ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)
CUDDALORE-1

PG & RESEARCH DEPARTMENT OF CHEMISTRY
UG - SYLLABUS 2019-2020
B.Sc. CHEMISTRY

Meeting of the board of studies for UG
Department of Chemistry

Date: 15.03.2019

Minutes:

The meeting of the board of studies for B.Sc., of Department of Chemistrywas held in the Chemistry department, St. Joseph's College of Arts and Science (Autonomous), Cuddalore, on 15th March 2019 at 10.00 am

CHAIRMAN
Mr. T. Antony Sandosh,
Head, PG and Research Department of Chemistry,
St. Joseph's College of Arts and Science (Autonomous), Cuddalore.

UNIVERSITY NOMINEE
Dr. M. Sekar,
Associate Professor,
Department of Chemistry,
Government Arts college,
C. Mutlur,Chidambaram.

SUBJECT EXPERT
Dr.C.Palanivel,
Assistant Professor,
Department of Chemistry,
Government Arts college,
C. Mutlur, Chidambaram.

ALUMNI
Dr.V.Selvaraj,
Associate Professor,
Department of Chemistry,
Anna University, Villupuram.

INDUSTRIAL EXPERT
Mr.P.Harinarayanan,
Manager, STRIDE SHASUN,
SIPCOT, Cuddalore.

MEMBERS

Dr. V. Periyanayagasamy	Asst. Professor
Mr. A. Amalorpavadoss	Asst. Professor
Mr. M. Sebastian Marianathan	Asst. Professor
Mr. G. Anand	Asst. Professor
Ms. B.Christina	Asst. Professor
Mr. S.Richard Rajkumar	Asst. Professor
Mr. F.Paul Arokiadoss	Asst. Professor

The meeting started with a prayer and the experts were formally introduced by the Chairman. The existing curriculum for B.Sc., Chemistry was taken for discussion. The members of the Board of studies suggested the following changes in the existing syllabus.It was discussed to prepare the programme outcome and course outcome for all courses and programme.

Changes introduced:

ORGANIC CHEMISTRY

In **ORGANIC CHEMISTRY – I (CH101T),** Unit-IV, topics were rearranged. The polymerization of dienes was removed**.** Textbooks and reference books were changed.

In **ORGANIC CHEMISTRY – II (CH407S), Unit-I,** the topics, leaving group ability was changed into leaving ability of the leaving group and the term pKa value was removed. In Unit-IV, 4.7 was shifted to **CH614T** and Rosenmund, Gattermann, Vilsmeier-Haack reactions were included. Textbooks and reference books were changed.

In **ORGANIC CHEMISTRY – III (CH509S),** Gattermann and Gomberg reactions were removed from 1.6. In Unit -II, interconversions of different projection formulas were included. In Unit – IV, Lossen and Smith reactions were included. From Unit – V, primary, secondary and tertiary structures of Proteins were removed. Textbooks were changed.

In **ORGANIC CHEMISTRY – III (CH614T)**, photochemical reactions of carbonyl compounds: Norrish type – I and II reactionswere included in Unit-IV.Alkaloid was shifted from Unit-IV to Unit-V. New Textbooks were included.

INORGANIC CHEMISTRY

In the course **Inorganic Chemistry-I (CH203T)**, the repeated topics (Applications of electronegativities) in Unit- I were replaced with the topics Hydrogen bonding in Unit – II, In Unit – IV, the topics Charge by ratio were moved to **Inorganic Chemistry –II (CH305T)** instead of the topic Chemistry of Ozone.

In **Inorganic Chemistry-III (CH510T**), the topics Metallurgical process in Unit - I were not specific so it was changed to, Methods involved in ore concentration - Magnetic separation, Hydraulic washing, leaching, froath floatation process - Conversion of concentrated ore in to metallic oxide - Roasting, calcination, smelting – Reduction of metal oxide - Chemical method, reduction by other metals, electrolytic reduction – Refining – Bessemerisation, cupelleation, electrolytic refining, van Arkel method, vapour phase refining. The topics, Differences between double salts and Coordination complexes were included in Unit – II. In unit – IV the topics, Facial and meridonial isomers, Consequences of CFSE and factors affecting CFSE were added and the Chemistry of carbonyls was moved to **Inorganic Chemistry-IV (CH615S)** and the topic Metal excess and metal deficiency were specified with the term types of metal excess and metal deficiency, GM counter and cloud chamber methods. Along with the content of **Inorganic Chemistry-IV (CH615S),** the topic of water gas shift reaction is added.

ALLIED CHEMISTRY

As per the request received from the Board of Studies for B.Sc. (Zoology) a new syllabus was prepared for the **Allied Chemistry for Zoology** for both theory (One Paper) and practical (One Paper) for one semester alone instead of two papers in two-semester (i.e.) in the Semester-II, namely **Allied Chemistry for Zoology**and for the Practical**Allied Chemistry Practical for Zoology.**

ELECTIVES:

In the course, **CHEMISTRY OF INDUSTRIAL PRODUCTS** (**ECH513),** in Unit-I, the topic,Biodegradation – environmental effects – ISI specifications and limits were removed.

PHYSICAL CHEMISTRY

In the course**Kinetic Theory of Gases and Chemical kinetics (CH102Q),**in Unit-I,the topic, units,and its dimensions were specified with Temperature, Length, Mass,Charge andEnergy

conversions. The topics,Numerical conversions related to Temperature, Length, Mass, Charge,and Energy conversions were added. In Unit-II, The topic, Numerical problems related to the types of velocities and molecular velocities was added. The topicsNumerical problems related to partial pressures, adsorption coefficients were added in Unit-III.The topic, Numerical problems of determining rate and order was added in Unit-IV. In Unit-V, Numerical problems related to concentrations and activity coefficientswere added.

In the course **CH408T**, in Unit-I, the topics, Mathematical expressions of s,p, d and f orbitals,Illustrative problems of surface temperatures and total radiation emission calculations of other planets, stars and Black body were included.

SSC (Self Study Course) - Optional

In Semester-V, as per the new curriculum template, a syllabus was framed for the Self-study Course,**EverydayChemistry**.

Skill Development course

In Semester –V, The existing course **Analytical techniques (ECH512)**, was changed as Skill development course.

Practical

It was decided For I and II yearsB.Sc. Chemistry students, the practical examinations for the Odd semesterpractical will be conducted in the Odd semester itself, instead of year-end examination.

Curriculum template

As it was discussed in the Curriculum development meeting, **Distribution of credits** for the subjects was restructured and the new curriculum design template is given below.

CURRICULUM DESIGN TEMPLATE FROM 2019- 2020

Sem	Part	Subject Title	Subject Codes	Hrs	Cr	Exam. Hrs
I	I	Language-I (Tamil/Hindi/French)	LT101T/ LH101S/ LF101	4	3	3
	II	Functional English-I	LE101T	4	3	3
	III	Main Paper – I(ORGANIC CHEMISTRY-I)	**19CH101**	4	3	3
	III	Main Paper – II(KINETIC THEORY OF GAS AND CHEMICAL KINETICS)	**19CH102**	4	3	3
	III	Main Practical – I (PRACTICAL CHEMISTRY-I VOLUMETRIC ANALYSIS)	**19CHP101**	3	2	3
	III	Allied 1 (ALLIED MATHEMATICS-I)	AMT101Q	8	6	3
	IV	AEC- English Communication	**19AEC101**	1	1	2
	IV	SEC- Value education	VE101T	2	2	2
		Total		**30**	**23**	
II	I	Language-II(Tamil/Hindi/French)	LT202T/ LH202S/ LF202	4	3	3
	II	Functional English-II	LE202T	4	3	3
	III	Main Paper – III (INORGANIC CHEMISTRY-I)	**19CH203**	4	3	3
	III	Main Paper – IV (ANALYTICAL CHEMISTRY-I)	CH204Q	4	3	3
	III	Main Practical – II (INORGANIC QUALITATIVE ANALYSIS AND PREPARATIONS)	CHP202	3	2	3
	III	Allied-2 (ALLIED MATHEMATICS-II)	AMT202T	8	6	3
	IV	AEC- English Communication	**19AEC202**	1	1	2
	IV	SEC- Personality development	EPD201T	2	2	3
		Total		**30**	**23**	

III	I	Language III(Tamil/Hindi/French)	LT303T/ LH303S/ LF303	4	3	3
	II	English Through Literature- III	LE303T	4	3	3
	III	Main Paper – V(INORGANIC CHEMISTRY-II)	**19CH305**	4	3	3
	III	Main Paper – VI(ANALYTICAL CHEMISTRY-II)	CH306S	4	3	3
	III	*Main Practical – III (QUALITATIVE ORGANIC ANALYSIS)	**19CHP303**	3	2	3
	III	ALLIED PHYSICS	APH301T	5	4	3
	III	ALLIED PHYSICS PRACTICALS	APHP301	3	2	3
	IV	Food processing technology	AOFT301	3	3	3
		Total		**30**	**23**	
IV	I	Language-IV(Tamil/Hindi/French)	LT404T/ LH404S/ LF404	4	3	3
	II	English-IV	LE404T	4	3	3
	III	Main Paper – VII(ORGANIC CHEMISTRY -II)	**19CH407**	4	3	3
	III	Main Paper – VIII (INTRODUCTION TO MOLECULAR STRUCTURE)	**19CH408**	4	3	3
	III	Main Practical – IV (PHYSICAL METHODS)	CHP404	3	2	3
	III	Allied COMPUTERS IN CHEMISTRY	ACCH401S	5	4	3
	III	Allied practical - COMPUTERS IN CHEMISTRY	ACHP401S	3	2	3
	IV	EVS	EVS401S	3	2	3
		Total		**30**	**22**	

V	III	Main Paper – IX (ORGANIC CHEMISTRY-III)	**19CH509**	4	4	3
	III	Main Paper – X (INORGANIC CHEMISTRY-III)	**19CH510**	4	4	3
	III	Main Paper XI – EQUILIBRIUM THERMODYNAMICS OF GASEOUS SYSTEMS	CH511S	4	4	3
	III	Skill development course ANALYTICAL TECHNIQUES / FORENSIC CHEMISTRY	ECH512/ ECH512A	4	3	3
	III	Elective Paper – I CHEMISTRY OF INDUSTRIAL PRODUCTS/ FOOD CHEMISTRY	**19ECH513/** ECH513A	4	3	3
	III	Main Practical – III GRAVIMETRIC ESTIMATION	CHP506	4	2	3
	III	Main Practical – IV ANALYTICAL CHEMISTRY PRACTICALS	CHP507S	3	2	3
	III	Main Practical - V PHYSICAL CHEMISTRY PRACTICALS	CHP505S	3	2	3
		Self-study course(Optional)- SSC EVERYDAY CHEMISTRY	**19SSCH52**		2*	
		Total		**30**	**24**	
VI	III	Main Paper – XII (ORGANIC CHEMISTRY-IV)	**19CH614**	4	4	3
	III	Main Paper – XIII (INORGANIC CHEMISTRY-IV)	**19CH615**	4	4	3
	III	Main Paper –XIV (Thermodynamics of Ideal and non-ideal solutions)	CH616T	4	4	3
	III	Elective Paper – III MEDICINAL CHEMISTRY / AGRICULTURAL CHEMISTRY	ECH617T/ ECH617A	4	3	3
	III	Elective Paper – IV POLYMER CHEMISTRY / GREEN CHEMISTRY	ECH618/ ECH618A	4	3	3
	III	PROJECT WORK	JCH601	10	5	
		Total		**30**	**23**	
		Extension activity	**EU601**		**2**	
		Total credits			**140**	

(UNDER GRADUATION) PROGRAMME OUTCOMES

PO1. The Students find their footings in life through wholesome and integral education.

