photochemical reactions – principles of energy transfer – photochemical reactions of ketones – Norrish type I and type II reactions – Paterno Buchi reaction – Dienone photochemistry – photo reduction, photochemical oxidation, Barton reaction – photochemistry of alkenes and dienes.

Pericyclic reactions Application of symmetry to orbital interactions – selection rules (Woodward and Hoffmann rules) – Electrocyclisation, cycloaddition and sigmatropic rearrangements – cheletropic reactions – Diels-Alder Reactions: Endoselectivity and regioselectivity – Explanation of these reaction in terms of correlation diagrams approach, FMO approach and Dewar – Zimmermann approach – (PMO) Huckel-Mobius concepts.

Unit-V Molecular rearrangements **(15 hrs)**

Classification – Nucleophilic, electrophilic, and radical – Mechanism of Favorski, Benzil-Benzilic acid, Bayer-Villiger, Wagner-Meerwin rearrangement, Carbanionic rearrangements, Stevan's rearrangement, Sommelet-Hauser, Cope, and Wesly-Moser rearrangement, Fries Rearrangement.

Acid catalyzed rearrangement – Arndt-Eistert synthesis – carbon to nitrogen migration – Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt and Beckmann rearrangement

Text book:

1. Jerry March.1992. Advanced Organic Chemistry, Reaction mechanism and structure, John Wiley and sons, 4th Edition, New York.

2. S. Warren,2004. Organic synthesis **-** The disconnection approach, John Wiley & Sons, UK, 2004**.**

3. Cary and Sundberg1990. Advanced Organic Chemistry, Part B, Reactions and Synthesis, Plenum Press, 3rd Edition.

4. R. K. Mackei and D. M. Smith1982. Guide Book to Organic synthesis, ELBS.

5. I.L. Finar2005. Organic Chemistry, Vol. II, V Edition, ELBS, New York.

6. W. Caruthers, Some modern methods of organic synthesis, Cambridge university.

7. C.H. Depuy and O.L. Chapman,1975. Molecular reactions and Photo Chemistry, Eastern and Economic Edition, Tata MacGraw Hill.

Reference Books:

1. Graham Solomons,1992. Organic Chemistry, John Wiley and Sons INC, 5th Edition.

2. Michael B. Smith, 1994.Organic Synthesis, McGraw Hill, International Edition.

3. Clayden, Greeve, Warren and Wothers, 2007.Organic Chemistry, OXFORD University Press.

4. A.J. Bellamy,1974. An introduction to conservation of orbital symmetry, Longman group Limited,

5. H. O. House,1972. Modern synthetic reactions, Cambridge University press, 3rd Edition.

6. W. Carruthers and I. Coldham, 2004. Modern methods of organic synthesis, Cambridge University Press, 4th Edition.

Course designer

1. Dr. P. Tharmaraj2. Dr. P. Prakash3. Dr. R. Mahalakshmy4. Dr. A.Tamilselvi

Course contents and lecture schedule

Units	Topic	lecture hrs
I	**Reagents in Organic Synthesis**	
1.1	Use of the following reagents in organic syntheses and functional group transformations – complex metal hydrides, Gilman's reagent,lithium dimethyl cuprate – lithium diisopropylamide (LDA)	3
1.2	trimethyl silyliodide – tri-n-butyl tin hydride – Jones reagent – pyridinium chloro chromate	2
1.3	SeO_2 – peracids – DMSO – $Pb(OAc)_4$ – HIO_4 – Prevost and Woodward hydroxylation	3
1.4	Etard's reagent – Waker's reagent – RuO_4 – $Hg(OAc)_2$ – Oppenauer oxidation – DDQ	3
1.4	$LiAlH_4$, $NaBH_4$, Lawesson's reagent – Crown ethers	2
1.5	Thallium nitrate – Phase transfer catalysts – Birch reduction.	2
II	**Advanced Organic Synthesis**	
2.1	Disconnection Approach: Importance of organic synthesis-Planning synthesis	2

2.1	Synthons and types – synthetic equivalents – latent functionality	2
2.3	Guideliness for best disconnection approach,	1
2.4	Reactions involving functional group interconversions – Reterosynthetic analysis, concept of umpolung	3
2.5	two group C-X disconnections and synthetic strategies 1,2-, 1,3-, 1,4-, 1,5- and 1,6- difunctionalised disconnection.	4
2.6	Steroselective and stereospecific reactions-Chemoselectivity– Stereoselectivity- Regioselectivity.	3
III	**Advanced Organic Synthesis II**	
3.1	Asymmetric synthesis: Definition of enantiomeric, disatereomeric excess – analytical methods to determine ee and de – strategy	3
3.2	Classification of methods of asymmetric synthesis – chiral substrates – Chiral auxiliaries – chiral reagents – chiral catalysts.	4
3.3	Chiral catalysts and chiral reagents: BINAP-ruthenium (II) Mc Murray‘s reagent – $Ti(i\text{-}PrO)_{4,}$ and $K_2Os_2(OH)_4$ – Sharpless asymmetric epoxidation, – Heck reactions – Suzuki Coupling – Sonogashira coupling.	8
IV	**Photochemistry and Pericyclic reactions**	
4.1	General principles – orbital symmetry considerations related to photochemical reactions, thermal versus photochemical reactions – principles of energy transfer	3
4.2	Photochemical reactions of ketones – Norrish type I and type II reactions – Paterno Buchi reaction – Dienone photochemistry.	2
4.3	Photo reduction, photochemical oxidation, Barton reaction – photochemistry of alkenes and dienes	3
4.4	Pericyclic reactions Application of symmetry to orbital interactions – selection rules (Woodward and Hoffmann rules).	2
4.5	Electrocyclisation, cycloaddition and sigmatropic rearrangements – cheletropic reactions – Diels-Alder Reactions.	2
4.6	Endoselectivity and regioselectivity – Explanation of these reaction in terms of correlation diagrams approach, FMO approach and Dewar – Zimmermann approach – (PMO) Huckel-Mobius concepts.	3
V	**Molecular rearrangements**	
5.1	Classification – Nucleophilic, electrophilic, and radical – Mechanism of Favorski, Benzil-Benzilic acid, Bayer-Villiger, Wagner-Meerwin rearrangement	5
5.2	Carbanionic rearrangements, Stevan‘s rearrangement, Sommelet-Hauser, Cope, and Wesly-Moser rearrangement, Fries Rearrangement.	5
5.3	Acid catalyzed rearrangement – Arndt-Eistert synthesis – carbon to nitrogen migration – Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt and Beckmann rearrangement.	5

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Course Code	Course title	Category	L	T	P	Credit
PCH19C32	**Inorganic Chemistry - III**	Core 8	5	-	-	5

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

Preamble

The course explains the various theories and reaction mechanism of coordination compounds. It also gives information on nano science and technology,spectral techniques and chemistry of lanthanides and actinides.

Prerequisite

Basic knowledge on coordination compounds, spectral techniques and chemistry of lanthanides and actinides at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Explainvarious theories andproperties of co-ordination compounds.	K1, K2
CO2	Examine the mechanism of co-ordination compounds.	K4
CO3	Summarize the preparation, characterization and evaluate application of nano particles.	K2, K5
CO4	Outline the basic principles and instrumentation of spectral techniques like IR, Raman, NMR, NQR and electronic spectroscopy and analyze their application in determining the structure and property of Inorganic compound/complexes	K3, K4
CO5	Make use of the occurance, extraction, spectral and magnetic properties of lanthanides and actinides.	K3

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

Mapping of COs with PSOs

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

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. LFT and MO theories- **pi bonding-**Influence of ligands on crystal field splitting-Octahedral and Tetrahedral splitting of "d" orbitals, CFSE. Spectrochemical series- Nephelauxetic effect– John Teller effect-site preferences. Spectral properties of complexes- Magnetic properties-**spin-orbit contribution-**Para, Dia, ferro magnetism and antiferro magnetism- Determination of magnetic properties – Gouy's method.

UNIT-II COORDINATION CHEMISTRY-II 15 Hrs

(INORGANIC REACTION MECHANISMS)

Substitution reactions- lability-inertness- square planar substitution reactions- Factors affecting reactivity of square planar complexes- Trans effect- Theories of Trans effect- Stereo chemistry 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 CHEMISTRY OF NANOSCIENCE AND TECHNOLOGY 15 Hrs

Introduction- Types of nano materials-Nanoparticles, nanotubes-Carbon nanotubes: SWCNT and MWCNT, nanowires, nanoribbons, nanorods, nano composites.

Preparation methods-Chemical vapour deposition, Sol-Gel method, Electrodeposition method, Ball milling method, Chemical reduction method, spin coating technique, Solvothernal synthesis, Colloidal method, Co-precipitation method, Flame spray synthesis (Arc Plasma)-Preparation of metal oxide nanoparticles- Properties of nanoparticles- Optical, mechanical, magnetic, electrical, thermal properties. Characterization Techniques like SEM, TEM, AFM, XRD, UV-DRS, B.E.T analysis, DLS, PL -Applications of Nanoparticles.

UNIT – IV PHYSICAL METHODS IN INGORGANIC 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 $\mathbf{d^2, d^3, d^7, d^8}$systems

IR and Raman spectra: Applications of IR and Raman. Selection rules to structure determination – IR spectral studies of carbonyl compounds.

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.NQR- Basic theory, principles and applications.

UNIT-V LANTHANIDES AND ACTINIDES 15Hrs

a) Lanthanides:-

Occurrence- differences between 4f and 5f orbitals-Separation techniques (Fractional crystallisation, precipitation, ion-exchange, solvent-extraction and thermal decomposition- Selective reduction and oxidation)- Electronic configuration- Oxidation states, Lanthanide contraction- Spectral and Magnetic properties- Ln chelates-organometallic compounds of Ln. Uses of lanthanides **(shift reagents, Pu bomb)** and their compounds- aqueous chemistry of uranyl compounds- position in the periodic table.

b) Actinides:-

Synthesis of elements- Extraction of Th and U and Pu- electronic configuration and oxidation states, spectral and magnetic properties- position in the periodic table.

TEXT BOOKS:

1. Shriver D. F. and Atkins, P.W.1999 Inorganic Chemistry, Oxford University Press, London.
2. Cotton F.A. and Wilkinson, G. 1988.Advanced Inorganic Chemistry, Wiley-Interscience publications, John Wiley & Sons, V Edn. New York.
3. Gurdeep R. Chatwal & M. S. Yadav,1993. Coordination Chemistry, Himalaya Publishing
4. House, I Edn.,
5. Figgis, B.N, 1964.Introduction to Ligand Fields, Wiley Interscience, Eartern Ltd., I Edn.,
6. New Delhi, .
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11. Nakamoto, Kazuo,1986. Infrared and Raman Spectra of Inorganic and coordination compounds, IV edition, John Wiley and Sons, New York.
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Course Designer1. Dr. A. Suganthi2. Dr.A. Elangovan3. Dr.D.S. Bhuvaneshwari
4. Dr.K.Selvakumar

Unit	Topic	No. of Lecture Hours
I	**Coordination Chemistry-I**	**15**
1.1	Nomenclature of coordination complexes-Stereochemistry of coordination.	3
1.2	Geometrical isomerism- optical isomerism of complexes having C.N.4,6 Compound.	2
1.3	Stability constants of complexes-stepwise and overall stability constant- their determination.	2
1.4	Jobs' continuous variation method-Chelate effect.	2
1.5	CFT. LFT and MO theories.	2
1.6	Influence of ligands on crystal field splitting- Octahedral and Tetrahedral splitting of "d" orbitals, CFSE	2
1.7	Spectrochemical series- Nephelauxetic effect– John Teller effect-site preferences.	1
1.8	Spectral properties of complexes- Magnetic properties- Para, Dia, ferro magnetism and antiferro magnetism.	1
1.9	Determination of magnetic properties – Gouy's method.	1
II	**Coordination Chemistry-I**	**15**
2.1	Substitution reactions- lability-inertness- square planar substitution reactions	2
2.2	Trans effect- Theories of Trans effect	2
2.3	Factors affecting reactivity of square planar complexes	2
2.4	Stereo chemistry of substitution in octahedral complexes.(SN1,SN2,SNiCB)	2
2.4	Reactions of coordinated ligands- Acid hydrolysis- anation reactions and base hydrolysis.	2
2.5	Mechanism of electron transfer reactions- Outer sphere, inner sphere electron transfer reactions	2
2.6	Marcus Theory and its applications	3
2.7	Synthesis of coordination compounds using electron transfer and substitution reaction	2
III	**CHEMISTRY OF NANOSCIENCE AND TECHNOLOGY**	**15**
3.1	Introduction- Types of nano materials-Nanoparticles, nanotubes-Carbon nanotubes: SWCNT and MWCNT,nanowires,nanoribbons,nanorods, nano composites	2
3.2	Preparation methods-Chemical vapour deposition, Sol-Gel method, Electrodeposition method, Ball milling method, Chemical reduction method, spin coating technique, Solvothernal synthesis, Colloidal method, Co-precipitation method,Flame spray synthesis(Arc Plasma	2
3.3	Peparation of metal oxide nanoparticles	2
3.4	Properties of nanoparticles- Optical, mechanical,	2

	magnetic,electrical, thermal properties.	
3.5	Characterisation Techniques like SEM,TEM,AFM, XRD, UV-DRS, B.E.T analysis , DLS, PL	2
3.6	Applications of Nanoparticles.	2
	Revision and test	3
IV	**PHYSICAL METHODS IN INGORGANIC CHEMISTRY-I**	**15**
4.1	Electronic spectra: selection rules – polarization – splitting of spectral terms.	2
4.2	L.S Coupling scheme- Russel- Saunders method- Term Symbols	2
4.3	Orgel and Tanabe-Sugano diagram	2
4.4	Effect of distortion and spin orbit coupling. Evaluation of 10 Dq and beta for octahedral Ni and tetrahedral Co complexes.	2
4.5	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	2
4.6	Kinetics of rearrangement reaction and metal chelates	2
4.7	Fluxional NMR of metal carbonyls and allyl complexes –	1
4.8	Paramagnetic NMR and contact and pseudo contact shifts.	1
4.9	NQR- Basic theory, principles and applications	1
V	**LANTHANIDES AND ACTINIDES**	**15**
5.1	Lanthanides:- Occurrence- differences between 4f and 5f orbitals.	1
5.2	Separation techniques (Fractional crystallisation, precipitation, ion-exchange, solvent-extraction and thermal decomposition- Selective reduction and oxidation)-	1
5.3	Electronic configuration- Oxidation states, Lanthanide contraction- Spectral and Magnetic properties- Ln chelates- organometallic compounds of Ln.	1
5.4	Lanthanides as shift reagents in NMR- uses of lanthanides and their compounds	1
5.5	Aqueous chemistry of uranyl compounds- position in the periodic table.	1
5.6	Actinides:- Synthesis of elements- Extraction of Th and U and Pu.	1
5.7	Electronic configuration and oxidation states, spectral and magnetic properties- position in the periodic table.	2

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 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19C33	**Physical Chemistry-I1I**	Core-9	5	-	-	5

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

Preamble

This course has been framed to enable the students to gain knowledge on basic and applications of group theory, spectroscopic techniques such as IR, Raman, UV, PES, ESR, and NQR.

Prerequisites

Basic knowledge on fundamental terms, definitions and concepts of group theory. Also the basic principles, instrumentation and applications of spectroscopic techniques such as IR, UV-Vis, microwave at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Summarise the fundamentals ofgroup theory.	K1, K2
CO2	Analyze the applications of group theory.	K4
CO3	Apply the concepts of spectroscopic techniques such as IR, Raman and microwave.	K3
CO4	Interpret the physical concepts of electronic and Photo electron spectroscopy.	K5
CO5	Apply thetheory and applications of ESR, Mossbauer and NQR spectroscopic techniques.	K3

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

Mapping of COs with PSOs

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

UNIT – I **15 Hrs**

GROUP THEORY – I (Basics of Group Theory)

(i) Introduction - Symmetry elements and symmetry operations - Definition of mathematical group – four cardinal properties of a group – closure, associative, idendity and inverse rule – cyclic group – Abelian group (H_2O only) and non-abelian group (NH_3 only) – Group multiplication table- C_2v and C_3v; subgroup – similarity transformation – class of group –Point group – Assignment of point group of simple molecules;

(ii) Matrix-introduction - matrix representation of the symmetry operations – idendity (E), Proper axis of rotation (C_n), Vertical reflection (σ_v), Improper axis of rotation (S_n) and Inverse (i); (iii) Representation definition – reducible and irreducible representation of a group –block factorization. The great orthogonality theorem (GOT) – rules for writing (properties of) irreducible representations – Projection operator (definition only) – character table definition – construction of character table C_{2V} and C_{3V}.

UNIT – II

GROUP THEORY – II (Applications of Group Theory) **15 Hrs**

Prediction of symmetry of atomic orbitals - linear vector, rotation vector – symmetries of tensor like properties (α & g); Prediction of orbitals and hybridization in BF_3 and CH_4 molecules ; Normal mode analysis – H_2O and NH_3; Direct product representation and its applications – identification of IR and Raman active vibration of H_2O and N_2F_2 – selection rules to predict allowed and forbidden electronic transition in UV-Visible spectra for example formaldehyde (HCHO); HMO energy calculation for ethylene and butadiene.

UNIT – III SPECTROSCOPY - I **15 Hrs**

Absorption and emission of electromagnetic radiation (emr) – LASER — Interaction of electromagnetic radiation with matter – Einstein coefficients; Microwave, IR and Raman spectroscopy of diatomic molecules – determination of molecular parameters – vibrational spectra of polyatomic molecules – IR and Raman active modes – overtone and combination bands – Fermi resonance – group frequencies and coupling interaction.

UNIT – IV SPECTROSCOPY – II **15 Hrs**

Electronic spectra of diatomic molecules – molecular quantum numbers – dissociation energy calculations – Birge-sponer extrapolation technique – pre-dissociation spectra – charge transfer spectra – Fortrat diagram – electronic spectra of molecules – absorbance – oscillator strength;

Photoelectron spectroscopy – basic principles, spectrum, X-ray PES, (ESCA) – vibrational structure – koopman‘s theorem – PES of argon, oxygen and nitrogen.

UNIT – V

SPECTROSCOPY - III **15 Hrs**

ESR spectroscopy – principle, g-factor, experimental method, spectrum, fine and hyperfine structures and applications (H-atom, CH_3 radical, *p*-1,4 benzosemiquinone radical anion, naphthalene anion, Tempol)

NQR spectroscopy – quadrupole movement, coupling constant, quadrupole transition-electric field gradient and molecular structure (${}_{7}N^{14}$, ${}_{5}B^{11}$, ${}_{17}Cl^{36}$)

Mossbauer spectroscopy – recoilless emission and resonance absorbtion, experimental method, isomeric shift and electric quadrupole splitting in Fe^{57}.

TEXT BOOKS: (UNIT I & II)

1. Ccotton F.A., 1971, Chemical applications of group theory, 3rd edition, wiley eastern Ltd., UK.
2. Ramakrishnan, V., Gopinathan M.S., 1988, Group theory in chemistry, Vishal publication, New delhi, India.
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REFERENCE BOOKS:

1. G.M. Barrow, Introduction to molecular spectroscopy, McGraw-Hill, Newyork.
2. Banwell G.M., Fundamentals of molecular spectroscopy, IV Edn., TMH company Ltd.
3. Chang R., 1971, Basic principles of spectroscopy, McGraw-Hill.
4. Straughan B.P., Walker S., 1976, Spectroscopy – Vol. 1, 2 and 3, Chapman and Hall.
5.Drago R.S., 1999, Physical methods in chemistry, Saunder college publishing.

Course Designers

1 Dr. R. Sayeekannan
2 Dr. A. R. Ramesh
3 Dr. T. Arumuganathan

Course contents and lecture schedule

UNIT	**TOPIC**	**No. OF LECTURE Hrs**
I	**GROUP THEORY – I (Basics of Group Theory)**	
1.1	(i) Introduction - Symmetry elements and symmetry operations	1
1.2	Definition of mathematical group – four cardinal properties of a group – closure, associative, idendity and inverse rule	2
1.3	Cyclic group – Abelian group (H_2O only) and non-abelian group (NH_3 only)	1
1.4	Group multiplication table- C_2v and C_3v; subgroup – similarity transformation – class of group –Point group – Assignment of point group of simple molecules;	2
1.5	(ii) Matrix-introduction - matrix representation of the symmetry operations – idendity (*E*), Proper axis of rotation (C_n), Vertical	2

	reflection (σ_v), Improper axis of rotation (S_n) and Inverse (i);	
1.6	(iii) Representation definition – reducible and irreducible representation of a group –block factorization;	2
1.7	The great orthogonality theorem (GOT) – rules for writing (properties of) irreducible representations – Projection operator (definition only);	2
1.8	Character table definition – construction of character table C_{2V}, C_{3V}, D_{3h} and Td point groups.	3
II	**GROUP THEORY – II (Applications of Group Theory)**	
2.1	Prediction of symmetry of atomic orbitals - linear vector, rotation vector – symmetries of tensor like properties (α & g);	2
2.2	Prediction of orbitals and hybridization in BF_3 and CH_4 molecules ;	3
2.3	Normal mode analysis – H_2O and NH_3;	2
2.4	Direct product representation and its applications – identification of IR and Raman active vibration of H_2O and NH_3	3
2.5	Selection rules to predict allowed and forbidden electronic transition in UV-Visible spectra for example formaldehyde (HCHO);	2
2.6	HMO energy calculation for ethylene and butadiene.	3
III	**SPECTROSCOPY -I**	
3.1	Absorption and emission of electromagnetic radiation (emr)	3
3.2	LASER, Interaction of electromagnetic radiation with matter – Einstein coefficients.	3
3.3	Microwave, IR and Raman spectroscopy of diatomic molecules	3
3.4	Determination of molecular parameters – vibrational spectra of polyatomic molecules	3
3.5	IR and Raman active modes – overtone and combination bands – Fermi resonance – group frequencies and coupling interaction.	3
IV	**SPECTROSCOPY - II**	
4.1	Electronic spectra of diatomic molecules – molecular quantum numbers	3
4.2	Dissociation energy calculations – Birge – sponer extrapolation technique, pre-dissociation spectra – charge transfer spectra	3
4.3	Fortrat diagram – electronic spectra of molecules – absorbance – oscillator strength	3
4.4	Photoelectron spectroscopy – basic principles, spectrum, X-ray PES, (ESCA)	3
4.5	Vibrational structure – koopman‘s theorem – PES of argon, oxygen and nitrogen.	3
V	**SPECTROSCOPY - III**	
5.1	ESR spectroscopy – principle, g-factor, experimental method	2
5.2	ESR spectrum, fine and hyperfine structures and applications (H-atom, CH_3 radical, *p*-1,4 benzosemiquinone radical anion, naphthalene anion, Tempol)	2
5.3	NQR spectroscopy – quadrupole movement, coupling constant,	3

	quadrupole transition	
5.4	electric field gradient and molecular structure ($_7N^{14}$, $_5B^{11}$, $_{17}Cl^{36}$)	2
5.5	Mossbauer spectroscopy – recoilless emission and resonance absorbtion, experimental method, isomeric shift and electric quadrupole splitting in Fe^{57}.	3

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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19CE31(A)	Computer applications in Chemistry	Core elective -2 (Option A)	5	-	-	5

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

Preamble

The course explains the concepts of internet programming, HTML, JAVA APPLET and their applications in chemistry. It gives hands-on experience on chemistry-related application softwares.

Prerequisites

Basic knowledge about internet, E-mail, HTML and Java programs.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Outline Internet protocols, online usage of internet, search engine, e-publication and electronic mail.	K1, K2
CO2	Make use of HTML and Java programs to chemistry.	K3
CO3	Analyze the chemical structures in scientific manner and get the mass and NMR simulations; and also get an idea about computational chemistry.	K4
CO4	Apply the knowledge of diffraction techniques to the study of structural chemistry; and understand the applications of shelx and PLATON software in crystallography.	K3
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 PSOs

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

UNIT-I: INTERNET AND E-MAIL T: 10 + P: 5 Hrs

INTERNET: Introduction- History- Importance of the Internet- Internet Access- Dial-Up connection, Direct connection and equipments –- Internet protocol(TCP/IP,FTP HTTP, TELNET and WAP)-Internet addressing – Domain Name-Mail address-Uniform Resource Locator(URL)-Web Browsing- Searching the Web- Search Engines(Yahoo, Google)- Intranet – Searching and utilizing Popular websites in Chemistry. On line literature survey- accessing of e-journals. Preparing articles for e-publications. Online structure drawing- Collection of spectral data using databases.

ELECTRONIC MAIL: Introduction-Working of E-Mail - Word processor for E-Mail- Mailing Basics – Composing and sending of an E-Mail- Address Book – Signature- File Attachments- Customizing your Mail program –Advantages and Disadvantages of E-Mail - Tips for effective E-Mail use- Smile keys.

UNIT- II: HTML T: 8 + P: 7 Hrs

HTML - Need- Structure of HTML Document- HTML Tags- Horizontal line Tags- Background and Text color Tags- Font Tags- MARQUEES Tags- Adding pictures - Ordered and Unordered Lists- Creating Links- Construction of Periodic Table with required data for first ten elements- Frames – Developing and hosting of Web Pages for a given molecule / chemical.

JAVA APPLETS: - Simple and Java applets with graphics- Applications of applet to draw 2D and 3D view of molecules.

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

Introduction- Tool Pallets- Construction of the molecule using Chem Draw- Tools- Manipulating a molecule-Model display- Display type- Structure displays- Molecular Surface display- NMR simulation and interpretation- Naming IUPAC- Structure from Name and Name from Structure- Computational Concepts: - Computational methods: - Potential energy surface, geometry Optimizations property (calculations)-Molecular Mechanics Theory in brief - Animations- Difference between Chemdraw and Chem 3D.

UNIT-IV: APPLICATIONS OF SHELX PROGRAM IN CHEMISTRY T: 5 + P: 10 Hrs

Basics of Crystals- Symmetry and operations- Seven Crystal systems- Bravais lattices – X-Ray Diffractometers- Unit cell parameters- X-ray data- Deduction of Space group - Structure solution and refinement using SHELX- Structure building using PLATON- H-Bonding.

UNIT-V: APPLICATIONS OF RASMOL and MATLAB IN CHEMISTRY-III 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 Books:

1. . Alexis Leon and Mathews Leon. 1999.Fundamentals of Information Technology Leon TECH World, UBS Publishers & Distributors Ltd., 1999.
2. E. Balagurusmy,2003. Programming with Java- A Primer, , Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Edn., 15th Reprint
3. C. Xavier,2000 World wide web design with HTML, , Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Reprint.

Reference Books:

1. Margaret Levine Young, 2001. Internet- Complete Reference, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Barbara Kassev,1998. Using the Internet, EE edition, New Delhi, IV Edition.
3.Alexis Leon and Mathews Leon,2000 Internet for Everyone, Leon TECH World, Publishers & Distributors Ltd..
4. John Zukowski,2000. Mastering Java 2, BPB Publications, New Delhi.
5 PatrickNaughten,2002. The Java Hand Book, Tata McGraw-Hill Publishing Company Ltd., NewDelhi, 11th Reprint.
6. Herbert Schildt,2001. Java 2- The Complete Reference, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 4th Edn.
7. Holzner, John Zukowski,1999. Java 2 Complete: Steven BPB Publications, New Delhi, 1st Indian Edn..
8. HarleyHahn,2001. The Internet Complete Reference, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Edn.
9 Chem Draw & Chem 3D –Manual
10. Shelx, Rasmol and MATLAB- Manuals.

