B.Sc. Chemistry

Programme Code - UCH

(Aided & SF)

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

Scientific Knowledge and Critical Thinking

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

Problem Solving

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

Communication and Computer Literacy

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

Life-Long Learning

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

Ethical, Social and Professional Understanding

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

Innovative, Leadership and Entrepreneur Skill Development

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

Department of Chemistry

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

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

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

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

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

BACHELOR OF CHEMISTRY
(PROGRAMMING CODE: UCH)

Program Educational Objectives (PEOs)

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

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

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

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

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with "A^{++}" Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2020 and after)

BACHELOR OF CHEMISTRY

Semester – I

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

Semester – II

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

Semester – III

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

Semester – IV

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

Semester – V

Course	Code	Subject	Hrs/ Week	Cre dits	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 9	UCH20C51	Solid state, Transition Elements and Co-ordination Chemistry	6	6	90	25	75	100
Core 10	UCH20C52	Chemistry of Aromatic compounds	6	6	90	25	75	100
Core11	UCH20C53	Wave Theory and Photo – Kinetics	6	6	90	25	75	100
Core lab-V	UCH20CL51	Inorganic Estimations and Preparations	4	2	60	40	60	100
Core elective. I	UCH20CE51 (A/B)	Group theory and Spectroscopy / Industrial Chemistry	6	6	90	25	75	100
SEC(I)	UCH20 SE51 (A/B/C)	Agricultural Chemistry/ Dairy Chemistry/Forensic Chemisty	2	2	30	15	35	50
Total			**30**	**28**	**450**			
	UCH20IN	**Internship**		**2**		**15**	**35**	**50**

Semester – VI

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

10 days Job training (during IV semester vacation):

Report : 35 marks

Viva-voce : 15 marks

Total marks : 50 marks

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 Enhancement Compulsory Course.
SEC : Skill Enhancement Course

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Course Code	Course title	Category	L	T	P	Credit
UCH20C31	Main group elements-II, Acid-Base Concepts and Non-Aqueous solvents	Core 5	3	-	-	3

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

Preamble

The course explains the chemistry of p-block elements and acid-base concepts.

Course Outcome

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

#	Course Outcome	Expected proficiency	Expected attainment
CO1	Comprehend the properties and structure of allotropes of carbon, silicates and oxides and chlorides of carbon compounds.	80 %	76%
CO2	Acquire the knowledge on preparation, properties and uses of nitrogen group compounds.	80 %	75%
CO3	Spell the importance of oxygen, oxyhalides and oxyacids of sulphur	80 %	75%
CO4	Compare and evaluate the properties and uses of halogens, oxy acids fluorocarbons and noble gases	75 %	70%
CO5	Apply the basic concepts and theories of acids and bases and their properties.	75 %	72%

Mapping of COs with POs

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy and assessment pattern

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

Course title: Main group elements-II, Acid-Base Concepts and Non-Aqueous solvents

Unit I: The Elements of Group 14 (9 hrs)

Group 14 (carbon group): General characteristics-catenation and heterocatenation, allotropy of carbon- Structural features of diamond, graphite and fullerenes; Structure and harmful effects of oxides and chlorides of carbon (CO, CO_2, $COCl_2$, CCl_4), sulphides of carbon (CS_2), Metal carbides, Applications of carbides in industry. Properties, structure and classification of silicates; $SiCl_4$.

Unit II: The Elements of Group 15 (9 hrs)

Group 15 (nitrogen group): General Characteristics- difference between nitrogen and the rest of the family members. Properties of Nitrogen. Allotropes and uses of phosphorus, Arsenic, Antimony; alloys of Bismuth. Test for arsenic traces.

Preparation and structural characteristics of ammonia and nitric acid; Structure and uses of dinitrogen pentoxide, phosphorus pentoxide, nitric oxide, nitrous acid, phosphinic acid, phosphonic acid, hypophosphoric acid, ortho, pyro and meta phosphoric acid, P_4S_3.

Preparation and structure of hydrazine (mono methyl and dimethyl hydrazine and its applications) hydrazoic acid:bonding in $(SiH_3)_3N$.

Structural formula and uses of sodium bismuthate, As_2O_3, Scheele's green and tartaremetic.

Preparation and uses of urea, superphosphate, triple superphosphate, potassium nitrate, Mixed fertilizers. Biological nitrogen fixation(Preliminary idea only).

Unit III: The Elements of Group 16 (9 hrs)

Group 16 (oxygen group): General Characteristics - preparation, properties and structure of ozone. Allotrophs of sulphur; Role of selenium in xerography.

Structure and properties of H_2O_2, S_2F_2, SF_6, S_2F_{10}, $TeCl_4$, SeO_2, SO_3, $SOCl_2$, S_4N_4, polythiazyl; oxyacids of Sulphur. Biological importance of sulphur compounds (Methionine, Cysteine, Nitrogeneous, Rubredoxin and Ferredoxins (preliminary idea only)

Unit IV: Halogens, Inter halogens and Noble gases (9 hrs)

Group 17 (halogens): General characteristics, anomalous behavior of fluorine, and comparison of oxidizing action of halogens. Nomenclature and structure of oxy acids of halogens. Acid strength of HX-Preparation, properties and structure of interhalogens and pseudohalogen compounds.

Noble Gases: origin of xenon reactivity- Isolation of noble gases from the atmosphere-ClF, ICl, ClF_3, BrF_3, ClF_5, BrF_5, IF_5, IF_7, $HClO_4$, I_2O_5, Fluorocarbons- structure and properties -Uses of noble gases. xenon hexafluoride, xenon oxyfluoride and xenon trioxide.

Unit V: Acids, Bases and Non-aqueous solvents (9 hrs)

Arrhenius concept, proton transfer theory – concept of Lowry and Bronsted – Luxflood concept – the solvent system concept – Lewis concept. 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. HSAB principle, symbiosis.

Classification of solvents-Non-aqueous solvents- Reactions in liq.NH_3, liq.SO_2, liq.HF.

Text Books:

1. Puri.B.R. Sharma.L.R., and Kalia. K.C 2004., Principles of Inorganic Chemistry, 28th edition, Vallabh Publication, New Delhi.
2. Sharma.B.K., 1996, Instrumental methods of chemical analysis, 5th edition, Goel publication, Meerut.
3. Lee, J. D, 2002, A New Concise Inorganic Chemistry, Blackwell Science Ltd., ELBS 5th Ed., London.
4. Cotton F.A., Wilkinson G, Gaus, P. L., 1995, Basic Inorganic Chemistry, 3rd edition, John Wiley & Sons, Inc. New York.

Reference Books:

1. Madan.R.D.2002, Modern Inorganic Chemistry, S. Chand & Company, 2nd edition, New Delhi.
2. Cotton F.A.,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.

Web Source:

1. https://www.youtube.com/playlist?list=PLENI0YTeW7RDlpqCQl6fTNVHhYRIljhwt
2. https://en.wikibooks.org/wiki/Introduction_to_Inorganic_Chemistry
3. https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/
4. https://www.slideshare.net/KennethBarrientos4/lecture-notes-for-inorganic-chemistry

Course designers

Dr. A. Suganthi
Dr.A. Elangovan
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THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
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Programme code: UCH

Course Code	Course title	Category	L	T	P	Credit
UCH20C32	Chemistry of Aliphatic compounds-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	Expected proficiency	Expected attainment
CO1	Spell the chemistry of alkenes and alkynes.	85%	80%
CO2	Explain the preparation and chemical properties of saturated and unsaturated alkyl halides.	85%	79%
CO3	Comprehend the preparation, chemical properties and uses of monohydric, dihydric and polyhydric alcohols.	80%	75%
CO4	Outline the preparation, chemical properties of ethers, thioethers and epoxides.	80%	76%
CO5	Apply the chemistry of aldehydes and ketones and able to write the mechanism of naming reactions related to this functional groups.	85%	80%

Mapping of COs with POs

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

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 and assessment pattern

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

Course title: Chemistry of aliphatic compounds-I

UNIT-I: UNSATURATED HYDROCARBONS (**9 hrs)**

Alkenes: Nomenclature, General methods of preparation: Dehydrohalogenation of alkyl halides, dehalogenation of vicinal dihalides, dehydration of alcohols, controlled reduction of alkynes, Hofmann elimination, Catalytic hydrogenation, Birch reduction, Saytzeffs and Hofmann's rule – physical properties, chemical properties: Electrophilic addition reactions, Markovnikov and anti-Markovnikov mechanism of addition to alkene and conjugated dienes.