PO2. The Students are encouraged to climb the academic ladder by pursuing Post Graduate Education in different domain.

PO3. The Students are academically and technically equipped to steer the Nation along the path of progress and peace.

PO4. The Students are trained to be Employable and Entrepreneurial Citizen of the Nation.

PO5. The Students are fortified intellectually, ethically and socially to face the challenges in life.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

B.Sc., Chemistry

PSO1. Moral, Social values and responsibilities in the context of studying Chemistry as a discipline.

PSO2. Access and interpret information, respond and adapt to changing situations.

PSO3. Critical thinking, the Analytical mind, solving social issues

PSO4. Skills necessary to live and work in a diverse world.

PSO5. Positive approach towards Environment and Ecology from the perspective of Chemistry.

PSO6. Entrepreneurial Skills and Employability Skills enable the students to find jobs/business in core-chemistry fields.

PSO7. Familiarized with the different branches of chemistry and their applications to apprise the students of its relevance in future studies.

PSO8. Cultivates the competency to synthesize, separate and characterize compounds using laboratory and instrumentation techniques

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester I	Course code 19CH101	Title of the Paper ORGANIC CHEMISTRY – I										Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	3	3	4	4	2	4	4	3	4	4	4	4	3.61
CO2	4	3	3	4	4	2	3	4	3	4	4	4	4	3.53
CO3	3	3	3	4	3	2	3	4	3	4	3	4	4	3.30
CO4	3	3	3	4	3	2	3	4	3	4	3	4	4	3.30
CO5	3	3	3	4	3	3	3	4	3	4	4	4	4	3.46
												Mean overall Score		3.44

Result: The Score for this Course is 3.44 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I B.Sc. (chem)	ORGANIC CHEMISTRY – I For the students admitted in the year 2019	19CH101
SEMESTER – I		HRS/WK – 4
CORE - 1		CREDIT – 3

Course outcome:

i. Understanding of the basic principles of Organic Chemistry and the IUPAC rules for naming organic molecules

ii. Knowledge of Preparation and Reactions of the Hydrocarbons like Alkanes , Alkenes and Alkynes

iii. Knowledge of Preparation and Reactions of Dienes and Allenes

iv. Knowledge and understanding of Conformational isomerism and Geometrical isomerism.

v. Knowledge of methods of distinguishing geometrical isomers

Unit -I BASIC CONCEPTS 12hrs.

1.1 IUPAC nomenclature of organic compounds- naming of simple organic Molecules, practicing line formula for organic molecules.

1.2 The geometry of molecules – Hybridisation - sp^3, sp^2, sp with examples.

1.3 Cleavage of Bonds – Homolytic and heterolytic cleavage.

1.4 Bond energy, Bond length, and Bond angle.

1.5 Electron displacement effects – inductive, inductomeric, electromeric, resonance, hyperconjugation and steric effects.

1.6 Reactive Intermediates: Carbocations, Carbanions, Carbenes, and free radicals.

Unit – II:ALKANES & CYCLOALKANES 12 hrs.

2.1 Alkanes – methods of preparation: Wurtz reaction, hydrogenation of alkenes, hydrolysis of Grignard reagents, Kolbe's method. Physical and Chemical properties of alkanes.

2.2 Cycloalkanes – Preparation using Wurtz's reaction – Dieckmann's ring closure and reduction of aromatic hydrocarbons.

2.3 Substitution and ring opening reactions of cycloalkanes.

2.4 Bayer's strain theory and theory of strainless rings.

Unit-III ALKENES 12hrs.

3.1 Alkene Nomenclature - structure and bonding - Isomerism in Alkenes – properties – stability.

3.2 Preparation of Alkenes – Elimination reactions: Dehydration of Alcohols, Dehydrohalogenation of Alkyl halides. E1 and E2 mechanism. Hofmann and Saytzeff's rules – Problems related to this mechanism.

3.3 Addition Reactions of Alkenes: Hydrogenation, Halogenation, Hydrohalogenation - mechanisms – Markovnikov's and Anti Markovnikov's rule. Mechanism of Hydration, Hydroboration, Ozonolysis, Hydroxylation with $KMnO_4$. Self-addition. Polymerization of Ethylene and Propylene problems.

UNIT – 4 – ALKYNES AND DIENES 12 hrs.

4.1 Alkynes – Sources of Alkynes - Nomenclature – the acidity of alkynes – addition reactions – hydrogenation, Hydrohalogenation, Hydration with $HgSO_4$.

4.2 Preparation of Alkynes by elimination reactions, Ozonolysis of alkynes Alkylation of alkynes through acetylides.

4.3 Dienes - preparation of dienes, classes of dienes - conjugated, isolated and cumulative - stability of dienes - the addition of hydrogen halides & halogens to conjugated dienes - Polymerization of dienes– Diels-Alder reaction - Problems

4.4 Allenes – preparation and structure.

UNIT – V: STEREOCHEMISTRY – I 12hrs

5.1 Conformational isomerism: Conformers, Dihedral angle, torsional strain.

5.2 Conformational analysis of ethane and n-butane.

5.3 Geometrical isomerism: Cis – trans, syn-anti and E-Z notations, Methods of distinguishing geometrical isomers using melting point, dipole moment, dehydration, cyclization and heat of hydrogenation.

Text Books:

1 Francis A.Carey, - Organic Chemistry- Tata McGraw Hill-1999.

2 Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009), Pearson New York

3 Paula Yurkanis Bruice - Organic Chemistry, Prentice Hall- 1999.

Reference Books:

1 Ahluwalia and Parassar- Organic Reaction mechanisms, Narosa Publishers.2004.

2 Bahl & Arun Bahl- Advanced Organic Chemistry, Sultan Chand-1996.

3 Seyhan Ege- Organic Chemistry-A.I.T.B.S Publishers-1999.

4 E.L. Eliel and S.H.Wilers, Stereochemistry of Organic Compounds, John Wiley and sons, 2004.

5 P.S.Kalsi, Stereochemistry: Conformation and Mechanism, Wiley Eastern Ltd -2007.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester I	Course code 19CH102	Title of the Paper Kinetic theory of gas and Chemical kinetics										Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	4	3	4	2	3	4	3	3	3	4	4	3.30
CO2	2	3	4	3	3	2	2	3	4	3	3	4	4	3.07
CO3	2	3	4	3	3	2	3	4	4	4	4	4	4	3.38
CO4	3	3	3	3	2	2	3	4	4	3	4	4	4	3.23
CO5	3	3	3	4	3	2	2	3	3	4	4	4	4	3.23
												Mean overall Score		3.24

Result: The Score for this Course is 3.24 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

I B.Sc (chem)	Kinetic theory of gas and Chemical kinetics For the students admitted in the year 2019	19CH102
SEMESTER – I		HRS/WK – 4
CORE-2		CREDIT – 3

Course outcome:

i. Students acquire the knowledge about units and their dimensions and a knowledge about gaseous laws and their applications.

ii. Students learn the kinetic gas equation and understands the concepts like diffusion, effusion and Collisions.

iii. Students learn the concept of equilibrium and adsorption.

iv. A knowledge on Chemical kinetics is given with problem solving skills.

v. Students understand the knowledge of solutions, concentration terms and mesophases.

UNIT – I **(12 hrs)**

1.1 Dimensions of units and its conversion-Temperature, Mass, Length, Charges and Energy

1.2 The perfect gas equation of state – Boyle's law, Charle's law,and Avogadro's principle.

1.3 Real gas equation –critical temperature – compression factor - Virial equations of state – Vanderwaals equation of state- Boyle temperature -Joule –Thomson effect- Linde refrigerator (Pages 12 – 34)

1.4 Numerical conversion problems related to Temperature, Mass, Length, Charges,and Energy.

UNIT – II **(12 hrs)**

2.1 Kinetic model of gases laws from the kinetic gas equation – Kinds of speed – mean, rms, most probable velocities. Maxwell's distribution of molecular speeds –Variation with temperature and molar mass.

2.2 Combined gas equation- Standard temperature and pressure.

2.3 A mixture of gases: partial pressures- Dalton's law.

2.4 Diffusion and effusion-Molecular collisions. [Pages 17-34]

2.5 Numerical problems related to partial pressures.

UNIT-III **(12 hrs)**

3.1 Concept of equilibrium- law of mass action – relationship between Kp&Kc – effect of concentration, pressure, partial pressure, temperature & volume – Le Chatlier's principle.

3.2 Adsorption – terminologies – Gibbs adsorption isotherm – Friendlich – Langmiur – BET theory – adsorption isotherms – applications of adsorption.

3.3 Numerical problems related to molecular velocities and types of velocities

UNIT-IV **(12 hrs)**

4.1 Concepts of reaction rates- rate and units of rate of a reaction- dependence of rate on concentration- rate expression and rate constant- order and molecularity.

4.2 Integrated rate equations-zero order, first order, and pseudo first order reaction-half-life of a reaction - temperature dependence of the rate of a reaction- the effect of the catalyst.

4.3 Numerical problems in the determination of rate and order and in the effects of temperature in kinetics and Arrhenius equation.

UNIT-V **(12 hrs)**

5.1Solutions- types of solutions- concentration units of solutions- ideal and non-ideal solutions.

5.2 Colloids- various types of classification – emulsions-applications of colloids.

5.3 Mesophases and disperse systems – liquid crystals- classification- surface, structure,and stability- electrical double layer.(403-407)

5.4 Numerical problems related to concentration terms and activity coefficients.

Text & reference books:

1 P.W. Atkins.Elements of Physical chemistry. Oxford University Press.3rd edition.1990.

2 Puri and Sharma. Principles of physical chemistry. 40th edition.2003

3 Arun Bahl, B.S.Bahl and G.D. Tuli. Essentials of Physical Chemistry. 26th edition (revised multicolour). 2009

I B.Sc (chem)	INORGANIC QUANTITATIVE ANALYSIS	19CHP101
SEMESTER –I		HRS/WK – 3
CORE PRACTICAL – I		CREDIT – 2

Course outcome:
Students learn inorganic quanitative analytical techniques.

VOLUMETRIC ANALYSIS

UNIT-I TITRIMETRIC QUANTITATIVE ANALYSIS

Estimation of HCl by NaOH using a standard oxalic acid solution

Estimation of Na_2CO_3 by HCl using a standard Na_2CO_3 solution

Estimation of Oxalic acid by $KMnO_4$ using a standard oxalic acid solution

Estimation of Iron(II) Sulphate by $KMnO_4$ using a standard Mohr's salt solution

Estimation of Iron(II) Sulphate by $K_2Cr_2O_7$ using a standard Mohr's salt solution

Estimation of Copper(II) Sulphate by $K_2Cr_2O_7$ solution.

Estimation of Magnesium(II) by EDTA solution.

UNIT – II

SOME APPLIED EXPERIMENTS

*Estimation of total Hardness of water

*Estimation of antacid

*Estimation of Bleaching powder

***Experiments will not be given for the examination**

Reference books:

1. Venkateswaran V, Veerasamy R., Kulandaivelu A.R.1997. Basic principles of Practical Chemistry. (2nd ed) New Delhi:SultanChand& Sons
2. Basset.J.et al.1985. Vogel's Textbook of Quantitative Inorganic Analysis, (4th edition) ELBS Longmann.