REFERENCES in the NET

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3.http://java.Sun.Com/applet/applets/chemical Models/index.html

4.http://ccl.osc.edu/chemistry.html5. http://www.umass.eud/microbio/rasmol/

6. http://www. Mdli.com/cgi/dynamic/welcome.html/ (for CHIME similar to Rasmol)

Course designers Dr. A. Elangovan

1. Dr. R. Mahalakshmy
2. Dr. A. Tamilselvi

Course contents and lecture schedule

Unit	Topic	No. of lecture hrs (T+P)
1	INTERNET AND E-MAIL	10+5
1.1	**INTERNET:** Introduction- History- Importance of the Internet- Internet Access- Dial-Up connection, Direct connection and equipments –- Internet protocol(TCP/IP,FTP HTTP, TELNET and WAP)-Internet addressing – Domain Name-Mail address-Uniform Resource Locator(URL)-Web Browsing- Searching the Web- Search Engines(Yahoo, Google)- Intranet	3+2
1.2	Searching and utilizing Popular websites in Chemistry. On line literature survey- accessing of e-journals. Preparing articles for e-publications. Online structure drawing- Collection of spectral data using databases.	3+2
1.3	**ELECTRONIC MAIL**: Introduction-Working of E-Mail - Word processor for E-Mail- Mailing Basics – Composing and sending of an E-Mail- Address Book – Signature- File Attachments- Customizing your Mail program –Advantages and Disadvantages of E-Mail - Tips for effective E-Mail use- Smile keys.	3+1
1.4	Revision	1
2	HTML	8+7
2.1	HTML - Need- Structure of HTML Document- HTML Tags- Horizontal line Tags- Background and Text color Tags- Font Tags- MARQUEES Tags- Adding pictures - Ordered and Unordered Lists	3+2
2.2	Creating Links- Construction of Periodic Table with required data for first ten elements- Frames – Developing and hosting of Web Pages for a given molecule / chemical.	3+2
2.3	**JAVA APPLETS:** - Simple and Java applets with graphics- Applications of applet to draw 2D and 3D view of molecules.	2+3
2.4	Revision and test	1
3	***APPLICATIONS OF CHEMDRAW AND CHEM3D SOFTWARE IN CHEMISTRY***	8+7
3.1	***Chemical drawing programs:- Chem- Draw and Chem 3D*** Introduction- Tool Pallets- Construction of the molecule using Chem Draw- Tools- Manipulating a molecule-Model display- Display type-Structure displays- Molecular Surface display- NMR simulation and interpretation- Naming IUPAC- Structure from Name and Name from Structure-Computational Concepts: - Computational methods: - Potential energy surface, geometry Optimizations property (calculations)-Molecular Mechanics Theory in brief - Animations- Difference between Chemdraw and Chem 3D.	8+7
4	***APPLICATIONS OF SHELX PROGRAM IN CHEMISTRY-II***	5+10
4.1	Basics of Crystals- Symmetry and operations- Seven Crystal systems**Bravais lattices- X-Ray Diffractometers- Unit cell parameters-**	

	X-ray data- Deduction of Space group- - Structure solution and refinement using SHELX- Structure building using PLATON- H-Bonding.	
5	APPLICATIONS OF RASMOL and MATLAB IN CHEMISTRY-III	8+7
	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.	4+4
	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).	4+3

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Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19CE31(B)	**Advanced Organic Synthesis**	Core elective -2 (Option B)	5	-	-	5

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

Preamble

The course explains the concepts od retrosynthetic analysis, biogenesis of natural products, biosynthesis of fatty acids and biotransformation.

Prerequisites

Basic knowledge on natural products chemistry at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Outline the synthetic strategy of few structurally complicated organic molecules.	K1, K2
CO2	Make use of the biogenesis of natural products such as alkaloids, terpenoids and flavones.	K3
CO3	Examine the biosynthesis of fatty acids and few essential amino acids.	K4
CO4	Utilizethe classification, preparation and uses of some important dyes.	K3
CO5	Evaluate biocatalysts such as enzymes, modifies enzymes and artificial enzymes to carry out various chemical reactions.	K5

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

Mapping of COs with PSOs

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

UNIT-I REETEROSYNTHETIC ANALYSIS (15 Hrs)

Synthetic Strategy of the following target molecules: longifolene-juvabione-jasmone- 5-hexenoic acid-trans-9-methyl I-decalone- bicyclo (4,1,0) heptan-2 one- α-onocerin-isonootketone.

UNIT-II BIOGENESIS OF ALKALOIDS,TERPENOIDS & FLAVONES (15 Hrs)

Alkaloids(pyridine,phenanthrene and indole type)-nicotine-gramine-harmine-morphine-codine- terpenoids of classes with examples Lanosterol & Cholesterol from squalene-coumarins-carbohydrates-fructose-6-phosphate-xylose-5-phosphate-ribulose-5-phosphate-sucrose-amylose and amylopectin-flavones-proteins.

Terpenoids: Geranyl diphosphate-Geraniol-Farnesol–Camphor-limonene-citronellol-caryophyllene(Corey methods) – santonin.

UNIT-III BIOSYNTHESIS OF FATTY ACIDS (15 Hrs)

Introduction-acetate pathway-acetyl co-enzyme-A-biosynthesis of fatty acids-malonyl co-A-malonyl ACP-Acyl ACP-Acetoacetyl Co-A- biosynthesis of unsaturated fatty acids Major biosynthetic pathways: 1) Acetate-Malonate pathway: Biosynthesis of aromatic compounds, 2) Shikimic acid pathway ; Biosynthesis of essential amino acids – phenylalanine, tyrosine and tryptophan, carboxylic acid derivatives 3)Mevalonic acid pathway : Biosynthesis of mevalonic acid.

UNIT-IV: DYES (15 Hrs)

Introduction, various methods of dyeing, classification of dyes, nitroso dyes,Azodyes,-Fast green, Methyl Orange, Methyl Red, Fast Red, tripheylmethane dyes-Malachite green, Rosaniline, Aniline blue, Crystal violet, Xanethene dyes-Fluorescein,Rhodamine B, Anthroquinone dyes –Alizarin –Preparation and uses.

UNIT – V : BIOTRANSFORMATION (15 Hrs)

Advantages and disadvantages of Biocatalysts – Biocatalytic application. Hydrolytic reaction, reduction, oxidation, peroxidation – addition and elimination Reaction. Formation of C-C bond-glycosyl transfer reactions - Immobilisation – adsorbtion – ion binding entrapment into gels, into membranes – compartments – Micells and vesicles – modified and artificial enzymes – semisynthetic enzymes – catalytic antibodies.

Text Books:

1. R.K. Mackie, D.M. Smith and R.A.Aitken,1990. Guide book to Organic synthesis, Longman group, UK, 2n edition.
2. S.Warren, 1997.Organic synthesis, The disconnection approach, John Wiley & Son.
3. C.Daniel Gutsche, Calixarent,1989. Royal Society of Chemistry, Cambridge UK.

References:

1. Organnic Synthesis-Robert E.Ireland-Prantice Hall of India Pvt Ltd,NewDelhi.

2. Advanced Organic Chemistry-Reaction & Synthesis-Francis A.Corey & Richard J.Sundberg-V Edition-Springer.

3. Organic Chemistry-Francis A.Corey & Robert M.Giuliano-Tata McGraw-Hill Edition

4.Organic Chemistry-Natural Products Volume II-Dr.O.P.Agarwal-Goel Publishing House.

5. Chemistry of Carbocyclic Compounds-Azhuwalia

6. Pharmaceutical,Medicinal and Natural Product Chemistry-P.S.Kalsi & Sangeetha Jagtap-Narosa Publishing House

7. Organic Chemistry-Jonathan Clayden,Nick Greeves and Stuart Warren-Second Editiion-Oxford University Press

8. Synthetic Dyes-Gurudeep Chatwal

9.Biotransformation in Organic Chemistry-Kurt Faber-A Textbook-V Edition-Springer.

Course Designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash

Unit	Topic	No. of lecture hrs
I	**RETEROSYNTHETIC ANALYSIS**	
1.1	Synthetic Strategy of the following target molecules: longifolene-juvabione-jasmone- 5-hexenoic acid-trans-9-methyl I-decalone-bicyclo (4,1,0) heptan-2 one- α-onocerin-isonootketone.	15
II	**BIOGENESIS OF ALKALOIDS,TERPENOIDS & FLAVONES**	
2.1	Alkaloids(pyridine,phenanthrene and indole type)-nicotine-gramine-harmine-morphine-codine- terpenoids of classes with examples Lanosterol & Cholesterol from squalene-coumarins-carbohydrates-fructose-6-phosphate-xylose-5-phosphate-ribulose-5-phosphate-sucrose-amylose and amylopectin-flavones-proteins	10
2.2	Terpenoids: Geranyl diphosphate-Geraniol-Farnesol–Camphor-limonene-citronellol-caryophyllene(Corey methods) – santonin	5
III	**BIOSYNTHESIS OF FATTY ACIDS**	
3.1	Introduction-acetate pathway-acetyl co-enzyme-A-biosynthesis of fatty acids-malonyl co-A-malonyl ACP-Acyl ACP-Acetoacetyl Co-A- biosynthesis of unsaturated fatty acids Major biosynthetic pathways: 1) Acetate-Malonate pathway.	6
3.2	Biosynthesis of aromatic compounds, 2) Shikimic acid pathway	2
3.3	Biosynthesis of essential amino acids – phenylalanine, tyrosine and tryptophan, carboxylic acid derivatives 3)Mevalonic acid pathway : Biosynthesis of mevalonic acid.	7
IV	**DYES** Introduction, various methods of dyeing, classification of dyes, nitroso dyes,Azodyes,-Fast green, Methyl Orange, Methyl Red, Fast Red, tripheylmethane dyes-Malachite green, Rosaniline, Aniline	15

	blue, Crystal violet, Xanethene dyes-Fluorescein,Rhodamine B, Anthroquinone dyes –Alizarin –Preparation and uses.	
V	**BIOTRANSFORMATION**	
5.1	Advantages and disadvantages of Biocatalysts – Biocatalytic application.	2
5.2	Hydrolytic reaction, reduction, oxidation, peroxidation – addition and elimination Reaction.	4
5.3	Formation of C-C bond-glycosyl transfer reactions - Immobilisation – adsorbtion – ion binding entrapment into gels, into membranes – compartments –	5
5.4	Micells and vesicles – modified and artificial enzymes – semisynthetic enzymes – catalytic antibodies.	4

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc., Chemistry on or after June 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19C41	**Organic Chemistry - IV**	Core-10	4	-	-	5

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

Preamble

The course explains the chemistry of heterocyclic compounds, terpenoids, alkaloids, steroids, vitamins, peptides and nucleic acid. It also explains the importance of green chemistry and its applications.

Prerequisites

Basic knowledge about reagents, organic synthesis, thermal, photochemical and molecular rearrangement reactions at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Outline the chemistry of nitrogen and oxygen containing heterocyclic compounds and natural products.	K1, K2
CO2	Apply their knowledge on isolation, biological activity and structural studies of selective terpenoids and alkaloids	K1, K3
CO3	Analyze the structure and activity of compounds with steroid skeleton and vitamins.	K4
CO4	Explain the structure and synthesis of amino acids, peptides, proteins and nucleic acid.	K5
CO5	Apply their knowledge to synthesis compounds in a greener way.	K3

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

Mapping of COs with PSOs

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

Unit - I CHEMISTRY OF HETEROCYCLIC COMPOUNDS (15 hrs)

Heterocyclics – Nomenclature – Compounds containing two hetero atoms: Synthesis and reactivity of pyrazole, imidazole, oxazole, thiazole, quinoline and isoquinoline. diazines: the chemistry of pyridazine, pyrimidine and pyrazine – Comparison of basicity of diazines.
Introduction to anthrocyanins and flavonoids.

Unit - II CHEMISTRY OF TERPENOIDS AND ALKALOIDS (15 hrs)

Chemistry of terpenoids: General methods of determining structure of terpenoids – α-pinene, Zingiberene, and Abietic acid.
Chemistry of alkaloids: General methods of determining structure of alkaloids – Structure elucidation of (i) Morphine (ii) Reserpine.

Unit- III CHEMISTRY OF STEROIDS AND VITAMINS (15 hrs)

Chemistry of steroids : Introduction – Structural elucidation of Cholesterol – Androsterone and Testosterone (male sex hormones) – Oesterone, progesterone (Female sex hormone).
Classification of Vitamins: Nomenclature of Vitamins – Strucure and Biological functions of vitamins: Vitamin A (Retinol), Vitamin B2 (Riboflavin), Vitamin B6 (Pyridoxine), Vitamin B12, Vitamin C, D and E (Structure elucidation and synthesis not required).

Unit IV CHEMISTRY OF PEPTIDES AND NUCLEIC ACID (15 hrs)

(a) Polypeptides – Classification - the peptide linkage - Structure of amino acids – 1^0, 2^0, 3^0 and quaternary structure) – Solid phase peptide synthesis (Merifield) – use of protecting groups and reagents – Structural elucidation of glutathione, thyroxin and oxytocin.
(b) Nucleosides, Nucleotides and Nucleic acids – structure and synthesis of nucleosides and nucleotides – Elementary treatment on the structure of DNA and RNA

Unit – V GREEN CHEMISTRY (15 hrs)

Green Chemistry: Importance and principles of Green chemistry - Solid state and Solvent free organic reactions – Solid supported reagents – Microwave assisted reactions - Sonochemical approach - Reactions in ionic liquids – supercritical CO_2 medium – aqueous medium - enzymatic and electrochemical methods.

Text Books:

1. I.L. Finar, 2005.Organic Chemistry, Vol. II, V Edition, ELBS, UK.
2. S.F. Dyke,1965. Chemistry of Vitamins, Interscience, Toronto.

3. O.P. Agarwal,2002 Chemistry of Natural products, Vol. I and II, Himalaya Publishing House, New Delhi..
4. V.K. Ahluwalia, M. Kidwai2006. " New trends in Green Chemistry" Second Edition, Anamaya publishers, New Delhi,.
5. Gurdeep Chatwal,1997. Organic Chemistry of natural products, Vol. I, Himalaya Publishing House .
6. Morrison and Boyd, Organic Chemistry, Prentice-Hall of India private limited, New Delhi, 6th Edition.

Reference Books

1. Hermann Dugus, 2004.Bioorganic Chemistry, Springer International, III Edition, New Delhi.
2. D.L. Nelson and M.M. Cox, 2008.Lehningers' Principal of Biochemistry, W.H. Freeman and Company, New York, 5th Edition.
3. L.F Fieser and M. Fieser,1991 Steroids, Reinhold Press, Atlanta,.

Course designer

1 Dr. P. Tharmaraj
2 Dr. P. Prakash
3 Dr. R. Mahalakshmy
4 Dr. A. Tamil Selvi

Course contents and lecture schedule

Unit	**Topic**	**lecture hrs**
I	**CHEMISTRY OF HETEROCYCLIC COMPOUNDS**	15
1.1	Heterocyclics – Nomenclature	2
1.2	Compounds containing two hetero atoms: Synthesis and reactivity of pyrazole, imidazole, oxazole, isoxazole, thiazole, isothiazole, quinoline and isoquinoline.	5
1.3	diazines: the chemistry of pyridazine, pyrimidine and pyrazine – Comparison of basicity of diazines.	4
1.4	Chemistry of anthrocyanins and flavonoids	3
1.5	Revision and test	1
II	**CHEMISTRY OF TERPENOIDS AND ALKALOIDS**	15
2.1	Chemistry of terpenoids: General methods of determining structure of terpenoids – α-pinene, α-cadinene, Zingiberene, Abietic acid and Heliangine.	7
	Chemistry of alkaloids: Alkaloids and Drugs: General methods of determining structure of alkaloids – Structure elucidation of (i) Morphine (ii) Reserpine (iii) Lysergic acid.	7
	Revision and test	1
III	**CHEMISTRY OF STEROIDS AND VITAMINS**	15
	Chemistry of steroids : Introduction – Structural elucidation of Cholesterol – Androsterone and Testosterone (male sex hormones) – Oesterone, progesterone (Female sex hormone).	7
	Classification of Vitamins: Nomenclature of Vitamins – Strucure and Biological functions of vitamins: Vitamin A (Retinol), Vitamin B2 (Riboflavin), Vitamin B6 (Pyridoxine), Vitamin B12 (Synthesis not included), Vitamin C, D and E	7

	Revision and test	1
IV	**CHEMISTRY OF PEPTIDES AND NUCLEIC ACID**	12
4.1	Polypeptides – Classification - the peptide linkage - Structure of amino acids – 1^0, 2^0, 3^0 and quaternary structure) – Solid phase peptide synthesis (Merifield) – use of protecting groups and reagents – Structural elucidation of glutathione, thyroxin and oxytocin.	8
4.2	Nucleosides, Nucleotides and Nucleic acids – structure and synthesis of nucleosides and nucleotides – Elementary treatment on the structure of DNA and RNA	6
	Revision and test	1
V	**GREEN CHEMISTRY AND ANTIBIOTICS**	15
5.1	Green Chemistry: Importance and principles of Green chemistry - Solid state and Solvent free organic reactions – Solid supported reagents – Microwave assisted reactions - Sonochemical approach - Reactions in ionic liquids – supercritical CO_2 medium – aqueous medium - enzymatic and electrochemical methods.	9
5.2	Antibiotics: Strucural features of following antibiotics (synthesis need not to be discussed): β-lactam antibiotic – Chloramphenicol.	5
	Revision and test	1

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Department of Chemistry
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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19C42	**Inorganic Chemistry – IV**	Core 11	5	-	-	4

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

Preamble

The course explains the synthesis, structure and reactivity or organometallic compounds and their catalytic applications, role of metal ion in biological systems, description of various inorganic physical methods, reaction mechanism of inorganic photochemistry.

Prerequisite

Basi knowledge on preparation and chemical properties of organometallic compounds, bioinorganic Chemistryand principle of photochemistryat undegraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Define the terms EAN, 18, 16-electron rule classify the organometallic compounds, structure and properties of organimetallic compounds such as metallocenes, alkenes, alkynes and arene complexes.	K1, K2
CO2	Explain the reaction mechanism and catalytic application of organometallic compounds.	K2, K3
CO3	Classify the essential and trace elements in biological systems to understand the functionality of various bio-inoranic molecules and application of metal complex in chelate and chemotherapy.	K4
CO4	Outline the principles of various spectral techniques like EPR, PES, IR, MBS etc and interpretation of the spectra.	K2, K3
CO5	Apply inorganic photochemical reactions to evaluate the reaction path and in photochemical energy conversion like solar cell, fuel cell etc.	K3, K5

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

Mapping of COs with PSOs

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

UNIT –I ORGANOMETALLIC CHEMISTRY –I 15 Hrs

Stability of organo metallic compounds- β hydrogen elimination- the sixteen and eighteen electron rule. Synthesis – structure and bonding in metal carbonyls – isoelectronic and isolobal analogy- use of IR in the structural elucidation of carbonyl compounds– metal nitrosyls – dinitrogen complexes. π donors-**Carboxylic ligands and complexes**. Synthesis structure bonding and reactivity of carbenes, carbines, metallocenes and other aromatic cyclopolyenes – Ferrocene – bonding and structure – sigma, pi and hapto nomenclature. Arene complexes – olefin – acetylene and pi allyl complexes.

UNIT – II ORGANOMETALLIC CHEMISTRY –II 15 Hrs

Catalysis involving organometallic compounds – properties of metals and ligands in homogeneous catalysis – oxidative addition and reductive elimination – hydrogen abstraction – activation of small molecules by complexation-agnostic interaction-insertion-alkyl migration-insertion and elimination-catalytic reactions- hydrogenation of olefins – Wilkinson's catalyst – hydroformylation –syn-gas-water gas shift reactions- oxidation of olefins – Wacker process – propylene polymerization - Olefin metathesis -Ziegler natta catalyst -cyclo oligomerisation of acetylene , butadiene- Reppe's catalyst . Mansanto's acetic acid synthesis-Fischer-Tropsch's synthesis of Synthetic gasoline.

UNIT –III BIO-INORGANIC CHEMISTRY 15Hrs

Essential and trace elements in biological systems –ion pump- metalloporphyrins – the porphyrine ring system – chlorophyll – photosynthetic electron transfer - Electron transport sequence – biological electron transfer – electron transfer agents – cytochromes – Hemoglobin – myoglobins – and synthetic oxygen carriers – nitrogen fixation – in vivo and in vitro – copper proteins-Metal complexes in medicine-Biomineralisation of iron-Metal complexes in medicine-Chelate therapy-Metals used for diagnosis and chemotherapy-metal-nucleic acid interactions.

UNIT-IV PHYSICAL METHODES IN INORGANIC CHEMISTRY-II 15Hrs

Electron paramagnetic resonance spectroscopy: Applications of hyperfine splitting and g factor to structural elucidation- Zero field splitting-Krammer's Degeneracy- EPR spectra of Cu (II) and Mn (II) in various site symmetry- covalency of metal-ligand bonding by EPR- study of dynamic processes in solids- Study of phase transition by Mn (II) – John Teller distortions in Cu (II) complexes.

Mossbauer spectroscopy: Basic principles- Doppler effect- Isomer shift- Electron nuclear hyperfine interactions- Quadrupole and magnetic interactions in the study of structure and bonding in Iron and Tin complexes and in Biological systems.

UNIT –V INORGANIC PHOTOCHEMISTRY 15 Hrs

Excited states of coordination complexes – properties of excited states charge transfer and energy transfer – photochemical pathways.

Photoredox reactions of Co(III) and Cr(III) complexes – photosubstitution reactions – photoaquation, photoanation and photorearrangements - Role of TiO_2 in solar energy conversion – Photoredox chemistry of Ruthenium bipyridyl and Ruthenium(II) poly pyridyl compounds-energy conversion and photochemical decomposition of water using Ru complexes- storage of solar energy.

TEXT BOOKS: -

1. Cotton F.A. and Wilkinson, G.1998. Advanced Inorganic Chemistry, Wiley- Interscience publications, John Wiley & Sons, V Edn. New York.
2. Wahid U. Malik, G.D. Tuli and R. D. Madan,2006. Selected Topics in Inorganic Chemistry, S. Chand & Co. Ltd., New Delhi,
3. Nakamoto, Kazuo, Paul J. McCarthy,1986. Spectroscopy and Structure of Metal Chelate Compounds, IV edition, John Wiley and Sons. Inc., New York.
4. Drago, R. S. Van Nostrand and Reinhold,1976. Physical Methods in Chemistry.
5. Purcell K.F. and Kotz J.C.,1977. Holt Saunders, Inorganic chemistry, Philadelphia.
6. Raymond Chang, 1971.Basic principles of Spectroscopy, Mc Graw Hill, New Delhi.
7. Straughan B. P. and Walker, S. 1976.Spectroscopy, Vol.3, Chapman and Hall, New York,
8. T.C. Gibbs,1978. Principles of Mossbauer Spectroscopy, Chapman and Hall, New York.
9. Arthur W. Adamson & Paul D. Fleischauer, 1975Concepts of Inorganic Photochemistry, John Wiley & Sons. In., New York.

REFERENCE BOOKS: -

1. Huheey, J. E., Ellen A. Keiter, Richard L. Keiter,2004. Inorganic chemistry, IV Edn., pearson Education (Singapore) (P) .Ltd., Delhi.
2. Wahid U. Malik, G.D. Tuli and R. D. Madan, 2006.Selected Topics in Inorganic
3. Chemistry, S. Chand & Co.Ltd., New Delhi.
4. A.G. Sharpe,2004.Inorganic Chemistry, III Edn., Addition – Weskey Longman, UK .
5. Gary L. Miessler and Donald A. Tarr, 2004.Inorganic Chemistry, Pearson Education, Inc., 3rd Edn., New Delhi.
6. D. F. Shriver and P.W. Atkins,1999. Inorganic Chemistry, Oxford University Press, London.
7. K. Hussain Reddy, 2005. Bioinorganic Chemistry, New Age International (P) Ltd., Delhi.
8. William W. Porterfield, 2005.Inorganic Chemistry, II Edn., Elsevier, New Delhi..

Course designers

1 Dr.A.Suganthi
2 Dr.A. Elangovan
3 Dr.D.S. Bhuvaneshwari
4 Dr.K.Selvakumar

Course Contents and Lecture Schedule

Unit	Topic	No. of Lecture Hours
I	**Organometallic Chemistry-I**	**15**
1.1	Stability of organo metallic compounds- β hydrogen elimination.	3
1.2	Synthesis – structure and bonding in metal carbonyls – isoelectronic and isolobal analogy.	2
1.3	Sixteen and eighteen electron rule.	2
1.4	Use of IR in the structural elucidation of carbonyl compounds.	2
1.5	Metal nitrosyls – dinitrogen complexes. π donors.	2
1.6	Synthesis structure bonding and reactivity of carbenes, carbines, metallocenes and other aromatic cyclopolyenes	2
1.7	Ferrocene – bonding and structure – sigma, pi and hapto nomenclature.	1
1.8	Arene complexes – olefin – acetylene and pi allyl complexes.	1
II	**OrganometallicChemistry-II**	**15**
2.1	Catalysis involving organometallic compounds – properties of metals and ligands in homogeneous catalysis - –-	2
2.2	oxidative addition and reductive elimination – hydrogen abstraction	2
2.3	Activation of small molecules by complexation-agnostic interaction	2
2.4	Insertion-alkyl migration-insertion and elimination-catalytic reactions-	2
2.4	Hydrogenation of olefins – Wilkinson's catalyst – hydroformylation – syn-gas-water gas shift reactions- oxidation of olefins – Wacker process	2
2.5	Propylene polymerization - Olefin metathesis -Ziegler natta catalyst - cyclo oligomerisation of acetylene , butadiene	2
2.6	Reppe's catalyst . Mansanto's acetic acid synthesis-	3
2.7	Fischer-Troppe's synthesis of Synthetic gasoline	2
III	**Bio-Inorganic Chemistry**	**15**
3.1	Essential and trace elements in biological systems –ion pump.	2
3.2	Metalloporphyrins – the porphyrine ring system.	2
3.3	Chlorophyll – photosynthetic electron transfer - Electron transport sequence – biological electron transfer.	2
3.4	Electron transfer agents – cytochromes.	2
3.5	Hemoglobin – myoglobins – and synthetic oxygen carriers.	2
3.6	Nitrogen fixation – in vivo and in vitro.	1
3.7	Copper proteins-Metal complexes in medicine-Biomineralisation of iron.	2
3.8	Metal complexes in medicine-Chelate therapy- Metals used for diagnosis and chemotherapy-metal-nucleic acid interactions.	2
IV	**PHYSICAL METHODS IN INORGANIC CHEMISTRY-II**	**15**
4.1	Electron paramagnetic resonance spectroscopy: Applications of hyperfine splitting and g factor to structural elucidation- Zero field splitting-Krammer's Degeneracy.	4
4.2	EPR spectra of Cu (II) and Mn (II) in various site symmetry- covalency	4

	of metal-ligand bonding by EPR- study of dynamic processes in solids- Study of phase transition by Mn (II) – John Teller distortions in Cu (II) complexes.	
4.3	Mossbauer spectroscopy: Basic principles- Doppler effect- Isomer shift.	3
4.4	Electron nuclear hyperfine interactions- Quadrupole and magnetic interactions in the study of structure and bonding in Iron and Tin complexes and in Biological systems.	4
V	**Inorganic Photochemistry**	**15**
5.1	Excited states of coordination complexes – properties of excited states charge transfer and energy transfer – photochemical pathways.	1
5.2	Photoredox reactions of Co(III) and Cr(III) complexes	1
5.3	photosubstitution reactions – photoaquation, photoanation and photorearrangements.	1
5.4	Role of TiO_2 in solar energy conversion.	1
5.5	Photoredox chemistry of Ruthenium bipyridyl and Ruthenium(II) poly pyridyl compounds.	1
5.6	Energy conversion and photochemical decomposition of water using Ru complexes.	1
5.7	Storage of solar energy.	2

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Department of Chemistry
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Programme Code: PCH

urse Code	Course title	Category	L	T	P	Credit
PCH19C43	**Physical Chemistry-IV**	Core-12	4	-	-	4

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

Preamble

The course enables the students to gain knowledge on theories and concepts of chemical kinetics, photochemistry, surface chemistry and polymer chemistry.