Alkynes: Nomenclature, Acidity of alkynes, general methods of preparation, Physical properties, chemical properties: substitution of acetylenic hydrogen in terminal alkynes, Nucleophilic and electrophilic addition reactions, reduction reactions, oxidation reaction and polymerization reactions

UNIT-II: ALKYL HALIDES **(9 hrs)**

Haloalkanes: Introduction – Methods of Preparation (from alkanes, alkenes, alcohols, Finkelstein reaction). Chemical properties: Substitution reactions (S_N^1, $S_N^2$and S_N^i mechanism) – Elimination reactions (E_1 and E_2 mechanism).

Unsaturated alkyl halides: Vinyl and allyl chlorides

UNIT-III: ALCOHOLS **(9 hrs)**

Classification: Mono, di, tri and polyhydric alcohols, Nomenclature

Monohydric alcohols: Classification (1°, 2° and 3°) – General methods of preparation: Hydrolysis of alkyl halides, direct hydration of alkenes, hydroboration - oxidation of alkenes, oxymercuration-demercuration of alkenes, using Grignard reagent – Physical properties, acidic nature of alcohols, chemical properties: reactions involving cleavage of O-H bonds, reactions involving cleavage of C-OH bond and uses.

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

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

UNIT-IV: ETHERS, THIOETHER AND EPOXIDES (9 h**rs)**

Ethers: Nomenclature - General methods of preparation, Williamson's Synthesis - Properties - Estimation of number of alkoxy groups – Zeisel'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: ALDEHYDES AND KETONES (9 hrs)

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 and Grignard Reagent; Wittig reaction, Reformatsky 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

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

3. I.L.Finar, 1997, Organic chemistry, Vol 1, 6th edition, Pearson Edition, 2005, Singapore.
4. R.T. Morrision and R.N. Boyd, 1997, Organic chemistry, 6th edition, Prentice Hall Private Limited, New Delhi.
5. P.L. Soni, 2005, Text Book of Organic Chemistry, Sultan Chand, New Delhi.
6. 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.

Web resources:

1. https://youtu.be/o3Db15Gw_mU (Unsaturated hydrocarbons)
2. https://youtu.be/jFrUTiQH1vE (Alkyl halides)
3. https://youtu.be/FXcgJ8dY444 (Alcohol)
4. https://youtu.be/gW8za1t2nFg (Ethers and thioether)
5. https://youtu.be/2seAPy1sZHE (Aldehyde and ketone)

Course designers

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

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Course Code	Course title	Category	L	T	P	Credit
UCH20CL31	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	Expected proficiency	Expected attainment
CO1	Apply acidimetric and alkalimetric method for the quantitative volumetric estimation of acids and bases.	85%	80%
CO2	Estimate the amount of inorganic compounds permanganometrically.	85%	80%
CO3	Utilize the dichrometric procedure for the estimation of ferrous ion and potassium dichromate.	82%	76%
CO4	Do the quantitative estimation Copper and Potassium dichromate iodometrically.	75%	70%
CO5	Apply various volumetric procedures for the estimation of any inorganic compounds.	80%	75%

Mapping of COs with POs

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

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)

References:

1. A. I. Vogel, "Quantitative Inorganic Analysis", ELBS, 3rd Edition, 1971.
2. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, "Basic principles of practical Chemistry", 2nd Edition, Sultan Chand & Sons publisher, 1997.
3. "Inorganic volumetric analysis", Laboratory Manual prepared by P. Prakash and R. Mahalakshmy, Department of the Chemistry, Thiagarajar College, Madurai -9.

Course Designers

1. Dr. A. Elangovan
2. Dr. D.S.Bhuvaneshwari
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THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
(Re-Accredited with "A^{++}" Grade by NAAC)
Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2020)
Programme code: UCH

Course Code	Course title	Category	L	T	P	Credit
UCH20NE31	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 Outcome	Expected proficiency	Course attainment
CO1	Tell the various ingredients present in the consumer products.	75%	70%
CO2	Explain the preparation of shampoos, colorants, tooth pastes, soap, face powder, detergent, hair conditioners, perfumes, colorants.	70%	65%
CO3	To know the composition and uses of consumer products like Sanitizer, safety matches, agarbattis etc.	68%	65%
CO4	Develop the skill of making cosmetics and consumer products.	65%	60%
CO5	To develop the entrepreneur skill after learning and implementation in cosmetic and consumer products	50%	60%

Mapping of COs with PSOs

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

Mapping of COs with POs - B.Sc.,

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

B.A. P.O.

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

B.B.A. P.O.

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

B.Com. P.O.

	PO1	PO2	PO3	PO4	PO5
CO1	S	S	S	M	M
CO2	S	S	S	M	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

Bloom's Taxonomy: Assessment pattern

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

Course title: Chemistry in Day-To-Day Life

Unit I: Cosmetics **(20 hrs)**

Dental Preparations: Tooth pastes- ingredients, their characteristics and functions. Mouth washes (Composition only). Soap- Hard soap, Soft soap- types. Detergents- anionic, cationic and non-ionic, Face powder (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, Eye liner, shaving creams, after shave preparations.

Unit II: Consumer Products **(10 hrs)**

Composition and Uses of Sanitizer, 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.

Web Resources:

1.https://www.youtube.com/watch?time_continue=1&v=YyQP4Oa-AFo
2.https://alison.com/course/diploma-in-makeup-artistry
3.https://www.youtube.com/watch?v=iipY_DDuAeg

Course Designer

Dr. D. S. Bhuvaneshwari
Dr. M. Sathiya
Dr. A. Jeevika

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Course Code	Course title	Category	L	T	P	Credit
UCH20C41	Chemistry of Aliphatic compounds-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 and their derivatives, 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	Expected proficency	Expected attainment
CO1	Tell the chemistry of saturated, unsaturated and substituted carboxylic acid.	80%	75%
CO2	Comprehend the preparation, properties and synthetic applications of aldehydic and ketonic acid.	82%	78%
CO3	Explain the preparation and chemical properties of aliphatic nitrogen compounds	80%	75%
CO4	Develop their knowledge on the chemistry of organometallic reagents and their synthetic applications.	85%	80%
CO5	Apply the chemistry of carbohydrates like glucose, fructose, sucrose, starch and cellulose.	83%	78%

Mapping of COs with POs

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

Bloom's Taxonomy and assessment pattern

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

Course title: Chemistry of Aliphatic compounds-II

UNIT –I: CARBOXYLIC ACID AND THER DERIVATIVES (9 hrs)

Saturated monocarboxylic acids: Nomenclature, resonance structure of the carboxyl group – relative strength of acidity of carboxylic acids, effect of substituents on acidity of carboxylic acid.
Acid derivatives: Preparation, physical and chemical properties of acid halides, acid anhydrides, amides and esters.
Unsaturated monocarboxylic acids: Preparation, physical properties, chemical properties and uses of acrylic and crotonic acids.
Hydroxy acids – Nomenclature, preparation of alpha and beta hydroxy acids – chemical properties – action of heat of α, β, γ, δ and ε hydroxy acids.
Chemistry of lactic and tartaric acids.

UNIT – II: ALDEHYDIC AND KETONIC ACIDS (9 hrs)

Preparation and properties of glyoxalic acids, pyruvic and laevulic acid.
Dicarboxylic acids:Preparation and properties of oxalic acid, malonic acid, succinic acid, glutaric acids – reactions of reactive methylene group - Preparation and synthetic importance of acetoacetic ester.
Unsaturated dicarboxylic acid: Preparation and properties of fumaric and maleic acid.

UNIT –III: ALIPHATIC NITROGEN COMPOUNDS (9 hrs)

Nitroalkanes: Preparation, properties, and structure of nitroalkanes – chemical reactions of nitroalkanes.
Alkyl cyanides and isocyanides: Preparation and chemical reactions – Distinction between ethyl cyanide and ethyl isocyanides.
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: ORGANOMETALLIC REAGENTS (9 hrs)

Organomagnesium halides: preparation, reactions and synthetic applications of Grignard reagents and its limitations.
Organolithiums: Preparation, properties and synthetic applications.
Lithium Dialkylcuprates (Gilman's reagent): Preparation and synthetic uses.
Tetra Ethyl Lead (TEL): preparation, reactions and synthetic uses.

UNIT-V:CARBHOYDRATES (9 hrs)

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 – Disaccharide – sucrose – structure elucidation – Polysaccharides - starch and cellulose (classification and structure only).

Text Book:

1. Bhupinder Mehta, Manju Mehta, "Organic Chemistry", Prentice Hall of India Pvt Ltd,. New Delhi, 2015.
2. B.S. Bahl and Arun Bahl, Advanced Organic Chemistry, 1st edition, S.Chand and Company Ltd, 1998, New Delhi.
3. M.K.Jain and S.C. Sharma, "Modern Organic Chemistry" revised edition, Vishal Publishing CO., Jalandar, Delhi (ISBN: 81-88646-67-9)

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.