SCHEME OF EVALUATION:

Error up to 1%	:	45 marks
1% - 2%	:	40 marks
2 % - 3%	:	30 marks
3% - 4%	:	20 marks
Above 4%	:	05 marks
Viva – voce	:	05 marks
Record	:	10 marks
Total	**:**	**60 marks**

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester II	Course code 19CH203	Title of the Paper INORGANIC CHEMISTRY – I										Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	2	3	3	3	3	3	3	3	3	4	3	3	3	3.0
CO2	2	3	3	3	3	3	3	3	4	3	3	4	2	3.00
CO3	2	3	3	3	3	2	3	3	3	3	4	4	4	3.07
CO4	3	3	3	3	2	2	3	4	3	3	3	4	3	3.0
CO5	3	3	3	2	3	3	2	3	3	4	2	4	4	3.0
												Mean overall Score		3.01

Result: The Score for this Course is 3.01 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I B.Sc (Chem)	INORGANIC CHEMISTRY – I For the students admitted in the year 2019	19CH203
SEMESTER – II		HRS/WK – 4
CORE- 3		CREDIT – 3

Course outcome:

1. Students acquire the knowledge about units atoms and accommodation of electrons and their periodic trends
2. Students learn the comparative account of alkali and alkaline earth metals
3. Students learn the elements of boron and their applications
4. A knowledge on ionic, covalent bonds and nature solvents.
5. Understanding on molecular orbital theory

Unit – I

Atomic orbitals and General periodic properties of elements (12 hrs)

1.1 Atomic orbitals - Shapes of s, p, d, f orbital. Hund's rule of maximum multiplicity- applications of Hund's rule- Aufbau principle - Pauli's exclusion principle - electronic configuration of elements - Stability of half filled and completely filled orbitals - classification of s, p, d and f block elements.

1.2 General periodic properties of elements - Periodic table- IUPAC - nomenclature of Inorganic compounds - Atomic radii and ionic radii – size - ionization energies – electron affinity - oxidation states and variable valencies - Inert pair effect – electro negativity - Pauling's and Mulliken scale- Alfred Rochow's scale.

1.3 Applications of electronegativities – Calculation of partial ionic character of a covalent bond, Calculation of enthalpies of formation of compounds - Calculation of bond length - Explanation of diagonal relationship.

Unit – II Chemistry of Alkali and Alkaline earth metals (12 hrs)

2.1 Chemistry of Alkali metals: Occurrence, comparative study of elements - oxides, halides, hydroxides and carbonates. Exceptional properties of Li. diagonal-relationship of Li with Mg.

2.2 Chemistry of Alkaline earth metals: Comparative study of elements – oxides - hydroxides, halides, sulphates and carbonates. Exceptional properties of Be. Diagonal relationship of Be and Al. Comparison of alkali metals with alkaline earth metals. Mg acting as bridging element between II A & II B groups resemblance of Mg with Zn.

2.3 Hydrogen bonding – Intra and Inter molecular hydrogen bonding – properties of hydrogen bonded Nitrogen, Oxygen, Fluorine and sulphur compounds.

Unit – III Chemistry of p – block elements - Boron family (12 hrs)

3.1 Chemistry of p – block elements – Boron family- semi metals - group discussion – anomalous behavior of B - diagonal relationship between B & Si - electron deficiency & electron acceptor behavior of BX_3.

3.2 Boron hydrides - Bonding in diborane, (VBT & MOT approach) Bonding in tetraborane. Borax, sodiumborate, sodiumtetraborate, or disodiumtetraborate - Boric acid.

3.3 Compounds of Boron with Nitrogen - Borazole and Boron nitrides**.**

Unit – IV Ionic, Covalent bonding and Acid- Base concepts (12 hrs)

4.1 Ionic Bond : Conditions for the formation of ionic bond – Radius ratio rules and its limitations – formation of NaCl – Hydration energy – Lattice energy and their applications – Born Haber cycle– General properties of ionic compounds.

4.2 Covalent bonding: Polarization and Fajan's rule, Effects of polarization, VBT-conditions for the formation of covalent bond – orbital overlap– hybridization- sigma and pi bonds - Characteristics of Covalent Compounds. Hannay smith equation.

4.3 Acid- Base concepts – Lewis, Lowry-Bronsted, Luxflood, Usanovich concepts & HSAB approach.

Unit – V - VSEPR Theory and Molecular Orbital Theory (12 hrs)

5.1 VSEPR Theory**:** Molecular shapes predicted by Sidgwick's Powell theory – Effect of lone pairs and Electronegativity – Effects of bonding and lone pairs on bond angles. Geometries of ClF_3, IF_7, XeF_6 , BF_4^-, BO_3^{3-}, NH_4^+, I_3^-.

5.2 Molecular Orbital Theory**:** LCAO method, criteria of orbital overlap – types of molecular orbitals - sigma and pi molecular orbitals, combination of atomic orbital to give sigma and pi molecular orbitals and their schematic illustration.

5.3 Qualitative molecular energy level diagram of homo and hetero diatomic molecules – H_2, N_2, O_2, CO, NO & HCl – bond order and stability of molecules.

Text Books:

1. J.D. Lee, A New Concise Inorganic Chemistry, 3rd Edn, ELBS, 1987.
2. R.D. Madan, Modern Inorganic Chemistry, 3rd Edn, Sulthan Chand Publications, 1988.

Reference Books:

1. F.A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, 5th Edn., John Wiley. 1985.
2. B. Douglas, D. McDaniel, J. Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edn, John Wiley, 2001.
3. J.E. Huheey, Inorganic Chemistry, 5th Edn, Harper International. 1993.
4. D.F. Shriver, P.W. Atkins, C.H. Langford, 3rd Edn. Inorganic Chemistry, ELBS. 1999.
5. W.V.Mallik, G.D. Tuli, R.D. Madan, Selected topics in Inorganic Chemistry, 4rd Edn., Sulthan Chan Publications,1992.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester II	Course code CH204Q	Title of the Paper ANALYTICAL CHEMISTRY-I											Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	4	4	3	3	4	3	3	4	3	4	3	3.54
CO2	4	3	3	3	3	4	3	2	3	4	3	4	4	3.31
CO3	3	4	3	3	4	3	2	3	4	3	4	3	3	3.23
CO4	3	4	3	3	3	3	3	3	3	3	3	4	3	3.23
CO5	4	3	3	4	3	2	4	2	3	4	3	3	4	3.15
CO6	3	4	2	3	4	3	4	3	3	4	3	4	3	3.31
													Mean overall Score	3.29

Result: The Score for this Course is 3.29 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I B.Sc (chem)	ANALYTICAL CHEMISTRY- I For the students admitted in the year 2018	CH204Q
SEMESTER – II		HRS/WK – 4
CORE-IV		CREDIT – 3

Course outcome:

The students will acquire knowledge of

i. To study about error analysis.
ii. To understand the various concentration units and to know how to prepare solutions of varying concentrations.
iii. To understand the basics of electronics
iv. Data handling/ statistical treatment of data.
v. Potentiometric, Coulometric, and Voltametric methods of analysis.
vi. Chromatographic Techniques and applications.

UNIT – I (12Hrs)

Theory of Errors – the idea of significant figures and its importance with examples – Precision, Accuracy- methods of expressing accuracy – Error analysis – minimizing errors – method of expressing precision – average deviation – Standard deviation – Confidence limit.

UNIT – II (12Hrs)

Definitions of Molality – Normality – Mole fraction and their calculations – Definition and examples for primary and secondary standards – Calculation of equivalent. Theories of acid-base – Redox, complexometric and Iodometric titrations – Problems on Volumetric analysis-strengths of solutions – Theories of indicators – acid, base, redox, metal ion,and adsorption indicators and choice of indicators.

UNIT – III (12Hrs)

Chemical formulae and percentage composition – Determination of empirical Formulae – and molecular formulae. Laws of chemical combination: Law of conservation of mass – Law of constant composition – Law of multiple proportions – Law of reciprocal proportions – Gay Lussac's law of Gaseous volumes.Equivalent weights of Compounds –methods of determination of equivalent weights using hydrogen displacement method, oxide method,

chloride method, metal displacement method – problems based on the law of normalities for acid, Alkali titrations – the concept of double and back titrations.

UNIT – IV (12Hrs)

Chemical Instrumentation: Elementary Electronics, Simple integrated circuit, Semiconductor, Power supply, transformer, Operational amplifier, Detectors (Oscilloscope and recorders), transducers, Rectifiers, Signal to noise ratio, Electronic components (Resistors, capacitors, inductors, and transistors), measuring instruments for pressure, temperature, current,and voltage.

UNIT – V (12Hrs)

Chromatographic technique – the principle of chromatography – definition of the terms – Rf value – paper chromatography – principle and applications – thin layer chromatography – theory and applications – ion exchange chromatography – principle, types,and applications

Text Books:

1. R.Gopalan, P.S.Subramanian, K.Rengarajan, S.Chand,and sons (1997) - Elements of Analytical Chemistry.
2. G. R. Chatwal, S. K. Anand - Instrumental Methods of Chemical Analysis – Himalaya Publishing House (2000)
3. B.K.Mehta, Rohit Mehta, Principle of electronics, 2004

Reference Books

1. D.A. Skoog and D.M. West, Fundamental of Analytical Chemistry, International Edition, 7th Edition (1996), Saunders College Publishing, Philadelphia, Holt, London.
2. R.L. Pecsok, L.D. Shields, T. Cairns,and L.C. Mc William, Modern Methods of Chemical Analysis, 2nd (1976), John Wiley & Sons, New York.

I B.Sc (chem)	INORGANIC QUALITATIVE ANALYSIS AND PREPARATIONS	CHP202
SEMESTER – II		HRS/WK – 3
CORE PRACTICAL – II		CREDIT – 2

Course outcome:

1. Students acquire the experimental skill of analyzing acid and basic radicals.
2. Students get to know the preparation of inorganic compounds.

UNIT – I SEMI – MICRO QUALITATIVE ANALYSIS

1. Analysis of simple acid radicals: Carbonate, Nitrate, Sulphate, Chloride
2. Analysis of interfering acid radicals: Fluoride, Oxalate, Borate, Phosphate
3. Elimination of interfering acid radicals and identifying the groups of the basic Radicals
4. Analysis of basic radicals (group-wise): Lead, Copper, Bismuth, Cadmium, Aluminium, Iron, Cobalt, Nickel, Manganese, Zinc, Barium, Calcium, Strontium.
5. Analysis of mixtures containing two cations and two anions (of which one is interfering)

UNIT –II PREPARATION OF INORGANIC COMPOUNDS

1. TetrammineCopper(II) Sulphate
2. Tris(thiourea)Copper(I) Chloride
3. Ferrous Ammonium Sulphate
4. Microcosmic salt
5. Potassiumtrisoxalato ferrate (II)
6. Chloropentammine Cobalt(III) Chloride

Reference books:

1. Inorganic Qualitative Analysis- V.V. Ramanujam
2. Practical Chemistry – B.Sharma
3. Vogel, Textbook of quantitative chemical analysis, 6th Ed, Prentice Hall, 2000.