Prerequisites

Basic knowledge onfundamental concepts and theories of chemical kinetics, photochemistry, surface chemistry and chemistry of polymers at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Understand the fundamental concepts on kinetics and reaction rate.	K1, K2
CO2	Developknowledge on various theories of chemical kinetics.	K3
CO3	Analyze the physical concepts of photochemistry.	K4
CO4	Make use of the kinetics and theories of surface chemistry.	K3
CO5	Explain the basics and applications on polymer chemistry.	K5

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

Mapping of COs with PSOs

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

UNIT-I **(12 hrs)**

CHEMICAL KINETICS-I

Simple Collision theory- modification - Absolute reaction rate theory (ARRT) - Statistical and thermodynamics formulation - Comparison of ARRT with collision theory- Significance of entropy of activation- Relation between ΔH and Ea- Transmission co-efficient; ARRT of termolecular reactions – Unimolecular reactions - Lindemann, Hinshelwood, RRKM and Slater treatments. – solution kinetics – ARRT of reaction in solution – Influence of ionic strength on the rates of ionic reactions (salt effects).

UNIT-II **(12 hrs)**

CHEMICAL KINETICS-II

Fast reactions-flow and relaxation techniques, Temperature Jump and pressure jump method - complex reactions – opposing, consecutive and parallel reactions; Chain reaction – kinetics and general characteristic – H_2 - Br_2 reaction, Rice – Herzfeld mechanism for decomposition of acetaldehyde & ethane – Branched chain reaction – study of H_2-O_2 explosive reaction- homogeneous catalysis – acid, base catalysis.

UNIT-III **(12 hrs)**

PHOTOCHEMISTRY

Physical properties of the electronically excited molecules – radiationless transitions – Jablonski diagram-Internal conversion and intersystem crossing – Stern-Volmer equation and its application – radiative transition – fluorescence, phosphorescence and other deactivation processes; Effect of temperature on emission process – photosensitization and Chemiluminescence; Experimental techniques in photochemistry, chemical actinometers.

photochemical Kinetics of H_2-X_2 reactions – Photolysis of acetaldehyde Photodimerisation of anthracene – Photoequation of $[Cr(NH_3)_5NCS]^{2+}$ and photo isomerisation of Cis-bis glycinato Pt(II); Applications of photochemistry – Solar energy conversion and storage – photo synthesis- excited state acidic property and energy transfer.

UNIT-IV **(12 hrs)**

SURFACE CHEMISTRY

Physisorption and Chemisorption – adsorption isotherm – derivation of Langmuir and Freundlich, derivation of B.E.T equation of multilayer adsorption – application of BET equation to surface area determination, derivation of Gibbs adsorption isotherm. Heterogeneous catalysis and their kinetics – chemical reactions on solid surfaces - Mechanism & Kinetics of unimolecular and bimolecular surface reactions – Langmuir –Hinshelwood, Langmuir –Ridel mechanism, ARRT of surface reactions; Basic concepts of Micelles and Reverse Micelles.

UNIT-V **(12 hrs)**

POLYMER CHEMISTRY

Introduction of Polymers – Classification-Tacticity - Polymerisation - Addition, Co-polymerisation and Condensation polymerisation – Kinetics of polymerization-Free radical Chain polymerization-

Cationic- anionic polymerization- Molecular weight determination – Osmotic pressure methods-Light Scattering method-Ultra Centrifuge and Viscosity methods;
Classification of Plastics-Thermosetting & Thermoplastic resins-Adhesives-Compounding of Plastic - Fabrication - compression moulding, injection moulding, extrusion moulding and Blow moulding.
Industrially important polymers – Preparation, Properties and uses of (LDPE & HDPE), Polystyrene, polyester, acrylo polymer, Teflon, Phenolic resins, amino resins and epoxy resins, Polyvinyl acetate-composites of Resins-ABS-Conducting Polymers-Polyacetylene, Polyaniline, Inorganic polymer-Silicone and Biopolymers-cellulose.

Text Books:

1. Glasstone S., 1974, Textbook of Physical chemistry, III Edition McMillan, Alasca.
2. Daniels F., Alberty, R.A. 1974, Physical Chemistry, John willey and sons , UK.
3. Moore, W.J. 1972, Physical Chemistry, V Edition, Orient Longman, UK.
4. Billmeyer Jr F.W., 1984, A text book of Polymer Chemistry – III edition, John Willey and Sons, UK.
5. Gowarikar V *et al*., 1986, Polymer Science, Willey Eastern Limited, New York.
6. Rodriguez F., 1987, Principles of polymer chemistry, Tata McGraw- Hill Publishing Co. Ltd., New Delhi, India.

Reference Books:

1. Laidler K.J., 2005, Chemical Kinetics, II Edition, Tata McGraw Hill, UK.
2. Frost A.A., Pearson R.G., 1990, Kinetics and Mechanism, New York.
3. Wilkinson F., 2000, Chemical Kinetics and Reaction Mechanism, Var Nostrard Reinhold Co., New York.
4. Rohatgi-Mukherjee K.K., 1999, Fundamentals of Photochemistry, Wiley Eastern Ltd., Revised edition, New York.
5. Adamson A.M., 2002, Physical Chemistry of Surfaces, V.Edition, John Willey, UK.
6. Laider, K.S., 2005, Chemical kinetics, III Edition, TMH, New York.
7. Allcock H.R., Lampe W., 1991, Contemporary polymer chemistry, Prentice Hall UK.
8. Young, 2002, Polymer Chemistry II, Chapman Hall.
9. Arora Singh, 2001, Polymer Chemistry, Anmol Publications Pvt. Ltd.

Course Designers1. Dr. R. Sayee Kannan2. Dr. A. R. Ramesh3. Dr. T. Arumuganathan

UNIT	TOPIC	No. of lecture hrs
I	**CHEMICAL KINETICS-I**	
1.1	Simple Collision theory- modification - Absolute reaction rate theory (ARRT)	2
1.2	Statistical and thermodynamics formulation - Comparison of ARRT with collision theory	2
1.3	Significance of entropy of activation- Relation between ΔH and Ea- Transmission co-efficient	2
1.4	ARRT of termolecular reactions – Unimolecular reactions - Lindemann, Hinshelwood	3
1.5	RRKM and Slater treatments. –Solution kinetics – ARRT of reaction in solution – Influence of ionic strength on the rates of ionic reactions (salt effects).	3
II	**CHEMICAL KINETICS-II**	
2.1	Fast reactions-flow and relaxation techniques, Temperature Jump and pressure jump method	2
2.2	Complex reactions – opposing, consecutive and parallel reactions.	3

2.3	Chain reaction – kinetics and general characteristic – H_2-Br_2 reaction,	2
2.4	Rice – Herzfeld mechanism for decomposition of acetaldehyde & ethane – Branched chain reaction	3
2.5	Study of H_2-O_2 Explosive reaction- Homogeneous catalysis – acid, base catalysis.	2
III	**PHOTOCHEMISTRY**	
3.1	Physical properties of the electronically excited molecules – radiationless transitions – Internal conversion and intersystem crossing.	2
3.2	Stern-Volmer equation and its application; radiative transition – fluorescence, phosphorescence and other deactivation processes.	3
3.3	Effect of temperature on emission process – photosensitization and Chemiluminescence; Experimental techniques in photochemistry, chemical actinometers.	2
3.4	Photochemical Kinetics of H_2-X_2 reactions – Photolysis of acetaldehyde Photodimerisation of anthracene – Photoequation of $[Cr(NH_3)_5NCS]^{2+}$ and photo isomerisation of Cis-bis glycinato Pt(II).	3
3.5	Applications of photochemistry – Solar energy conversion and storage – photo synthesis.	2
IV	**SURFACE CHEMISTRY**	
4.1	Physisorption and Chemisorption – adsorption isotherm – derivation of Langmuir and Freundlich	3
4.2	Derivation of B.E.T equation of multilayer adsorption – application of BET equation to surface area determination, derivation of Gibbs adsorption isotherm.	3
4.3	Heterogeneous catalysis and their kinetics – chemical reactions on solid surfaces - Mechanism & Kinetics of unimolecular and bimolecular surface reactions-Langmuir –Hinshelwood, Langmuir –Ridel mechanism, ARRT of surface reactions.	5
4.4	Basic concepts of Micelles and Reverse Micelles.	1
V	**POLYMER CHEMISTRY**	
5.1	Introduction of Polymers –Classification-Tacticity - Polymerisation - Addition, Co-polymerisation and Condensation polymerization.	2
5.2	Kinetics of polymerization-Free radical Chain polymerization-Cationic- anionic polymerization.	1
5.3	Molecular weight determination – Osmotic pressure methods-Light Scattering method-Ultra Centrifuge and Viscosity methods.	2
5.4	Classification of Plastics-Thermosetting & Thermoplastic resins.	2
5.5	Adhesives-Compounding of Plastic - Fabrication - compression moulding, injection moulding, extrusion moulding and Blow moulding.	2
5.6	Industrially important polymers – Preparation, Properties and uses of (LDPE & HDPE), Polystyrene, polyester, acrylo polymer, Teflon, Phenolic resins, amino resins and epoxy resins, Polyvinyl acetate.	3
5.7	Composites of Resins-ABS-Conducting Polymers-Polyacetylene, Polyaniline, Inorganic polymer-Silicone and Biopolymers-cellulose.	1

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 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19CL41	**Organic Chemistry Lab**	Core Lab - 4	-	-	5	5

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

Preamble

This lab course describes the experiomental procedure fpr the double stage preparation of organic compounds and quantitative estimation organic compounds such as ketone, amino acid and glucose.

Prerequisites

Laboratory skill on estimation and preparation of simple organic compounds at undergraduate level.

Course Outcomes

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

#	Course Outcome
CO1	Gain practical skill on multi step synthesis of organic compounds.
CO2	Orient the skill of writing the reaction mechanism of the synthesized compounds.
CO3	Estimate the amount of glucose by adopting different procedures.
CO4	Apply iodometric method to estimate Ketonic compound.
CO5	Estimate amino acid viz., Glycine.

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

DOUBLE STAGE PREPARATION

1. p-Nitroaniline
2. p-Bromoaniline
3. 1,3,5-Tribromobenzene
4. Benzanilide
5. m-Nitrobenzoic acid

6. p-Iodonitrobenzene (III stage)

7. 2,5-dihydroxy acetophenone

(any five preparations only)

ESTIMATION

1. Estimation of glucose – Lane and Eynon method
2. Estimation of glucose-Betrand method
3. Estimation of ethyl methyl ketone
4. Estimation of acetone
5. Estimation of glycine

Course Designers

1. Dr. P. Prakash
2. Dr. R. Mahalakshmy

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 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19CL42	**Inorganic Estimation and Preparation**	Core Lab - 5	-	-	5	5

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

Preamble

This lab course enables the students to acquire practical knowledge on quantitative estimation of inorganic metal ions by gravimetric and colorimetric methods. Also enhances the laboratory skill of preparing simple inorganic complexes and gives hands on training on chromatographic and UV-Vis spectrophotometric techniques.

Prerequisites

Laboratory skill on quantitative estimation of metal ions and preparation of simple inorganic metal complexes at undergraduate level.

Course Outcomes

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

#	Course Outcome
CO1	Estimate inorganic metal ions such as lead, nickel and magnesium by gravimetric estimation.
CO2	Determine iron or copper by colorimetric method.
CO3	Prepare potassium cupricsulphate and Potassium trioxalatoaluminate complexes.
CO4	Prepare coordination complexes such as Hexathioureaplumbusnitrate, Tetrammine copper(II)sulphate and Ferrous/Ferric oxalate in the laboratory.
CO5	Explain the principle and application of chromatorgraphic and UV-Vis specrophotometric techniques.

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

I. ESTIMATIONS: By VOLUMETRIC METHOD By GRAVIMETRIC METHOD (Any FOUR)

1. Estimation of COPPER and NICKEL
2. Estimation of CALCIUM and MAGNESIUM
3. Estimation of BARIUM and ZINC
4. Estimation of IRON and NICKEL
5. Cement Analysis
6. Estimation of Paracetamol
7. Pesticide analysis

II. PREPARATIONS(Any FIVE)

1. Tetramminecopper(II) sulphate
2. Potassium cupricsulphate
3. Potassium trioxalatoaluminate(III)
4. Sodium nitroprusside
5. Trithioureacopper(II) sulphate
6. Pentathioureadicuprous nitrate
7. Hexathioureaplumbus nitrate
8. Nitropentamminecobalt(III)
9. DithiocyanatotetrapyridineIron(III)
10. Potassium troxalatoferrate III
11. Preparation and Analysis of $K_2[Cu(ox)_2].2H_2O$

III. Colorimetry: (Any ONE)

a) Estimation of Iron (III)
b) Estimation of Copper (II)

IV. Chromatography (Demo only NOT for the Exam)
a) Paper Chromatography: Chromatographic separation of a mixture of Co, Mn, Ni and Zn

b) Column Chromatography: Chromatographic separation of potassium permanganate and dichromate**.**

V. UV-visible spectrophotometer (Demo only NOT for the Exam)
Determination stability constant for a complex.

Total Marks = 100 (Internal 40 + External 60)

Course Designers
1. Dr. A. Suganthi
2. Dr. D. S. Bhuvaneshwari

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 2019)
Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH19PJ41	**Project**	-	-	-	6	3

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

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

Laboratory skill on preparation and estimation of organic/inorganic compounds and ability to do some physical chemistry experiments at undergraduate 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	**S**	S	**M**	S
CO3	S	**S**	S	**M**	S
CO4	S	**M**	S	**S**	S
CO5	S	**L**	M	**S**	S

S-Strong; M-Medium; L-Low

M.Sc. Chemistry

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

Title of the courses	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
Organic chemistry- I	15	10	10	01	15
Inorganic Chemistry-I	15	11	07	07	15
Physical Chemistry –I	15	07	07	04	15
Organic Chemistry-Lab I					
Inorganic Chemistry-Lab I					
Physical Chemistry-Lab I					
Organic chemistry-II	15	13	08	10	15
Inorganic Chemistry-II	15	14	10	10	15
Physical Chemistry-II	15	09	07	08	15
C-Programming Fundamentals & Applications in Chemistry	15	15	07	15	15
Medicinal Chemistry	12	08	08	12	12
Organic Chemistry-Lab-1	12	15	15	15	15
Inorganic Chemistry-Lab I	08	12	12	12	12
Physical Chemistry –Lab I	15	15	15	05	15
Organic chemistry-III	15	10	13	08	15
Inorganic Chemistry-III	15	06	06	05	15
Physical Chemistry –III	15	09	09	08	15
Computer Applications in Chemistry	12	12	06	12	12
Advanced Organic synthesis	15	10	14	08	15
Organic Chemistry-Lab 2					
Inorganic Chemistry-Lab 2					
Organic chemistry-IV	15	13	10	09	15
Inorganic Chemistry-IV	15	09	09	08	15
Physical Chemistry –IV	15	06	04	05	15
Organic Chemistry-Lab 2	15	10	15	15	15
Inorganic Chemistry-Lab 2	15	10	15	15	15
Project	15	11	14	12	15

M.Sc., Chemistry (Spl.)

Programme Code –PCF

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 presentation 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

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.Sc Chemistry(Spl) programme is toprepare/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 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 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 onadvanced 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 literatue 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
(From 2019 -2020 batchonwards)
MASTER OF CHEMISTRY(Spl)
Semester – I

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 1	PCF19C11	Organic chemistry	4	4	60	25	75	100
Core 2	PCF19C12	Inorganic Chemistry	4	4	60	25	75	100
Core 3	PCF19C13	Physical Chemistry	4	4	60	25	75	100
Core 4	PCF19CSL14	Separation techniques and quantitative analysis.	4	4	60	40	60	100
Core lab 1	PCF19CL21	Organic Chemistry-Lab	5	*	75	-	-	-
Core lab 2	PCF19CL22	Inorganic Chemistry-Lab	5	*	75	-	-	-
Core lab 3	PCF19CL23	Physical Chemistry-Lab	4	*	60	-	-	-
Total			**30**	**16**	**400**	**75**	**225**	**400**

***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 SE	Total
Core 4	PCF19C21	Organic chemistry	4	4	60	25	75	100
Core 5	PCF19C22	Inorganic Chemistry	4	4	60	25	75	100
Core 6	PCF19C23	Physical Chemistry	4	4	60	25	75	100
Core elective-1	PCF19CE21(A)	C-Programming Fundamentals & Applications in Chemistry **(Option A)**	5	5	75	25	75	100
	PCF19CE21(B)	Medicinal Chemistry **(Option B)**						
*Core lab 1	PCF19CL21	Organic Chemistry-Lab	5	4	75	40	60	100
*Core lab 2	PCF19CL22	Inorganic Chemistry-Lab	4	4	60	40	60	100
*Core lab -3	PCF19CL23	Physical Chemistry –Lab	4	4	60	40	60	100
Total			**30**	**29**	**450**	**220**	**480**	**700**

Semester – III

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 7	PCF19C31	Organic chemistry-III	5	4	75	25	75	100
Core 8	PCF19C32	Inorganic Chemistry-III	5	4	75	25	75	100
Core 9	PCF19C33	Physical Chemistry – III	5	4	75	25	75	100
Core elective-1	PCF19CE31(A)	Computer Applications in Chemistry **(Option A)**	5	5	75	25	75	100
	PCF19CE31(B)	Advance organic synthesis **(Option B)**						
*Core – lab 4	PCF19CL41	Organic Chemistry-Lab	5*	-	-	-	-	-
*Core lab -5	PCF19CL42	Inorganic Chemistry-Lab	5*	-	-	-	-	-
Total			**30**	**17**	**450**	**220**	**480**	**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	PCF19C41	Organic chemistry-IV	4	4	75	25	75	100
Core 11	PCF19C42	Inorganic Chemistry-IV	4	4	75	25	75	100
Core 12	PCF19C43	Physical Chemistry –IV	4	4	75	25	75	100
*Core lab - 4	PCF19CL41	Organic Chemistry-Lab	4	4	75	40	60	100
*Core lab -5	PCF19CL42	Inorganic Chemistry-Lab	4	5	75	40	60	100
Special Lab	PCF19CL43	Synthesis and spectral analysis	4	4	75	40	60	100
SPJ	PCF19PJ41	Project	6	3	4	40	60	100
Total			**30**	**28**	**450**	**225**	**405**	**700**

A) CONSOLIDATION OF CONTACT HOURS AND CREDITS: PG

Semester	Contact hours	Credits
I	30	16
II	30	29
III	30	17
IV	30	28
Total	**120**	**90**

B) Curriculum Credits

Core	(16+12+12+12) = 52 Credits
Core Lab	(12+13) = 25 Credits
Core electives	5+5 = 10 Credits
Project	= 03 Credits
Total	**= 90 Credits**

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc., Chemistry (Spl) on or after June 2019)
Programme Code: PCF

Course Code	Course title	Category	L	T	P	Credit
PCF19C11	**Organic Chemistry - I**	Core-1	4	-	-	4

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 reactionmechanism viz.,substitution, elimination and addition.

Prerequisites

Students with the minimum knowledge on fundamentals of reaction mechanism of addition,elimination and substitution reaction at under graduate 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, K2
CO2	Explain the reaction mechanism for all types of reaction.	K5
CO3	Analyze the reaction mechanism in relation to nucleophilic substitution reactions.	K4
CO4	Determine the mechanism for elimination reactions.	K3, K5
CO5	Apply reaction mechanism to various addition reactions.	K3

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

Mapping of COs with Pos

	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 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**

UNIT-I Delocalized chemical bonding, Aromaticity and Reaction intermediate (12 hrs)

Electron displacement – Steric effect – Tautomerism

Concept of aromaticity – Benzenoid and non-benzenoid compounds – Huckel's rule - Non aromatic and anti aromaticity - Alternant and non alternant hydrocarbons - aromaticity of cyclopentadienyl anion and Tropylium cation – Azulenes and annulenes.

Generation , structure, stability, reactivity and reactions of carbocations, carbanions, free radicals (reactions include Pinacol coupling, McMurray reactions, acyloin reaction, selective radical bromination). Carbenes: Stability - Structure – Generation – Types – Reactions. Nitrenes: Generation and reactions.

UNIT - II Reaction mechanism-I (Basics) (12 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) **(12 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 nuleophiles.

Aromatic Nucleophilic Substitution Reactions – Unimolecular, Bimolecular 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-IVReaction 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-VReaction Mechanism IV (Addition to carbon-Carbon multiplebonds) **(12 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 Dieckman condensation.

Text books:

1. Jerry March,1992. Advanced Organic Chemistry, Reaction mechanism and structure, John Wiley and sons, 4th Edition, New york.
2. R.O.C. Norman,2001. Principles of organic synthesis, 3rd Edition Nelson Thorines, Hong Kong
3. P.J. Garrat,1991. Aromaticity, Mc Graw Hill.
4. F.A. Carey and R.J. Sundberg,1990. Advanced Organic Chemistry, Part A and B, Plenum Press, 3rd Edition .
5. G.M. Badger, 2001.Aromatic character and Aromaticity, Cambridge, USA.

Reference Books:

1. Clayden, Greeves, Warren and Wothers, 2007. Organic Chemistry, Oxford University Press.
2. E.S. Gould,1960 Mechanism and structure in Organic Chemistry, Holtoo INC.
3. G. Solomon, 1992.Organic Chemistry, John Wiley and sons INC, 5th Edition.
4. R.K. Mackie and D.M. Smith,1993. Guide Book to Organic synthesis,Longman, UK.
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. Tamil Selvi

Course contents and lecture schedule

Unit	Topic	lecture hrs
I	**Delocalized chemical bonding, Aromaticity and Reaction intermediate**	12
1.1	Electron displacement – Steric effect – Tautomerism	1
1.2	Concept of aromaticity – Benzenoid and non-benzenoid compounds – Huckel’s rule - Non aromatic and anti aromaticity	2
1.3	Alternant and non alternant hydrocarbons - aromaticity of cyclopentadienyl anion and Tropylium cation – Azulenes and annulenes.	2
1.4	Synthesis, structure, stability, reactivity and reactions of carbocations, carbanions.	3
1.5	Synthesis , structure, stability, reactivity and reactions of free radicals (reactions include Pinacol coupling, McMurray reactions, acyloin reaction, selective radical bromination).	2
1.6	Carbenes: Stability - Structure – Generation – Types – Reactions. Nitrenes: Generation and reactions.	2
II	**Reaction mechanism-I**	12
2.1	Guidelines for proposing reasonable mechanism – Energetics and energy profile diagrams – transition state – Intermediate	2
2.2	Hammond’s postulate – principle of microscopic reversibility - kinetic and thermodynamic controls	2
2.3	Kinetic and non-kinetic methods of determining organic reaction	2

	mechanism	
2.4	primary and secondary kinetic isotope effects – Effect of structure on reactivity: Resonance and field effects	2
2.5	Quantitative treatments – Hammett and Taft equation.	3
	Revision and test	1
III	**Reaction mechanism-II**	**12**
3.1	**Substitution Reactions:**Aliphatic Nucleophilic Substitution Reactions - Mechanism – S_N1 and S_N2, mixed S_N1& S_N2, S_Ni, SET,	3
3.2	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 nuleophiles.	3
3.3	Aromatic Nucleophilic Substitution Reactions – Unimolecular, Bimolecular and Benzyne mechanism – Effect of substrate, leaving group and attacking nucleophile.	3
3.4	Electrophilic substitution reactions: Aliphatic: Bimolecular mechanism SE2 and SE1 – Aromatic: Arenium ion mechanism – Orientation and reactivity: Ortho and Para ratio, partial rate factor	3
IV	**Reaction Mechanism III Total**	**12**
4.1	Elimination reactions: E_1, E_2 and E_1CB mechanism	2
4.2	Competition between substitution and elimination – orientation of double bonds (Bredt's rule and Hofmann and saytzeff rules)	3
4.3	Effect of substrate structure, attacking nucleophile, leaving group and nature of reaction medium on reactivity	3
4.4	Mechanism and orientation in pyrolytic eliminations - Cope and Chugaev reaction (cis-elimination)	3
	Revision	1
V	**Reaction Mechanism IV**	**12**
5.1	Addition to carbon – carbon multiple bonds:Electrophilic, Nucleophilic & free radical addition	2
5.2	Mechanism, Orientation and reactivity and reactions - addition to conjugated systems	3
5.3	Addition to α,β-unsaturated carbonyl and nitrile systems- Michael addition –	2
5.4	Addition of Grignard reagents-Diels Alder reaction- Enamine reaction	2
5.5	Mechanism of Reformatsky reaction- Darzen reaction- Mannich reaction - Wittig reaction - Stobbe and Dieckman condensation	3
	Total	**60**

THIAGARAJAR COLLEGE, MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc., Chemistry (Spl) on or after June 2019)
Programme Code: PCF

Course Code	Course title	Category	L	T	P	Credit
PCF19C12	**Inorganic Chemistry - I**	Core-2	4	-	-	4

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

Preamble

The course gives in-depth knowledge onelectronic structure of atom, bonding and its applications, acid-base concepts and nuclear chemistry.

Prerequisites

Students with the minimum knowledge on fundamentals of electronic structure of atom, chemical bonding, acid-base concepts 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	Comprehend the electronic structure of atom and periodic properties of elements.	K1, K2
CO2	Explain and compare the concepts of chemical bonding.	K2, K4
CO3	Apply the concepts of VB, MO and VSEPR theory to determine the structure of molecules.	K3, K5
CO4	Illustrateacid-base concepts, its measures and to evaluate various effects on acid base strength.	K2, K5
CO5	Experiment with different types of nuclear reactions, nuclear reactors and to list various nuclear waste disposal and safety measures.	K3,K4

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

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	M	S
CO5	S	S	S	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**

UNIT – I: ELECTRONIC STRUCTURE OF ATOM 12 Hrs

Modern views on atomic structure: Wave mechanical description of electron and orbitals, radial density functions and orbital energies, angular functions and orbital shapes-term symbol.