Web resources

1. https://youtu.be/iU0yt2XkUCU
2. https://youtu.be/9fxj2Z2sWqA
3. https://youtu.be/PDgxdwdxxbA
4. https://youtu.be/QDju_-r4y3Y
5. https://youtu.be/doe_zZDjU5c

Course designers

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Programme code: UCH

Course Code	Course title	Category	L	T	P	Credit
UCH20C42	**Thermodynamics and Equilibria**	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	Expected Proficiency	Expected attainment
CO1	Understand the fundamentals of first law and zeroth law of thermodynamics.	75%	70%
CO2	Gain knowledge on the second and third law of thermodynamics and its applications.	78%	75%
CO3	Aware of the heat changes accompanying in chemical reactions.	80%	75%
CO4	Application of Phase rule for one and two component systems	75%	70%
CO5	Understand the basic principles of chemical equilibrium.	78%	75%

Mapping of COs with POs

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

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

Blooms taxonomy and assessment pattern

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

Course title: Thermodynamics and Equilibria

UNIT – I:THERMODYNAMICS –I (9 hrs)

Thermodynamics first law - 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- Molar heat capacity at constant P & V-Correlation between Cp and Cv - Joule Thomson effect – inversion temperature and simple problems in I law.

UNIT – II:THERMODYNAMICS - II & III (9 hrs)

Second law: Need and Different forms of second law, Carnot cycle-efficiency of Carnot engine and Simple problems; entropy- Entropy changes in reversible and irreversible processes, Entropy of mixing, Physical significance of entropy- Maxwell's relationships, The Gibbs-Helmholtz equation-Clausius Clapeyron equation- Application of Clausius- Clapeyron equation.

Third law of thermodynamics: Nernst heat theorem-statement of third law of thermodynamics, definition of absolute entropy and residual entropy-their calculation- zeroth law.

UNIT – III:THERMOCHEMISTRY (9 hrs)

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

UNIT-IV: PHASE RULE (9 hrs)

Definition – phase, component, degrees of freedom in phase equilibria; Gibbs-Phase rule statement and its applications into one component systems – water and sulphur only; Reduced phase rule and its applications into two component system - simple eutectic Lead – Silver system (Pattinson's process): Two component - compound formation - congruent melting point (Zn – Mg) and incongruent melting point (Na – K) definition only.

UNIT – V: CHEMICAL EQUILIBRIUM (9 hrs)

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 and physical equilibria.

TEXT BOOKS

1. Puri B.R., Sharma L.R. and Pathania M.S., 2007, Principles of Physical chemistry, 30th edition, Vishal publication, 2007, Jalandhar-Delhi, India.
2. Bahl B.S., Tuli G.D. and Arun Bahl, 2004, Essential of Physical chemistry, S.Chand publications, Ram nagar, New Delhi, India.

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

Reference Books

1. Elements of Physical Chemistry – S. Glasstone, D. Lewis -2nd edition, 1960
2. Physical chemistry – Thermodynamics and Kinetics P. Atkins, J.D. Paula, J. Keeler 2018 edition

Course Designers

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Department of Chemistry
(For those joined B.Sc Chemistry on or after June 2020)
Programme code:UCH

Course Code	Course title	Category	L	T	P	Credit
UCH20CL41	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 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	Expected Proficiency	Expected attainment
CO1	Do the quantitative estimation of organic compounds such as Phenol, aniline and glycine.	85%	80%
CO2	Apply volumetric procedure for the quantitative estimation of Ascorbic acid (Vit.C).	82%	78%
CO3	Determine the saponification value and iodine value of oil.	75%	70%
CO4	Synthesize organic compounds.	70%	65%
CO5	Develop the practical skill of estimation and preparation of any given organic compounds.	75%	70%

Mapping of COs with POs

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

ORGANIC ESTIMATIONS

1. Estimation of Phenol
2. Estimation of Aniline
3. Estimation of Glycine

4. Determination of Iodine value
5. Estimation of Saponification value of an oil
6. Estimation of Ascorbic acid (Vitamin C)

(Any three estimations only)

ORGANIC PREPARATIONS

1. Benzoic acid from Methyl or ethylbenzoate
2. Salicylic acid from Methyl or ethylsalicylate
3. Osazone from Glucose
4. Benzoic acid from Benzaldehyde

References:

1. B. S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Vogel's textbook of Practical Organic Chemistry, Pearson, 5th edition, 1989.
2. N.S. Gnanpragasam and G. Ramamurthy, Organic Chemistry Lab Manual, S. Viswanathan Pvt. Ltd.

Course Designers

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4. Dr. A. Tamilselvi

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

Course Code	Course title	Category	L	T	P	Credit
UCH20NE41	Processing of consumer products (Lab)	Non major elective	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
II	IV	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	Expected Proficiency	Expected attainment
CO1	Identify the various ingredients present in the consumer products.	70%	65%
CO2	Gain theoretical knowledge on the preparation of consumer products.	70%	65%
CO3	Prepare consumer products like detergent powder, cleaning powder, tooth powder, etc., on their own.	70%	65%
CO4	Become an entrepreneur in making consumer products.	68%	65%
CO5	Become an entrepreneur in making consumer products.	65%	60%

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**
CO5	**M**	**M**	**M**	**M**	**M**

S-Strong; M-Medium; L-Low

Mapping of COs with POs
B.Sc., P.O.

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

S-Strong; M-Medium; L-Low

B.A. P.O.

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

B.B.A. P.O.

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

B.Com. P.O.

	PO1	PO2	PO3	PO4	PO5
CO1	**S**	**S**	**M**	**M**	**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

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

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

GENERIC ELECTIVES

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

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

L - Lecture T - Tutorial P – Practical

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

Preamble

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

Course Outcomes

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

#	Course Outcome	Expected Proficiency	Expected attainment
CO1	Summarize the structures, reactions and functional group interconversion of carbohydrates.	75%	70%
CO2	Explain the fundamentals of proteins and enzymes	70%	65%
CO3	Outline the ion exchange and basic properties of soils treatment	75%	70%
CO4	Identify the chemical processes involved in industries and agricultural applications.	70%	65%
CO5	Outline the classification, characteristics and applications of Insectisides and pesticides.	75%	70%

Mapping of COs with POs

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

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

Course Title: Chemistry for Life Sciences

UNIT –I: CARBOHYDRATE CHEMISTRY (12hrs)

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

UNIT – II: Proteins and enzymes (12hrs)

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

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

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

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

Unit-III: Soil Chemistry (12hrs)

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

Unit-IV: Fertilizers (12hrs)

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

Soil analysis – analysis of NPK - Mixed fertilizer – Urea

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

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

Course Designer:

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

Text book:

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

Reference Book:

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

Web Soruces:

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2. https://www.slideshare.net/krishnaSethi1/fertilizer-and-its-classification
3. https://www.google.com/search?sxsrf=ALeKk03vba7YoQOqVXJKQGQc3TWCNQVCaA%3A1594827271629&ei=ByIPX9yNJo2O4-EP7eWKoA4&q=soil+treatment+ncert&oq=soil+treatment+ncer&gs_lcp=CgZwc3ktYWIQARgAMgcIIRAKEKABMgcIIRAKEKABMgcIIRAKEKABOgQIABBHOgIIADoGCAAQFhAeOgUIIRCgAVCnL1jWM2DjQGgAcAF4AIAB3gWIAdQTkgEFNS0zLjGYAQCgAQGqAQdnd3Mtd2l6&sclient=psy-ab
4. https://www.google.com/search?sxsrf=ALeKk01PfNtLe3uvuJzpyqeSp9r75DK1eQ%3A1594827336285&ei=SCIPX-v_EKeJ4-EPi5ez-AQ&q=biomolecules+slideshare&oq=biom+slideshare&gs_lcp=CgZwc3ktYWIQARgBMgYIABAHEB4yBggAEAcQHjIGCAAQBxAeMgYIABAHEB4yBggAEAcQHjIGCAAQBxAeMgYIABAHEB4yBggAEAcQHjIGCAAQBxAeMgYIABAHEB46BAgAEA06CAgAEA0QBRAeOggIABAIEA0QHlDEMFi1T2DqZmgCcAB4AIAB7AGIAdoJkgEFMC4zLjOYAQCgAQGqAQdnd3Mtd2l6&sclient=psy-ab

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

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

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

Preamble

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

Course Outcomes

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

#	Course Outcome	Expected Proficiency	Expected attainment
CO1	Demonstrate purification of water.	70%	65%
CO2	Outline the classification, characteristics and applications of fuels.	75%	70%
CO3	Identify the chemical processes involved in industries for the preparation of some important compounds.	78%	75%
CO4	Summarise the food additives.	70%	65%
CO5	To apply the use of food additives and testing	70%	65%