SCHEME OF EVALUATION:

Salt Analysis	:	35 marks
Preparation	:	10 marks
Viva – voce	:	05 marks
Record	:	10 marks
Total	**:**	**60 marks**

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester III	Course code 19CH305	Title of the Paper INORGANIC CHEMISTRY – II											Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	2	3	3	4	4	2	3	3	3	4	4	3	3	3.15
CO2	2	3	2	3	3	2	3	3	4	4	3	3	2	2.85
CO3	3	3	3	4	3	4	3	4	3	3	4	3	4	3.38
CO4	3	3	3	2	3	3	3	3	3	3	3	4	3	3.00
CO5	3	3	3	2	3	2	3	3	3	4	3	3	3	2.92
													Mean overall Score	3.06

Result: The Score for this Course is 3.06 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

II B.Sc (chem)	INORGANIC CHEMISTRY-II For the students admitted in the year 2019	19CH305
SEMESTER – III		HRS/WK – 4
CORE-V		CREDIT – 3

Course outcome

i. Students acquire the knowledge about the theory behind the practicals and solvents
ii. Students learn the comparative study of carbon group elements and their applications
iii. Students learn the elements of nitrogen and oxygen group elements
iv. A knowledge on halogen family and its applications
v. Students acquire the knowledge about halogens and their reactivity

Unit I

Principles of Inorganic Qualitative Analysis and Types of Solvent (12 hrs)

1.1 Principles of acid-base equillibria - Common ion effect, solubility product and their applications in qualitative analysis. Reactions involved in the separation and identification of cations and anions in qualitative analysis – Spot reagents – aluminon, Cupferon, DMG, Thiourea, magneson, alizarin and Nessler's reagent.

1.2 Types of solvents: Physical properties of solvents, protic and aprotic solvents, amphiprotic and amphoteric solvents – aqueous and non aqueous solvents – Liquid NH_3 as a solvent - HF as a solvent - solvation number – medium effect - Vander waal's forces - ion-dipole, dipole-dipole interactions

Unit II - Carbon family and Types of Chemical reactions (12 hrs)

2.1 Carbon family: Group discussion - valencies, oxides, halides, hydrides of C and Si - catenation and hetero catenation – allotropy of carbon, comparison of properties of C & Si. Carbides: salt like carbides – Interstitial carbides – covalent carbides – applications of carbides in Industry.

2.2 Types of chemical reactions: Acid – Base, oxidation – reduction, electron transfer, double decomposition reaction – balancing chemical reactions by oxidation number and ion, electron method.

Unit III - Nitrogen and Oxygen family (12hrs)

3.1 Nitrogen family - Comparative study of N, P, As, Sb, Bi oxides – N_2O_3, P_4O_6, N_2O_5 and P_4O_{10}. Oxy-acids: HNO_2, HNO_3, H_3PO_2, H_3PO_3 and H_3PO_4 –properties and structure. Halides – PCl_3, PCl_5 – properties and structure. Hydrides – NH_3, PH_3, AsH_3 and BiH_3 – structure, trends in boiling point, basic character and hydrogen bonding. Properties, structure and uses of hydrazine and hydroxylamine

3.2 Oxygen family: Comparative study of O, S, Se, Te elements – anomalous behavior of Oxygen, oxides of sulphur – SO_2 and SO_3, properties and structure.Oxoacids of sulphur – H_2SO_3, H_2SO_4 and $H_2S_2O_7$, properties and structure. Peroxosulphuric acids- Caro's acid, Marshall's acid - structure and comparison – Dithionic and Polythionic acids. Chemistry of ozone

Unit IV – Halogens (12hrs)

Halogens – Comparative study of F, Cl, Br, I, At elements – reactivities – comparison of fluorine with oxygen – hydrogen halides – preparation and properties of HF, HCl, HBr and HI – Bleaching powder, estimation of available of chlorine. Oxyacids of halogens – Sodiumhypochloride and Soduim chlorite – Poly halides - interhalogen compounds (ClF_3, ICl, BrF_3, ClF_5, BrF_5, IF_5 structure and properties) – Psuedo halogens (CN^-, SCN^-, N_3^- structure and properties). Basic properties of halogens - positive iodine – exceptional properties of fluorine, similarities between H_2O & HF.

Unit V - Noble gases

Noble gases: electronic configuration – reasons for placing in zero group – position in the periodic table - chemical inertness of noble gases – reasons – applications – clathrates – hybridization and geometries of XeF_2, XeF_4, XeF_6, $XeOF_4$. Uses of noble gases.

Text Books:

1. Vogels, Text book of quantitative chemical analysis, 6th Ed, Prentice Hall, 2000.
2. J.D.Lee, A New Concise Inorganic Chemistry, 3rd Edn., ELBS, 1987.
3. R.D.Madan, Modern Inorganic Chemistry , 3rd Edn., Sulthan Chand Publications,1988.
4. R. Gopalan,. Inorganic Chemistry For Undergraduates, university press pvt ltd, 1st ed, 2009.
5. B.R. Puri,; L.R.Sharma,; K.C.Kalia, Priciples of Inorganic Chemistry, Lal Nagin chand and co. Delhi 1996.

Reference Books:

1. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5th Edn., John Wiley.1985.
2. B.Douglas, D.McDaniel, J.Alexander, Concepts and Models of Inorganic Chemistry, 3rd Edn., John Wiley,2001.
3. J.E. Huheey, Inorganic Chemistry, 5th Edn., Harper International.1993.
4. W.V.Mallik, G.D.Tuli , R.D.Madan , Selected topics in Inorganic Chemistry, 4rd Edn., Sulthan Chand Publications,1992.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester III	Course code CH306S	ANALYTICAL CHEMISTRY- II For the students admitted in the year 2014											Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	3	4	3	4	4	4	4	4	4	4	3	3.69
CO2	3	3	3	3	3	3	3	3	4	3	3	4	4	3.23
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53
CO4	3	3	3	3	3	3	3	4	4	3	4	4	4	3.38
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38
													Mean overall Score	3.44

Result: The Score for this Course is 3.44 (High Relationship)

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

II B.Sc (chem)	ANALYTICAL CHEMISTRY- II For the students admitted in the year 2014	CH306S
SEMESTER – III		HRS/WK – 4
CORE-VI		CREDIT – 3

Course outcome:

i. Students learn about the principles of gravimetric analysis and thermo analytical methods.
ii. Students learn separation and purification techniques.
iii. Students learn about the principles and uses of Polarography, Polarimetry and Amperometry.
iv. To learn UV- Visible spectroscopy, X-Ray methods.
v. To impart the knowledge of water treatment and parameter calculations.

UNIT – I **[12 Hrs]**

GRAVIMETRIC ANALYSIS AND THERMAL ANALYTICAL METHODS

Characteristics of precipitating agents- Choice of precipitants and conditions of precipitation – Specific and selective precipitants- Use of sequestering agents- Co-precipitation- Post precipitation- Peptisation- Differences- Reduction of error –Precipitation from homogeneous solution- Calculations in gravimetric methods- use of gravimetric factors.

The principle involved in thermogravimetric analysis and differential thermal analysis- Discussion of various components with block diagram- Characteristics of TGA&DTA- Factors affecting TGA & DTA curves- Thermometric titrations

UNIT II **[12 Hrs]**

SEPARATION AND PURIFICATION TECHNIQUES

Principles involved in the separation of solids- Purification of solid organic compounds- Crystallisation- Fractional crystallization- Sublimation- Purification of liquids- Experimental techniques of distillation- Fractional distillation- Vacuum distillation- Steam distillation- Electrophoresis.

UNIT III **[12 Hrs]**

POLAROGRAPHY, AMPEROMETRY AND POLARIMETRY

Principle – concentration polarization- dropping mercury electrode- advantages and disadvantages – convention- migration and diffusion currents- Ilkovic equation (derivation

not required) and significance- experimental assembly- electrodes- capillary solutions- current voltage curve- oxygen wave- influence of temperature and agitation on diffusion layer- Polarography as an analytical tool in quantitative & qualitative analysis. **Amperometry** – basic principle & uses. **Polarimetry** principle- instrumentation- comparison of strengths of acids- Estmation of glucose.

Unit IV: **[12Hrs]**

UV- VISIBLE SPECTROSCOPY AND X-RAY METHODS

Absorption laws- calculations involving Beer – Lambert's law – instrumentation – photocalorimeter and spectrophotometer – block diagram with a description of components with the theory – types of electronic transitions – chromophore – auxochromes – absorption bands and intensity – factors governing absorption maximum and intensity.Bragg's equation – explanation of terms – experimental methods – Rotating crystal technique – powder technique – determination of the structure of NaCl.

Unit V: **[12 Hrs]**

TECHNOLOGY OF WATER

Hardness of water – Hard water – soft water – Temporary and permanent hardness- problems on calculating temporary and permanent hardness – Estimation of hardness using EDTA method and their problems – Water treatment – lime soda process – calculation of amount of soda lime required for water softening – zeolite process – problems – Demineralisation process – Reverse osmosis – Electrodialysis – biological oxygen demand – chemical oxygen demand - treatment of domestic water supply – sedimentation – coagulation – filtration – sterilization of water

Text Books:

1. R. Gopalan, P.S. Subramanian and K. Rengarajan "Elements of Analytical Chemistry", 2nd edition (1991). Sultan Chand & sons educational publishers.
2. B. K. Sharma, "Industrial chemistry" Seventeenth edition (2004) Goel publishing house, Meerut.
3. G. R. Chatwal, S. K. Anand "Instrumental Methods of Chemical Analysis" Enlarged edition (2007) Himalaya publishing house Mumbai.
4. S. S. Dara, "A Text Book of Engineering Chemistry" fifth revised edition (1996) S Chand Company limited, New Delhi.

Reference Books:

1. Skoog and D. M. West, "Fundamentals of Analytical Chemistry", International edition, seventh edition (1996), Saunders College publishing Philadelphia, Halt, London.
2. Jagmohan, Spectroscopy of Organic chemistry, Narosa Publications

II B.Sc (chem)	PRACTICAL CHEMISTRY – III	19CHP303
SEMESTER – IV	QUALITATIVE ORGANIC	HRS/WK – 3
CORE PRACTICAL –III	ANALYSIS PRACTICAL	CREDIT – 2

ORGANIC ANALYSIS

Identification of an organic compound through the functional group analysis.

Detection of special elements (N,S,and halogens).(Microscale)

ORGANIC PREPARATIONS

1. NITRATION: Prepartion of m-dinitrobenzene and p-nitroacetanilide.
2. ACETYLATION: Preparation of acetyl derivatives of aniline, salicylic acid,and glucose.
3. DIAZOTIZATION: Preparation of methyl orange and methyl red.
4. REDUCTION: Preparation of aniline from nitrobenzene.
5. OXIDATION: Preparation of benzoic acid from benzaldehyde.
6. HALOGENATION: Preparation of p-bromoacetanilide.