Modern periodic table: Periodic properties-Ionisation potential, Ionic radii and covalent radii, Electron affinity, Electronegativity and their trend in the periodic table- Comparison of transition metals of 3d, 4d and 5d series.

UNIT – II: NATURE OF THE CHEMICAL BOND 12Hrs

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. Goldschmidths radius ratio- packing of atoms and ions in solids. Calculation of ionic radius –Pauling's method and Linde's method. Effective nuclear charge-Slater's rule.

Covalent bond – qualitative treatment of valence bond theory – Heitler-London theory – Pauling theory and Molecular orbital theory LCAO theory – Hybridisation and resonance.

UNIT – III: BONDING APPLICATION 12 Hrs

Application of VB and MO theories to the structure of homonuclear (H_2, B_2, C_2, N_2 and O_2) and 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. Partial ionic character of covalent bonds-Fajan's Rule –Effects of polarization. VSEPR theory and its applications to H_2O, NH_3, ICl_2^-, IF_5 IF_7, ClO_4^- ions. VSEPR applied to Xenon compounds like Xenon halides and xenon oxides.

UNIT – IV: ACID-BASE SYSTEMS AND NON-AQUEOUS SOLVENTS. 12Hrs

A generalized acid base concepts – steric effects and solvation effects – 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 of solvents – properties of ionizing solvents. Typical reactions in non–aqueous solvents- liquid HF, liquid SO_2, liquid NH_3, and Sulphuric acid.

UNIT – V: NUCLEAR CHEMISTRY 12Hrs

Radioactive decay and equilibrium- Different types of nuclear reaction – 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. Radio isotopes 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 Clyde Day, M. Jr & Joel Selbin,1967. Theoretical Inorganic Chemistry, Chapman & Hall Ltd., London, 5th Reprint.
2 Chandra,A. K. 1988.Introductory Quantum Chemistry, Tata McGraw Hill, New Delhi, 3rd Edn..
3 Lee, J. D. 2002.Concise Inorganic Chemistry, Blackwell Science Ltd., V Edn., London. .
4 Durrant P. J. and Durrant, B. 1970.Introduction to advanced inorganic chemistry, Longman Group Ltd, London.
5 Glasstone, S. 1967.Source Book of Atomic Energy, Van Nostrand, III Edn, East West Press (P) Ltd., New Delhi.
6 Friedlander, G. Kennedy J.S and Millodr, M. M. 1984.Nuclear and radiochemistry, John Wiley & Sons, New York.

REFERENCE BOOKS:

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

Course Designer

1. Dr. A. Suganthi
2. Dr. A. Elangovan
3. Dr. D.S. Bhuvaneshwari
4.Dr. K.Selvakumar

Course contents and lecture schedule

Unit	Topic	No. of Lecture Hours
I	**Electronic Structure of atom**	**12**
1.1	Modern views on atomic structure: Wave mechanical description of electron.	2
1.2	Radial density functions	2
1.3	Orbitals, and orbital energies	2
1.4	Angular functions and orbital shapes	2
1.5	Radii of atoms and ions	1
1.6	Modern periodic table: Periodic properties-Ionisation potential, Ionic radii and covalent radii, Electron affinity, Electro negativity- their trend in the periodic table.	3

II	**Nature of the Chemical bond**	**12**
2.1	Ionic bond – Lattice energy and its determination by Born-Haber cycle and Born Lande Equation.	1
2.2	Hardness, electrical conductivity and solubility of ionic compounds – ionic radii.	1
2.3	Goldschmidths radius ratio-packing of atoms and ions in solids.	2
2.4	Calculation of ionic radius –Pauling’s method and Linde’s method.	2
2.4	Effective nuclear charge-Slater’s rule.	2
2.5	Covalent bond – qualitative treatment of valence bond theory – Heitler-London theory –	2
2.6	Pauling theory and Molecular orbital theory LCAO theory.	2
2.7	Hybridisation and resonance.	2
III	**Bonding Application**	**12**
3.1	Application of VB and MO theories to the structure of homonuclear (H_2, B_2, C_2, N_2).	2
3.2	Heteronuclear (CO,NO,HCl,HF) diatomic and selective polyatomic molecules (CO_3^{2-}, NO_2, BeH_2, CO_2)	2
3.3	Comparison of VB and MO theories.	1
3.4	Bond properties, bond order, bond energy, bond length and bond polarity	2
3.5	Partial ionic character of covalent bonds-Fajan’s Rule	2
3.6	VSEPR theory and its applications to H_2O, NH_3, , IF_5 IF_7, ClO_4^- ions	2
3.7	VSEPR applied to Xenon compounds like Xenon halides and xenon oxides	1
IV	**ACID-BASE SYSTEMS AND NON-AQUEOUS SOLVENTS**	**12**
4.1	A generalized acid base concepts	1
4.2	Steric effects and solvation effects	1
4.3	Measures of Acid-Base strength –Factors affecting the strength of acids and bases	2
4.4	Common ion effect and Henderson’s equation	2
4.5	Hard and Soft acids and bases – symbiosis – theoretical basis of hardness and softness	2
4.6	Classification of solvents – properties of ionizing solvents. Typical reactions in non–aqueous solvents- liquid HF, Hydrogen cyanide	2
4.7	Sulphuric acid and acetic acid.	2
V	**Nuclear Chemistry**	**12**
5.1	Radioactive decay and equilibrium	1
5.2	Different types of nuclear reaction – spallation – fission and fusion	1
5.3	Theories of fission. Fissile and Fertile isotopes.	1
5.4	Radio isotopes and their applications.	1
5.5	Nuclear fusion – stellar energy	1
5.6	Nuclear forces: Liquid drop model, shell model	1
5.7	Detectors: Scintillation counter , Gas Ionisation chamber. Proportional Counter, Cerenkov CounterAccelerators: Cyclotron, Synchrocyclotron, Betatron.	1
5.8	Calculation of Q-values – Cross section	1

5.9	Applications: Activation analysis, Isotopic dilution technique-radiometric titration	1
5.10	Nuclear reactors: Types (Thermo nuclear and breeder reactors) feed materials production. Reprocessing of nuclear materials waste disposal.	1
5.11	Atomic power projects in India. Hazardous of radioactive materials and Safety measures.	2

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Programme Code: PCF

Course Code	Course Title	Category	L	T	P	Credit
PCF19C13	**Physical Chemistry – I**	Core 3	4	-	-	4

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

Preamble

The course enables the students to gain knowledge on properties of gases, thermodynamic equilibrium and bio-physicochemical behavior of molecules.

Prerequisites

Basic knowledge on fundamentals concepts of gases and liquids, thermodynamics and quantum chemistry at undergraduate level.

Course Outcomes

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

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

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

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**

UNIT-I

PROPERTIES OF GASES AND LIQUID CRYSTAL (12 HRS)

Equations of states - molecular speeds- Maxwell distribution of molecular velocities - one, two and three dimensions; Energy distribution-Maxwell – 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 (cholestryl benzoate), smectic (ethyl-p-azoxybenzoate)- theory and its application in liquid crystals display.

UNIT-II

THERMODYNAMICS – EQUILIBRIUM AND NON-EQUILIBRIUM (12 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 principle- equilibria respond to pressure and temperature; Non Equlibrim Thermodynamics -Basic concepts - Principle of microscopic reversibility and the Onsager reciprocal relations.

UNIT –III

QUANTUM CHEMISTRY-I (12 HRS)

Black Body radiation- Heisenberg‘s uncertainity principle- de Broglie wave particle duality- Experimental verification of matter waves- Compton effect- The Schrodinger equation and the postulates of quantum mechanics- operators –linear and non-linear operators- commutative and non-commutative operators- Hermitian operators- Eigen function, Eigen values and degeneracy-

Orthogonality and Normalization of wave functions- Derivation of Schrodinger's wave equation.

UNIT- IV

QUANTUM CHEMISTRY-II (12 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-V

PHYSICO-CHEMICAL PRINCIPLES AND BIOLOGICAL REACTIONS (12 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 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 equation (ii) Medicinal Chemistry – QSAR; Partition parameters – Partition Coefficients (P) – hydrophobicity or lipophilicity constant (π); Electronic Parameters – Hammett constant (σ); Steric parameters – Taft Steric paramerter (Es); Hansch equation; Craig Plot – Topliss Scheme; ΔG criteria for biological reactions – ATP and ADP conversion.

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. Glasstone S., 2002, Thermodynamics for Chemists, Eastern Wiley publications.
5. Atkins P, 2002, Physical Chemistry, VII Edition, Oxford University Press, UK.
6. Atkins P. W., 1986, Molecular Quantum Mechanics, II Edition, Oxford University Press, UK.
7. Hanna H. W., 1983, Quantum Mechanics in Chemistry, Benjamin- Cummiza London, Publishing company, UK.
8. Chandra A.K., 1988, Introductory quantum chemistry, 3rd edition, Tata McGrow- Hill 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. Lehniger A.L., 2006, Principles of BioChemistry, 4th Edition.

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. Klotz, M., Rosenberg, R. M., 1996, Chemical thermodynamics, 4th edition, Benjamin, New York.
4.Glasstone, S., 2002, Thermodynamics for Chemists, 5th edition, Eastern Wiley publications.
5. Rajaram J., Kuriakose J. C., 1999, Thermodynamics, 3rd edition, S. N. Chand, New Delhi.
6. Levine, 2006, Quantum Chemistry, 6th edition, Prentice-Hall, New Delhi.
7. Mcquarrie D. A., 2003, Quantum Chemistry,Viva Books Pvt. Ltd., New Delhi.
8. Levine , 2003, Quantum Chemistry, 5th edition, Prentice-Hall, UK.
9.Raymond Chang, 2002, Physical Chemistry with application to biochemical system, Mc Millan Publishing Company. Inc., New Delhi.
10. Graham L Patrick, An Introduction to Medicinal Chemistry, Oxford University Press.

Course Designers

1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan

Course contents and lecture schedule

UNIT	TOPIC	No. OF LECTURE Hrs
I	**PROPERTIES OF GASES AND LIQUID CRYSTAL**	12
1.1	Equations of states - molecular speeds- Maxwell distribution of molecular velocities - one, two and three dimensions	2
1.2	Energy distribution-Maxwell – Boltzmann distribution law- Rotation, vibrations and translational degree of freedom- principle of equipartition of energy and heat capacity;	2
1.3	Molecular collisions- collision diameter, cross-section, number, frequency, mean free path (definition only);	2
1.4	Transport phenomena in gases - Viscosity of gases – viscosity in terms of momentum transfer, thermal conductivity, and diffusion.	2
1.5	Liquid crystals- Nematic (p-methoxycinnamic acid), cholesteric (cholestryl benzoate), smectic (ethyl-p-azoxybenzoate)	2
1.6	Liquid crystals theory and its application in liquid crystals display.	2
II	**THERMODYNAMICS – EQUILIBRIUM AND NON-EQUILIBRIUM**	12
2.1	A general review of enthalpy, entropy and free energy concepts: Nernst heat theorem- Genesis of third law and its limitations.	2
2.2	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.	3
2.3	Thermodynamics of open systems - partial molar properties- internal energy, molar enthalpy, molar entropy, molar volume, free energy (chemical potential).	3

2.4	Determination of partial molar properties; Chemical potential- relationship between partial molal quantities - Gibbs - Duhem equation- Duhem Margules equation.	3
2.5	Thermodynamic properties of real gases- Fugacity concept- Determination of Fugacity of real gases.	1
III	**QUANTUM CHEMISTRY-I**	12
3.1	Black Body radiation- de Broglie wave particle duality- Heisenberg‘s uncertainity principle	2
3.2	Experimental verification of matter waves- Compton effect	2
3.3	The Schrodinger equation and the postulates of quantum mechanics	2
3.4	operators –linear and non-linear operators- commutative and non-commutative operators- Hermitian operators-	2
3.5	Eigen function, Eigen values and degeneracy; Orthogonality and Normalization of wave functions	2
3.6	Derivation of Schrodinger‘s wave equation	2
IV	**QUANTUM CHEMISTRY-II**	12
4.1	Application of quantum mechanics to simple system.	2
4.2	Application of Schrodinger wave equation (SWE) to free particle moving in one dimension	2
4.3	Particle moving in a one dimension box	2
4.4	Particle moving in 3D cubical and rectangular box	2
4.5	Quantum Mechanical tunneling - particle in a ring- rigid rotor- Simple Harmonic oscillator	2
4.6	Hydrogen atom- angular momentum spin momentum- ladder operator	2
V	**PHYSICO-CHEMICAL PRINCIPLES AND BIOLOGICAL REACTIONS**	12
5.1	(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 equation.	2
5.2	Ion channels – membrane and static potentials - Role of Na+ / K+ ions in neural communications –Na^+ / K^+ ion pump;	2
5.3	Allosterism and oxygen saturation curves for hameoglobin and myoglobin – derivation of Hill equation	2
5.4	(ii) Medicinal Chemistry – QSAR;	2
5.5	Partition parameters – Partition Coefficients (P) – hydrophobicity or lipophilicity constant (π); Electronic Parameters – Hammett constant (σ); Steric parameters – Taft Steric paramerter (Es)	2
5.6	Hansch equation	1
5.7	Craig Plot – Topliss Scheme	1

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Department of Chemistry
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Programme Code: PCF

Course Code	Course title	Category	L	T	P	Credit
PCF19CSL14	**Separation technique and quantitative analysis**	Core special lab	4	-	-	4

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

Preamble

This lab course has been framed to enhance the pratical skill of the students by giving hands on training on various separation techniques (column, thin layer and paper chromatograpy), extraction and estimation methods.

Prerequisites

Students with the minimum knowledge on preparation and estimation of simple organic compounds at undergraduate level.

Course Outcomes

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

#	Course Outcome
CO1	Apply the column, thin layer and paper chromatographic techniques to separate and identify the components present in a mixture of amino acids and carbohydrates.
CO2	Extract lactose from milk and citric acid from lemon.
CO3	Estimate the saponification value of an oil.
CO4	Determine the Iodine value and Reichert –Meissel value of an oil.
CO5	Do quantitative estimation of ascorbic acid.

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

I.SEPARATION TECHNIQUE
(i) Chromatographic Separation of Carbohydrates.
(ii) Separation of amino acids by TLC.

(iii) Separation of amino acids by paper chromatography
(iv) Separation of organic compounds by Column chromatography

II. EXTRACTION
(i) Isolation of lactose from milk.
(ii) Isolation of Citric acid from lemon
.
III. ESTIMATIONS
(i) Iodine value on an Oil using Hanus method.
(ii) Saponification value of an oil.
(iii) Estimation of Ascorbic acid.
(iv) Reichert-Meissel value of an oil.

Course Designers
1. Dr. P. Tharmaraj
2. Dr. S. Pitchaimuthu

THIAGARAJAR COLLEGE, MADURAI-625 009
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Course Code	Course title	Category	L	T	P	Credit
PCF19C21	**Organic Chemistry - I**	Core-4	4	-	-	4

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, K2
CO2	Make use of the basic principles underlying NMR spectroscopy and its application in structural elucidation.	K3
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

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

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**

Unit-I UV and IR Spectrsocopy (12 Hrs)

Ultraviolet spectroscopy – basic principle – instrumentation – the absorption laws, types of electronic transitions – Effect of solvent 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 – Molecular Vibrations – instrumentation – characteristic IR absorption of different functional groups – factors influencing the vibrational frequencies

Unit-II ^{1}H NMR and ^{13}C 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 2D experiments – HOMO and HETERO nuclear correlation – J resolved correlation. Correlation Spectroscopy (COSY): Pulse sequence – 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 – structural applications – 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 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, 2004. Stereochemistry of Organic compounds 2^{nd} edition, New Age International, New Delhi.
2. William Kemp, 1994.Organic Spectroscopy, 4^{th} Edition, ELBS, UK.
3. R.M. Silverstein, G.C. Bassler and T.C. Morrill, 2005. Spectrometric Identification of organic compounds, 6^{th} Edition, John Wiley, New York.

Reference Books:

1.E.L. Eliel andS.H.Wiley, 2003.Stereochemistry of carbon compounds. John Wiley & Son,
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, 1990Nuclear Magnetic Resonance, Springer Verlog, New York.

Course designer

1 Dr. P. Tharmaraj
2 Dr. P. Prakash
3 Dr. R. Mahalakshmy
4 Dr. A. Tamil Selvi

Course contents and lecture schedule

Unit	Topic	Lecture hrs
I	**UV and IR Spectrsocopy**	12
1.1	Ultraviolet spectroscopy – basic principle – instrumentation – the absorption laws, types of electronic transitions – Effect of solvent and hydrogen bonding on λ_{max} values.	2
1.2	Effect of solvent and hydrogen bonding on λ_{max} values.	1
1.3	Woodward rules to calculate λ_{max} values of conjugated dienes, conjugated polyenes, and carbonyl compounds.	2
1.4	Infrared spectroscopy – basic principle – Molecular Vibrations –	3

	instrumentation.	
1.5	Characteristic IR absorption of different functional groups.	1
1.6	Factors influencing the vibrational frequencies.	2
1.7	Revision and test	1
II	**^{1}H NMR and ^{13}C NMR spectroscopy**	12
2.1	**^{1}H NMR spectroscopy**: Basic principles – number of signals – chemical shift	1
2.2	Chemical shift –factors influencing chemical shift – spin-spin coupling – coupling constant and factors influencing coupling constant.	3
2.3	Simplification of complex spectra – shift reagents, deuterium substitution and spin decoupling.	1
2.4	**^{13}C NMR spectroscopy**: Basic principle – comparison with ^{1}H NMR – noise decoupling – off resonance decoupling – factors affecting the C-13 chemical shifts.	2
2.5	**Advanced NMR Spectroscopy -**Introduction to 2D-NMR - Classification of 2D experiments – HOMO and HETERO nuclear correlation – J resolved correlation.	2
2.6	Correlation Spectroscopy (COSY): Pulse sequence – HOMO-COSY, HETERO-COSY, 1D- and 2D- INADEQUATE and NOESY.	2
	Revision and test	1
III	**Mass Spectroscopy, ORD and CD**	12
3.1	Basic instrumentation of Mass spectrometer - types of ions – molecular, isotopic, metastable and fragmentation ions – Tests for molecular ion peak.	3
3.2	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.	4
3.3	Optical rotatory dispersion (ORD) and Circular Dichroism (CD): Circularly polarized light – Circular birefringence and CD – plain curves and their applications – Cotton effects curves – structural applications – axial haloketone rule, octant rule and their applications.Solving problems based on UV, IR, NMR and Mass data.	4
	Revision and test	1
IV	**Organic Stereochemistry**	12
4.1	**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 allenes and spiranes – StereoChemistry of nitrogen compounds.	6
4.2	**Geometrical isomerism** E and Z notation – Determination of configuration of geometrical isomers by simple techniques like	5

	hydroxylation, hydroboration and methods based on physical properties – Stereoisomerism in cyclic compounds – 3, 4 and 5 membered ring systems.	
	Revision and test	1
V	**Conformational Analysis**	12
5.1	Configuration and conformation – definition – conformational free energy- atropisomers- conformational analysis of acyclic, cyclic, heterocyclic systems.	4
5.2	Conformational analysis of cyclohexane system: stability and isomerism in mono and disubstituted cyclohexanes.	2
5.3	Conformation and reactivity of cyclohexane derivatives - conformational analysis of fused ring system - decalins, and perhydrophenanthrene.	5
	Revision and test	1

THIAGARAJAR COLLEGE(Autonomous), MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
PCF19C22	**Inorganic Chemistry – II**	Core-5	4			4

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

Preambe

The course gives detailed information about supramolecular chemistry, solid state chemistry, inorganic rings, cages clusters and polymers, It also explains the principle and applications of various analytical techniques.

Prerequisite

Basic knowledge on supramolecular chemistry, solid state chemistry and analytical techniques at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Describe supramolecular chemistry of transition metal compounds, structure and their application in various fields.	K1, K2, K3
CO2	Analyze the structure and defects of solids.	K4
CO3	Compare and solve the structures of Borone, S-N, P-N of inorganic rings, cages, clusters and polymers.	K3, K5
CO4	Categorize the given S-N, P-N, silicone, P-O compounds and deduce their structure.	K4, K5
CO5	Apply suitable analytical techniques to examine and estimate the inorganic compounds.	K3

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

Mapping of COs with Pos

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

UNIT I SUPRAMOLECULAR CHEMISTRY (12 Hrs)

Definition, Nature of supramolecular interactions- Non- Covalent interactions, Host - guest interaction, complexing involving crowns and cryptands-cyclodextrine - Inclusion compounds-Clatharates-intercalation compounds -Molecular recognition, Types of recognition, Self-assembly. General properties of Supra molecular complexes- Molecular Library- Transition metal mediated supramolecules- Directional bond approach- Molecular triangles (Pd and Pt)- Molecular squares (Pd, Pt and Re)- Molecular rectangles-(Pd, Pt, Cu and Re) Molecular Cages (Pd, Pt and Re) and their applications.

UNIT II SOLID-STATE CHEMISTRY (12 Hrs)

Packing of atoms and ions- close packing arrangements-HCP, CCP and BCC 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). Bragg's equation- problems involving Bragg's equation. Crystal structure determination- X-ray diffraction study, Electron and Neutron diffractions

Crystal defects- point – Schotky and Frenkel defect - line and plane defects- colour centers- non-stoichiometric Compounds- 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-III Inorganic Rings, Cages, Clusters and Polymers- I (12 Hrs)

Electron deficient compounds: Borane and carboranes- Synthesis, structure and bonding (VBT and MO approach) –topological treatment-wades rule –styx numbers-structural studies by NMR-metallocarboranes-other heteroatom boron derivatives,borates-boroxines-B-P and B-As heterocycles. Synthesis, structure and bonding in Binary sulphur nitrils, S-N cations and anions, cyclic S-N compounds, S-N halogen compounds-bonds and electron counting in S-N heterocycles-polythiazyls. Structure of aluminosilicates- mica, clay, zeolites, fullers earth.Manufacture, Types and Uses of glasses.

UNIT- IV Inorganic Rings, Cages, Clusters and Polymers- II (12 Hrs)

P-N Heterocyclics- Phosphonitrilic compounds: Synthesis, Structure and bonding-phosphazene oligomers-high polymers-polymeric phosphorus nitrides-hydrolysis of phosphazenes- reactions of halo phosphazenes- aminolysis-metathetical reactions-reaction with organometallic reagents-Friedel-

Crafts substitutions-rearrangements-theories of bonding-electronic structure and aromaticity-posphazene oligomers-high polymers-polymeric phosphorus nitrides. High, low nuclearcity carbonyl clusters-halide clusters. Isolobal analogy-Synthesis, structure and bonding in Poly anions and isopoly anions of phosphorous, vanadium, chromium, Nolybdenum and tugston. Hetero poly anions of molybdenum and tungsten. Structural prediction by Wade's rule-Cappit rule

UNIT-V ANALYTICAL CHEMISTRY-1 (12 Hrs)

Principles and practice of complexometric estimations/- Spectro analytical methods:-Principles and applications of colorimetry and spectro photometry, fluorimetry, nephelometry and turbidimetry-emission and atomic absorption spectroscopy (AAS) and atomic fluorescence spectroscopy.

ANALYTICAL CHEMISTRY-II

Principles, Instrumentation and applications of Cyclic Voltametry, Thermogravimetry, Differential thermal analysis and differential scanning colorimetry, Chromatography: GC, HPLC and Ion Exchange Chromatographic techniques.

Text book:

1. Bradley J. Holliday & Chad A. Mirkin, 2001Strategies for the Construction of Supramolecular Compounds through Coordination Chemistry- Reviews, Angew. Chem. Int. Ltd., Ed., 40, 2022-2043., Chemie@Wiley-VCH
2. Katsuhiko Ariga, Toyoki Kunitaka,2006. Supramolecular Chemistry-Fundamentals and Applications: Advanced Textbook, Springer Science & Business Media.
3. W. Jones, C. N. R. Rao,2001Supramolecular Organization and Materials Design, Cambridge University Press, Landon,
4. Lee, J. D.2002 Concise Inorganic Chemistry, Blackwell Science Ltd., V Edn., London.
5. Keer, H.V. 1993.Principles of the Solid State, Wiley Eastern Ltd..
6. H. G.Heal,1980. the Inorganic Heterocyclic Chemistry of Sulphur, Nitrogen and Phosphorus, Academic press, New York.
7. J. D. Woolings,1989. Non Metal Rings, Cages and Clusters, John Wiley and sons, New York.
8. P.J. Durrant and B. Durrant,1970 Introduction to advanced inorganic chemistry, Longman Group Ltd, London,.
9. Purcell K.F. and Kotz J.C., Saunders,1977 Inorganic Chemistry, Philadelphia.
10. D. A. Skoog and D. M. West,1998 Fundamentals of Analytical Chemistry, Holler Saunders college publishing, USA.VI Edn.
11. F.A. Cotton and G. Wilkinson,1988. Advanced Inorganic Chemistry, Wiley-Interscience publications, John Wiley & Sons, V Edn., New Delhi.
12. Walter E. Harris and Byron Kratochvil, 1982.An Introduction to Chemical Analysis, Saunders Golden Sunburst Series, Philadelphia.
13. Galen W. Ewing, 1987.Instrumental Methods of Chemical Analysis, Mc Graw Hill International Editions, V Edn., New Delhi.
14. K. Sharma,1993. Instrumental Methods of Chemical Analysis, GOEL Publishing House, 12th Reprint, New Delhi.

REFERENCE BOOKS:

1. J. E. Huheey, Ellen A. Keiter, Richard L. Keiter, 2004.Inorganic Chemistry, Pearson Education (Singapore) Pte. Ltd., IV Edn., Delhi.
2. K. Chakrabarthy,2005 Solid State Chemistry, New Age International Publishers, (P) Ltd.,

3. D. F. Shriver and P.W. Atkins,1999. Inorganic Chemistry, Oxford University Press, London.
4. Wahid U. Malik, G.D. Tuli and R. D. Madan,2006. Selected Topics in Inorganic Chemistry, S. Chand & Co. Ltd., New Delhi.
5. William W. Porterfield,2005 Inorganic Chemistry, II Edn., Elsevier, New Delhi.
6. A.G. Sharpe,2004 Inorganic Chemistry, III Edn., Addition – Wesley Longman, UK .
7. I. Vogel,2002 Textbook of Quantitative Chemical Analysis, ELBS Longman Singapore Publisher (P) Ltd., Singapore. V Edn.,
8. Azaroff, 2004.Introduction to Solids, Tata McGraw hill, New Delhi.