Mapping of COs with POs

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

S-Strong; M-Medium; L-Low

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

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

Course Title: Industrial Chemistry

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

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

Unit-II: FUELS **12 Hrs**

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

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

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

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

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

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

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

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

Course Designer:

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

Text Books:

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

Reference Books:

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

Web source:

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

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

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

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

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

Preamble

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

Course Outcomes

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

#	Course Outcome	Expected Proficiency	Expected attainment
CO1	Spell the basic concepts and theories of atomic structure.	80%	75%
CO2	Demonstrate purification of water.	75%	70%
CO3	Summarize the structures, reactions and functional group interconversion of carbohydrates.	70%	65%
CO4	Outline the classification, characteristics and applications of fuels.	70%	65%
CO5	Identify the chemical processes involved in industries and agricultural applications.	70%	65%

Mapping of COs with POs

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

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

Course Title: General Chemistry - I

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

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

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

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

Unit-III: CARBOHYDRATE **12 Hrs**

Classification

Glucose: Preparation, properties and uses

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

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

Cellulose and starch: Industrial preparation, applications

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

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

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

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

Text Books

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

Reference Books

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

Course designers

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

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

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

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

Preamble

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

Course Outcomes

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

#	Course Outcome	Expected Proficiency	Expected attainment
CO1	Tell the basic concepts, theories and applications of electrolysis.	70%	65%
CO2	Explain types of catalysts and reaction mechanism of catalysis.	70%	65%
CO3	Outline the application of nuclear reactions.	75%	70%
CO4	Utilize the chemistry of amino acids and vitamins.	75%	70%
CO5	Make use of nano-chemistry and green chemistry.	80%	75%

Mapping of COs with POs

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

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

Course Title : General Chemistry - II

Unit- I: ELECTROCHEMISTRY **12 Hrs**

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

Unit- II: CATALYSIS **12Hrs**

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

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

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

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

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

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

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

Text Books:

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

Reference Books

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

Course designers

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

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

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

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

Preamble

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

Course outcomes

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

#	Course Outcome	Expected Proficiency	Expected attainment
CO1	Apply acidimetric and alkalimetric method for the quantitative volumetric estimation of acids and bases.	85%	80%
CO2	Estimate the amount of inorganic compounds permanganometrically.	85%	80%
CO3	Apply dichrometric procedure for the estimation of ferrous ion and potassium dichromate.	80%	75%
CO4	Do the quantitative estimation Copper and Potassium dichromate iodometrically.	70%	65%
CO5	Do the quantitative estimation Potassium dichromate iodometrically	70%	65%

Mapping of Cos and POs

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

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

I ACIDIMETRY - ALKALIMETRY

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

II PERMANGANIMETRY

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

III DICHROMETRY

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

IV IODOMETRY

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

Course Designers

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

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

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

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

Preamble

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

Course outcomes

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

#	Course Outcome	Expected Proficiency	Expected attainment
CO1	Analysis of important compounds in milk, fruit, leaf other plant parts	70%	65%
CO2	Estimate the amount of organic/inorganic compounds in beverages, soap and water.	70%	65%
CO3	Extraction of Pure/ Mixture of organic compounds from flowers and fruits	68%	65%
CO4	Determination of pure compounds from turmeric & in mild beverages like tea, coffee.	68%	65%
CO5	Determination of pure compounds from mild beverages like tea, coffee.	67%	65%

Mapping of COs with POs

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

Mapping of COs with PSOs

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

S-Strong; M-Medium; L-Low

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

I**. Estimations** (any five)

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

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

II. Extractions: (Any two)

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

Course Designers

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

M.Sc. Chemistry

(Programme Code-PCH)

(Aided & SF)

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

Knowledge

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

Complementary skills

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

Applied learning

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

Communication

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

Problem solving

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

Environment and sustainability

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

Teamwork, collaborative and management skills

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

Department of Chemistry

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

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

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

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

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

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

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

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

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

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with "A^{++}" Grade by NAAC)
DEPARTMENT OF CHEMISTRY
(For those who join in 2020 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	PCH20C11	Aromaticity and reaction mechanism	5	5	75	25	75	100
Core 2	PCH20C12	Advanced Inorganic Chemistry - I	5	5	75	25	75	100
Core 3	PCH20C13	Wave Theory and Physicochemical Properties	5	5	75	25	75	100
Core lab -1	PCH20CL21	Preparation and qualitative analysis of Organic compounds	5	*	75	-	-	-
Core lab -2	PCH20CL22	Inorganic ChemistryLab-I	5	*	75	-	-	-
Core lab- 3	PCH20CL23	Physical ChemistryLab	5	*	75	-	-	-
Total			**30**	**15**	**450**	**75**	**225**	**300**

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

Semester – II

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

Semester – III

Course	Code No	Subject	Hrs/ Week	Cred.	Total Hrs	Max Mark CA	Max Marks SE	Total
Core 7	PCH20C 31	Organic synthesis, photochemistry and pericyclic reactions	5	5	75	25	75	100
Core 8	PCH20C 32	Organometallics, Spectroscopy and Inorganic rings-cages	5	5	75	25	75	100
Core elective -2	PCH20C E31	Group theory and spectroscopy	5	5	75	25	75	100
Core elective -3	PCH20C E32(A)	Research methodology **(Option A)**	5	5	75	25	75	100
	PCH20C E32(B)	Advanced Organic synthesis **(Option B)**						
Core lab - 4	PCH20C L41	Estimation and preparation of Organic compounds	5*	-	75	-	-	-
Core lab -5	PCH20C L42	Inorganic Chemistry Lab-II	5*	-	75	-	-	-
Total			**30**	**20**	**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	PCH20C41	Chemistry of heterocyclic compounds, natural products and green chemical methods	5	4	75	25	75	100
Core 11	PCH20C42	f-block elements and Applied Chemistry	5	4	75	25	75	100
Core 12	PCH20C43	Kinetics and Macromolecules	4	4	60	25	75	100
Core lab - 4	PCH20CL41	Estimation and preparation of Organic compounds	5	5	75	40	60	100
Core Lab - 5	PCH20CL42	Inorganic Chemistry Lab - II	5	5	75	40	60	100
PJ	PCH20PJ 41	Project	6	3	90	40	60	100
Total			**30**	**25**	**450**	**225**	**405**	**600**

A) CONSOLIDATION OF CONTACT HOURS AND CREDITS: PG

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

B) Curriculum Credits

Core 12 papers	(15+12+15+12) = 49 Credits
Core Lab 11	(13+10) = 23 Credits
Core electives	5+5+5 = 15 Credits
Project	= 03 Credits
Total	**= 90 Credits**

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

Course Code	Course title	Category	L	T	P	Credit
PCH20C31	Organic synthesis, photochemistry and pericyclic reactions	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 photochemical, pericyclic and molecular rearrangement reaction.

Prerequisites

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

Course Outcomes

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

#	Course Outcome	Expected proficiency	Expected attainment
CO1	Make use of chemical reagents in various organic transformation such as oxidation, reduction, catalysis etc.,	85%	80%
CO2	Evaluate the synthetic route for complex organic molecules which find medicinal, industries of commercial importance.	75%	70%
CO3	Apply the concept and mechanism of photochemical reactions.	80%	75%
CO4	Analyze the concepts and mechanism of pericyclic reactions.	80%	75%
CO5	Apply their knowledge in writing the mechanism of molecular rearrangement reaction.	85%	78%

Mapping of COs with POs

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

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 and assessment pattern

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

Course title: Organic synthesis, photochemistry and pericyclic reactions

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 –Birch reduction, Heck reaction, Suzuki coupling, Sonogashira coupling.

Unit-II: Retro and Advanced Organic Synthesis (15 hrs)

Disconnection Approach: Importance of organic synthesis-Planning synthesis – Synthons and types – synthetic equivalents – 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.

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,

Unit-III: Photochemistry (15hrs)

Introduction - General principles – orbital symmetry considerations related to photochemical reactions, thermal versus photochemical reactions —- photochemical reactions of ketones – Norrish type I and type II reactions – Paterno Buchi reaction – photochemistry of alkenes and dienes - photochemistry of enones and Dienones, photo reduction, photochemical oxidation (di-pi methane or Zimmerman rearrangement), Oxa-di-pi methane rearrangement, Barton reaction –photo Fries rearrangement - photo chemistry of α , β unsaturated carbonyl compounds – photo chemistry of arenes.