Reference books:

1. Mann and Saunders,LaboratoryManual of Organic Chemistry.
2. Vogel's Quantitative Organic Analysis.

Scheme of evaluation

Analysis	**:**	**35 marks**
i) Saturated/ unsaturated	:	3 marks
ii) Special elements	:	6 marks
iii) Aromatic / Aliphatic	:	3 marks
iv) Identification of functional group	:	6 marks
v) Confirmatory tests	:	5 marks
vi) Preparation of derivative	:	6 marks
vii) Systematic procedure	:	6 marks
Preparation	:	**15 marks**
i) Crude sample	:	10 marks
ii) Recrystallised Sample	:	5 marks
Record	:	10 marks
Total	**:**	**60 marks**

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester IV	Course code 19CH407	Title of the Paper ORGANIC CHEMISTRY II											Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	4	3	4	2	3	4	3	3	3	4	4	3.30
CO2	2	3	4	3	3	2	2	3	4	3	3	4	4	3.07
CO3	2	3	4	3	3	2	3	4	4	4	4	4	4	3.38
CO4	3	3	3	3	2	2	3	4	4	3	4	4	4	3.23
CO5	3	3	3	4	3	2	2	3	3	4	4	4	4	3.23
													Mean overall Score	3.24

Result: The Score for this Course is 3.24 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

II B.Sc. (chem)	**ORGANIC CHEMISTRY - II** **For the students admitted in the year 2019**	**19CH407**
SEMESTER – IV		**HRS/WK – 4**
CORE-VII		**CREDIT – 3**

Course Outcomes:

At the end of the Course the students should be able to exhibit

CO1: Knowledge pertaining to reaction and mechanism of aliphatic nucleophlic substitution

CO2: Logic to explain aromatic electrophilic and nucleophlic substitutions

CO3: Expertise in preparation and reactions of alcohols, ethers and phenols

CO4: Expertise in reactions of aldehydesa and ketones

CO5**:** Reaction of carboxylic acids

UNIT – I ALIPHATIC NUCLEOPHILIC SUBSTITUTION 12 hrs.

1.1 Nucleophiles – Nucleophilicity.

1.2 Aliphatic nucleophilic substitution – Mechanisms of SN1, SN2,and SNi. Energy Profile diagrams – Effects of nature of substrates, solvent, nucleophile,andleaving groups. Leaving ability of the leaving groups. Basicity and Nucleophilicity – a comparison.

1.3 Substitution Vs elimination – with examples.

1.4 Stereochemistry of Substitution reactions – a brief introduction.

Unit – II AROMATIC ELECTROPHILIC & NUCLEOPHILIC SUBSTITUTION. 12hrs.

2.1 Aromaticity – Huckel's theory of aromaticity and its applications to Benzene and polynuclear hydrocarbons like naphthalene. Resonance and delocalization in benzene. Examples of aromatic, anti-aromatic and non-aromatic compounds. Problems.

2.2 Aromatic electrophilic substitution. Mechanisms of Nitration, halogenation, Sulfonation. Friedel – Crafts alkylation and acylation. Substituent effects in Aromatic electrophilic substitution. Reactivity and orientation. Ortho-para ratio. Problems.

2.3 Synthesis of simple substituted benzenes using the above reactions.

2.4 Aromatic nucleophilic substitutions. The addition-elimination mechanism AdE2. The elimination-addition mechanism - Benzyne mechanism.

Unit – III:ALCOHOLS, ETHERS & PHENOLS 12 hrs.

3.1 Alcohols – Sources – Nomenclature – Preparation by reduction of aldehydes, Ketones, acids,and esters. Preparation using Grignard reagents. Types of Alcohols and their reactivity. Diols and polyhydric alcohols.

3.2 Reactions of alcohols – oxidation, esterification,and dehydration. Cleavage of Diols using periodic acid (HIO4) and lead tetraacetate.

3.3 Allyl alcohol – its preparation. Allylic substitution using N-bromosuccinimide (NBS).

3.4 Phenols – Nomenclature – structure,and bonding. Sources of phenols –the acidityof phenol and substituent effects on its acidity. Reactions of phenols: Reimer-Tiemann, Kolbe-Schmidt, Lederer-Manasse reactions and coupling with diazonium salts. Problems

3.5 Ethers – Nomenclature – structure and bonding – Preparation – Williamson synthesis. Cleavage of ethers by acids.

UNIT –IV: ALDEHYDES AND KETONES 12 hrs.

4.1 Nomenclature and classification

4.2 Preparation of aldehydes and ketones: Rosenmund and Gattermann -Koch reactions.

4.3 Reactivity of carbonyl groups, the acidity of alpha hydrogen.

4.4 Reactions: Mechanism of enolization reactions, nucleophilic addition, oxidation and reduction reactions, addition reactions with Grignard reagents, cyanide and bisulphate. Preparation of derivatives of ammonia and alcohols.

4.5 Mechanism of aldol, Cannizaro perkin, knoevenagel reactions. Benzoin condensation, Claisen reactions.

4.6 Mechanisms of reductions with $NaBH_4$, $LiAlH_4$, Wolff- Kishner, Clemmensen,and MPV reductions.

UNIT – V CARBOXYLIC ACIDS 12 hrs.

5.1 Carboxylic acids – nomenclature.

5.2 Ionization of carboxylic acids – acidity constants.

5.3 Comparison of acid strengths of substituted haloacids and substituted benzoic acids.

5.4 Reactions of carboxylic acids. Hell-Volhard-Zelinsky reaction.

5.5 Conversion of acids to their derivatives.

5.6 Dicarboxylic acids – nomenclature.

5.7 Preparation and properties of oxalic, malonic,succinic, glutaric and adipic acids.

Text Books:

1. Francis A.Carey, - Organic Chemistry- Tata McGraw Hill-1999.
2. M.K.Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co.
3. Morrison R T, Boyd R N and Batcharjee S K, Organic Chemistry, 7th Ed., (2009), Pearson New York.
4. Paula Yurkanis Bruice - Organic Chemistry, Prentice Hall- 1999.

Reference Books:

1 Ahluwalia and Parassar- Organic Reaction mechanisms, Narosa Publishers.2004.Bahl & Arun Bahl- Advanced Organic Chemistry, Sultan Chand-1996.Paula Yurkanis Bruice - Organic Chemistry, Prentice Hall- 1999.

2 E.L. Eliel and S.H.Wilers,Stereochemistry of Organic Compounds, John Wiley and sons, 2004.

3 P.S.Kalsi,Stereochemistry: Conformation and Mechanism, Wiley Eastern Ltd -2007.

4 Seyhan Ege- Organic Chemistry-A.I.T.B.S Publishers-1999.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester IV	Course code 19CH408	INTRODUCTION TO MOLECULAR STRUCTURE For the students admitted in the year 2019											Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	3	3	3	4	3	4	4	3	5	4	4	4	3.46
CO2	4	4	4	3	4	4	4	5	5	4	4	3	3	4.30
CO3	5	3	4	4	3	3	4	4	3	3	4	3	3	3.53
CO4	4	4	3	4	3	5	4	4	4	3	3	4	4	3.76
CO5	3	3	4	3	3	3	4	4	4	3	3	3	3	4.00
													Mean overall Score	3.81

Result: The Score for this Course is 3.81 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

II B.Sc (chem)	INTRODUCTION TO MOLECULAR STRUCTURE For the students admitted in the year 2019	19CH408
SEMESTER – IV		HRS/WK – 4
CORE-VIII		CREDIT – 3

Course outcome:

i. To study the quantum concept and atomic and molecular structures.
ii. To study about bonding and orbitals.
iii. To study the principle, selection rules and applications of spectroscopy.
iv. To study about symmetry elements and properties of solid state .
v. To understand about electronic , vibrational ,raman and microwave spectroscopy to molecular level.

UNIT – I (12 hrs)

1.1 Quantum Chemistry – the failures of classical physics-block body radiation – Photo electric effect –diffraction of electrons.(Pages 270-278)

1.2 Schrodinger equation –the Born interpretation-uncertainty principle. (Pages 280-283)

1.3 Quantum numbers- wave functions – s orbitals-p and d orbitals and their mathematical expressions-electron spin. (Pages 301-307)

1.4 Illustrative problems of surface temperatures and total radiation emission calculations of other planets, stars and Black body.

UNIT – II (12 hrs)

2.1 Chemical bond-classification of bonds-potential energy curves-VBT-diatomic molecules-polyatomic molecules-promotion and hybridization-resonance.(Pages 326-332)

2.2 Molecular orbitals-linear combinations of atomic orbitals- bonding orbitals -anti bonding orbitals-structure of diatomic molecules- hydrogen and helium molecules- period 2 diatomic molecules.(Pages 334-339)

UNIT – III (12 hrs)

3.1 Electric and magnetic properties – Clausius-Mosotti equations – Debye equation – measurement of dipole moments – dependence of polarizability on frequency.

3.2 Molar refractivity – dipole moments and molecular structure – magnetic permeability – magnetic susceptibility – diamagnetism – Para magnetism – measurement of magnetic susceptibility

UNIT-IV **(12 hrs)**

4.1 Group theory – symmetry elements and operations –classes and subgroups –group multiplication table- postulates of a group.

4.2 Solid state- Amorphous and crystalline- classification of crystalline solids- bonding and electrical conductivity in solids – crystal lattices and unit cells-Bravais lattices.

Unit – V **(12 hrs)**

5.1 General features of spectroscopy – experimental techniques – intensities & line widths

5.2 Rotational spectroscopy-the rotational energy levels of molecules-rotational transitions-microwave spectroscopy-rotational Raman spectra.

5.3 Vibrational spectroscopy – the vibrations of molecules –transitions- vibrational Raman spectra of diatomic molecules-vibrations of polyatomic molecules and vibrational Raman spectra of polyatomic molecules.

5.4 Electronic transitions – UV and visible spectra –Franck Condon principle-measures of intensity-spin selection rules, spectral transitions and types of transitions. (Pages 415-446)

Text Book:

P.W. Atkins.Elements of Physical chemistry. Oxford University Press.3rd edition.1990.

Further reading:

1 K.V.Raman. Group theory. 1996. (5th edition)

2 Puri and Sharma. Principles of physical chemistry. 40th edition.2003

3 R. K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi, 2nd edition,1992

4 C.N Banwell, fundamentals of molecular spectroscopy, Chapman and hall 4th edition, 1991.

II B.Sc (chem)	PRACTICAL CHEMISTRY – IV PHYSICAL METHODS PRACTICAL	CHP404
SEMESTER – IV		HRS/WK – 3
CORE PRACTICAL –IV		CREDIT – 2

Course outcome:

1. Students learn the ability to find melting point and boiling point of chemicals.
2. Students learn the purification of impure Naphthalene and decolourisation of brown sugar.
3. Students learn the determination of Viscosity and Surface tension.

Part -I

Determination of melting point

Naphthalene, Benzoic acid, Urea, Succinic acid, m-Dinitrobenzene, Acetanilide, p-Dichlorobenzene.

Determination of boiling point

Ethanol, Cyclohexane, Toluene

Part - II

Decolorisation and crystallization using Charcoal

1. Decolorisation of brown sugar (sucrose) with animal charcoal using gravity filtration.
2. Crystallization and decolorization of impure naphthalene from ethanol.

Part - III

Viscosity, Surface Tension

1. To determine the percentage composition of a given mixture by the viscosity method.
2. To determine the percentage composition of a given binary mixture by surface tension method.
3. To determine the viscosity of amyl alcohol in water at different concentrations.