Course designers

1 Dr.A.Suganthi
2 Dr.A. Elangovan
3 Dr.D.S. Bhuvaneshwari
4 Dr.K.Selvakumar

Course contents and lecture schedule

Unit	Topic	No. of Lecture Hours
I	**Supramolecular Chemistry**	**12**
1.1	Definition, Nature of supramolecular interactions- Non- Covalent interactions.	2
1.2	Host - guest interaction.	1
1.3	Complexing involving crowns and cryptands-cyclodextrine	1
1.4	Molecular recognition, Types of recognition.	2
1.5	Self- assembly.	2
1.6	General properties of Supra molecular complexes-	1
1.7	Molecular Library- Transition metal mediated supramolecules- Directional bond approach	1
1.8	Molecular triangles (Pd and Pt)- Molecular squares (Pd, Pt and Re)- Molecular rectangles-(Pd, Pt, Cu and Re) Molecular Cages (Pd, Pt and Re) and their applications	1
1.9	Inclusion compounds-Clatharates-intercalation compounds	1
II	**Solidstate Chemistry**	**12**
2.1	Packing of atoms and ions- close packing arrangements-HCP,CCP and BCC lattice.	2
2.2	Radius ratio rules- Limiting radius ratio.	1
2.3	Structure of typical lattices such as calcite, cesium chloride, Nickel arsenide, Fluorite, Antifluorite, Cadmium iodide, Perovskite, Spinels (normal and inverse).	2
2.4	Bragg's equation- problems involving Bragg's equation.	1
2.4	Crystal structure determination- X-ray diffraction study, Electron and Neutron diffractions.	1
2.5	Crystal defects- point – Schotky and Frenkel defect - line and plane defects- colour centers- non- stoichiometric Compounds- experimental methods of study of non-stoichiometry	2

2.6	Effect of imperfections and non- stoichiometry on physical properties	1
2.7	Types of solids-electronic structure of solids- free electron and band theories.	2
III	**CAGES AND METAL CLUSTERS- POLYMERIC INORGANIC COMPOUNDS**	**12**
3.1	Electron deficient compounds: Borane and carboranes -	2
3.2	Synthesis, structure and bonding (VBT and MO approach)	1
3.3	Topological treatment-wades rule –styx numbers	1
3.4	Structural studies by NMR-metallocarboranes-other heteroatom boron derivatives-borates-boroxines-B-P and B-As heterocycles	2
3.5	P-N HETEROCYCLICS- Phosphonitrilic compounds: Synthesis, Structure and bonding-phosphazene oligomers-high polymers-polymericphosphorus nitrides.	2
3.6	**S-N HETEROCYCLICS**: Synthesis, structure and bonding in Binary sulphur nitrils, S-N cations and anions, cyclic S-N compounds, S-N halogen compounds	2
3.7	Bonds and electron counting in S-N heterocycles-polythiazyls.	2
IV	**Si-O, P-O, P-S SYSTEMS**	**12**
4.1	Synthesis of P-N-skeleton.	1
4.2	Hydrolysis of phosphazenes- reactions of halo phosphazenes-aminolysis-metathetical reactions.	2
4.3	Reaction with organometallic reagents.	1
4.4	Friedel-Crafts substitutions-rearrangements.	2
4.5	Theories of bonding-electronic structure and aromaticity	2
4.6	Phosphazene oligomers-high polymers-polymeric phosphorus nitrides.	2
4.7	METAL CLUSTERS: Synthesis, structure and bonding in Poly anions and isopoly anions of phosphorous,vanadium, chromium,Nolybdenum and tugston. Hetero poly anions of molybdenum and tungsten	2
V	**Analytical Chemistry**	**12**
5.1	Principles and practice of complexometric titrations.	1
5.2	Spectro analytical methods	1
5.3	EstimationsPrinciples and applications of colorimetry and spectro photometry, fluorimetry, nephelometry and turbidimetry	2
5.4	Emission and atomic absorption spectroscopy (AAS) and atomic fluorescence spectroscopy.	2
5.5	Instrumentation and applications of Cyclic Voltametry	2
5.6	Thermogravimetry, Differential thermal analysis and differential scanning colorimetry.	2
5.7	Chromatography: GC, HPLC and Ion Exchange Chromatographic techniques.	2

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
PCF19C23	**Physical Chemistry-II**	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 quantum chemistry.

Prerequisites

Basic knowledge on fundamental concepts and theories of electrochemistry, statistical thermodynamics and quantum chemistry 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, K2
CO2	Make use of the applications of electrochemistry.	K3
CO3	Identify the need and fundamental derivation of statistical thermodynamics.	K3
CO4	Examine the applicationsof statistical thermodynamics.	K4
CO5	Measure their knowledge on advanced quantum chemistry.	K5

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
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**

UNIT-I **(12 Hrs)**

ELECTROCHEMISTRY-I

Theory of strong electrolytes – Interionic attraction theory – Debye-Huckel theory of strong electrolytes - Debye-Huckel model of ionic atmosphere–Debye-Huckel Onsager equation-derivation, verification and modifications- Debye – Falkenhagen effect and Wien 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 rule. Types of corrosion- galvanic, aeration, stress, pitting corrosion and passivity – factor influencing corrosion – corrosion control- cathodic production - corrosion inhibitors.

Principles of Polorography - Cyclic Voltametry –quasi – reversible – irreversible voltamogram; electrochemical energy conversions-Nickel Cadmium, lead acid battery; Fuel cells – H_2 - O_2 Fuel cell – methyl alcohol fuel cell.

UNIT-III **(12 Hrs)**

STATISTICAL THERMODYNAMICS-I

Need for statistical mechanics or thermodynamics-Ensemble- types of ensemble – micro canonical - canonical and grand canonical ensemble; Phase space- microstates- probability and distribution- Maxwell Boltzmann classical distribution law- derivation in term of degeneracy; Partition function (Q) – 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 Sackur-Tetrode equation- thermodynamic properties of monoatomic gases.

UNIT-IV **(12 Hrs)**

STATISTICAL THERMODYNAMICS-II

Quantum statistics- Bose-Einstein Statistics derivation- application of Bose-Einstein statistics for a photon gas – Planck‘s radiation formula-Derivation of Rayleigh-Jeans law-Stefan Boltzman equation. Fermi-Dirac statistics derivation -Application of Fermi-Dirac statistics to electron gas in metals; Population inversion-negative absolute temperature -heat capacity of diatomic gases-Einstein‘s theory and Debye's theory of heat capacities of solids- third law of thermodynamics and statistical entropy - hydrogen ortho and para nuclear states.

UNIT –V (12 Hrs)

Approximation methods, application of SWE to many electron systems.

Necessity for approximation methods- Variation methods for the Hydrogen atom – Perturbation (first order) method to Helium atom - Slater determinant wave function- secular determinant – Hartree – Fock self consistent field method to Helium atom – HMO bielectron theory of Ethylene and Butadiene.

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.
6. Chandra A. K., 1988, Introductory Quantum Chemistry, 3rd edition, Tata McGraw-Hill Publishing Co, New Delhi, India.
7. Mc Quarie D.A., 1983, Quantum Mechanics, Oxford University press, Oxford,UK.

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. Levine, 2006, Quantum Chemistry, 6th Edition, Prentice-Hall, New Delhi, 2006.
6. H.W. Hanna, 1993, Quantum Mechanics in Chemistry-Benjamin –Cummiza London Publishing Company, New Delhi, India.

Course Designed by1. Dr. R. Sayee Kannan2. Dr. A. R. Ramesh 3. Dr. T. Arumuganathan

Course contents and lecture schedule

UNIT	TOPIC	LECTURE Hrs
I	**ELECTROCHEMISTRY-I**	12
1.1	Theory of strong electrolytes -Interionic attraction theory- Debye – Huckel theory of strong electrolytes - Debye-Huckel model of ionic atmosphere.	2
1.2	Debye–Huckel Onsager equation-derivation, verification and modifications- Debye – Falkenhagen effect and Wien effect.	2
1.3	Electrical double layers – formation – Structure of electrified interfaces – Stern model. Debye Huckel limiting law- extension.	2
1.4	Huckel Bronsted equation - Determination of activity coefficients using Bronsted equation.	2
1.5	Applications of conductivity measurements – Nernst equation and its significance.	2
1.6	Reversible and irreversible cells - Electrodes – SHE – Calomel – Glass electrode – Platinum electrode – Glassy carbon electrode – ion selective electrode and measurement of pH.	2
II	**ELECTROCHEMISTRY-II**	12
2.1	Over voltage- Theories of over voltage- applications of over voltage	1
2.2	electrode processes - Kinetics of electrode processes - Butler-Volmer equation- Tafel equation-	2

2.3	Corrosion- principles of electrochemical corrosion – dry and wet corrosion and its mechanism – Pilling-Bedworth rule.	2
2.4	Types of corrosion- galvanic, aeration, stress, pitting corrosion and passivity – factor influencing corrosion – corrosion control- cathodic production - corrosion inhibitors.	2
2.5	Principles of Polorography - Cyclic Voltametry –quasi – reversible – irreversible voltamogram	2
2.6	– electrochemical energy conversions-Nickel Cadmium, lead acid battery.	2
2.7	Fuel cells – H_2 - O_2 Fuel cell – methyl alcohol fuel cell.	1
III	**STATISTICAL THERMODYNAMICS-I**	12
3.1	Need for statistical mechanics or thermodynamics-Ensemble- types of ensemble – micro canonical - canonical and grand canonical ensemble;	2
3.2	Phase space- microstates- probability and distribution- Maxwell Boltzmann classical distribution law- derivation in term of degeneracy;	3
3.3	Partition function (Q) – 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);	5
3.4	Derivation of Sackur-Tetrode equation-thermodynamic properties of monoatomic gases.	2
IV	**STATISTICAL THERMODYNAMICS-II**	12
4.1	Quantum statistics- Bose-Einstein Statistics derivation- application of Bose-Einstein statistics for a photon gas	3
4.2	Planck‘s radiation formula-Derivation of Rayleigh-Jeans law-Stefan Boltzman equation	2
4.3	Fermi-Dirac statistics derivation -Application of Fermi-Dirac statistics to electron gas in metal	2
4.4	Population inversion-negative absolute temperature -heat capacity of diatomic gases-Einstein‘s theory and Debye‘s theory of heat capacities of solids-	3
4.5	Third law of thermodynamics and statistical entropy - hydrogen ortho and para nuclear states.	2
V	**Approximation methods, application of SWE to many electron systems.**	12
5.1	Necessity for approximation methods - Variation methods for the Hydrogen atom	2
5.2	Perturbation (first order) method to Helium atom	2
5.3	Slater determinant wave function- secular determinant	3
5.4	Hartree – Fock self consistent field method to Helium atom	2
5.5	HMO bielectron theory of Ethylene and Butadiene.	3

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
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Course Code	Course title	Category	L	T	P	Credit
PCF19CE21(A)	C-Programming: Fundamentals And Applications in Chemistry	Core elective -1 (Option A)	4	-	-	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.

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.	K1, K2
CO2	Build a program using proper data input and output logics.	K3
CO3	Developa programs using the decision making looping logics.	K3
CO4	Construct the C Programs for solving the problems by chemical formula translation.	K4
CO5	Evaluate C programs to compute the output for chemical formula in organic, inorganic and physical chemistry.	K5

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

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)	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 Introduction and overview of C (12 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.
Expressions- Arithmetic - Evaluation of expression- Procedure of arithmetic operators- Library functions.

UNIT-II Data input and Output (T: 6 HRS + P: 6 HRS)

Character input- The getchar function – Character output- The putchar function – Entering input data- the Scanf function-Writing output data- The printf function- Formatted input and output data-the gets and puts functions-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.

UNIT-III (T: 8 HRS + P: 4 HRS)

Decision making and Looping: The WHILE statement – The DO statement-The FOR statement – Jumps in loops.
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.

UNIT-IV Applications of C in Chemistry-I (T: 4 HRS + P: 8 HRS)

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

13. Calculation of Molecular weight of Organic Compounds.
14. Calculation of pH.
15. Determination on First Order rate constant for the given reaction
16. Evaluation of lattice energy using
    i). Born- Haber Cycle
    ii). Born –Lande equation
17. Computing ionic radii- Lande's method and Paulings method
18. Calculation of Normality, Molarity and Molality of a given solution
19. Converting Kelvin to Celsius temperature and vice versa.
20. Determination of enthalpy of a given solution

21. Evaluation of Cell constant
22. Calculation of energy of Hydrogen atom spectral lines.

UNIT-V: Applications of C in Chemistry-II (T: 4 HRS + P: 8 HRS)

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

Organic Chemistry:

3. Use of Recursive functions to calculate the number of π Resonance structures for an organic conjugated system using

   res - str = n! / ((n/2)! * ((n/2) + 1)!)
4. Empirical formula of Hydrocarbons and other Organic compounds.

Inorganic Chemistry:

1. Array manipulation to balance the chemical equations.
2. Half life and average life periods of radioactive nuclei.
3. Binding energy of nucleus.
4. Program to get output as First ten elements of Periodic Table with their Name, Symbol, Atomic number and Atomic Weight.

Physical chemistry:

1. Calculation of RMS, average and MPV of gases.
2. Solving Quadratic equation to evaluate the Equilibrium constant for the reaction

   $H_2 + I_2 \quad 2HI$
3. Illustrate use of Loop to calculate the NMR frequency for a nucleus with Spin ½
4. Mean activity coefficient of an Electrolyte (KCl)

TEXT BOOK

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

REFERENCES:

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..

Course designer Dr. A. ElangovanDr. R. MahalakshmyDr. A. Tamilselvi

Course contents and lecture schedule

Units	Topic	lecture hrs
I	**Introduction and overview of C**	
1.1	Introduction – Importance of C-structure of C-programs- Simple programs-style of the language.	3
1.2	Characters–Keywords, Variables and parameters-Data types-Constants-Declaration of and assignments of values to variables.	3
1.3	Operators-Arithmetic, Relational, Logical, assignment, Increment and Decrement, Conditional and bitwise operators-Special operators.	3
1.4	Expressions- Arithmetic - Evaluation of expression- Procedure of arithmetic operators- Library functions.	2
1.5	Revision and test	1

II	**Data input and Output**	
2.1	Character input- The getchar function – Character output- The putchar function – Entering input data- the Scanf function-Writing output data- The printf function- Formatted input and output data-the gets and puts functions-preparing and running a complete program.	6
2.2	**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.	6
III	**Unit III**	
3.1	**Decision making and Looping:** The WHILE statement – The DO statement-The FOR statement – Jumps in loops.	4
3.2	**Arrays:** One dimensional array –Two dimensional arrays –Initializing two dimensional arrays- Multidimensional arrays.	3
3.3	**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.	4
2.3	Revision and test	1
IV	**Applications of C in Chemistry-I**	
4.1	**E**xplanation of the formulae, equations and programs to solve the following problems in chemistry: 11. Calculation of Molecular weight of Organic Compounds. 12. Calculation of pH. 13. Determination on First Order rate constant for the given reaction 14. Evaluation of lattice energy using i). Born- Haber Cycle ii). Born –Lande equation 15. Computing ionic radii- Lande's method and Paulings method 16. Calculation of Normality, Molarity and Molality of a given solution 17. Converting Kelvin to Celsius temperature and vice versa. 18. Determination of enthalpy of a given solution 19. Evaluation of Cell constant 20. Calculation of energy of Hydrogen atom spectral lines.	4T+8P
V	**Applications of C in Chemistry-II**	
5.1	Explanation of the formulae, equations and programs to solve the following problems in chemistry: **Organic Chemistry:** 3. Use of Recursive functions to calculate the number of π Resonance structures for an organic conjugated system using res - str = n! / ((n/2)! * ((n/2) + 1)!) 4. Empirical formula of Hydrocarbons and other Organic compounds. **Inorganic Chemistry:** 1. Array manipulation to balance the chemical equations. 2. Half life and average life periods of radioactive nuclei. 3. Binding energy of nucleus. 4. Program to get output as First ten elements of Periodic Table	4T+8P

	with their Name, Symbol, Atomic number and Atomic Weight. **Physical chemistry:** 1. Calculation of RMS, average and MPV of gases. 2. Solving Quadratic equation to evaluate the Equilibrium constant for the reaction $H_2 + I_2 \quad 2HI$ 3. Illustrate use of Loop to calculate the NMR frequency for a nucleus with Spin ½ 4. Mean activity coefficient of an Electrolyte (KCl)	

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Course Code	Course title	Category	L	T	P	Credit
PCF19CE21(B)	**Medicinal Chemistry**	Core elective -1 (Option B)	4	-	-	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

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

#	Course Outcome	Knowledge level
CO1	Tell the properties of Adsorption, Distribution, Metabolism, Elimination(ADME) and usage of pharmacokinetics in drug design.	K1, K2
CO2	Explain drug discovery by design and compare the structural activity relationship properties.	K4, K5
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.	K3

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

Mapping of COs with POs

	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**

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**

Unit – I : Introduction to Drug Design **12 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 dsign**.**

b) Pharmacodynamics - Stereoelectronic structure.

Unit II Drug Discovery by Design **12 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 lead-isosteres,bioisoteres.

Unit III a)Quantitative-structural Activity-Relationship (QSAR) **12 hrs**

Partition parameters-partition coefficients(p), Lipophilic subtituents constants (□) Electronic parameters-The Hammett constants-Steric parameters-The Taft Steric parameters (Es), Molar refractivity (MR), Hansch analysis-craig plots, The toplss decision tree. Compute –aided drug design-Modelling 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: **12 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 **12 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.Dorge, 2003 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, 2004. Strategies for Organic Drug Synthesis and Design, John Wiley.

2. Gareth Thomas, 2004. Medicinal Chemistry, An introduction, John wiley& sons,Ltd.,

3. M.L Gangwa l2007. Medicinal chemistry Lectures on Drug design and Synthetic Drugs, Student publishing House.

Course Designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash

Course contents and lecture schedule

Units	Topic	No. of lecture hrs
I	**Introduction to Drug Design:**	
1.1	**a) ADME Properties** The pharmacokinetics phase-Adsorption-Distribution, Metabolism-Elimination-Bioavailability of drug. pharmacokinetics models,	6
1.2	Intravascular and Extravascular administration. The use of pharmacokinetics in Drug dsign.	3
1.3	**b) Pharmacodynamics** - Stereoelectronic structure	3
II	**Drug Discovery by Design**	
2.1	**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	**5**

2.2	**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 lead-isosteres,bioisoteres.	**7**
III		
3.1	**Quantitative-structural Activity-Relationship**	
	Partition parameters-partition coefficients(p), Lipophilic subtituents constants ( ) Electronic parameters-The Hammett constants-Steric parameters-The Taft Steric parameters (Es), Molar refractivity (MR), Hansch analysis-craig plots, The toplss decision tree.	5
3.2	Computer –aided drug design- Modelling Drug-Receptor Interaction.	3
3.3	**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	4
IV		
4.4	**a) Antineoplastic Agents: 15 hrs** Introduction, cancer chemotherapy, special problems, role of alkylating agents and antimetabolites in treatment of cancer	4
4.2	**b) Psychoactive drugs – The chemotherapy of Mind:** Introduction, neutotransmitters, CNS depressants, general anaesthetics, mode of action of hypnotics, sedatives, neurochemistry of mental diseases	4
4.3	**c) Cardiovascular Drugs and Local Antiinfective Drugs:** Introduction, Cardiovascular diseases, drug inhibitors of peripheral sympathetic function, central intervention of cardiovascular output.	4
V	**Synthesis of Drugs**	
5.1	**a) Synthesis of Antineoplastic agents** Mechlorethamine, Cyclophosphamide uracil, mustards and 6-mercaptopurine	4
5.2	**b) Synthesis of cardiovascular drugs** Amyl-nitrate, sorbitrate, , Verapamil.	3
5.3	**c) Synthesis of Phychoactive drugs** Synthesis of Diazepam, Chlorazepam, oxazepam, Alprazolam, Phenyltocin or Diphenylhydantoin, Barbitol, Phenobarbital.	5

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Course Code	Course title	Category	L	T	P	Credit
PCF19CL21	**Organic chemistry lab -1**	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 presnt 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	Learn 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	Identifythe functional groups in a given organic compound.
CO5	Preparethe derivatives for the given organic compound.

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 Designers1. Dr. P. Tharmaraj2. Dr. A. Tamilselvi

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Course Code	Course Title	Category	L	T	P	Credit
PCF19CL22	**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 enable the students to acquire laboratory skill on quantitative estimation of inorganic metal ions 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	Analyse the familiar cations present in the given mixture of salts.
CO4	Analyse the less familiar cations present in the given salt mixture
CO5	Acquire the laboratory skill of quantitative as well as qualitative analysis of metal ions.

Mapping of COs with PSOs

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

Semi micro analysis of samples containing two Familiar Cations and two Less Familiar Cations. – Maximum of Five samples.

Course Designers1. Dr. A.ElangovanDr. T. Arumuganathan

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Course Code	Course title	Category	L	T	P	Credit
PCF19CL23	Physical Chemistry lab-1	Core lab 3	-	-	5	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 aknowledge 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	Deveop analytical skill on adsorption experiments.
CO4	Apply colorimetric estimation techniques.
CO5	Identify various types of conductometric titrations.

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.	EXPERIMENT
1	Kinetics of Acid hydrolysis of an ester
2	Estimation of strong acid conductometrically
3	Estimation of mixture of acids conductometrically
4	Estimation of NH_4Cl by Conductometrically
5	Estimation of CH_3COONa by conductometrically
6	Estimation of $BaCl_2$ by conductometrically
7	Estimation of Fe(II) using $K_2Cr_2O_7$ by Potentiometry
8	Estimation of Fe(II) using CAS by Potentiometry
9	Estimation of KI with $KMnO_4$ by Potentiometry
10	Estimation of Copper (II) by Spectrocolorimetry
11	Determination of the Adsorption Parameters of Oxalic acid on Charcoal
12	Adsorption of acetic acid on to activated charcoal
13	Estimation of thiocyanate using iron (III) by spectrocolorimetry
14	Determination of Iron ion content by photometric method based on complex formation

Course Designed by

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

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Course Code	Course title	Category	L	T	P	Credit
PCF19C31	**Organic Chemistry - III**	Core-7	5	-	-	4

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

Preamble

The course explains the application of various reagents in organic synthesis. It imparts laboratory skill to the students. It gives in-depth knowledge on the mechanism of pericyclic, photochemical and molecular rearrangement reaction.

Prerequisites

Basic knowledge about reagents, organic synthesis, thermal, photochemical and molecular rearrangement reactions at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Make use of chemical reagents in various organic transformation such as oxidation, reduction, catalysis etc.,	K3
CO2	Outline synthetic route for complex organic molecules which find medicinal, industries of commercial importance.	K1, K2
CO3	Evaluate various methods to synthesize optically active compounds.	K5
CO4	Analyze the concepts and mechanism of photochemical and thermal reactions of carbonyl, alkenes and conjugated pi electrons compounds.	K4
CO5	Apply their knowledge in writing the mechanism of molecular rearrangement reaction.	K3

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

Mapping of COs with PSOs

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

Unit-I: Reagents in Organic Synthesis (15 Hrs)

Use of the following reagents in organic syntheses and functional group transformations – complex metal hydrides, Gilman‘s reagent, lithium dimethyl cuprate – lithium diisopropylamide (LDA) — trimethyl silyliodide – tri-n-butyl tin hydride – Jones reagent – pyridinium chloro chromate – SeO_2 – peracids – DMSO – $Pb(OAc)_4$ – HIO_4 – Prevost and Woodward hydroxylation – Etard‘s reagent – Waker‘s reagent – RuO_4 – $Hg(OAc)_2$ – Oppenauer oxidation – DDQ – $LiAlH_4$, $NaBH_4$, Lawesson‘s reagent – Crown ethers – Thallium nitrate – Phase transfer catalysts – Birch reduction.

UNIT-II Advanced Organic Synthesis I (Retro-synthesis) (15 hrs)

Disconnection Approach: Importance of organic synthesis-Planning synthesis – Synthons and types – synthetic equivalents – latent functionality Guideliness for best disconnection approach, Reactions involving functional group interconversions – Reterosynthetic analysis – concept of umpolung – two group C-X disconnections and synthetic strategies 1,2-, 1,3-, 1,4-, 1,5- and 1,6- difunctionalised disconnection. Steroselective and stereospecific reactions-Chemoselectivity–Stereoselectivity-Regioselectivity.

UNIT-III Advanced Organic Synthesis II (Asymmetric synthesis) (15 hrs)

Definition of enantiomeric, disatereomeric excess – analytical methods to determine ee and de – strategy and classification of methods of asymmetric synthesis – chiral substrates – Chiral auxiliaries – chiral reagents – chiral catalysts.

Chiral catalysts and chiral reagents: BINAP-ruthenium (II) Mc Murray‘s reagent – $Ti(i\text{-}PrO)_4$, and $K_2Os_2(OH)_4$ – Sharpless asymmetric epoxidation, – Heck reactions – Suzuki Coupling – Sonogashira coupling.

UNIT-IV Photochemistry and Pericyclic reactions (15 hrs)

General principles – orbital symmetry considerations related to photochemical reactions, thermal versus photochemical reactions – principles of energy transfer – photochemical reactions of ketones – Norrish type I and type II reactions – Paterno Buchi reaction – Dienone photochemistry – photo reduction, photochemical oxidation, Barton reaction – photochemistry of alkenes and dienes.

Pericyclic reactions Application of symmetry to orbital interactions – selection rules (Woodward and Hoffmann rules) – Electrocyclisation, cycloaddition and sigmatropic rearrangements – cheletropic reactions – Diels-Alder Reactions: Endoselectivity and regioselectivity – Explanation of these reaction in terms of correlation diagrams approach, FMO approach and Dewar – Zimmermann approach – (PMO) Huckel-Mobius concepts.

UNIT-V Molecular rearrangements (15 hrs)

Classification – Nucleophilic, electrophilic, and radical – Mechanism of Favorski, Benzil-Benzilic acid, Bayer-Villiger, Wagner-Meerwin rearrangement, Carbanionic rearrangements, Stevan‘s rearrangement, Sommelet-Hauser, Cope, and Wesly-Moser rearrangement, Fries Rearrangement.
Acid catalyzed rearrangement – Arndt-Eistert synthesis – carbon to nitrogen migration – Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt and Beckmann rearrangement

Text book:

1. Jerry March.1992. Advanced Organic Chemistry, Reaction mechanism and structure, John Wiley and sons, 4th Edition, New York.
2. S. Warren,2004. Organic synthesis **-** The disconnection approach, John Wiley & Sons, UK, 2004**.**
3. Cary and Sundberg1990. Advanced Organic Chemistry, Part B, Reactions and Synthesis, Plenum Press, 3rd Edition.
4. R. K. Mackei and D. M. Smith1982. Guide Book to Organic synthesis, ELBS.
5. I.L. Finar2005. Organic Chemistry, Vol. II, V Edition, ELBS, New York.
6. W. Caruthers, Some modern methods of organic synthesis, Cambridge university.
7. C.H. Depuy and O.L. Chapman,1975. Molecular reactions and Photo Chemistry, Eastern and Economic Edition, Tata MacGraw Hill.

Reference Books:

1. Graham Solomons,1992. Organic Chemistry, John Wiley and Sons INC, 5th Edition.
2. Michael B. Smith, 1994.Organic Synthesis, McGraw Hill, International Edition.
3. Clayden, Greeve, Warren and Wothers, 2007.Organic Chemistry, OXFORD University Press.
4. A.J. Bellamy,1974. An introduction to conservation of orbital symmetry, Longman group Limited,
5. H. O. House,1972. Modern synthetic reactions, Cambridge University press, 3rd Edition.
6. W. Carruthers and I. Coldham,2004. Modern methods of organic synthesis, Cambridge University Press, 4th Edition.