Unit-IV: Pericyclic reactions (15 hrs)

Pericyclic reactions Application of symmetry to orbital interactions – selection rules (Woodward and Hoffmann rules) – Electrocyclic reactions, cycloaddition and sigmatropic rearrangements-sigmatropic migrations of hydrogens and carbons - Claisen, Cope and Aza–Cope rearrangements).

– cheletropic reactions – Diels-Alder Reactions and 1,3 dipolar 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 rearrangement electrophilic rearrangement and radical – rearrangement Mechanism of Favorski, Benzil-Benzilic acid, Bayer-Villiger, Wagner-Meerwin rearrangement, Carbanionic rearrangements, Stevan's rearrangement, Sommelet-Hauser, Cope, and, Fries Rearrangement.

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

~~Text book~~s:

1. Jerry March 2010. Advanced Organic Chemistry, Reaction mechanism and structure, John Wiley and sons, 7th 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 Mac Graw 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.

Web resources:

https://www.slideshare.net/nitinlambe/seminar-on-name-reaction
https://www.slideshare.net/binujass1/photooxidation
https://youtu.be/JROZc-9DayM (photochemistry of carbonyl compounds)
https://youtu.be/ClmH7mB6CPY (Pericyclic reaction)
NPTEL course on "pericyclic and photochemistry".
NPTEL course on "Reagents in organic synthesis".

Course designer

1. Dr. P. Tharmaraj
2. Dr. P. Prakash
3. Dr. R. Mahalakshmy
4. Dr. A.Tamilselvi
5. Dr. J. Thirupathy

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Department of Chemistry
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Programme Code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20C32	**Organometallics, Inorganic Spectroscopy and rings - cages**	Core 8	5	-	-	5

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

Preamble

The course explains the synthesis, structure and reactivity or organometallic compounds and their catalytic applications, various characterization techniques of inorganic compounds, preparation, properties and uses of inorganic rings and cages of boron, silica, sulphur, and phosphorous derivatives.

Prerequisite

Basic knowledge on organometallic compounds, nuclear and electrical spectral techniques, chemistry and reactivity of boron, silica, sulphur and phosphorous are required at undergraduate level.

Course Outcomes

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

#	Course Outcome	Expected proficiency	Expected attainment
CO1	Describe the terms EAN, 18, 16-electron rule classify the organometallic compounds, structure and properties of organometallic compounds such as metallocenes, alkenes, alkynes andarene complexes.	80 %	75%
CO2	Explain Outline the reaction mechanism of organometallic compounds.	70 %	65%
CO3	Explain the catalytic application of organometallic compounds.	80 %	75%
CO4	Outline the basic principles of various spectral techniques like EPR, Mossbauer spectroscopy and NQR and interpretation of the spectra of inorganic complexes.	70 %	65%
CO5	Compare and solve the structures of Borane, B-N and boron heteroatoms, Si, Si-Al inorganic rings, cages, clusters and materials.	70 %	65%

Mapping of COs and POs

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

S-Strong; M-Medium; L-Low

Mapping of COs and PSOs

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

Blooms taxanomy and assessment pattern

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

Course title: Organometallics, Inorganic Spectroscopy and rings-cages

UNIT – I: Chemistry of Metal carbonyls (15 Hrs)

Complexes of Pi acceptor ligands – metal carbonyls andits types– the 16electron and 18 electron rule – classification preparation – properties – uses of metal carbonyls – bonding in metal carbonyls – 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- polynuclear carbonyl complex. Tetra nuclear carbonyls of iridium-Stability of organo metallic compounds- β hydrogen elimination-Synthesis – structure and bonding in metal carbonyls – isoelectronic and isolobal analogy- IR spectra of metal carbonyl- cis – trans isomerism – determination of bond order of CO – differentiating terminal and bridging CO -NMR in the structural elucidation of carbonyl compounds–High, low nuclearity carbonyl clusters-halide clusters. Structural prediction by Wade's rule-Capping rule-chevrel phases-Zintl ions.

UNIT – II: Organometallic Chemistry (15 Hrs)

Synthesis structure bonding and reactivity ofmetal nitrosyls – dinitrogen complexes- π-donors-Carboxylic ligands and complexes-carbenes, carbines, metallocenes and other aromatic cyclopolyenes– sigma, pi and hapto nomenclature – sandwich compounds-MOT of Ferrocene – bonding, structureand reactivity(acetylation, alkylation, metallation, Mannich Condensation). Structure and aromaticity.Comparison of aromaticity and reactivity with benzene.Covalentvs ionic bonding nature of metallocenes- reactivity- Arene complexes – olefin – acetylene and pi allyl complexes- Ligand cone angles- oxidative addition and reductive elimination of organometallic

complexes- Insertion and Elimination reactions- Nucleophile and electrophilic reaction of organometallic complexes.

UNIT – III: Organometalliccatalysis (15 Hrs)

Catalysis involving organometallic compounds – properties of metals and ligands in homogeneous catalysis – 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 –Ziegler-Natta catalyst- Stereo-regular polymers - Olefin metathesis cyclo-oligomerisation of acetylene, butadiene- Reppe's catalyst. Mansanto's acetic acid synthesis-Fischer-Tropsch's synthesis of synthetic gasoline-Industrial application of catalysts.

UNIT- IV: PHYSICAL METHODS IN INORGANIC CHEMISTRY (15 Hrs)

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) – Jahn-Teller distortions in Cu (II) complexes.

Mossbauer spectroscopy: Basic principles- Doppler effect- Isomer shift- Electron nuclear hyperfine interactions- Quadrupole and magnetic interactions - structure and bonding in Iron, Gold and Tin complexes and applicationsin Biological systems.

NQR- Basic theory, principles and applications.

UNIT-V: INORGANIC RINGS, CAGES OF BORAN AND SILICA (15 Hrs)

Electron deficient compounds: Borane and carboranes- Synthesis, structure and bonding (VBT and MO approach) –topological treatment- Wade's rule –styx numbers-structural studies by NMR-metallocarboranes- monocarboranes – carboranes with more than two cage carbon atoms-borates-boroxines-B-P and B-As heterocycles- Borazines – N and B substituted borazines- hydrolytic stability – B-O systems – borates.

Classification – asbestos minerals – zeolites – organosilicon compounds – silicone polymer – types – preparation – applications – siloxanes – reactions – polymerisation of cyclicsiloxane – mechanism – factors influencing polymerization.Structure of aluminosilicates- mica, clay, zeolites, fullers earth.

Text book:

1. F.A. Cotton and G. Wilkinson, 1988. Advanced Inorganic Chemistry, Wiley-Interscience publications, John Wiley & Sons, V Edn., New Delhi.
2. H. G. Heal, 1980. The Inorganic Heterocyclic Chemistry of Sulphur, Nitrogen and Phosphorus, Academic press, New York.
3. J. D. Woolings, 1989. Non Metal Rings, Cages and Clusters, John Wiley and sons, New York.
4. P.J. Durrant and B. Durrant, 1970 Introduction to advanced inorganic chemistry, Longman Group Ltd, London,.
5. K.F. Purcell and J.C. Kotz, Saunders, 1977 Inorganic Chemistry, Philadelphia.
6. Nakamoto, Kazuo, J. Paul McCarthy, 1986. Spectroscopy and Structure of Metal Chelate Compounds, IV edition, John Wiley and Sons. Inc., New York.
7. R. S. Drago, Van Nostrand and Reinhold, 1976. Physical Methods in Chemistry
8. Raymond Chang, 1971.Basic principles of Spectroscopy, McGraw Hill, New Delhi.
9. B. P. Straughan and S. Walker, 1976.Spectroscopy, Vol.3, Chapman and Hall, New York,
10. T.C. Gibbs, 1978. Principles of Mossbauer Spectroscopy, Chapman and Hall, New York.

REFERENCE BOOKS:

1. J. E. Huheey, Ellen A. Keiter, Richard L. Keiter, 2004.Inorganic Chemistry, Pearson Education (Singapore) Pte. Ltd., IV Edn., Delhi.
2. D. F. Shriver and P.W. Atkins, 1999. Inorganic Chemistry, Oxford University Press, London.
3. U. Wahid, G.D. Malik, Tuli and R. D. Madan, 2006.Selected Topics in Inorganic 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.