Scheme of evaluation

Part I	:	10 marks
Part II	:	10 marks
Part III		
i) Procedure	:	5 marks
ii) Formula	:	2 marks
iii) Calculation	:	8 marks
iv) Result	:	15 marks
Record	:	10 marks
Total	**:**	**60 marks**

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester V	Course code 19CH509	Title of the Paper ORGANIC CHEMISTRY – III											Hrs/ wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	3	4	3	3	4	3	3	3	4	4	3.46
CO2	3	3	4	3	3	2	2	3	4	4	3	4	4	3.23
CO3	3	3	4	3	4	2	3	4	4	4	4	4	4	3.54
CO4	3	4	3	3	4	2	3	4	4	3	4	4	4	3.46
CO5	3	3	3	4	3	3	2	3	4	4	4	4	4	3.38
Mean overall Score														3.41

Result: The Score for this Course is 3.41 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.Sc. (Chem)	ORGANIC CHEMISTRY - III For the students admitted in the year 2019	19CH509
SEMESTER – V		HRS/WK – 4
CORE – IX		CREDIT –4

Course outcome:

i. Students learn the chemistry of nitro compounds and their applications
ii. Students will learn the fundamental aspects of stereochemistry and its influence on chemical properties.
iii. Students acquire the knowledge in carbonyl compounds
iv. Students learn the application of some named reactions and their mechanisms.
v. Students learn about chemistry of carbohydrate, amino acids and its applications.

Unit I Nitrogen containing compounds 12 hrs.

1.1 Nomenclature and classification, Preparation

1.2 Nitrocompounds: aliphatic and aromatic nitro compounds, classification, general properties.

1.3 Reactions: reduction by a chemical and electrolytic method

1.4 Di- and tri-substitution of aromatic nitro compounds: synthesis of o-, m-, p-dinitrobenzenes and trinitrobenzene.

1.5 Aromatic Amines. Preparation of primary, secondary and tertiary amines.

1.6 Reactions: basicity of amines, the effect of substituents on basicity of aromatic amines.

1.7 Diazonium salts: Preparation, diazotization reaction, Sandmeyer, and coupling reactions.

Unit II Stereochemistry – II 12 hrs.

2.1 Conformational analysis of cyclohexane, mono and disubstituted cyclohexanes – Factors affecting stability

2.2 Optical isomerism, optical activity, optical and specific rotations, conditions for optical activity. Asymmetric center, chirality, achiral molecules, (+) and (-) and D and L notations, elements of symmetry, racemization, methods of racemization, methods of resolution, asymmetric synthesis (partial and absolute synthesis), Walden inversion.

2.3 Projection formula: Fischer, flying wedge, sawhorse and Newmann projection formulae and their interconversions-notations of optical isomers- Cahn- Ingold-Prelog rules, R and

S notations for optical isomers with one or two asymmetric carbon atoms, erythro and threo representations.

2.4 Optical activity in compounds not containing asymmetric carbon atoms namely biphenyls, allenes,andspiranes.

Unit III Synthesis involving an active methylene group and Tautomer's12hrs.

3.1 Carbonyl polarization – reactivity – the acidity of alpha hydrogen- malonic – acetoacetic and cyanoacetic esters – characteristic reactions of active methylene group – synthetic uses of malonic, acetoacetic and cyanoacetic esters.

3.2 Diazomethane and diazoacetic ester: Preparation, structure and synthetic applications.

3.3 Tautomerism: Definition- keto-enol tautomerism- identification, acid and base-catalyzed mechanisms, evidence – amido – imidol and nitro- acinitro tautomerisms.

Unit IV Molecular Rearrangements 12 hrs.

4.3 Classification as anionotropic, cationotropic, free radical, inter and intramolecular rearrangement

4.4 Pinacol-pinacolone rearrangement –mechanism, evidence for carbonium ion intermediate formation – migratory aptitude

4.5 Beckmann, Hoffmann, Curtius, Lossen Smith, Benzillic acid and Baeyer Villiger rearrangements.

4.6 Fries rearrangement (two mechanisms)

Unit V Carbohydrates and amino acids 12hrs.

5.1 Carbohydrates: Structural elucidation of glucose and fructose – pyranose and furanose forms – determination of ring size – Haworth projection formula – epimerization reactions of glucose and fructose – Osazone formation, mutarotation,and its mechanism – chain lengthening and chain shortening of aldoses – interconversion of aldoses and ketoses.

5.2 Structural elucidation of sucrose and maltose. Structure and properties of starch and cellulose.

5.3 Amino acids: Classification and structure of amino acids – Gabriel phthalimide synthesis – Strecker synthesis – Erlenmeyer synthesis – Zwitterion, isoelectric point – peptide – Merrifield synthesis – End group analysis

Text Books:

1 R. T. Morrison and R. N. Boyd, Organic chemistry, 6th edition, Prentice Hall of India Limited., New Delhi, 1992.

2 B. Y. Paula Yurkanis Bruise, Organic Chemistry, 3rd edition, Pearson Education, New Delhi 2002.

3 M.K.Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co.

4 Finar.I. L. Organic chemistry, 6th edition, ELBS, 1990.

5 O. P. Agarwal, Chemistry of organic natural products vol 1, Goel publishing house, 2002.

6 Gurdeep Chatwal, Chemistry of organic natural products, vol 1, Goel publishing house, 2002.

7 B. S. Bahl and Arun Bahl, Organic chemistry, S. Chand and Sons, New Delhi, 2005.

Reference Books:

1 Jerry March, Advanced organic chemistry, 4th edition, John Wiley and Sons, New York, 1992.

2 S. H. Pine, Organic chemistry, 5th edition, Mcgraw Hill international edition chemistry series, New York, 1987.

3 Seyhan. N. Ege, Organic chemistry, structure and reactivity, 3rd edition, A.I.T.B.S., New Delhi,1998.

4 P. S. Kalsi, Stereochemistry: Conformation and Mechanism, 2nd edition, Wiley eastern ltd, 1993.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester V	Course code 19CH510	Title of the Paper INORGANIC CHEMISTRY - III											Hrs/ wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	4	4	4	2	4	4	4	2	4	4	3	3.54
CO2	2	3	4	4	4	2	4	4	4	2	2	3	3	3.15
CO3	3	3	3	3	3	3	3	3	4	2	3	3	3	3.00
CO4	3	4	4	4	4	3	4	4	4	3	4	4	3	3.69
CO5	2	3	3	4	3	3	4	3	4	3	4	3	3	3.23
													Mean overall Score	3.32

Result: The Score for this Course is 3.32 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs =	Mean Overall Score for COs =
$\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	$\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.SC(Chem)	INORGANIC CHEMISTRY – III For the students admitted in the year 2019	19CH510
SEMESTER – V		HRS/WK – 4
CORE – X		CREDIT – 4

Course outcome:

I. To understand the general characteristics and the metallurgical process of the d block elements.

II. To explain the isomerism in coordination compounds.

III. To describe Werner's theory, valence bond theory, crystal field theory of coordination compounds

IV. To improve the level of understanding of the CFSE, Jahn – Teller effect and its consequences.

V. To describe the principles concerning solid state structures

Unit I: Chemistry of d-block elements and Metallurgical processes [12 Hrs]

1.1 Chemistry of d-block elements - Characteristics of d-block elements - occurrence - oxidation states, magnetic properties, and color

1.2 Metallurgical processes: Methods involved in ore concentration – magnetic separation, hydraulic washing, leaching, froath floatation process – conversion of concentrated ore in to metallic oxide – roasting, calcination, smelting – reduction of metal oxide – chemical method, reduction by other metals, electrolytic reduction – refining – bessemerisation, cupellation, electrolytic refining, Van Arkel method, vapour phase refining

1.3 Metallurgy of Ti, V, W, Cr

UNIT II: Coordination Chemistry I [12 Hrs]

2.1 Coordination Chemistry: Definition of terms used – the difference between double salts and coordination complexes - Nomenclature of Co-ordination complexes - Classification of ligands.

2.2 Isomerism in complexes – ionization isomerism, hydrate isomerism, linkage isomerism, ligand isomerism, Coordination isomerism and polymerization isomerism -

Geometrical and optical isomerism in tetra and hexacoordinated complexes – fac &mer isomers.

UNIT III - Coordination Chemistry II [12 Hrs]

3.1 Werner's theory - Sidgwick's theory - EAN rule, - Valence bond theory – hybridization - geometry and magnetic properties - the failure of VBT.

3.2 Crystal field theory - Splitting of d-orbitals in octahedral, tetrahedral and square planar complexes - crystal field stabilization energy - calculation of CFSE in octahedral complexes - low spin and high spin complexes – explanation of magnetic properties and color of complexes using CFT

UNIT-IV Coordination Chemistry III [12 Hrs]

4.1 consequences of CFSE on atomic radii, lattice energy, the heat of hydration - factors affecting CFSE – oxidation state, spectrochemical series, principal quantum number, geometry

4.2 Comparison of VBT and CFT. Trans effect and Jahn-Teller effect and its consequences

UNIT V - Solid State Chemistry [12 Hrs]

5.1 X-Ray diffraction – Bragg's equation - the principle of X-ray diffraction - comparison of X-ray, electron and neutron diffraction

5.2 Radius ratio and coordination number of Crystal structure – NaCl, Rutile, Wurtzite, Zincblende, and CaF_2, - Crystal defects – Schottky, Frenkel, types of metal excess and metal deficiency defects, and their consequences. Metallic bond, Metallic properties, Band theory of metals, semiconductors - n and p-type semiconductors - Superconductors.

Text Books

1 R. Gopalan, V.Ramaligam, Concise Co-ordination Chemistry, 2nd Ed, Vikas publishing house, 2008.

2 R. Gopalan, Inorganic Chemistry for Undergraduates, university press PvtLtd, 1sted, 2009.

3 B.R. Puri, L.R.Sharma, K.C.Kalia, Principles of Inorganic Chemistry, Lal Nagin Chandand co. Delhi 1996.

4 J. D. Lee, Concise Inorganic Chemistry, 5th ed, Blackwell science, London 1996.

Reference Books:

1. W. R. West, Solid State Chemistry and Its Applications, John Wiley and Sons, New York, l984.
2. W. L. Jolly, Modern Inorganic Chemistry, 2nd ed, Mc-Graw Hill 1991.
3. J.E.Huheey, E.A.Keiter, R.L.Keiter, Inorganic Chemistry Principles of Structure and Reactivity, 4th ed, Harper and Collins 1993.
4. L. E. Smart, E. A. Moore, Solid State Chemistry – An introduction 3rd ed, Taylor and Francis group 2005.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester V	Course code CH511S	Title of the Paper EQUILIBRIUM THERMODYNAMICS OF GASEOUS SYSTEMS											Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	2	4	3	3	3	3	3	4	3	3	4	4	3	3.23
CO2	3	4	3	3	3	2	3	3	3	3	4	3	4	3.15
CO3	3	4	3	4	3	4	4	4	3	3	4	4	4	3.61
CO4	3	4	3	4	3	2	4	4	3	3	4	4	4	3.46
CO5	2	4	2	3	2	4	3	4	3	2	3	4	4	3.07
													Mean overall Score	3.30

Result: The Score for this Course is 3.30 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.Sc(Chem)	Equilibrium Thermodynamics of gaseous systems For the students admitted in the year 2014	CH511S
SEMESTER - V		HRS/WK – 4
CORE – XI		CREDIT - 4

Course outcome:

i. To learn the concept of thermodynamics and apply it to physical and chemical systems.

ii. To study the fundamental aspects of thermochemistry and able to calculate enthalpy of reaction.

iii. To understand the efficient way of converting energy into work from the thermodynamic perspective and to learn the physical significance of entropy.

iv. To study the third law of thermodynamics and to acquire knowledge about the conditions for spontaneity of chemical reactions.

v. Students get to know the informations through Phase diagram and to learn the basic concepts of Phase equlibria

Unit I **[12 Hrs]**

1.1 Thermodynamics-the conservation of energy-systems and surroundings-work and heat-the measurement of work- the measurement of heat.