Course designer

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

Course contents and lecture schedule

Units	Topic	lecture hrs
I	**Reagents in Organic Synthesis**	15
1.1	Use of the following reagents in organic syntheses and functional group transformations – complex metal hydrides, Gilman‘s reagent,lithium dimethyl cuprate – lithium diisopropylamide (LDA)	3
1.2	trimethyl silyliodide – tri-n-butyl tin hydride – Jones reagent – pyridinium chloro chromate	2
1.3	SeO_2 – peracids – DMSO – $Pb(OAc)_4$ – HIO_4 – Prevost and Woodward hydroxylation	3

1.4	Etard‘s reagent – Waker‘s reagent – RuO_4 – $Hg(OAc)_2$ – Oppenauer oxidation – DDQ	3
1.4	$LiAlH_4$, $NaBH_4$, Lawesson‘s reagent – Crown ethers	2
1.5	Thallium nitrate – Phase transfer catalysts – Birch reduction.	2
II	**Advanced Organic Synthesis**	15
2.1	Disconnection Approach: Importance of organic synthesis- Planning synthesis	2
2.1	Synthons and types – synthetic equivalents – latent functionality	2
2.3	Guideliness for best disconnection approach,	1
2.4	Reactions involving functional group interconversions – Reterosynthetic analysis, concept of umpolung	3
2.5	two group C-X disconnections and synthetic strategies 1,2-, 1,3-, 1,4-, 1,5- and 1,6- difunctionalised disconnection.	4
2.6	Steroselective and stereospecific reactions-Chemoselectivity–Stereoselectivity- Regioselectivity.	3
III	**Advanced Organic Synthesis II**	15
3.1	Asymmetric synthesis: Definition of enantiomeric, disatereomeric excess – analytical methods to determine ee and de – strategy.	3
3.2	classification of methods of asymmetric synthesis – chiral substrates – Chiral auxiliaries – chiral reagents – chiral catalysts.	4
3.3	Chiral catalysts and chiral reagents: BINAP-ruthenium (II) Mc Murray‘s reagent – $Ti(i\text{-}PrO)_4$, and $K_2Os_2(OH)_4$ – Sharpless asymmetric epoxidation, – Heck reactions – Suzuki Coupling – Sonogashira coupling.	8
IV	**Photochemistry and Pericyclic reactions**	15
4.1	General principles – orbital symmetry considerations related to photochemical reactions, thermal versus photochemical reactions – principles of energy transfer	3
4.2	photochemical reactions of ketones – Norrish type I and type II reactions – Paterno Buchi reaction – Dienone photochemistry.	2
4.3	photo reduction, photochemical oxidation, Barton reaction – photochemistry of alkenes and dienes	3
4.4	Pericyclic reactions Application of symmetry to orbital interactions – selection rules (Woodward and Hoffmann rules).	2
4.5	Electrocyclisation, cycloaddition and sigmatropic rearrangements – cheletropic reactions – Diels-Alder Reactions:	2
4.6	Endoselectivity and regioselectivity – Explanation of these reaction in terms of correlation diagrams approach, FMO approach and Dewar – Zimmermann approach – (PMO) Huckel-Mobius concepts.	3
V	**Molecular rearrangements**	15
5.1	Classification – Nucleophilic, electrophilic, and radical – Mechanism of Favorski, Benzil-Benzilic acid, Bayer-Villiger, Wagner-Meerwin rearrangement.	5

5.2	Carbanionic rearrangements, Stevan‘s rearrangement, Sommelet-Hauser, Cope, and Wesly-Moser rearrangement, Fries Rearrangement.	5
5.3	Acid catalyzed rearrangement – Arndt-Eistert synthesis – carbon to nitrogen migration – Hofmann rearrangement, Curtius rearrangement, Lossen rearrangement, Schmidt and Beckmann rearrangement.	5

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
(Re-Accredited with 'A' Grade by NAAC)
Department of Chemistry
(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
PCF19C32	**Inorganic Chemistry - III**	Core 8	5	-	-	4

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

Preamble

The course explains the various theories and reaction mechanism of coordination compounds. It also gives information on nano science and technology,spectral techniques and chemistry of lanthanides and actinides.

Prerequisite

Basic knowledge on coordination compounds, spectral techniques and chemistry of lanthanides and actinides 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 andproperties of co-ordination compounds.	K1, K2
CO2	Examine the mechanism of co-ordination compounds.	K4
CO3	Summarize the preparation, characterization and evaluate application of nano particles.	K2, K5
CO4	Outline the basic principles and instrumentation of spectral techniques like IR, Raman, NMR, NQR and electronic spectroscopy and analyze their application in determining the structure and property of Inorganic compound/complexes	K3, K4
CO5	Make use of the occurance, extraction, spectral and magnetic properties of lanthanides and actinides.	K3

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

Mapping of COs with PSOs

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

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, LFT and MO theories- **pi bonding-**Influence of ligands on crystal field splitting-Octahedral and Tetrahedral splitting of "d" orbitals, CFSE. Spectrochemical series- Nephelauxetic effect– John Teller effect-site preferences. Spectral properties of complexes- Magnetic properties-**spin-orbit contribution-**Para, Dia, ferro magnetism and antiferro magnetism- Determination of magnetic properties – Gouy's method.

UNIT-II COORDINATION CHEMISTRY-II 15Hrs
(INORGANIC REACTION MECHANISMS)

Substitution reactions- lability-inertness- square planar substitution reactions- Factors affecting reactivity of square planar complexes- Trans effect- Theories of Trans effect- Stereo chemistry 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 CHEMISTRY OF NANOSCIENCE AND TECHNOLOGY 15 Hrs

Introduction- Types of nano materials-Nanoparticles, nanotubes-Carbon nanotubes: SWCNT and MWCNT, nanowires, nanoribbons, nanorods, nano composites.

Preparation methods-Chemical vapour deposition, Sol-Gel method, Electrodeposition method, Ball milling method, Chemical reduction method, spin coating technique, Solvothernal synthesis, Colloidal method, Co-precipitation method, Flame spray synthesis (Arc Plasma)-Preparation of metal oxide nanoparticles- Properties of nanoparticles- Optical, mechanical, magnetic, electrical, thermal properties. Characterization Techniques like SEM, TEM, AFM, XRD, UV-DRS, B.E.T analysis, DLS, PL -Applications of Nanoparticles.

UNIT – IV PHYSICAL METHODS IN INGORGANIC 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: Applications of IR and Raman. Selection rules to structure determination – IR spectral studies of carbonyl compounds.

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.

NQR- Basic theory, principles and applications.

UNIT-V LANTHANIDES AND ACTINIDES 15Hrs

a) Lanthanides:-

Occurrence- differences between 4f and 5f orbitals-Separation techniques (Fractional crystallisation, precipitation, ion-exchange, solvent-extraction and thermal decomposition- Selective reduction and oxidation)- Electronic configuration- Oxidation states, Lanthanide contraction- Spectral and Magnetic properties- Ln chelates-organometallic compounds of Ln. Uses of lanthanides **(shift reagents, Pu bomb)** and their compounds- aqueous chemistry of uranyl compounds- position in the periodic table.

b) Actinides:-

Synthesis of elements- Extraction of Th and U and Pu- electronic configuration and oxidation states, spectral and magnetic properties- position in the periodic table.

TEXT BOOKS:

1. Shriver D. F. and Atkins, P.W. 1999.Inorganic Chemistry, Oxford University Press, London.
2. Cotton F.A. and Wilkinson, G.1988. Advanced Inorganic Chemistry, Wiley-Interscience publications, John Wiley & Sons, V Edn. New York.
3. Gurdeep R. Chatwal & M. S. Yadav,1993 Coordination Chemistry, Himalaya Publishing House, I Edn..
4. Figgis, B.N, 1964.Introduction to Ligand Fields, Wiley Interscience, Eartern Ltd., I Edn., New Delhi.
5. Banerjea, D,1993. Coordination Chemistry, Tata McGraw- Hill Publishing Co. Ltd.,.
6. Purcell, K. F. Kotz, J.C. Holt Saunders,1977. Inorganic Chemistry, Philedelphia,USA.
7. Pradeep, T, A.2003 Textbook of Nanoscience and Nanotechnology Tata McGraw-Hill Education, New Delhi.
8. Drago, R. S. Van Nostrand and Reinhold,1976. Physical methods in Chemistry.
9. Nakamoto, Kazuo,1986. Infrared and Raman Spectra of Inorganic and coordination compounds, IV edition, John Wiley and Sons, New Yark.
10. Raymond Changm,1971. Basic principles of Spectroscopy, Mc Graw Hill, New Delhi.
11. Straughan B. P. and Walker S. 1976. Spectroscopy Vol.3, Chapman and Hall, New Delhi.

REFERENCES:

1 Douglas and McDaniel, A 2002.Concise of Inorganic Chemistry,Oxford and IBH Publishing Company (P) Ltd., New Delhi.

2 E. Huheey, Ellen A. Keiter, Richard L. Keiter,2004. Inorganic Chemistry, IV Edn., Pearson Education (Singapore) (P).Ltd., Delhi.

3 Wahid U. Malik, G. D. Tuli and R. D. Madan, 2006.Selected Topics in Inorganic Chemistry, S. Chand & Co. Ltd., New Delhi.

4 William W. Porterfield, 2005.Inorganic Chemistry, Elsevier, II Edn., New Delhi.

5 A.G. Sharpe, 2004.Inorganic Chemistry, Addition – Wesley Longman, UK III Edn.

6 Gary L. Miessler and Donald A. Tarr, 20004.Inorganic Chemistry, Pearson Education, Inc., 3rd Edn., New Delhi.

7 Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons and Burkhard Raguse2005. Nano technology-Basic Science and Emerging Technologies, Overseas Press India (P). Ltd. New Delhi Ist Edn, .
8 Mark Ratner and Daniel Ratnar, 2003.Nanotechnology-A Gentle Introduction to the Next Big Idea, Pearson Education Inc., US
9 D.N. Sathyanarayana, 2001 Electronic Absorption Spectroscopy and Related Techniques, Universities Press (India) Limited.

Unit	Topic	No. of Lecture Hours
I	**Coordination Chemistry-I**	**15**
1.1	Nomenclature of coordination complexes-Stereochemistry of coordination.	3
1.2	Geometrical isomerism- optical isomerism of complexes having C.N.4,6 Compound.	2
1.3	stability constants of complexes-stepwise and overall stability constant- their determination.	2
1.4	Jobs' continuous variation method-Chelate effect	2
1.5	CFT. LFT and MO theories.	2
1.6	Influence of ligands on crystal field splitting- Octahedral and Tetrahedral splitting of "d" orbitals, CFSE.	2
1.7	Spectrochemical series- Nephelauxetic effect– John Teller effect-site preferences.	1
1.8	Spectral properties of complexes- Magnetic properties- Para, Dia, ferro magnetism and antiferro magnetism	1
1.9	Determination of magnetic properties – Gouy's method.	1
II	**Coordination Chemistry-I**	**15**
2.1	Substitution reactions- lability-inertness- square planar substitution reactions	2
2.2	Trans effect- Theories of Trans effect	2
2.3	Factors affecting reactivity of square planar complexes	2
2.4	Stereo chemistry of substitution in octahedral complexes.(SN1,SN2,SNiCB)	2
2.4	Reactions of coordinated ligands- Acid hydrolysis- anation reactions and base hydrolysis.	2
2.5	Mechanism of electron transfer reactions- Outer sphere, inner sphere electron transfer reactions	2
2.6	Marcus Theory and its applications	3
2.7	Synthesis of coordination compounds using electron transfer and substitution reaction	2
III	**CHEMISTRY OF NANOSCIENCE AND TECHNOLOGY**	**15**
3.1	Introduction- Types of nano materials-Nanoparticles, nanotubes-Carbon nanotubes: SWCNT and MWCNT,nanowires,nanoribbons,nanorods, nano composites.	2
3.2	Preparation methods-Chemical vapour deposition, Sol-Gel method, Electrodeposition method, Ball milling method, Chemical reduction method, spin coating technique, Solvothernal synthesis, Colloidal method, Co-precipitation method,Flame spray synthesis(Arc Plasma.	2
3.3	Peparation of metal oxide nanoparticles.	2
3.4	Properties of nanoparticles-Optical, mechanical, magnetic,electrical, thermal properties.	2
3.5	Characterisation Techniques like SEM,TEM,AFM, XRD, UV-DRS, B.E.T analysis , DLS, PL.	2
3.6	Applications of Nanoparticles	2
	Revision and test	3

IV	**PHYSICAL METHODS IN INGORGANIC CHEMISTRY-I**	**15**
4.1	Electronic spectra : selection rules – polarization – splitting of spectral terms.	2
4.2	L.S Coupling scheme- Russel- Saunders method- Term Symbols	2
4.3	Orgel and Tanabe-Sugano diagram	2
4.4	Effect of distortion and spin orbit coupling. Evaluation of 10 Dq and beta for octahedral Ni and tetrahedral Co complexes.	2
4.5	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.	2
4.6	kinetics of rearrangement reaction and metal chelates.	3
4.7	Fluxional NMR of metal carbonyls and allyl complexes.	2
4.8	paramagnetic NMR and contact and pseudo contact shifts.	
4.9	NQR- Basic theory, principles and applications.	
V	**LANTHANIDES AND ACTINIDES**	**15**
5.1	Lanthanides:-Occurrence- differences between 4f and 5f orbitals.	1
5.2	Separation techniques (Fractional crystallisation, precipitation, ion-exchange, solvent-extraction and thermal decomposition- Selective reduction and oxidation)-	1
5.3	Electronic configuration- Oxidation states, Lanthanide contraction- Spectral and Magnetic properties- Ln chelates-organometallic compounds of Ln.	1
5.4	Lanthanides as shift reagents in NMR- uses of lanthanides and their compounds	1
5.5	Aqueous chemistry of uranyl compounds- position in the periodic table.	1
5.6	Actinides:- Synthesis of elements- Extraction of Th and U and Pu.	1
5.7	electronic configuration and oxidation states, spectral and magnetic properties- position in the periodic table.	2

Course Designers1. Dr.A.Suganthi2. Dr.A. Elangovan3. Dr.D.S. Bhuvaneshwari
4. Dr.K.Selvakumar

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
PCF19C33	**Physical Chemistry-I1I**	Core-9	5	-	-	4

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

Preamble

This course has been framed to enable the students to gain knowledge on basic and applications of group theory, spectroscopic techniques such as IR, Raman, UV, PES, ESR, and NQR.

Prerequisites

Basic knowledge on fundamental terms, definitions and concepts of group theory. Also the basic principles, instrumentation and applications of spectroscopic techniques such as IR, UV-Vis, microwave at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Summarise the fundamentals ofgroup theory.	K1, K2
CO2	Analyze the applications of group theory.	K4
CO3	Apply the concepts of spectroscopic techniques such as IR, Raman and microwave.	K3
CO4	Interpret the physical concepts of electronic and Photo electron spectroscopy.	K5
CO5	Apply the theory and applications of ESR, Mossbauer and NQR spectroscopic techniques.	K3

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

Mapping of COs with PSOs

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

UNIT – I **15 Hrs**

GROUP THEORY – I (Basics of Group Theory)

(i) Introduction - Symmetry elements and symmetry operations - Definition of mathematical group – four cardinal properties of a group – closure, associative, idendity and inverse rule – cyclic group – Abelian group (H_2O only) and non-abelian group (NH_3 only) – Group multiplication table- C_2v and C_3v; subgroup – similarity transformation – class of group –Point group – Assignment of point group of simple molecules;

(ii) Matrix-introduction - matrix representation of the symmetry operations – idendity (E), Proper axis of rotation (C_n), Vertical reflection (σ_v), Improper axis of rotation (S_n) and Inverse (i); (iii) Representation definition – reducible and irreducible representation of a group –block factorization. The great orthogonality theorem (GOT) – rules for writing (properties of) irreducible representations – Projection operator (definition only) – character table definition – construction of character table C_{2V} and C_{3V}.

UNIT – II

GROUP THEORY – II (Applications of Group Theory) **15 Hrs**

Prediction of symmetry of atomic orbitals - linear vector, rotation vector – symmetries of tensor like properties (α & g); Prediction of orbitals and hybridization in BF_3 and CH_4 molecules ; Normal mode analysis – H_2O and NH_3; Direct product representation and its applications – identification of IR and Raman active vibration of H_2O and N_2F_2 – selection rules to predict allowed and forbidden electronic transition in UV-Visible spectra for example formaldehyde (HCHO); HMO energy calculation for ethylene and butadiene.

UNIT – III SPECTROSCOPY - I **15 Hrs**

Absorption and emission of electromagnetic radiation (emr) – LASER — Interaction of electromagnetic radiation with matter – Einstein coefficients; Microwave, IR and Raman spectroscopy of diatomic molecules – determination of molecular parameters – vibrational spectra of polyatomic molecules – IR and Raman active modes – overtone and combination bands – Fermi resonance – group frequencies and coupling interaction.

UNIT – IV SPECTROSCOPY – II **15 Hrs**

Electronic spectra of diatomic molecules – molecular quantum numbers – dissociation energy calculations – Birge-sponer extrapolation technique – pre-dissociation spectra – charge transfer spectra – Fortrat diagram – electronic spectra of molecules – absorbance – oscillator strength;

Photoelectron spectroscopy – basic principles, spectrum, X-ray PES, (ESCA) – vibrational structure – koopman‘s theorem – PES of argon, oxygen and nitrogen.

UNIT – V

SPECTROSCOPY - III **15 Hrs**

ESR spectroscopy – principle, g-factor, experimental method, spectrum, fine and hyperfine structures and applications (H-atom, CH_3 radical, *p*-1,4 benzosemiquinone radical anion, naphthalene anion, Tempol)

NQR spectroscopy – quadrupole movement, coupling constant, quadrupole transition-electric field gradient and molecular structure ($_7N^{14}$, $_5B^{11}$, $_{17}Cl^{36}$)

Mossbauer spectroscopy – recoilless emission and resonance absorbtion, experimental method, isomeric shift and electric quadrupole splitting in Fe^{57}.

TEXT BOOKS: (UNIT I & II)

1. Ccotton F.A., 1971, Chemical applications of group theory, 3rd edt. wiley eastern Ltd., UK.
2. Ramakrishnan, V., Gopinathan M.S., 1988, Group theory in chemistry, Vishal pub, New delhi,
3. Veera Reddy, K. 1998, Symmetry and spectroscopy of molecules, New age International (p) Ltd., New Delhi.

REFERENCE BOOKS:

1. G.M. Barrow, Introduction to molecular spectroscopy, McGraw-Hill, Newyork.
2. Banwell G.M., Fundamentals of molecular spectroscopy, IV Edn., TMH company Ltd.
3. Chang R., 1971, Basic principles of spectroscopy, McGraw-Hill.
4. Straughan B.P., Walker S., 1976, Spectroscopy – Vol. 1, 2 and 3, Chapman and Hall.
5. Drago R.S., 1999, Physical methods in chemistry, Saunder college publishing.

Course Designed by

1. Dr. R. Sayeekannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan

UNIT	**TOPIC**	**No. of lecture hrs**
I	**GROUP THEORY – I (Basics of Group Theory)**	15
1.1	(i) Introduction - Symmetry elements and symmetry operations.	1
1.2	Definition of mathematical group – four cardinal properties of a group – closure, associative, idendity and inverse rule.	2
1.3	cyclic group – Abelian group (H_2O only) and non-abelian group (NH_3 only).	1
1.4	Group multiplication table- C_2v and C_3v; subgroup – similarity transformation – class of group –Point group – Assignment of point group of simple molecules.	2
1.5	(ii) Matrix-introduction - matrix representation of the symmetry operations – idendity (E), Proper axis of rotation (C_n), Vertical reflection (σ_v), Improper axis of rotation (S_n) and Inverse (i).	2
1.6	(iii) Representation definition – reducible and irreducible representation of a group –block factorization.	2
	The great orthogonality theorem (GOT) – rules for writing	2

	(properties of) irreducible representations – Projection operator (definition only).	
1.7	character table definition – construction of character table C_{2V}, C_{3V}, D_{3h} and Td point groups.	3
II	**GROUP THEORY – II (Applications of Group Theory)**	15
2.1	Prediction of symmetry of atomic orbitals - linear vector, rotation vector – symmetries of tensor like properties (α & g);	2
2.2	Prediction of orbitals and hybridization in BF_3 and CH_4 molecules.	3
2.3	Normal mode analysis – H_2O and NH_3.	2
2.4	Direct product representation and its applications – identification of IR and Raman active vibration of H_2O and NH_3.	3
2.5	selection rules to predict allowed and forbidden electronic transition in UV-Visible spectra for example formaldehyde (HCHO).	2
2.6	HMO energy calculation for ethylene and butadiene.	3
III	**SPECTROSCOPY -I**	15
3.1	Absorption and emission of electromagnetic radiation (emr).	3
3.2	LASER, Interaction of electromagnetic radiation with matter – Einstein coefficients.	3
3.3	Microwave, IR and Raman spectroscopy of diatomic molecules.	3
3.4	determination of molecular parameters – vibrational spectra of polyatomic molecules.	3
3.5	IR and Raman active modes – overtone and combination bands – Fermi resonance – group frequencies and coupling interaction.	3
IV	**SPECTROSCOPY - II**	15
4.1	Electronic spectra of diatomic molecules – molecular quantum numbers.	3
4.2	dissociation energy calculations – Birge – sponer extrapolation technique, pre-dissociation spectra – charge transfer spectra.	3
4.3	Fortrat diagram – electronic spectra of molecules – absorbance – oscillator strength.	3
4.4	Photoelectron spectroscopy – basic principles, spectrum, X-ray PES, (ESCA).	3
4.5	vibrational structure – koopman‘s theorem – PES of argon, oxygen and nitrogen.	3
V	**SPECTROSCOPY – III**	12
5.1	ESR spectroscopy – principle, g-factor, experimental method	2
5.2	ESR spectrum, fine and hyperfine structures and applications (H-atom, CH_3 radical, *p*-1,4 benzosemiquinone radical anion, naphthalene anion, Tempol).	2

5.3	NQR spectroscopy – quadrupole movement, coupling constant, quadrupole transition.	3
5.4	electric field gradient and molecular structure ($_{7}N^{14}$, $_{5}B^{11}$, $_{17}Cl^{36}$).	2
5.5	Mossbauer spectroscopy – recoilless emission and resonance absorbtion, experimental method, isomeric shift and electric quadrupole splitting in Fe^{57}.	3

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
PCF19CE31(A)	Computer applications in Chemistry	Core elective -2 (Option A)	5	-	-	5

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

Preamble

The course explains the concepts of internet programming, HTML, JAVA APPLET and their applications in chemistry. It gives hands-on experience on chemistry-related application softwares.

Prerequisites

Basic knowledge about internet, E-mail, HTML and Java programs.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Outline Internet protocols, online usage of internet, search engine, e-publication and electronic mail.	K1, K2
CO2	Make use of HTML and Java programs to chemistry.	K3
CO3	Analyze the chemical structures in scientific manner and get the mass and NMR simulations; and also get an idea about computational chemistry.	K4
CO4	Apply the knowledge of diffraction techniques to the study of structural chemistry; and understand the applications of shelx and PLATON software in crystallography.	K3
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 PSOs

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

UNIT-I: INTERNET AND E-MAIL T: 10 + P: 5 Hrs

INTERNET: Introduction- History- Importance of the Internet- Internet Access- Dial-Up connection, Direct connection and equipments –- Internet protocol(TCP/IP,FTP HTTP, TELNET and WAP)-Internet addressing – Domain Name-Mail address-Uniform Resource Locator(URL)-Web Browsing- Searching the Web- Search Engines(Yahoo, Google)- Intranet – Searching and utilizing Popular websites in Chemistry. On line literature survey- accessing of e-journals. Preparing articles for e-publications. Online structure drawing- Collection of spectral data using databases.

ELECTRONIC MAIL: Introduction-Working of E-Mail - Word processor for E-Mail- Mailing Basics – Composing and sending of an E-Mail- Address Book – Signature- File Attachments- Customizing your Mail program –Advantages and Disadvantages of E-Mail - Tips for effective E-Mail use- Smile keys.

UNIT- II: HTML T: 8 + P: 7 Hrs

HTML - Need- Structure of HTML Document- HTML Tags- Horizontal line Tags- Background and Text color Tags- Font Tags- MARQUEES Tags- Adding pictures - Ordered and Unordered Lists- Creating Links- Construction of Periodic Table with required data for first ten elements- Frames – Developing and hosting of Web Pages for a given molecule / chemical.

JAVA APPLETS: - Simple and Java applets with graphics- Applications of applet to draw 2D and 3D view of molecules.

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

Introduction- Tool Pallets- Construction of the molecule using Chem Draw- Tools- Manipulating a molecule-Model display- Display type- Structure displays- Molecular Surface display- NMR simulation and interpretation- Naming IUPAC- Structure from Name and Name from Structure- Computational Concepts: - Computational methods: - Potential energy surface, geometry Optimizations property (calculations)-Molecular Mechanics Theory in brief - Animations- Difference between Chemdraw and Chem 3D.

UNIT-IV: APPLICATIONS OF SHELX PROGRAM IN CHEMISTRY

T: 5 + P: 10 Hrs

Basics of Crystals- Symmetry and operations- Seven Crystal systems- Bravais lattices – X-Ray Diffractometers- Unit cell parameters- X-ray data- Deduction of Space group - Structure solution and refinement using SHELX- Structure building using PLATON- H-Bonding.

UNIT-V: APPLICATIONS OF RASMOL and MATLAB IN CHEMISTRY-III

: 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 Books:

1. . Alexis Leon and Mathews Leon. 1999.Fundamentals of Information Technology Leon TECH World, UBS Publishers & Distributors Ltd.
2. E. Balagurusmy,2003. Programming with Java- A Primer, , Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Edn., 15th Reprint
3. C. Xavier,2000 World wide web design with HTML, , Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Reprint.

Reference Books:

1. Margaret Levine Young,2001. Internet- Complete Reference, Tata McGraw-Hill Publishing Company Ltd., New Delhi.
2. Barbara Kassev,1998. Using the Internet, EE edition, New Delhi, IV Edition.
3.Alexis Leon and Mathews Leon,2000 Internet for Everyone, Leon TECH World, Publishers & Distributors Ltd..
4. John Zukowski,2000. Mastering Java 2, BPB Publications, New Delhi.
5 PatrickNaughten,2002. The Java Hand Book, Tata McGraw-Hill Publishing Company Ltd., NewDelhi, 11th Reprint.
6. Herbert Schildt,2001. Java 2- The Complete Reference, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 4th Edn.
7. Holzner, John Zukowski,1999. Java 2 Complete: Steven BPB Publications, New Delhi, 1st Indian Edn..
8. HarleyHahn,2001. The Internet Complete Reference, Tata McGraw-Hill Publishing Company Ltd., New Delhi, 2nd Edn.
9 Chem Draw & Chem 3D –Manual
10. Shelx, Rasmol and MATLAB- Manuals.