Web Resources:

1. a. https://nptel.ac.in/courses/104/101/104101123/
   b. https://nptel.ac.in/courses/104/101/104101091/
2. a. https://www.youtube.com/watch?v=zfrJxG9m6aI
   b. https://www.youtube.com/watch?v=soQes2znsEU
3. https://www.youtube.com/watch?v=tX8gdpDJTHU
4. https://www.youtube.com/watch?v=E8Ee_-h48IM

Course designers

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

THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc Chemistry on or after June 2020)
Programme code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CE31	**Group Theory and Spectroscopy**	Core Elective - 2	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	Expected Proficiency	Expected attainment
CO1	Summarise the fundamentals of group theory.	76%	72%
CO2	Analyze the applications of group theory.	77%	75%
CO3	Apply the concepts of spectroscopic techniques such as IR, Raman and microwave.	80%	75%
CO4	Interpret the physical concepts of electronic and Photo electron spectroscopy.	75%	70%
CO5	Apply the theory and applications of ESR, Mossbauer and NQR spectroscopic techniques.	78%	75%

Mapping of COs with POs

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

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

Course title: Group Theory and Spectroscopy

UNIT – I: GROUP THEORY – I (Basics of Group Theory) (15 Hrs)

(i) Introduction - Symmetry elements and symmetry operations - Definition of mathematical group – four cardinal properties of a group – closure, associative, identity 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.

(iii) Representation definition – reducible and irreducible representation of a group –block factorization. The great orthogonality theorem (GOT) – rules for writing (properties of) irreducible representations — 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 NH_3 – 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) — Interaction of electromagnetic radiation with matter;

Rotational spectroscopy – moment of inertia – reduced mass - rotational spectra of rigid rotor – selection rule - application in bond distance calculation (CO, CN and HCl only)

IR spectroscopy – Vibrational spectra of diatomic molecule – Hook's law – Zero point energy – selection rule; Polyatomic molecules - Finger print region –overtone, combination and difference bands – Fermi resonance. Raman spectroscopy – Quantum theory of Raman scattering – Raleigh and Raman scattering (Stokes and anti stokes lines) – Selection rule – Mutual exclusion principle-active and inactive modes of di and triatomic molecules (N_2, CO, N_2O and CO_2).

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 to H-atom, CH_3 radical, *p*-1,4-benzosemiquinone radical anion, naphthalene anion, Tempol.

NQR spectroscopy – quadrupole moment, coupling constant, quadrupole transition-electric field gradient and studies on the isotopes $_7N^{14}$, $_5B^{11}$, $_{17}Cl^{36}$.

Mossbauer spectroscopy – recoilless emission and resonance absorption, experimental method, isomeric shift and electric quadrupole splitting in ^{57}Fe.

TEXT BOOKS: (UNIT I & II)

1. Cotton 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.
3. Veera Reddy, K. 1998, Symmetry and spectroscopy of molecules, New age International (p) Ltd.,
4. A. S. Kunju, G. Krishnan, Group theory and its applications in chemistry, 2nd edition, PHI learning publishers, 2015.
5. B. K. Sharma, 2015, spectroscopy, Goel publication.

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

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THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
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Department of Chemistry
(For those joined M.Sc Chemistry on or after June 2020)
Programme code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CE32(A)	Research methodology	Core elective - 3 (Option A)	5	-	-	5

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

Preamble

Research in chemistry requires the knowledge of errors in chemical analysis, instrumental methods, literature, laboratory skill, analytical skill and report writing skill. This course fulfills the said requirements.

Prerequisites

Students with minimum knowledge on analytical and laboratory skill at undergraduate level.

Course Outcomes

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

#	Course Outcome	Expected proficiency	Expected attainment
CO1	Assess and evaluate sensitivity, important sources of interferences and errors, and also suggest alternative analytical methods for quality assurance.	80%	75%
CO2	Demonstrate the safety measures in chemistry laboratory and extract the species using organic solvents	90%	85%
CO3	Make use of the working principle and applications of analytical instruments	85%	80%
CO4	Apply the spectroscopy concepts to infer and assess the spectral peaks that in-turn helps in deducing the structure of various organic compounds	80%	75%
CO5	Design and execute a meaningful research project that uses the knowledge and skills learned	85%	75%

Mapping of COs with POs

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**S**	**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 Taxonomy and assessment pattern			
Blooms Taxonomy	**CA**		**End of Semester (Marks)**
	First (Marks)	**Second(Marks)**	
Knowledge -K1	15% (9)	15% (9)	15% (20)
Understand -K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze-K4	20% (12)	20% (12)	20% (25)
Evaluate-K5	20% (12)	20% (12)	20% (25)
Total Marks	**60**	**60**	**130**

Course title: Research methodology

UNIT I: ERRORS IN CHEMICAL ANALYSIS (15 hrs)

Introduction, types of errors - significant figures - precision and accuracy - methods of expressing accuracy - methods of expressing precision - the confidence limit - tests of significance - the F test - the student T test - rejection of results - the Q test.

Statistics for small data sets - linear least squares - correlation coefficient- using spreadsheets for plotting calibration curves - slope, intercept and coefficient of determination - numericals.

UNIT II: LAB SAFETY MEASURES AND SOLVENT EXTRACTION METHOD(15 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.

Principles of solvent extraction - formation of metal complexes - extractions involving ion pairs and solvates - distribution of extractable species - Nernst distribution law - quantitative treatment of extractable equillibria - Methods of extraction - techniques in extraction.

UNIT III: INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS (15 hrs)

Principle, instrumentation and applications: Flame Emission spectroscopy - Atomic absorption spectroscopy (AAS), Inductively coupled plasma (ICP), HPLC, GC-MS and Electro analytical Techniques (CV, DPV, LSV, EIS, Amperometry) - Spectrofluorimetry.

Thermal analysis: Thermogravimetric Analysis (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).

UNIT IV: INTERPRETATION OF COMBINED SPECTRAL DATA OF ORGANIC MOLECULES (15 hrs)

Spectroscopy overview of IR, UV-Vis, mass and NMR with problems.

UV-Vis and IR problems

Determination of molecular formula using the given elemental analysis data – Interpretation of Mass spectral data – determination of molecular formula using the mass peaks –Mass problem solving

NMR problem solving – Analyzing and deducing structures using ^{1}H and ^{13}C NMR data.

Combined Problems based on UV, IR, NMR and Mass spectral data.

UNIT V: LITERATURE SURVEY AND THESIS WRITING (15 hrs)

Definition and purpose of research - goals of scientific research - types of research - choosing a problem.

Searching the chemical literature - primary sources & secondary sources of literature survey - Scifinder and Reaxys - Chemical abstracts online.

Thesis layout - Reference Systems - documenting – appendices - use of appendix and its format - presenting a scientific seminar - art of writing a thesis - publication of research paper - plagiarism - Ethics in Writing.

References:

1. G.D. Christian, Analytical Chemistry, John Willey sons, 1986, IV edition.
2. Geffery, G. H., Basselt, J., Mendhan, J. and Denney, R. C., Vogel's Text book of Quantitative Chemical Analysis, V Edn., Longman Scientific and Industrial, UK, 1989.
3. D.A. Skoog, D.M. West & F.J. Holler, Fundamentals of Analytical Chemistry, VII Edn., Saunders College Publishing, New York, 1996.
4. Hobart H. Willard, Lynne L. Merritt,Jr., John A. Dean, Frank A. Settle, Jr, Instrumental Methods of Analysis, VII edition, CBS publishers and distributors, New Delhi, 1986.
5. F.A. Settle Handbook of Instrumental techniques for analytical chemistry, Editor – prentice Hall Inc. 1997.
6. B.K. Sharma, Instrumental Methods of Chemical analysis, Goel publishing House, Meerut, 1995.
7. Kaur, Instrumental Methods of Chemical analysis.
8. Willam Kemp, Organic Spectroscopy, Palgrave, 3rd edition, 1991.
9. R.M. Silverstein, G.C. Bassler & T.C. Morril, Spectrometric Identification of Organic Compounds, John Wiley & Sons, V Edn., New York, 2001.
10. R.S Drago, Physical Methods in Chemistry, Saunders College Publishing, Philadelphia, 1977.
11. J. Anderson, B.H. Durston and M. Poole, Thesis and Assignment Writing, Wiley Eastern Ltd., New Delhi, 1997.
12. F. Abdul Rahim - Thesis Writing - A Manual Researcher, New age International Ltd., New Delhi, 1996.

Web resources:

1. https://youtu.be/5W3cMaowR-c (Laboratory safety)
2. https://youtu.be/pOtnzAXlXvI (Error analysis)
3. https://youtu.be/LLPMxBB9hRw (Instrumental methods of chemical analysis)
4. https://youtu.be/H6EnGz609hY (interpretation of spectral data)
5. NPTEL course on "Introduction to research". (Refer video lectures and course materials)

Course designers

1.Dr. R. Mahalakshmy
2.Dr. D.S.Bhuvaneshwari
3. Dr. A. Tamilselvi

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Department of Chemistry
(For those joined M.Sc Chemistry on or after June 2020)
Programme code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CE32 (B)	**Advanced Organic Synthesis**	Core elective -3 (Option B)	5	-	-	5

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

Preamble

The course explains the concepts of retrosynthetic analysis, biogenesis of natural products, biosynthesis of fatty acids and biotransformation.