1.2 Internal energy –enthalpy- the temperature variation of the enthalpy.(Pages 37-56)

Unit II **[12 Hrs]**

2.1 Thermo chemistry-physical change-the enthalpy of phase transition-atomic and molecular change.

2.2 Chemical change – standard enthalpy changes- the combination of reaction enthalpies-standard Enthalpies of formation –a variation of reaction enthalpy with temperature. (Pages 57-76)

Unit III **[12 hrs]**

3.1 II law of thermodynamics-entropy –The Carnot Cycle – Carnot theorems – Entropy and Carnot cycle – Entropy a measure of randomness and probability.

3.2 The direction of spontaneous change-entropy and II law-entropy changes for typical processes- entropy changes in the surroundings. (Pages 77-85)

Unit IV **[12 hrs]**

4.1 III law of thermodynamics- Nernst heat theorem- Gibbs-Duhem equation-effect of temperature and pressure on chemical potential – chemical potential in systems of ideal gases- Duhem-Margules equation. Absolute entropies – standard reaction entropy.

4.2 The spontaneity of Chemical reactions –Gibbs free energy – focusing on the system properties of the Gibbs energy. (Pages 77-90).

Unit-V **[12 hrs]**

5.1 Phase equilibria-thermodynamics of transition –condition of stability- variation of Gibbs energy with pressure- variation of Gibbs energy with temperature.

5.2 Phase diagrams –phase boundaries-location of phase boundaries-characteristic points - Phase rule –phase diagram for typical materials. (Pages 95-110)

Text Book

1. P.W. Atkins.Elements of Physical chemistry. Oxford University Press.3rd edition.1990.

Further reading

1. J.Rajaram and J.C.Kuriacose,Thermodynamics For Students of Chemistry,Lal Nagin Chand,New Delhi, 3rd edition, 1986.
2. Puri and Sharma. Principles of physical chemistry. 40th edition.2003
3. Arun Bahl, B.S.Bahl and G.D. Tuli. Essentials of Physical Chemistry. 26th edition (revised multicolour). 2009.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester V	Course code ECH512	Title of the Paper ANALYTICAL TECHNIQUES										Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	5	2	4	5	2	4	2	4	2	5	4	3	3.54
CO2	5	5	2	4	5	2	4	2	4	2	5	4	3	3.62
CO3	5	5	3	4	5	2	4	2	4	2	5	4	3	3.69
CO4	4	5	3	5	4	3	3	3	5	3	4	5	4	3.92
CO5	4	5	2	4	5	2	4	2	4	2	5	4	3	3.54
CO6	4	5	2	5	4	3	4	3	5	3	4	5	4	3.92
													Mean overall Score	3.70

Result: The Score for this Course is 3.70 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.Sc (Chem)	ANALYTICAL TECHNIQUES For the students admitted in the year 2014	ECH512
SEMESTER – V		HRS/WK – 4
SDC- I		CREDIT- 3

Course outcome:

i. To learn the basic analytical methods and appreciate what is involved in an analysis

ii. To enable the students to develop instrumentation skills.

iii. Be able to describe Ultraviolet and visible spectrophotometry

iv. Be able to know Infrared Spectroscopy

v. Be able to Know Nuclear Magnetic Resonance (NMR)

vi. Be able to define Nephlometry and Turbidometry

UNIT-1

1.1. **Introduction:** Introduction to instrumental methods of chemical analysis.

1.2. **Microwave spectroscopy:** Introduction–instrumentation–the source and monochromator–sample and sample space–detector–spectrum analyzer–working.

1.3. **IR-spectroscopy:** Introduction – source - monochromators –sample cells & sampling substances – a sampling of solids – detector – bolometers – thermocouples – thermisters – Golay cell – photoconductivity cell – single beam & double beam spectrometers.

UNIT-II

2.1 **Raman spectroscopy:** Introduction – instrumentation – the source of light – filters – sample holder – spectrograph

2.2 **UV spectroscopy:** Introduction–instrumentation–radiation source – monochromators–detectors–recording system–sample cells–power supply

2.3 **NMR spectroscopy:** introduction - instrumentation – sample holder – magnet – sweep generator – radio frequency generator – radio frequency receiver.

UNIT-III

3.1 **NQR spectroscopy**: Introduction – Instrumentation

3.2 **ESR spectroscopy:** Introduction – instrumentation – source – circulator – sample cavity – magnet system – crystal detectors

3.3 **Mass spectroscopy:** Introduction – instrumentation – inlet system – ion source – electrostatic accelerating system – ion collector – vacuum system

UNIT-IV

4.1 **Mossbauer spectroscopy**: Introduction – instrumentation

4.2 **Atomic absorption spectroscopy:** Introduction – instrumentation –radiation source – chopper – production of the atomic vapor – nebulization of the liquid sample – monochromators – detectors – amplifiers

4.3 **Flame photometry:** Introduction –instrumentation – burner – mirrors – monochromators – filters - detectors

UNIT-V

5.1 **Nephlometry and Turbidimetry:** Introduction – instrumentation – sources – detectors – cells – turbidimeters - nephlometers

5.2 **pH meter:** Introduction – instrumentation – potentiometric type – direct reading type

5.3 **Fluorimetry and Phosphorimetry**: Introduction – instrumentation – flourimeters & spectroflourimetrs

Text Books:

1. Instrumental methods of chemical analysis; Chatwal & Anand, Himalaya Publishing House.
2. R. Gopalan, Analytical chemistry, S. Chand & Co., New Delhi, 2002.
3. D. A. Skoog; D. M. West; F. J. Holler, Analytical chemistry: An introduction, 5th edition, Saunders college publishing, Philadelphia, 1990.

Reference Books:

1. A. K. Srivastava, P. C. Jain, Chemical Analysis – an instrumental approach for B. Sc., honors and M.Sc., classes, S. Chand &Company Ltd., Ram Nagar, New Delhi.
2. R. M. Roberts, J. C. Gilbert, L. B. Rodewald, A. S. Wingrove, Modern experimental chemistry, 4th edition, Holt-Saunders International edition.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester V	Course code ECH512A	FORENSIC CHEMISTRY For the students admitted in the year 2017											Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	4	3	4	4	4	4	4	4	4	3	3.76
CO2	4	3	3	3	3	3	3	3	4	3	3	4	4	3.30
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53
CO4	4	3	3	3	3	3	3	4	4	3	4	4	4	3.46
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38
													Mean overall Score	3.48

Result: The Score for this Course is 3.48 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

III B.SC(Chem)	FORENSIC CHEMISTRY For the students admitted in the year 2017	ECH512A
SEMESTER - V		HRS/WK – 4
SDC - I		CREDIT- 3

Course outcome:

i. Students acquire the awareness of adulteration in various food materials
ii. Students get to know the analytical idea for detecting various crime and defusing live bombs.
iii. To give an exposure to find, analyze and suitable methods to detect the crime.
iv. understanding and detecting forgery and Counterfeiting
v. Able to explain medical application and prevention

UNIT 1: FOOD ADULTERATION

Contamination of wheat, rice, dhal, milk, butter, etc. with clay, sand, stone, water and toxic chemicals (e.g. Kasseri dhal with mentanil yellow).Food poisons: natural poisons (alkaloids, nephrotoxins), pesticides (DDT, BHC, Follidol), Chemical poisons (KCN). First aid and Antidotes for poisoned persons.Heavy metal (Hg, Pb, Cd) Contamination of Seafood. Use of neutron activation analysis in detecting poisoning (e.g., as in human hair)

UNIT 2: TRANSPORTATION

Drunken driving: breath analyzer for ethanol. Incendiary and timed bombs in the road and railway tracks. Defusing live bombs. Hit -and-go traffic accidents: paint analysis by AAS. The soil of toxic and corrosive chemicals (e.g., conc.acids) from tankers.

UNIT 3: CRIME DETECTION

Accidental explosions during manufacture of matches and fireworks (as in Sivakasi). Human bombs, possible explosives (gelatin sticks,RDX). Metal detector devices and other security measures for VVIP. The composition of bullets and detection of powder burns.

UNIT 4: FORGERY and COUNTERFEITING

Detecting forgery in bank cheques/drafts and educational records (mark lists, certificates), using UV-light. Alloy analysis using AAS to detect counterfeit coins. Jewelry: detection of

gold purity in 22-carat ornaments, detecting gold plated jewels, the authenticity of diamonds (natural, synthetic, glassy).

UNIT 5: MEDICAL ASPECTS

AIDS: Cause and prevention. Burns and their treatment by plastic surgery. Metabolite analysis, using mass spectrum - gas chromatography. Detecting steroid consumption among athletes and racehorses.

Textbooks:

1. Jay A. Siegel, Forensic chemistry- Fundamentals and applications, Wiley, 2015
2. Suzanne Bell, Forensic chemistry- Second edition, Pearson,2012

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester V	Course code 19ECH513	Title of the Paper Chemistry of Industrial Products										Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	3	4	2	4	3	3	3	4	5	4	4	3.46
CO2	3	4	4	4	2	4	3	3	3	4	5	4	4	3.62
CO3	3	3	3	4	3	2	3	3	3	4	5	4	4	3.38
CO4	3	4	3	4	3	4	4	3	4	4	5	5	4	3.85
CO5	4	4	3	4	4	4	4	3	4	4	4	4	4	3.85
												Mean overall Score		3.63

Result: The Score for this Course is 3.63 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.SC(Chem)	CHEMISTRY OF INDUSTRIAL PRODUCTS For the students admitted in the year 2019	19ECH513
SEMESTER – V		HRS/WK – 4
ELECTIVE – I		CREDIT- 3

Course outcome:

1.Students learn about the preparation and applications of soaps and detergents

2. Students acquire the knowledge of shampoos and dyes

3.Students learn about preparation of face powder and nail polish

4.Students learn about leather,sugar and agricultural chemistry

5.Students get to know the chemical aspects of lubricants and explosives

UNIT -I SOAPS AND DETERGENTS

1.1 Saponification of oils and fats – Manufacture of soaps – Formulation of Toilet soaps– Different ingredients used–Their functions–Medicated soaps. Herbal soaps– Mechanism of action of soap–Soft soaps–Shaving soaps and creams–ISI specifications– Testing procedures and limits.

1.2 Anionic detergents: Manufacturere of LAB (Linear Alkyl Benzene) – Sulphonation of LAB – preparation of acid slurry–Different ingredients in the formulation of detergent powders and soaps–Liquid detergents–Foam boosters–AOS (alpha-olefin sulphonates).

1.3 Cationic detergents: Examples– Manufacture and applications.

1.4 Non-ionic detergents: Examples–Manufacture of ethylene oxide condensate.

1.5 Mechanism of action of detergents: Comparison of soaps and detergents– Biodegradation – environmental effects – ISI specifications and limits.

UNIT- II SHAMPOOS AND DYES.

2.1 Manufacture of Sodium lauryl sulphate and Sodium Laureth sulphate: Ingredients– Functions–Different kinds of shampoos – anti-dandruff–anti-lice–herbal and baby shampoos.

2.2 Hair dye: Manufacture of conditioners – Coco betaines or coco diethanolamides – ISI specifications – Testing procedures and limits.

2.3 Introduction: Methods of dying – Classifications of dyes – Methods of application of dyes – Fluorescent brightening agent – non-textile uses of dyes

UNIT-III SKIN PREPARATIONS.