REFERENCES in the NET

1.http://SCS 99.unige. Che/eng/toc.html
2.http://hackberry.chem.niu.edu: to/o/webpage.html
3.http://java.Sun.Com/applet/applets/chemical Models/index.html

4.http://ccl.osc.edu/chemistry.html
5. http://www.umass.eud/microbio/rasmol/
6. 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. Tamilselvi

Unit	Topic	No. of lecture hrs (T+P)
1	**INTERNET AND E-MAIL**	10+5
1.1	**INTERNET:** Introduction- History- Importance of the Internet- Internet Access- Dial-Up connection, Direct connection and equipments –- Internet protocol(TCP/IP,FTP HTTP, TELNET and WAP)-Internet addressing – Domain Name-Mail address-Uniform Resource Locator(URL)-Web Browsing- Searching the Web- Search Engines(Yahoo, Google)- Intranet	3+2
1.2	Searching and utilizing Popular websites in Chemistry. On line literature survey- accessing of e-journals. Preparing articles for e-publications. Online structure drawing- Collection of spectral data using databases.	3+2
1.3	**ELECTRONIC MAIL:** Introduction-Working of E-Mail - Word processor for E-Mail- Mailing Basics – Composing and sending of an E-Mail- Address Book – Signature- File Attachments- Customizing your Mail program –Advantages and Disadvantages of E-Mail - Tips for effective E-Mail use- Smile keys.	3+1
1.4	Revision and test	1
2	HTML	8+7
2.1	HTML - Need- Structure of HTML Document- HTML Tags- Horizontal line Tags- Background and Text color Tags- Font Tags- MARQUEES Tags- Adding pictures - Ordered and Unordered Lists	3+2
2.2	Creating Links- Construction of Periodic Table with required data for first ten elements- Frames – Developing and hosting of Web Pages for a given molecule / chemical.	3+2
2.3	**JAVA APPLETS:** - Simple and Java applets with graphics- Applications of applet to draw 2D and 3D view of molecules.	2+3
2.4	Revision and test	1
3	**APPLICATIONS OF CHEMDRAW AND CHEM3D SOFTWARE IN CHEMISTRY**	8+7
3.1	Chemical drawing programs:- Chem- Draw and Chem 3D Introduction- Tool Pallets- Construction of the molecule using Chem Draw- Tools- Manipulating a molecule-Model display- Display type- Structure displays- Molecular Surface display- NMR simulation and interpretation- Naming IUPAC- Structure from Name and Name from	8+7

	Structure-Computational Concepts: - Computational methods: - Potential energy surface, geometry Optimizations property (calculations)-Molecular Mechanics Theory in brief - Animations- ***Difference between Chemdraw and Chem 3D.***	
4	***APPLICATIONS OF SHELX PROGRAM IN CHEMISTRY-II***	5+10
4.1	Basics of Crystals- Symmetry and operations- Seven Crystal systems. Bravais lattices- X-Ray Diffractometers- Unit cell parameters- X-ray data- Deduction of Space group- Structure solution and refinement using SHELX- Structure building using PLATON- H-Bonding.	5+10
5	APPLICATIONS OF RASMOL and MATLAB IN CHEMISTRY-III	8+7
	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.	4+4
	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).	4+3

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Course Code	Course title	Category	L	T	P	Credit
PCF19CE31(B)	**Advanced Organic Synthesis**	Core elective -2 (Option B)	5	-	-	5

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

Preamble

The course explains the concepts od retrosynthetic analysis, biogenesis of natural products, biosynthesis of fatty acids and biotransformation.

Prerequisites

Basic knowledge on natural products chemistry at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Outline the synthetic strategy of few structurally complicated organic molecules.	K1, K2
CO2	Make use of the biogenesis of natural products such as alkaloids, terpenoids and flavones.	K3
CO3	Examine the biosynthesis of fatty acids and few essential amino acids.	K4
CO4	Utilize the classification, preparation and uses of some important dyes.	K3
CO5	Evaluate biocatalysts such as enzymes, modifies enzymes and artificial enzymes to carry out various chemical reactions.	K5

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

Mapping of COs with PSOs

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

UNIT-I REETEROSYNTHETIC ANALYSIS (15 Hrs)

Synthetic Strategy of the following target molecules: longifolene-juvabione-jasmone-5-hexenoic acid-trans-9-methyl I-decalone- bicyclo (4,1,0) heptan-2 one- α-onocerin-isonootketone.

UNIT-II BIOGENESIS OF ALKALOIDS,TERPENOIDS & FLAVONES (15 Hrs)

Alkaloids(pyridine,phenanthrene and indole type)-nicotine-gramine-harmine-morphine-codine-terpenoids of classes with examples Lanosterol & Cholesterol from squalene-coumarins-carbohydrates-fructose-6-phosphate-xylose-5-phosphate-ribulose-5-phosphate-sucrose-amylose and amylopectin-flavones-proteins

Terpenoids: Geranyl diphosphate-Geraniol-Farnesol–Camphor-limonene-citronellol-caryophyllene(Corey methods) – santonin

UNIT-III BIOSYNTHESIS OF FATTY ACIDS (15 Hrs)

Introduction-acetate pathway-acetyl co-enzyme-A-biosynthesis of fatty acids-malonyl co-A-malonyl ACP-Acyl ACP-Acetoacetyl Co-A- biosynthesis of unsaturated fatty acids Major biosynthetic pathways: 1) Acetate-Malonate pathway: Biosynthesis of aromatic compounds, 2) Shikimic acid pathway ; Biosynthesis of essential amino acids – phenylalanine, tyrosine and tryptophan, carboxylic acid derivatives 3)Mevalonic acid pathway : Biosynthesis of mevalonic acid.

UNIT-IV: DYES (15 Hrs)

Introduction, various methods of dyeing, classification of dyes, nitroso dyes,Azodyes,-Fast green, Methyl Orange, Methyl Red, Fast Red, tripheylmethane dyes-Malachite green, Rosaniline, Aniline blue, Crystal violet, Xanethene dyes-Fluorescein,Rhodamine B, Anthroquinone dyes –Alizarin – Preparation and uses.

UNIT – V : BIOTRANSFORMATION (15 Hrs)

Advantages and disadvantages of Biocatalysts – Biocatalytic application. Hydrolytic reaction, reduction, oxidation, peroxidation – addition and elimination Reaction. Formation of C-C bond-glycosyl transfer reactions - Immobilisation – adsorbtion – ion binding entrapment into gels, into membranes – compartments – Micells and vesicles – modified and artificial enzymes – semisynthetic enzymes – catalytic antibodies.

Text Books:

1. R.K. Mackie, D.M. Smith and R.A.Aitken,1990. Guide book to Organic synthesis, Longman group, UK, 2n edition.
2. S.Warren, 1997.Organic synthesis, The disconnection approach, John Wiley & Son.
3. C.Daniel Gutsche, Calixarent,1989. Royal Society of Chemistry, Cambridge UK.

References:

1. Organnic Synthesis-Robert E.Ireland-Prantice Hall of India Pvt Ltd,NewDelhi.
2. Advanced Organic Chemistry-Reaction & Synthesis-Francis A.Corey & Richard J.Sundberg-V Edition-Springer.
3. Organic Chemistry-Francis A.Corey & Robert M.Giuliano-Tata McGraw-Hill Edition
4. Organic Chemistry-Natural Products Volume II-Dr.O.P.Agarwal-Goel Publishing House.
5. Chemistry of Carbocyclic Compounds-Azhuwalia
6. Pharmaceutical,Medicinal and Natural Product Chemistry-P.S.Kalsi & Sangeetha Jagtap-Narosa Publishing House
7. Organic Chemistry-Jonathan Clayden,Nick Greeves and Stuart Warren-Second Editiion-Oxford University Press
8. Synthetic Dyes-Gurudeep Chatwal
9. Biotransformation in Organic Chemistry-Kurt Faber-A Textbook-V Edition-Springer

Course designer

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

Course contents and lecture schedule

Unit	Topic	No. of lecture hrs
I	**RETEROSYNTHETIC ANALYSIS**	
1.1	Synthetic Strategy of the following target molecules: longifolene-juvabione-jasmone- 5-hexenoic acid-trans-9-methyl I-decalone- bicyclo (4,1,0) heptan-2 one- α-onocerin-isonootketone.	15
II	**BIOGENESIS OF ALKALOIDS,TERPENOIDS & FLAVONES**	
2.1	Alkaloids(pyridine,phenanthrene and indole type)-nicotine-gramine-harmine-morphine-codine- terpenoids of classes with examples Lanosterol & Cholesterol from squalene-coumarins-carbohydrates-fructose-6-phosphate-xylose-5-phosphate-ribulose-5-phosphate-sucrose-amylose and amylopectin-flavones-proteins.	10
2.2	Terpenoids: Geranyl diphosphate-Geraniol-Farnesol–Camphor-limonene-citronellol-caryophyllene(Corey methods) – santonin.	5
III	**BIOSYNTHESIS OF FATTY ACIDS**	
3.1	Introduction-acetate pathway-acetyl co-enzyme-A-biosynthesis of fatty acids-malonyl co-A-malonyl ACP-Acyl ACP-Acetoacetyl Co-A-biosynthesis of unsaturated fatty acids Major biosynthetic pathways: 1)	6

	Acetate-Malonate pathway:;	
3.2	Biosynthesis of aromatic compounds, 2) Shikimic acid pathway	2
3.3	Biosynthesis of essential amino acids – phenylalanine, tyrosine and tryptophan, carboxylic acid derivatives 3)Mevalonic acid pathway : Biosynthesis of mevalonic acid.	7
IV	**DYES** Introduction, various methods of dyeing, classification of dyes, nitroso dyes,Azodyes,-Fast green, Methyl Orange, Methyl Red, Fast Red, tripheylmethane dyes-Malachite green, Rosaniline, Aniline blue, Crystal violet, Xanethene dyes-Fluorescein,Rhodamine B, Anthroquinone dyes –Alizarin –Preparation and uses.	15
V	**BIOTRANSFORMATION**	
5.1	Advantages and disadvantages of Biocatalysts – Biocatalytic application.	2
5.2	Hydrolytic reaction, reduction, oxidation, peroxidation – addition and elimination Reaction.	4
5.3	Formation of C-C bond-glycosyl transfer reactions - Immobilisation – adsorbtion – ion binding entrapment into gels, into membranes – compartments –	5
5.4	Micells and vesicles – modified and artificial enzymes – semisynthetic enzymes – catalytic antibodies.	4

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Course Code	Course title	Category	L	T	P	Credit
PCF19C41	**Organic Chemistry - IV**	Core-10	4	-	-	4

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

Preamble

The course explains the chemistry of heterocyclic compounds, terpenoids, alkaloids, steroids, vitamins, peptides and nucleic acid. It also explains the importance of green chemistry and its applications.

Prerequisites

Students with basic knowledge about reagents, organic synthesis, thermal, photochemical and molecular rearrangement reactions at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Outline the chemistry of nitrogen and oxygen containing heterocyclic compounds and natural products.	K1, K2
CO2	Apply their knowledge on isolation, biological activity and structural studies of selective terpenoids and alkaloids	K1, K3
CO3	Analyze the structure and activity of compounds with steroid skeleton and vitamins.	K4
CO4	Explain the structure and synthesis of amino acids, peptides, proteins and nucleic acid.	K5
CO5	Apply their knowledge to synthesis compounds in a greener way.	K3

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

Mapping of COs with PSOs

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

Unit - I CHEMISTRY OF HETEROCYCLIC COMPOUNDS (12 hrs)

Heterocyclics – Nomenclature – Compounds containing two hetero atoms: Synthesis and reactivity of pyrazole, imidazole, oxazole, thiazole, quinoline and isoquinoline. diazines: the chemistry of pyridazine, pyrimidine and pyrazine – Comparison of basicity of diazines.
Introduction to anthrocyanins and flavonoids.

Unit - II CHEMISTRY OF TERPENOIDS AND ALKALOIDS (12 hrs)

Chemistry of terpenoids: General methods of determining structure of terpenoids – α-pinene, Zingiberene, and Abietic acid.
Chemistry of alkaloids: General methods of determining structure of alkaloids – Structure elucidation of (i) Morphine (ii) Reserpine.

Unit- III CHEMISTRY OF STEROIDS AND VITAMINS (12 hrs)

Chemistry of steroids : Introduction – Structural elucidation of Cholesterol – Androsterone and Testosterone (male sex hormones) – Oesterone, progesterone (Female sex hormone).
Classification of Vitamins: Nomenclature of Vitamins – Strucure and Biological functions of vitamins: Vitamin A (Retinol), Vitamin B2 (Riboflavin), Vitamin B6 (Pyridoxine), Vitamin B12, Vitamin C, D and E (Structure elucidation and synthesis not required).

Unit IV CHEMISTRY OF PEPTIDES AND NUCLEIC ACID (12 hrs)

(c) Polypeptides – Classification - the peptide linkage - Structure of amino acids – 1^0, 2^0, 3^0 and quaternary structure) – Solid phase peptide synthesis (Merifield) – use of protecting groups and reagents – Structural elucidation of glutathione, thyroxin and oxytocin.
(d) Nucleosides, Nucleotides and Nucleic acids – structure and synthesis of nucleosides and nucleotides – Elementary treatment on the structure of DNA and RNA

Unit – V GREEN CHEMISTRY (12 hrs)

Green Chemistry: Importance and principles of Green chemistry - Solid state and Solvent free organic reactions – Solid supported reagents – Microwave assisted reactions - Sonochemical approach - Reactions in ionic liquids – supercritical CO_2 medium – aqueous medium - enzymatic and electrochemical methods.

Text Books:

1. I.L. Finar, 2005. Organic Chemistry, Vol. II, V Edition, ELBS, UK.
2. S.F. Dyke,1965 Chemistry of Vitamins, Interscience, Toronto,USA.

3. O.P. Agarwal,2002. Chemistry of Natural products, Vol. I and II, Himalaya Publishing House, New Delhi.
4. V.K. Ahluwalia, M. Kidwai 2006"New trends in Green Chemistry" Second Edition, Anamaya publishers, New Delhi.
5. Gurdeep Chatwal,1997. Organic Chemistry of natural products, Vol. I, Himalaya Publishing House New Delhi.
6. Morrison and Boyd, Organic Chemistry, Prentice-Hall of India private limited, New Delhi, 6th Edition.

Reference Books

1. Hermann Dugus, 2004.Bioorganic Chemistry, Springer International, III Edition, New Delhi,
2. D.L. Nelson and M.M. Cox,2008 Lehningers' Principal of Biochemistry, W.H. Freeman and Company, New York, 5th Edition.
3. L.F Fieser and M. Fieser, 1991.Steroids, Reinhold Press, Atlanta,USA.

Course designers

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A. Tamil Selvi

Unit	Topic	No. of lecture hrs
I	**CHEMISTRY OF HETEROCYCLIC COMPOUNDS**	12
1.1	Heterocyclics – Nomenclature	2
1.2	Compounds containing two hetero atoms: Synthesis and reactivity of pyrazole, imidazole, oxazole, isoxazole, thiazole, isothiazole, quinoline and isoquinoline.	4
1.3	diazines: the chemistry of pyridazine, pyrimidine and pyrazine – Comparison of basicity of diazines.	3
1.4	Chemistry of anthrocyanins and flavonoids.	2
1.5	Revision and test	1
II	**CHEMISTRY OF TERPENOIDS AND ALKALOIDS**	24
2.1	Chemistry of terpenoids: General methods of determining structure of terpenoids – α-pinene, α-cadinene, Zingiberene, Abietic acid and Heliangine.	6
	Chemistry of alkaloids: Alkaloids and Drugs: General methods of determining structure of alkaloids – Structure elucidation of (i) Morphine (ii) Reserpine (iii) Lysergic acid.	6
III	**CHEMISTRY OF STEROIDS AND VITAMINS**	
	Chemistry of steroids : Introduction – Structural elucidation of Cholesterol – Androsterone and Testosterone (male sex hormones) – Oesterone, progesterone (Female sex hormone).	6
	Classification of Vitamins: Nomenclature of Vitamins – Strucure and Biological functions of vitamins: Vitamin A (Retinol), Vitamin B2 (Riboflavin), Vitamin B6 (Pyridoxine), Vitamin B12 (Synthesis not	6

	included), Vitamin C, D and E	
IV	**CHEMISTRY OF PEPTIDES AND NUCLEIC ACID**	12
4.1	Polypeptides – Classification - the peptide linkage - Structure of amino acids – 1^0, 2^0, 3^0 and quaternary structure) – Solid phase peptide synthesis (Merifield) – use of protecting groups and reagents – Structural elucidation of glutathione, thyroxin and oxytocin.	7
4.2	Nucleosides, Nucleotides and Nucleic acids – structure and synthesis of nucleosides and nucleotides – Elementary treatment on the structure of DNA and RNA.	5
V	**GREEN CHEMISTRY AND ANTIBIOTICS**	12
5.1	Green Chemistry: Importance and principles of Green chemistry - Solid state and Solvent free organic reactions – Solid supported reagents – Microwave assisted reactions - Sonochemical approach - Reactions in ionic liquids – supercritical CO_2 medium – aqueous medium - enzymatic and electrochemical methods.	8
5.2	Antibiotics: Strucural features of following antibiotics (synthesis need not to be discussed): β-lactam antibiotic – Chloramphenicol.	4

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(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
PCF19C42	**Inorganic Chemistry – IV**	Core 11	4	-	-	4

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

Preamble

The course explains the synthesis, structure and reactivity or organometallic compounds and their catalytic applications, role of metal ion in biological systems, description of various inorganic physical methods, reaction mechanism of inorganic photochemistry.

Prerequisite

Basi knowledge on preparation and chemical properties of organometallic compounds, bioinorganic Chemistryand principle of photochemistry at undegraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Define the terms EAN, 18, 16-electron rule classify the organometallic compounds, structure and properties of organimetallic compounds such as metallocenes, alkenes, alkynes and arene complexes.	K1, K2
CO2	Explain the reaction mechanism and catalytic application of organometallic compounds.	K2, K3
CO3	Classify the essential and trace elements in biological systems to understand the functionality of various bio-inoranic molecules and application of metal complex in chelate and chemotherapy.	K4
CO4	Outline the principles of various spectral techniques like EPR, PES, IR, MBS etc and interpretation of the spectra.	K2, K3
CO5	Apply inorganic photochemical reactions to evaluate the reaction path and in photochemical energy conversion like solar cell, fuel cell etc.	K3, K5

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

Mapping of COs with PSOs

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

UNIT –I ORGANOMETALLIC CHEMISTRY –I 12 Hrs

Stability of organo metallic compounds- β hydrogen elimination- the sixteen and eighteen electron rule. Synthesis – structure and bonding in metal carbonyls – isoelectronic and isolobal analogy- use of IR in the structural elucidation of carbonyl compounds– metal nitrosyls – dinitrogen complexes. π donors-**Carboxylic ligands and complexes**. Synthesis structure bonding and reactivity of carbenes, carbines, metallocenes and other aromatic cyclopolyenes – Ferrocene – bonding and structure – sigma, pi and hapto nomenclature. Arene complexes – olefin – acetylene and pi allyl complexes.

UNIT – II ORGANOMETALLIC CHEMISTRY –II 12 Hrs

Catalysis involving organometallic compounds – properties of metals and ligands in homogeneous catalysis – oxidative addition and reductive elimination – hydrogen abstraction – activation of small molecules by complexation-agnostic interaction-insertion-alkyl migration-insertion and elimination-catalytic reactions- hydrogenation of olefins – Wilkinson's catalyst – hydroformylation –syn-gas-water gas shift reactions- oxidation of olefins – Wacker process – propylene polymerization - Olefin metathesis -Ziegler natta catalyst -cyclo oligomerisation of acetylene , butadiene- Reppe's catalyst . Mansanto's acetic acid synthesis-Fischer-Tropsch's synthesis of Synthetic gasoline.

UNIT –III BIO-INORGANIC CHEMISTRY 12Hrs

Essential and trace elements in biological systems –ion pump- metalloporphyrins – the porphyrine ring system – chlorophyll – photosynthetic electron transfer - Electron transport sequence – biological electron transfer – electron transfer agents – cytochromes – Hemoglobin – myoglobins – and synthetic oxygen carriers – nitrogen fixation – in vivo and in vitro – copper proteins-Metal complexes in medicine-Biomineralisation of iron-Metal complexes in medicine-Chelate therapy-Metals used for diagnosis and chemotherapy-metal-nucleic acid interactions.

UNIT-IV PHYSICAL METHODES IN INORGANIC CHEMISTRY-II 12Hrs

Electron paramagnetic resonance spectroscopy: Applications of hyperfine splitting and g factor to structural elucidation- Zero field splitting-Krammer's Degeneracy- EPR spectra of Cu (II) and Mn (II) in various site symmetry- covalency of metal-ligand bonding by EPR- study of dynamic processes in solids- Study of phase transition by Mn (II) – John Teller distortions in Cu (II) complexes.

Mossbauer spectroscopy: Basic principles- Doppler effect- Isomer shift- Electron nuclear hyperfine interactions- Quadrupole and magnetic interactions in the study of structure and bonding in Iron and Tin complexes and in Biological systems.

UNIT –V INORGANIC PHOTOCHEMISTRY 12 Hrs

Excited states of coordination complexes – properties of excited states charge transfer and energy transfer – photochemical pathways.

Photoredox reactions of Co(III) and Cr(III) complexes – photosubstitution reactions – photoaquation, photoanation and photorearrangements - Role of TiO_2 in solar energy conversion – Photoredox chemistry of Ruthenium bipyridyl and Ruthenium(II) poly pyridyl compounds-energy conversion and photochemical decomposition of water using Ru complexes- storage of solar energy.

TEXT BOOKS: -

1. Cotton F.A. and Wilkinson, G.1998. Advanced Inorganic Chemistry, Wiley- Interscience publications, John Wiley & Sons, V Edn. New York.
2. Wahid U. Malik, G.D. Tuli and R. D. Madan,2006. Selected Topics in Inorganic Chemistry, S. Chand & Co. Ltd., New Delhi,
3. Nakamoto, Kazuo, Paul J. McCarthy,1986. Spectroscopy and Structure of Metal Chelate Compounds, IV edition, John Wiley and Sons. Inc., New York.
4. Drago, R. S. Van Nostrand and Reinhold,1976. Physical Methods in Chemistry .
5. Purcell K.F. and Kotz J.C.,1977. Holt Saunders, Inorganic chemistry, Philadelphia.
6. Raymond Chang, 1971.Basic principles of Spectroscopy, Mc Graw Hill, New Delhi..
8. Straughan B. P. and Walker, S. 1976.Spectroscopy, Vol.3, Chapman and Hall, New York, .
9. T.C. Gibbs,1978. Principles of Mossbauer Spectroscopy, Chapman and Hall, New York.
10. Arthur W. Adamson & Paul D. Fleischauer, 1975Concepts of Inorganic Photochemistry, John Wiley & Sons. In., New York.

REFERENCE BOOKS: -

1. Huheey, J. E., Ellen A. Keiter, Richard L. Keiter,2004. Inorganic chemistry, IV Edn., pearson Education (Singapore) (P) .Ltd., Delhi.
2. Wahid U. Malik, G.D. Tuli and R. D. Madan, 2006.Selected Topics in Inorganic Chemistry, S. Chand & Co.Ltd., New Delhi.
3. A.G. Sharpe,2004.Inorganic Chemistry, III Edn., Addition – Weskey Longman, UK .
4. Gary L. Miessler and Donald A. Tarr, 2004.Inorganic Chemistry, Pearson Education, Inc., 3rd Edn., New Delhi.
5. D. F. Shriver and P.W. Atkins,1999. Inorganic Chemistry, Oxford University Press,
6. London.
7. K. Hussain Reddy,2005. Bioinorganic Chemistry, New Age International (P) Ltd., Delhi.
8. William W. Porterfield, 2005.Inorganic Chemistry, II Edn., Elsevier, New Delhi..

Course Designers Dr.A.SuganthiDr.A. ElangovanDr.D.S. Bhuvaneshwari

1 Dr.K.Selvakumar

Course Contents and Lecture Schedule

Unit	Topic	No. of Lecture Hours
I	**Organometallic Chemistry-I**	
1.1	Stability of organo metallic compounds- β hydrogen elimination.	2
1.2	Synthesis – structure and bonding in metal carbonyls – isoelectronic and isolobal analogy	2
1.3	the sixteen and eighteen electron rule	1
1.4	use of IR in the structural elucidation of carbonyl compounds	2
1.5	metal nitrosyls – dinitrogen complexes. π donors	2
1.6	Synthesis structure bonding and reactivity of carbenes, carbines, metallocenes and other aromatic cyclopolyenes	1
1.7	Ferrocene – bonding and structure – sigma, pi and hapto nomenclature.	1
1.8	Arene complexes – olefin – acetylene and pi allyl complexes.	1
II	**OrganometallicChemistry-II**	
2.1	Catalysis involving organometallic compounds – properties of metals and ligands in homogeneous catalysis.	1
2.2	Oxidative addition and reductive elimination – hydrogen abstraction.	1
2.3	Activation of small molecules by complexation-agnostic Interaction.	1
2.4	insertion-alkyl migration-insertion and elimination-catalytic reactions.	2
2.4	Hydrogenation of olefins – Wilkinson's catalyst – hydroformylation –syn-gas-water gas shift reactions- oxidation of olefins – Wacker process.	2
2.5	propylene polymerization - Olefin metathesis -Ziegler natta catalyst -cyclo oligomerisation of acetylene , butadiene.	2
2.6	Reppe's catalyst . Mansanto's acetic acid synthesis.	3
2.7	Fischer-Troppe's synthesis of Synthetic gasoline.	2
III	**Bio-Inorganic Chemistry**	
3.1	Essential and trace elements in biological systems –ion pump.	1
3.2	Metalloporphyrins – the porphyrine ring system.	1
3.3	Chlorophyll – photosynthetic electron transfer - Electron transport sequence – biological electron transfer.	1
3.4	Electron transfer agents – cytochromes.	2
3.5	Hemoglobin – myoglobins – and synthetic oxygen carriers.	2
3.6	Nitrogen fixation – in vivo and in vitro.	1
3.7	copper proteins-Metal complexes in medicine-Biomineralisation of iron.	2
3.8	Metal complexes in medicine-Chelate therapy- Metals used for diagnosis and chemotherapy-metal-nucleic acid interactions.	2
IV	**PHYSICAL METHODS IN INORGANIC CHEMISTRY-II**	
4.1	Electron paramagnetic resonance spectroscopy: Applications of hyperfine splitting and g factor to structural elucidation- Zero field splitting-Krammer's	3

	Degeneracy.	
4.2	EPR spectra of Cu (II) and Mn (II) in various site symmetry- covalency of metal-ligand bonding by EPR- study of dynamic processes in solids- Study of phase transition by Mn (II) – John Teller distortions in Cu (II) complexes.	3
4.3	Mossbauer spectroscopy: Basic principles- Doppler effect- Isomer shift.	2
4.4	Electron nuclear hyperfine interactions- Quadrupole and magnetic interactions in the study of structure and bonding in Iron and Tin complexes and in Biological systems.	4
V	**Inorganic Photochemistry**	
5.1	Excited states of coordination complexes – properties of excited states charge transfer and energy transfer – photochemical pathways.	2
5.2	Photoredox reactions of Co(III) and Cr(III) complexes	2
5.3	photosubstitution reactions – photoaquation, photoanation and photorearrangements.	2
5.4	Role of TiO_2 in solar energy conversion.	2
5.5	Photoredox chemistry of Ruthenium bipyridyl and Ruthenium(II) poly pyridyl compounds.	1
5.6	Eenergy conversion and photochemical decomposition of water using Ru complexes.	1
5.7	Storage of solar energy.	2

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Course Code	Course title	Category	L	T	P	Credit
PCF19C43	**Physical Chemistry-IV**	Core-12	4	-	-	4

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

Preamble

The course enables the students to gain knowledge on theories and concepts of chemical kinetics, photochemistry, surface chemistry and polymer chemistry.