Prerequisites

Basic knowledge on chemistry of natural products at undergraduate level.

Course Outcomes

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

#	Course Outcome	Expected proficiency	Expected attainment
CO1	Outline the synthetic strategy of few structurally complicated organic molecules.	75%	70%
CO2	Make use of the biogenesis of natural products such as alkaloids, terpenoids and flavones.	70%	65%
CO3	Examine the biosynthesis of fatty acids and few essential amino acids.	75%	70%
CO4	Utilize the classification, preparation and uses of some important dyes.	70%	65%
CO5	Evaluate biocatalysts such as enzymes, modifies enzymes and artificial enzymes to carry out various chemical reactions.	75%	70%

Mapping of COs with POs

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

S-Strong; M-Medium; L-Low

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

Blooms taxonomy and assessment pattern

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

Course title: Advanced Organic Synthesis

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, 2nd 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
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Department of Chemistry
(For those joined M.Sc Chemistry on or after June 2020)
Programme code:PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20C41	Chemistry of heterocyclic compounds, natural products and green chemical methods	Core-10	4	1	-	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

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	Expected proficiency	Expected outcome
CO1	Outline the chemistry of nitrogen and oxygen containing heterocyclic compounds and natural products.	80%	75%
CO2	Apply their knowledge on isolation, biological activity and structural studies of selective terpenoids and alkaloids	75%	70%
CO3	Analyze the structure and activity of compounds with steroid skeleton and vitamins.	75%	70%
CO4	Explain the structure and synthesis of amino acids, peptides, proteins and nucleic acid.	80%	75%
CO5	Apply their knowledge to synthesis compounds in a greener way.	85%	75%

Mapping of COs with POs

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

CO5	S	**S**	**S**	**S**	**S**	**M**	**M**

Mapping of COs with PSOs					
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	**S**	**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 taxonomy and assessment pattern

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

Course title: Chemistry of heterocyclic compounds, natural products and green chemical methods

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.

Chemistry of anthrocyanins and flavonoids, Chromone, coumarin.

Unit – II: CHEMISTRY OF TERPENOIDS AND ALKALOIDS (15 hrs)

Chemistry of terpenoids: General methods of determining structure of terpenoids – structural elucidation of α-pinene, Zingiberene, α – Cadinene 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 – classifications - Structural elucidation of Cholesterol – Androsterone and Testosterone (male sex hormones) – Oesterone, progesterone (Female sex hormone).

Classification of Vitamins: Nomenclature of Vitamins – Structural elucidation and synthesis of Vitamin A1, A2, B2, B6 and C. Biological functions of vitamins: Vitamin B12, Vitamin-D and E (Structure elucidation and synthesis not required).

Unit – IV: CHEMISTRY OF PEPTIDES AND NUCLEIC ACID (15 hrs)

(a) Polypeptides – Classification - nomenclature - the peptide linkage - Solid phase peptide synthesis (Merifield) – use of protecting groups and reagents – synthesis of dipepides – Structureof proteins – 1^0, 2^0, 3^0 and quaternary structure) –Structural elucidation of glutathione, thyroxin and oxytocin.

(b) Nucleosides, Nucleotides and Nucleic acids – nomenclature, composition, 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, purposes and illustration of twelve basic principles of Green chemistry - Solid state organic reactions- Solvent free organic reactions – Solid supported reagents – Microwave assisted reactions: principle of microwave, reaction set up, advantages and disadvantages, microwave assisted organic synthesis in aqueous and organic media - Sonochemical approach: working principle, advantages, ultrasound assisted organic synthesis - Ionic liquids: classification, synthesis using ionic liquids, advantages and applications – Organic synthesis in supercritical H_2O and CO_2 medium – - enzymatic and electrochemical methods.

Text Books:

7. I.L. Finar, 2005, Organic Chemistry, Vol. II, V Edition, ELBS, UK.
8. S.F. Dyke, 1965, Chemistry of Vitamins, Interscience, Toronto.
9. O.P. Agarwal, 2002 Chemistry of Natural products, Vol. I and II, Himalaya Publishing House, New Delhi.
10. V.K. Ahluwalia, M. Kidwai2006. "New trends in Green Chemistry" Second Edition, Anamaya publishers, New Delhi,.
11. Gurdeep Chatwal, 1997. Organic Chemistry of natural products, Vol. I, Himalaya Publishing House.
12. Morrison and Boyd, Organic Chemistry, Prentice-Hall of India private limited, New Delhi, 6th Edition.

Reference Books

13. Hermann Dugus, 2004, Bioorganic Chemistry, Springer International, III Edition, NewDelhi.
14. D.L. Nelson and M.M. Cox, 2008.Lehningers' Principal of Biochemistry, W.H. Freeman and Company, New York, 5th Edition.
15. L.F Fieser and M. Fieser, 1991 Steroids, Reinhold Press, Atlanta.

Web resources

1. https://youtu.be/zyRRHfH9_Zg (heterocyclic compound)
2. https://youtu.be/Al1cCVsFoT0 (Terpenoids and alkaloids)
3. https://youtu.be/s_wBupj_ECM (peptides and nucleic acid)
4. https://youtu.be/l1XPIFXhhE8 (Vitamins)
5. https://youtu.be/X4J32_B9bn8 (Green chemistry)

Course designer

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19. Dr. A. Tamil Selvi
20. Mrs. P. Rajam

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Programme code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20C42	**F-block elements and Applied Chemistry**	Core 11	4	1	-	4

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

Preamble

The course explains the properties of lanthanides and actinides. It also describes the properties of various π acceptor ligands, their applications, synthesis and bonding interaction of rings and cages, inorganic photochemical reactions and supramolecular and nano chemistry.

Prerequisite

Students with the minimum knowledge on fundamentals of orbital participation inorganic rings and cages, nano technology,supramolecular chemistry and analytical techniques in undergraduate level.

Course Outcomes

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

#	Course Outcome	Expected proficiency	Expected attainment
CO1	Make use of the occurrence, extraction, spectral and magnetic properties of lanthanides and actinides, their comparison	70 %	65%
CO2	Categorize the given S-N, P-N compounds, polymers, cluster of polyanions and heteroanions and deduce their structures.	70 %	65%
CO3	Apply inorganic photochemical reactions to evaluate the reaction path, photochemical energy conversion like solar cell, fuel cell etc, Flash photolysis	70 %	65%
CO4	Describe supramolecular chemistry of transition metal compounds, structure and their application in various fields.	70 %	65%
CO5	Summarize the preparation, characterization and evaluate application of nano particles and quantum dots.	70 %	65%

Mapping of COs and POs

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

S-Strong; M-Medium; L-Low

Mapping of COs with PSOs					
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	M	-	L
CO2	S	S	S	-	-
CO3	S	S	S	L	L
CO4	S	M	L	-	-
CO5	S	S	S	S	S

S-Strong; M-Medium; L-Low

Blooms taxonomy and assessment pattern

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

Course title: F-block elements and Applied Chemistry

UNIT- I: LANTHANIDES AND ACTINIDES (15 Hrs)

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. Comparison of the spectral and magnetic properties of lanthanides and actinides.

UNIT-II:RINGS, CAGES OF SULPHUR AND PHOSPHOROUS (15 Hrs)

Synthesis, structure and bonding in Binary sulphur nitriles, S-N cations and anions, cyclic S-N compounds, S-N halogen compounds-bonds and electron counting in S-N heterocycles- polythiazyls. P-N heterocyclics- Phosphonitrilic compounds: Glass transition temperature-Synthesis, Structure and bonding-phosphazenetrimer and tetramer- oligomers -high polymers-hydrolysis of phosphazenes-reactions of halo phosphazenes- aminolysis- metathetical reactions-reaction with organometallic reagents-Friedel-Crafts substitutions. Synthesis, structure and bonding in poly anions and isopoly anions of phosphorous, vanadium, chromium, Molybdenum and tungsten. Hetero poly anions of molybdenum and tungsten.

UNIT –III: 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 – photo substitution reactions – photoaquation, photoanation and photorearrangements–Comparison of Photochemical reaction of Cr(III) and Co(III). Role of TiO_2 in solar energy conversion – Photoredox chemistry of Ruthenium (II)bipyridylcompounds-energy conversion and photochemical decomposition of water using Ru

complexes- storage of solar energy. Actinometry – scavenging of reaction intermediates – flash photolysis.

UNIT IV:SUPRAMOLECULAR CHEMISTRY (15 Hrs)

Definition, Nature of supramolecular interactions- Non- Covalent interactions, Host - guest interaction, complexing involving crowns and cryptands-cyclodextrine - Inclusion compounds-Clatharates-intercalation compounds (one example each) -Molecular recognition, Types of recognition(neutral molecules, anions and cations), Self- assembly. General properties of Supramolecularcomplexes- Molecular Library (Directional bond approach) - Transition metal mediated supramolecules- Molecular triangles, Molecular squares, Molecular rectangles and Molecular Cages (Pd and Pt).

UNIT – V:CHEMISTRY OF NANOSCIENCE AND TECHNOLOGY (15 Hrs)

Introduction- Types of nano materials-Nanoparticles, nanotubes-Carbon nanotubes: SWCNT and MWCNT, nanowires, nanoribbons, nanorods- Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.

Preparation methods-Chemical vapour deposition, Sol-Gel method, Electro-deposition 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.

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. Purcell, K. F. Kotz, J.C. Holt Saunders,1977. Inorganic Chemistry, Philedelphia,USA.
4. 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
5. Katsuhiko Ariga, Toyoki Kunitaka, 2006. Supramolecular Chemistry-Fundamentals and Applications: Advanced Textbook, Springer Science & Business Media.
6. W. Jones, C. N. R. Rao,2001Supramolecular Organization and Materials Design, Cambridge University Press, Landon,
7. Lee, J. D.2002 Concise Inorganic Chemistry, Blackwell Science Ltd., V Edn., London.
8. Pradeep, T, A.2003 Textbook of Nanoscience and Nanotechnology Tata McGraw-Hill Education, New Delhi.
9. Arthur W. Adamson & Paul D. Fleischauer, 1975Concepts of Inorganic Photochemistry, John Wiley & Sons. In., New York.
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, McGraw Hill International Editions, V Edn., New Delhi.
14. K.Sharma, 1993. Instrumental Methods of Chemical Analysis, GOEL Publishing House, 12th Reprint, New Delhi.
15. Lee, J. D.2002 Concise Inorganic Chemistry, Blackwell Science Ltd., V Edn., London.

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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. I.Vogel,2002 Textbook of Quantitative Chemical Analysis, ELBS Longman Singapore Publisher (P) Ltd., Singapore. V Edn., Mick Wilson, KamaliKannangara, 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

Web Resources

1. dynamic-light-scattering-for-biotech-and-nanotech-1fa0073af12a7822ed2d2947411d588a=applications1fa0073af12a7822ed2d2947411d588a=
2. https://buc.kim/d/6JnWCW7ZjLNQ?pub=link

Course designers

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

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

Course Code	Course title	Category	L	T	P	Credit
PCH20C43	**Kinetics and Macromolecules**	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	Expected Proficiency	Expected Outcome
CO1	Understand the fundamental concepts on kinetics and reaction rate.	75%	70%
CO2	Develop knowledge on various theories of chemical kinetics.	75%	70%
CO3	Analyze the physical concepts of photochemistry.	80%	75%
CO4	Make use of the kinetics and theories of surface chemistry.	78%	75%
CO5	Explain the basics and applications on polymer chemistry.	80%	75%

Mapping of COs with POs

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

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 taxonomy and assessment pattern

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

Course title: Kinetics and Macromolecules

UNIT-I: CHEMICAL KINETICS-I (12 hrs)

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: CHEMICAL KINETICS-II (12 hrs)

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: PHOTOCHEMISTRY (12 hrs)

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: SURFACE CHEMISTRY (12 hrs)

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: POLYMER CHEMISTRY (12 hrs)

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.
7. Laidler K.J., 2005, Chemical Kinetics, II Edition, Tata McGraw Hill, UK

Reference Books:

1. Frost A.A., Pearson R.G., 1990, Kinetics and Mechanism, New York.
2. Wilkinson F., 2000, Chemical Kinetics and Reaction Mechanism, Var Nostrard Reinhold Co., New York.
3. Rohatgi-Mukherjee K.K., 1999, Fundamentals of Photochemistry, Wiley Eastern Ltd., Revised edition, New York.
4. Adamson A.M., 2002, Physical Chemistry of Surfaces, V.Edition, John Willey, UK.
5. Allcock H.R., Lampe W., 1991, Contemporary polymer chemistry, Prentice Hall UK.
6. Young, 2002, Polymer Chemistry II, Chapman Hall.
7. Arora Singh, 2001, Polymer Chemistry, Anmol Publications Pvt. Ltd.

Course Designers

Dr. R. Sayee Kannan
Dr. A. R. Ramesh
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Dr. M. Sathiya
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THIAGARAJAR COLLEGE (Autonomous), MADURAI-625 009
(Re-Accredited with "A^{++}" Grade by NAAC)
Department of Chemistry
(For those joined M.Sc Chemistry on or after June 2020)
Programme code:PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CL41	Estimation and preparation of Organic compounds	Core Lab - 4	-	-	5	5

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

Preamble

This lab course describes the experimental procedure for 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	Expected proficiency	Expected attainment
CO1	Gain practical skill on multi step synthesis of organic compounds.	90%	75%
CO2	Orient the skill of writing the reaction mechanism of the synthesized compounds.	85%	80%
CO3	Estimate the amount of glucose by adopting different procedures.	90%	85%
CO4	Apply iodometric method to estimate Ketonic compound.	90%	85%
CO5	Estimate amino acid viz., Glycine.	92%	85%

Mapping of COs with POs

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

Mapping of COs with PSOs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	**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

PREPARATION (DOUBLE STAGE)

1. p-Nitroaniline (Acetanilide → p-Nitroacetanilide → p-Nitroaniline)
2. p-bromoaniline (Acetanilide → p-bromoacetanilide → p-bromoaniline)
3. Benzanilide (Benzophenone → Benzophenone oxime →Benzanilide)
4. Benzpinacolone (Benzophenone → Benzpinacol → Benzpinacolone) - Photochemical reaction
5. Benzilic acid (Benzoin → Benzil → Benzilic acid

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

References

1. B. S. Furniss, A.J. Hannaford, P.W.G. Smith, A.R. Tatchell, Vogel's textbook of Practical Organic Chemistyry, Pearson, 5th edition, 1989.
2. N.S. Gnanpragasam and G. Ramamurthy, Organic Chemistry Lab Manual, S. Viswanathan Pvt. Ltd.
3. N.K. Vishnoi, Advanced Practical Organic Chemistry, Vikas Publishing, 1st edition, 1979.

Course Designers

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

THIAGARAJAR COLLEGE, MADURAI- 9

(Re-Accredited with "A^{++}" Grade by NAAC)

DEPARTMENT OF CHEMISTRY

(For those joined M.Sc Chemistry on or after June 2017)

Programme code:PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20CL42	**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	Expected Proficiency	Expected attainment
CO1	Estimate inorganic metal ions such as lead, nickel and magnesium by gravimetric estimation.	90%	85%
CO2	Determine iron or copper by colorimetric method.	90%	85%
CO3	Prepare potassium cupric sulphate and Potassium trioxalatoaluminate complexes.	90%	85%
CO4	Prepare coordination complexes such as Hexathioureaplumbusnitrate, Tetrammine copper(II)sulphate and Ferrous/Ferric oxalate in the laboratory.	90%	85%
CO5	Explain the principle and application of chromatorgraphic and UV-Vis specrophotometric techniques.	90%	85%

Mapping of COs with POs

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

Mapping of COs with PSOs					
	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	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 (Any FOUR) METHOD

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. Trithioureacopper(II) sulphate
5. Pentathioureadicuprous nitrate
6. Hexathioureaplumbus nitrate
7. Potassium troxalatoferrate III
8. Preparation and Analysis of $K_2[Cu(ox)_2].2H_2O$

III. Colorimetry: (Any ONE)

1. Estimation of Iron (III)
2. Estimation of Copper (II)

IV. Chromatography (Demo only NOT for the Exam)

1. Paper Chromatography: Chromatographic separation of a mixture of Co, Mn, Ni and Zn
2. 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 on or after June 2020)

Programme code: PCH

Course Code	Course title	Category	L	T	P	Credit
PCH20PJ41	**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, and 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	Expected proficiency	Expected attainment
CO1	Get skills on developing novel materials through new synthetic routes.	85%	80%
CO2	Characterize the materials using various analytical techniques.	90%	80%
CO3	Interpret the analytical data and able to correlate theoretical and experimental results.	90%	80%
CO4	Communicate the laboratory scientific results both in oral, written and electronic format to both chemists and non-chemists.	90%	80%
CO5	Learn research methodologies along with literature survey	92%	80%

Mapping of COs with POs

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

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 : Evaluation of Project: 60

Internal Examiner : Evaluation of Project: 40

100