Prerequisites

Basic knowledge on fundamental concepts and theories of chemical kinetics, photochemistry, surface chemistry and chemistry of polymers at undergraduate level.

Course Outcomes

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

#	Course Outcome	Knowledge level
CO1	Understand the fundamental concepts on kinetics and reaction rate.	K1, K2
CO2	Develop knowledge on various theories of chemical kinetics.	K3
CO3	Analyze the physical concepts of photochemistry.	K4
CO4	Make use of the kinetics and theories of surface chemistry.	K3
CO5	Explain the basics and applications on polymer chemistry.	K5

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

Mapping of COs with PSOs

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

UNIT-I **(12 hrs)**

CHEMICAL KINETICS-I

Simple Collision theory- modification - Absolute reaction rate theory (ARRT) - Statistical and thermodynamics formulation - Comparison of ARRT with collision theory- Significance of entropy of activation- Relation between ΔH and Ea- Transmission co-efficient; ARRT of termolecular reactions – Unimolecular reactions - Lindemann, Hinshelwood, RRKM and Slater treatments. – solution kinetics – ARRT of reaction in solution – Influence of ionic strength on the rates of ionic reactions (salt effects).

UNIT-II **(12 hrs)**

CHEMICAL KINETICS-II

Fast reactions-flow and relaxation techniques, Temperature Jump and pressure jump method - complex reactions – opposing, consecutive and parallel reactions; Chain reaction – kinetics and general characteristic – H_2 - Br_2 reaction, Rice – Herzfeld mechanism for decomposition of acetaldehyde & ethane – Branched chain reaction – study of H_2-O_2 explosive reaction- homogeneous catalysis – acid, base catalysis.

UNIT-III **(12 hrs)**

PHOTOCHEMISTRY

Physical properties of the electronically excited molecules – radiationless transitions – Jablonski diagram-Internal conversion and intersystem crossing – Stern-Volmer equation and its application – radiative transition – fluorescence, phosphorescence and other deactivation processes; Effect of temperature on emission process – photosensitization and Chemiluminescence; Experimental techniques in photochemistry, chemical actinometers.

photochemical Kinetics of H_2-X_2 reactions – Photolysis of acetaldehyde Photodimerisation of anthracene – Photoequation of $[Cr(NH_3)_5NCS]^{2+}$ and photo isomerisation of Cis-bis glycinato Pt(II); Applications of photochemistry – Solar energy conversion and storage – photo synthesis- excited state acidic property and energy transfer.

UNIT-IV **(12 hrs)**

SURFACE CHEMISTRY

Physisorption and Chemisorption – adsorption isotherm – derivation of Langmuir and Freundlich, derivation of B.E.T equation of multilayer adsorption – application of BET equation to surface area determination, derivation of Gibbs adsorption isotherm. Heterogeneous catalysis and their kinetics – chemical reactions on solid surfaces - Mechanism & Kinetics of unimolecular and bimolecular surface reactions – Langmuir –Hinshelwood, Langmuir –Ridel mechanism, ARRT of surface reactions; Basic concepts of Micelles and Reverse Micelles.

UNIT-V **(12 hrs)**

POLYMER CHEMISTRY

Introduction of Polymers – Classification-Tacticity - Polymerisation - Addition, Co-polymerisation and Condensation polymerisation – Kinetics of polymerization-Free radical Chain polymerization-Cationic- anionic polymerization- Molecular weight determination – Osmotic pressure methods-Light Scattering method-Ultra Centrifuge and Viscosity methods;

Classification of Plastics-Thermosetting & Thermoplastic resins-Adhesives-Compounding of Plastic - Fabrication - compression moulding, injection moulding, extrusion moulding and Blow moulding.

Industrially important polymers – Preparation, Properties and uses of (LDPE & HDPE), Polystyrene, polyester, acrylo polymer, Teflon, Phenolic resins, amino resins and epoxy resins, Polyvinyl acetate-composites of Resins-ABS-Conducting Polymers-Polyacetylene, Polyaniline, Inorganic polymer-Silicone and Biopolymers-cellulose.

Text Books:

1. Glasstone S., 1974, Textbook of Physical chemistry, III Edition McMillan, Alasca.
2. Daniels F., Alberty, R.A. 1974, Physical Chemistry, John willey and sons , UK.
3. Moore, W.J. 1972, Physical Chemistry, V Edition, Orient Longman, UK.
4. Billmeyer Jr F.W., 1984, A text book of Polymer Chemistry – III edition, John Willey and Sons, UK.
5. Gowarikar V *et al*., 1986, Polymer Science, Willey Eastern Limited, New York.
6. Rodriguez F., 1987, Principles of polymer chemistry, Tata McGraw- Hill Publishing Co. Ltd., New Delhi, India.

Reference Books:

1. Laidler K.J., 2005, Chemical Kinetics, II Edition, Tata McGraw Hill, UK.
2. Frost A.A., Pearson R.G., 1990, Kinetics and Mechanism, New York.
3. Wilkinson F., 2000, Chemical Kinetics and Reaction Mechanism, Var Nostrard Reinhold Co., New York.
4. Rohatgi-Mukherjee K.K., 1999, Fundamentals of Photochemistry, Wiley Eastern Ltd., Revised edition, New York.
5. Adamson A.M., 2002, Physical Chemistry of Surfaces, V.Edition, John Willey, UK.
6. Laider, K.S., 2005, Chemical kinetics, III Edition, TMH, New York.
7. Allcock H.R., Lampe W., 1991, Contemporary polymer chemistry, Prentice Hall UK.
8. Young, 2002, Polymer Chemistry II, Chapman Hall.
9. Arora Singh, 2001, Polymer Chemistry, Anmol Publications Pvt. Ltd.

Course Designers

1. Dr. R. Sayee Kannan
2. Dr. A. R. Ramesh
3. Dr. T. Arumuganathan

Course contents and lecture schedule

UNIT	TOPIC	LECTURE Hrs
I	**CHEMICAL KINETICS-I**	**12**
1.1	Simple Collision theory- modification - Absolute reaction rate theory (ARRT).	2
1.2	Statistical and thermodynamics formulation - Comparison of ARRT with collision theory.	2
1.3	Significance of entropy of activation- Relation between ΔH and Ea-	2

	Transmission co-efficient.	
1.4	ARRT of termolecular reactions – Unimolecular reactions - Lindemann, Hinshelwood.	3
1.5	RRKM and Slater treatments. –Solution kinetics – ARRT of reaction in solution – Influence of ionic strength on the rates of ionic reactions (salt effects).	3
II	**CHEMICAL KINETICS-II**	12
2.1	Fast reactions-flow and relaxation techniques, Temperature Jump and pressure jump method.	2
2.2	Complex reactions – opposing, consecutive and parallel reactions.	3
2.3	Chain reaction – kinetics and general characteristic – H_2-Br_2 reaction.	2
2.4	Rice – Herzfeld mechanism for decomposition of acetaldehyde & ethane – Branched chain reaction.	3
2.5	Study of H_2-O_2 Explosive reaction- Homogeneous catalysis – acid, base catalysis.	2
III	**PHOTOCHEMISTRY**	12
3.1	Physical properties of the electronically excited molecules – radiationless transitions – Internal conversion and intersystem crossing.	2
3.2	Stern-Volmer equation and its application; radiative transition – fluorescence, phosphorescence and other deactivation processes.	3
3.3	Effect of temperature on emission process – photosensitization and Chemiluminescence; Experimental techniques in photochemistry, chemical actinometers.	2
3.4	Photochemical Kinetics of H_2-X_2 reactions – Photolysis of acetaldehyde Photodimerisation of anthracene – Photoequation of $[Cr(NH_3)_5NCS]^{2+}$ and photo isomerisation of Cis-bis glycinato Pt(II).	3
3.5	Applications of photochemistry – Solar energy conversion and storage – photo synthesis.	2
IV	**SURFACE CHEMISTRY**	12
4.1	Physisorption and Chemisorption – adsorption isotherm – derivation of Langmuir and Freundlich	3
4.2	derivation of B.E.T equation of multilayer adsorption –application of BET equation to surface area determination, derivation of Gibbs adsorption isotherm.	3
4.3	Heterogeneous catalysis and their kinetics – chemical reactions on solid surfaces - Mechanism & Kinetics of unimolecular and bimolecular surface reactions-Langmuir –Hinshelwood, Langmuir – Ridel mechanism, ARRT of surface reactions;	5
4.4	Basic concepts of Micelles and Reverse Micelles.	1
V	**POLYMER CHEMISTRY**	**13**
5.1	Introduction of Polymers –Classification-Tacticity - Polymerisation - Addition, Co-polymerisation and Condensation polymerization.	2
5.2	Kinetics of polymerization-Free radical Chain polymerization-Cationic- anionic polymerization.	1
5.3	Molecular weight determination – Osmotic pressure methods- Light Scattering method-Ultra Centrifuge and Viscosity methods.	2
5.4	Classification of Plastics-Thermosetting & Thermoplastic resins.	2
5.5	Adhesives-Compounding of Plastic - Fabrication - compression moulding, injection moulding, extrusion moulding and Blow moulding.	2
5.6	Industrially important polymers – Preparation, Properties and uses of	3

	(LDPE & HDPE), Polystyrene, polyester, acrylo polymer, Teflon, Phenolic resins, amino resins and epoxy resins, Polyvinyl acetate.	
5.7	Composites of Resins-ABS-Conducting Polymers-Polyacetylene, Polyaniline, Inorganic polymer-Silicone and Biopolymers-cellulose.	1

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Course Code	Course title	Category	L	T	P	Credit
PCF19CL41	**Organic Chemistry Lab-2**	Core Lab - 4	-	-	4	4

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

Preamble

This lab course describes the double stage preparation of organic compounds and quantitative estimation organic compounds such as ketone, amino acid and glucose.

Prerequisites

Laboratory skill on estimation and preparation of simple organic compounds at undergraduate level.

Course Outcomes

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

#	Course Outcome
CO1	Gain practical skill on multi step synthesis of organic compounds.
CO2	Orient the skill of writing the reaction mechanism of the synthesized compounds.
CO3	Estimate the amount of glucose by adopting different procedures.
CO4	Apply iodometric method to estimate Ketonic compound.
CO5	Estimate amino acid viz., Glycine.

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

DOUBLE STAGE PREPARATION

1. p-Nitroaniline
2. p-Bromoaniline
3. 1,3,5-Tribromobenzene

4. Benzanilide

5. m-Nitrobenzoic acid

6. p-Iodonitrobenzene (III stage)

7. 2,5-dihydroxy acetophenone

(any five preparations only)

ESTIMATION

1. Estimation of glucose – Lane and Eynon method

2. Estimation of glucose-Betrand method

3. Estimation of ethyl methyl ketone

4. Estimation of acetone

5. Estimation of glycine

Course Designers

1.Dr. P. Prakash

2.Dr. R. Mahalakshmy

THIAGARAJAR COLLEGE, MADURAI- 9

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

DEPARTMENT OF CHEMISTRY

(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
PCF19CL42	**Inorganic Chemistry lab-2**	Core Lab - 5	-	-	4	4

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

Preamble

This lab course enables the students to acquire practical knowledge on quantitative estimation of inorganic metal ions by gravimetric and colorimetric methods. Also enhances the laboratory skill of preparing simple inorganic complexes and gives hands on training on chromatographic and UV-Vis spectrophotometric techniques.

Prerequisites

Laboratory skill on quantitative estimation of metal ions and preparation of simple inorganic metal complexes at undergraduate level.

Course Outcomes

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

#	Course Outcome
CO1	Estimate inorganic metal ions such as lead, nickel and magnesium by gravimetric estimation.
CO2	Determine iron or copper by colorimetric method.
CO3	Prepare potassium cupricsulphate and Potassium trioxalatoaluminate complexes.
CO4	Prepare coordination complexes such as Hexathioureaplumbusnitrate, Tetrammine copper(II)sulphate and Ferrous/Ferric oxalate in the laboratory.
CO5	Explain the principle and application of chromatorgraphic and UV-Vis specrophotometric techniques.

Mapping of COs with POs

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

S-Strong; M-Medium; L-Low

I. ESTIMATIONS: By VOLUMETRIC METHOD By GRAVIMETRIC METHOD (Any FOUR)

1. Estimation of COPPER and NICKEL
2. Estimation of CALCIUM and MAGNESIUM
3. Estimation of BARIUM and ZINC
4. Estimation of IRON and NICKEL
5. Cement Analysis
6. Estimation of Paracetamol
7. Pesticide analysis

II. PREPARATIONS(Any FIVE)

1. Tetramminecopper(II) sulphate
2. Potassium cupricsulphate
3. Potassium trioxalatoaluminate(III)
4. Sodium nitroprusside
5. Trithioureacopper(II) sulphate
6. Pentathioureadicuprous nitrate
7. Hexathioureaplumbus nitrate
8. Nitropentamminecobalt(III)
9. DithiocyanatotetrapyridineIron(III)
10. Potassium troxalatoferrate III
11. Preparation and Analysis of $K_2[Cu(ox)_2].2H_2O$

III. Colorimetry: (Any ONE)

a) Estimation of Iron (III)
b) Estimation of Copper (II)

IV. Chromatography (Demo only NOT for the Exam)

a) Paper Chromatography: Chromatographic separation of a mixture of Co, Mn, Ni and Zn
b) Column Chromatography: Chromatographic separation of potassium permanganate and dichromate**.**

V. UV-visible spectrophotometer (Demo only NOT for the Exam)
Determination stability constant for a complex.

Total Marks = 100 (Internal 40 + External 60)

Course Designers
1. Dr. A. Suganthi
2. Dr. D. S. Bhuvaneshwari

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
PCF19CSL43	**Synthesis & spectral analysis**	Special lab-2	-	-	4	4

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

Preamble

The course has been framed to develop both laboratory skill as well as technical skill of handling the spectroscopic instruments.

Prerequisite

Students with basic laboratory skill on preparationof simple inorganic metal complexes and organic compounds at undergraduate level.

Course Outcomes

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

	Course Outcomes
CO1	Synthesize any given of organic compounds.
CO2	Prepare any inorganic metal complexes.
CO3	Compare the spectral data of compounds which are recorded in solution and vapour phase.
CO4	Intepret the UV-Vis and IR spectral data.
CO5	Handle spectroscopic instrumentS.

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

I. Characterization of the following complexes by electronic and IR spectral data.

(i) Tetraammine Copper (II) sulphate

(ii) Zinc-Oxine

(iii) Nickel-DMG

II. Study the folllowing reaction using IR and UV spectra.

(i) benzophenone → benzophenone oxime

(ii) acetone + benzaldehyde → dibenzalacetone

(iii) salicylic acid → aspirin

III. Study the Adduct formation using the spectral data.

(i) hydroquinone --- p-benzoquinone ---- anthracene adduct

(ii) urea-salicylic acid

IV. Compare the spectra of the following:

(i) $[Cu(NH_3)_4)]^{2+}$ of solution and solid-vapor process

(ii) Reaction between $CuSO_4$ and aniline under solution and solid-vapor process

Course Designers

1. Dr.A.Suganthi
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THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those joined M.Sc Chemistry(Spl) on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
PCF19PJ41	**Project**	-	-	-	6	3

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

Preamble

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

Prerequisites

Students with basic laboratory skill on preparation and estimation of organic/inorganic compounds and ability to do some physical chemistry experiments at undergraduate 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	**S**	S	**M**	S
CO3	S	**S**	S	**M**	S
CO4	S	**M**	S	**S**	S
CO5	S	**L**	M	**S**	S

S-Strong; M-Medium; L-Low

Marks
External Examiner **:** Viva : 20
External Examiner **:** Evaluation of Project : 40
Internal Examiner **:** Evaluation of Project : 40

100

M.Sc. Chemistry (special)

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

Title of the courses	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
Organic chemistry I	15	10	10	01	15
Inorganic Chemistry I	15	11	07	07	15
Physical Chemistry I	15	07	07	04	15
Separation techniques and quantitative analysis.	10	15	15	10	15
Organic Chemistry-Lab 1					
Inorganic Chemistry-Lab 1					
Physical Chemistry-Lab 1					
Organic chemistry II	15	13	08	10	15
Inorganic Chemistry II	15	14	10	10	15
Physical Chemistry II	15	09	07	08	15
C-Programming Fundamentals & Applications in Chemistry (Option A)	15	15	07	15	15
Medicinal Chemistry (Option B)	12	08	08	12	12
Organic Chemistry-Lab1	12	15	15	15	15
Inorganic Chemistry-Lab1	08	12	12	12	12
Physical Chemistry –Lab	15	15	15	05	15
Organic chemistry-III	15	10	13	08	15
Inorganic Chemistry-III	15	06	06	05	15
Physical Chemistry -III	15	09	09	08	15
ComputerApplications in Chemistry (Option A)	12	12	06	12	12
Advanced organic synthesis (Option B)	15	10	14	08	15
Organic Chemistry-Lab2					
Inorganic Chemistry-Lab2					
Organic chemistry-IV	15	13	10	09	15
Inorganic Chemistry-IV	15	09	09	08	15
Physical Chemistry –IV	15	06	04	05	15
Organic Chemistry-Lab 2	15	10	15	15	15
Inorganic Chemistry-Lab 2	15	10	15	15	15
Synthesis and spectral analysis	10	12	15	07	15
Project	15	11	14	12	15

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 indepth 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.

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(For those joined M.Phil Chemistryon or after June 2019)

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	MCH19C11	Research methodology	6	90	100	100	200
Core 2	MCH19C12	Course work	6	90	100	100	200
Core 3	MCH19C13	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	MCH19PJ21	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

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DEPARTMENT OF CHEMISTRY

(For those joined M.Phil Chemistryon or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
MCH19C11	**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, K2, K3
CO2	Illustrate the properties, structure and bonding in molecules/compounds using chem office, SHELX and molecular modeling softwares.	K2, K3, K4
CO3	Make use ofthe working principle and applications of analytical instruments, such as AAS, TGA, SEM, TEM, HPLC, GC-MS and cyclic voltammetry.	K3, K4, K5
CO4	Demonstrate the safety measures in chemistry laboratory. Also to prepare and purify reagents and solvents.	K3, K4
CO5	Write their research findings report effectively.	K3,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	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

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 - 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.

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8. Andrew R. Leach, Molecular Modeling Principles and Applications, II Edn., Dorset publishers, Dorchester, 2001.

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12. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons & Burkhard Raguse, Nanotechnology, Ist Indian Edition, New Delhi, 2005.

Course Contents and Lecture Schedule

Unit	Topic	Lecture Hours
I	**Literature Survey**	**18**
1.1	Searching the chemical literature, primary sources & secondary sources of literature survey.	3
1.2	Importance of journals and patents, impact factor, h-index, i-index, ISSN, ISBN –Science Citation Index - chemistry journal index.	3
1.3	Choosing a problem - Computers in literature search using Internet websites.	3
1.4	ACS-pubs, Royal Society, Springer link, science direct, Wiley – Interscience.	3
1.5	Search engines-Google, Yahoo, Alta Vista, etc.	3
1.6	Chemical Abstract Online.	3
II	**Computers in Chemistry**	**18**
2.1	Desk-top chemical software: **Chemoffice:** Chemdraw, Chem 3D & Chem finder, Linear regression, Multi regression. MS Excel: Graph drawing and calculations –Origin.	3
2.2	**Rasmol:** Visualization of Protein molecules – highlighting amino acids, helices, beta sheets, non-hydrogen, hydrogen and sulphur bonds, identification of metal atoms and active sites.	3
2.3	**Kinemages :** Construction and visualization of one’s own protein molecules	2
2.4	**SHELX :** Structure solving and refinement using Shelxs and Shelxl.	2
2.5	**Molecular modeling**:Coordinate systems - Cartesian and internal coordinate systems.	2
2.6	Wire frame, ball and stick, space filling and surface models.	2
2.7	Potential energy surfaces – force fields in molecular mechanics and	2

	potential energy calculation.	
2.8	Optimization of small molecules using Gaussian software.	2
III	**Instrumental Methods of Chemical Analysis**	**18**
3.1	Principle, instrumentation and applications of spectroscopic techniques.	1
3.2	Flame Emission spectroscopy - Atomic absorption spectroscopy (AAS)	2
3.3	Thermal analysis-Thermo Gravimetry (TGA), Differential Thermal Analysis (DTA) & Differential scanning calorimetry (DSC).	3
3.4	Scanning Electron Microscopy(SEM), Transmission Electron Microscopy (TEM).	3
3.5	Atomic Force Microscopy (AFM) and Scanning Tunneling Microscope (STM).	3
3.6	Principle, instrumentation and applications- HPLC, GC-MS.	3
3.7	Cyclic voltammetry- Spectrofluorimetry.	3
IV	**Laboratory Techniques**	**18**
4.1	Safety in chemical lab - explosion and fire hazards.	2
4.2	hazards due to toxic chemicals - electrical safety - UV radiation	2
4.3	first aids for various kinds of accidents including toxic chemicals.	2
4.4	preparation and purification of reagents.	2
4.5	precipitation- filtration – evaporation.	2
4.6	preparation of deionised water.	2
4.7	choice of solvents and liquids.	2
4.8	purification - distillation - steam and fractional distillation.	2
4.9	solvents and reagents.	2
V	**Effective Thesis Writing**	**18**
5.1	Thesis layout - preliminaries - title page - certificates – declaration.	2
5.2	Abstracts - preface - acknowledgements - table of contents - list of tables - figures and symbols.	3
5.3	Text of the thesis - chapter division - subdivision - heading – subheadings.	2
5.4	Pagination - margins - paragraph - format and conventions.	2
5.5	Use of tables and figures - numbering - captions – referencing	3
5.6	Reference Systems - documenting –appendices - use of appendix and its format - puntuation and mechanics.	3
5.7	Presenting a scientific seminar - art of writing a thesis- publication of research paper.	3

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Department of Chemistry
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Course Code	Course title	Category	L	T	P	Credit
MCH19C12	**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 PSOs

	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

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:

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Course designer

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2. Dr. A. Elangovan
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5. Dr. R. Mahalakshmy

6. Dr. A. R. Ramesh

Course Contents and Lecture Schedule

Unit	Topic	No. of Lecture Hours
I	**Advanced Organic Synthesis**	**18**
1.1	Importance of organic synthesis- Key intermediates – A synthon, retron, synthetic equivalent, synthetic starting materials	3
1.2	Retro synthetic analysis- Guideline for best disconnection	3
1.3	Synthesis involving functional group interconversion	3
1.4	Chemo selectivity, regioselecitivity, stereo selectivity	3
1.5	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	3
1.6	Carbon-carbon bond forming reaction-suzuki coupling, Heck reaction, sharpless epoxidation.	3
II	**Nano/Green Chemistry**	**18**
2.1	Nanoparticles and Carbon nanotubes (singlewalled and multiwalled carbon nanotubes) – Uses.	3
2.2	Introduction - Methods of preparations – CVD, Laser ablation method.	3
2.3	zinc Oxide, Cadmium sulphide, Titanium dioxide – Synthesis and characterization.	2
2.4	Application of nanoparticles: Phosphors, Batteries - Information storage - Solar cells.	2
2.5	Need for Green Chemistry - Solvent free reactions - Microwave assisted synthesis.	2
2.6	Role of ionic liquids in green chemistry.	2
2.7	Cleaner technology with super critical fluids.	2
2.8	Catalytic approach to green chemistry (use of Zeolites, clays, mesoporous materials).	2
III	**BioInorganic Chemistry**	**18**
3.1	Metalloproteins: Transport and storage protein: e.g Fe-S protein, Blue-copper protein, Ferritin, Transferritin, Hemocyanin and Heme erythrin.	1
3.2	Metalloenzymes: Hydrolases (e.g. Carboxy peptidases and amino peptidases), Oxido reductases (e.g. Superoxide dismutase), Isomerases and Synthatases – (e.g. Vit B_{12})	2
3.3	Nickel containing enzymes.	3
3.4	Structure of DNA - types of Nucleic acid interactions.	3
3.5	Coordination, intercalation and hydrogen bonding.	3
3.6	Interactions of metal ion with Nucleic acid	3
3.7	Redox Chemistry, Hydrolytic Chemistry.	3
IV	**Polymer Chemistry**	**18**
4.1	Polymer-Introduction-Classification-Tactictity.	2
4.2	Polymerization- Addition, Co-polymerisation and condensation.	2

4.3	Mechanism of polymerization – Free radical mechanism, Ionic mechanism, Zeigler-Nata polymerization.	2
4.4	Stucture-Property relationships in polymer.	2
4.5	Classification of plastics- Thermosetting and Thermoplastic resins-Additives-Compounding of plastic-Fabrication-Compression moulding, Injection moulding, Extrusion moulding and Blow moulding.	2
4.6	Molecular weight determination-Light scattering, viscosity, osmometry methods- Number average and Average number weight polymer.	2
4.7	Preparation, properties and uses of some important polymeric resins-PE (LDPE and HDPE).	2
4.8	Phenol-formaldehyde resins, Silicon resins.	2
4.9	Composite-ABS, Cellulose-Bio-degradable plolymer.	2
V	**Spectroscopy**	**18**
5.1	NMR Spectroscopy - Proton and ^{13}C- fluxional NMR.	2
5.2	2-dimensional NMR - uses of Shift reagents.	3
5.3	ESR spectroscopy - Hyperfine splitting -factors affecting 'g' value - anisotropy of 'g' and 'A' tensors.	2
5.4	Zero field splitting - Krammer's degernacy.	2
5.5	EPR spectra of Cu (II) Complexes. Jahn -Teller distortion in Cu(II) complexes. Evaluation of bonding parameters.	3
5.6	Analysis and Interpretation of Spectra of simple Aliphatic and Aromatic compounds using IR, UV, NMR,	3
5.7	MASS, XRD techniques.	3

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Department of Chemistry
(For those joined M.Phil Chemistry on or after June 2019)

Course Code	Course title	Category	L	T	P	Credit
MCH19C13	**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

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

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 2017)

Course Code	Course title	Category	L	T	P	Credit
MCH19PJ21	**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

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

M.Phil. Chemistry

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

Title of the courses	**PSO1**	**PSO2**	**PSO3**	**PSO4**	**PSO5**
Research methodology	15	15	15	13	15
Course work	15	04	12	15	15
In depth study	15	12	15	13	15
Project	15	123	15	12	15