3.1 Face and skin powders: Ingredients – functions – Different types – Snows and face creams – A chemical ingredients used – Antiperspirants.

3.2 Sunscreen preparation: UV absorbers – Skin bleaching agents – Depilatories – Turmeric and neem preparations – Vitamin oil.

3.3 Nail polishes: Nail polish preparation – Nail polish removers – Article removers – Lipsticks – roughs, eyebrow pencils – Ingredients and functions – hazards – ISI specifications.

UNIT-IV LEATHER & SUGAR CHEMISTRY, AGRICULTURAL CHEMISTRY

4.1 Introduction: Manufacture of leather–Preparation of hides for tanning– Vegetable–chrome and oil tanning–tannery effluents–pollution control.

4.2 Introduction– manufacture of cane sugar– recovery of sugar from molasses–manufacture of sucrose from beetroot–testing and estimation of sugar.

4.3 Classification and examples for insecticides, fungicides,and herbicides –fluorine compounds, boron compounds, arsenic compounds, mercuric compounds, pyridine compounds – ill effects of the use of chemical fertilizers and insecticides.

UNIT-V LUBRICANTS, EXPLOSIVES AND PROPELLANTS.

5.1 Mechanism of lubrication: Classification of lubricants–lubricating oils– greases or semi-solid lubricants– solid lubricants and synthetic lubricants.

5.2 Explosives: Classification of explosives, primary explosives–high explosive and low explosive. Blasting fuses–manufacture of important explosives–propellants and rocket fuels–classification of propellants and uses.

Text Books:

1. Gobala Rao. S, Outlines of chemical technology, Affiliated East West Press, 1998.
2. Kafaro, Wasteless chemical processing, Mir Publishers, 1995.

Reference Books:

1. Sawyer. W, Experimental cosmetics, Dover publishers, New York, 2000.
2. B.K.Sharma, Industrial Chemistry, Goel Publishing House, 2004

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester V	Course code ECH513A	Title of the Paper Food Chemistry										Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	3	4	4	5	4	4	4	4	5	5	3	4.0
CO2	4	4	4	4	4	5	4	4	4	4	4	4	3	4.0
CO3	3	3	3	5	4	4	3	4	4	3	4	4	4	3.7
CO4	3	3	3	4	3	3	3	3	4	4	4	4	3	3.4
CO5	4	3	4	4	4	4	3	3	4	4	4	4	4	3.7
												Mean overall Score		3.76

Result: The Score for this Course is 3.76 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.SC(Chem)	FOOD CHEMISTRY For the students admitted in the year 2017	ECH513A
SEMESTER – V		HRS/WK – 4
ELECTIVE –I		CREDIT- 3

Course outcome:

1. To impart the awareness about food adulteration
2. Students aware of food poison and first aid for poison consumed victims.
3. Students learn about various concepts of food additives
4. Students get the knowledge of beverages
5. Students get to know edible oils and preventing of heart diseases

UNIT - I: FOOD ADULTERATION

Sources of food, types, advantages, and disadvantages. Food adulteration -contamination of Wheat, Rice Alial, Milk, Butter etc. with clay stones, water, and toxic chemicals - Common adulterants. Common adulterants Ghee adulterantsand their detection. Detection of adultered Foods with simple analytical techniques.

UNIT- II: FOOD POISON

Food Poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT,BHC, Malathion) - Chemical poisons - First aid for Poison consumed victims.

UNIT - III: FOOD ADDITIVES

Food additives - artificial sweeteners - Saccharin - Cyclamate and aspartate.Food flavours - esters, aldehydes,and heterocyclic compound. Food colours. Emulsifying agents – preservatives - leavening agents. Baking powder - yeast -tastemakers - MSG vinegar.

UNIT - IV: BEVERAGES

Beverages - soft drinks - soda - fruit juices - alcoholic beverages examples.Carbonation - addiction to alcohol – diseases of the liver and social problems.

UNIT – V: EDIBLE OILS

Fats, Oils - Sources of oils - Production of refined vegetable oils -Preservation. Saturated and unsaturated fats - iodine value - the role of MUFA andPUFA in preventing heart diseases - determination of iodine value, RM value,saponification values,and their significance.

BOOKS FOR REFERENCE

1. Swaminathan M., Food Science and Experimental oods, Ganesh and Company.

2. Jayashree Ghosh, Fundamental concepts of Applicated chemistry, S. Chand & Co. Publishers.

3. Thanlamma Jacob, Text Books of applied chemistry for Home Science and allied Sciences, Macmillan.

III B.SC(Chem)	GRAVIMETRIC ESTIMATION	CHP506
SEMESTER - V		HRS/WK – 4
CORE PRACTICAL-V		CREDIT- 2

Course outcome:
Students learn various estimations through gravimetric methods.

GRAVIMETRIC ESTIMATIONS

1. Estimation of Sulphate as barium sulphate.
2. Estimation of Barium as barium sulphate.
3. Estimation of Barium as barium chromate.
4. Estimation of Lead as lead chromate.
5. Estimation of Calcium as calcium oxalate monohydrate.

GRAVIMETRIC ESTIMATION PRACTICAL EXAMINATION

Continuous Internal Assessment (CIA): (40 MARKS)

Based on the periodical evaluation of record and experiments assessed by the staff incharge.

External Examination: (60 MARKS)

1. Experiment	20 marks
2. Manipulation	20 marks
3. Accuracy of the report	10 marks
4. Record	10 marks

III B.SC(Chem)	ANALYTICAL CHEMISTRY PRACTICALS	CHP507S
SEMESTER - V		HRS/WK – 3
CORE PRACTICAL – VI		CREDIT- 2

Course outcome:

1. Students learn Chromatographic techniques of TLC and Column.
2. Students learn Conductometry and Potentiometry through various determinations.
3. Students learn Colorimetry and pH metry.

1. Chromatography:

a) Thin – layer chromatography.

b) Column chromatography.

2. Conductometry:

a) Determination of strength of strong acid (HCl Vs NaOH).

b) Verification of Onsager's equation.

c) Determination of strength of a mixture of acids (HCl + CH_3COOH Vs NaOH).

3. Potentiometry:

a) Determination of single electrode potential.

b) Determination of pKa of weak acid using std. NaOH solution.

4. Colorimetry:

Determination of unknown concentration using a photoelectric colorimeter.

5. pH meter:

Determination of pKa of acetic acid.

ANALYTICAL CHEMISTRY PRACTICAL EXAMINATION

Continuous Internal Assessment (CIA): (40 MARKS)

Based on the periodical evaluation of record and experiments assessed by the staff in charge.

External Examination: (60 MARKS)

1. Short procedure and work sheet preparation	5 marks
2. Experiment	20 marks
3. Manipulation	20 marks
4. Accuracy of the report	5 marks
5. Record	10 marks

III B.SC(Chem)	PHYSICAL CHEMISTRY PRACTICALS For the students admitted in the year 2016	CHP505S
SEMESTER - V		HRS/WK – 3
CORE PRACTICAL-VII		CREDIT- 2

Scheme of evaluation

Continuous Internal Assessment (CIA): (40 MARKS)

Based on the periodical evaluation of record and experiments assessed by the staff in charge.

External Examination: (60 MARKS)

Aim & short procedure	– 10
Record	– 10
Experiment & Manipulation	– 25
Viva voce	– 10
Accuracy	– 5
Total	**- 60**

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester V	Course code 19SSCH52	EVERYDAY CHEMISTRY For the students admitted in the year 2019											Hrs/wk 0	Credits 2*
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	4	3	4	4	4	4	4	4	4	3	3.76
CO2	4	3	3	3	3	3	3	3	4	3	3	4	4	3.30
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53
CO4	4	3	3	3	3	3	3	4	4	3	4	4	4	3.46
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38
													Mean overall Score	3.48

Result: The Score for this Course is 3.48 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

III B.Sc (chem)	EVERYDAY CHEMISTRY For the students admitted in the year 2019	19SSCH52
SEMESTER – V		HRS/WK –0
Optional		CREDIT – 2*

Course outcome:

i. Students know the basics of chemistry in our life. To know the chemicals used in day today life
ii. Students know their own diet and sources of nutrition
iii. Students know about the food colours, Plastics, drugs etc.
iv. Understanding the importance of chemistry (and science) in developing sustainable environmental and agricultural practices
v. Students know the preservation methods

UNIT: I

1.1 General Survey of Chemicals used in everyday life.

1.2 Cosmetics: Talcum Powder, Toothpastes, Shampoos, Nail Polish - General formulationsand preparation – possible.

UNIT-II

5.1 Food and Nutrition: Carbohydrates, definitions, sources and their physiological importance - balanced diet.

5.2 Adulterants in milk, ghee, oil, coffee powder, tea, chili powder, pulses and turmeric powder - identification.

UNIT-III

3.1 Color chemicals used in food - soft drinks and its health hazards.

3.2 Plastics, polythene, PVC, Bakelite, polyesters, resins, and their applications

UNIT-IV

1.1 Chemicals in food production - fertilizers used in natural sources - Fertilizers urea, NPK, and Super phosphates need - uses and hazards.

1.2 Food preservatives-Definition-Examples-Methods of preservation-Low and high temperature Dehydration-Osmotic pressure-Food irradiation

Reference Books:

1. Chemical Process Industries - Norris Shreve Joseph A.Brine .Jr.
2. Perfumes, Cosmetic and Soaps - W.A. Poucher (Vol 3).
3. Environmental Chemistry - A .K. DE.
4. Industrial Chemistry, B.K. Sharma- Goel publishing house Meerut.
5. Food Science-B.Srilakshmi-III Editio-New Age International Publishers 2005.
6. Food Chemistry Lillian Hoagland Meyer-CBS publishers& distributors - 2004.
7. Fundamental concepts of Applied Chemistry -Jayashree Ghosh-S.Chand& Co Ltd., New Delhi.
8. Applied chemistry - K.Bagavathi Sundari - MJP Publishers.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester VI	Course code 19CH614	Title of the Paper ORGANIC CHEMISTRY – IV											Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	3	4	4	3	2	4	4	3	3	4	4	4	3.54
CO2	4	3	4	4	3	2	3	4	3	4	4	4	4	3.54
CO3	3	3	3	4	3	2	3	4	4	4	4	4	4	3.46
CO4	3	3	4	4	3	2	3	4	3	4	4	4	4	3.46
CO5	3	3	4	4	4	3	3	4	3	4	4	4	4	3.61
													Mean overall Score	3.52

Result: The Score for this Course is 3.52 (High Relationship)

Note:

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

III B.SC(Chem)	ORGANIC CHEMISTRY -IV For the students admitted in the year 2019	19CH614
SEMESTER - VI		HRS/WK – 4
CORE – XII		CREDIT- 4

Course outcome:

1. Knowledge and understanding of the principles of UV and IR spectroscopic techniques and the ability to interpret the data obtained from UV and IR Spectrometers.
2. Knowledge and understanding of the principles of NMR and Mass spectroscopic techniques and the ability to interpret the NMR and Mass spectral data.
3. Knowledge of the oxidizing and reducing agents and their applications in organic synthesis.
4. Understanding of the principles of pericyclic and photochemical reactions and the ability to apply them in solving problems.
5. Knowledge of preparation and properties of heterocycles, Terpenoids and some specific alkaloids.

Unit I UV-Visible and IR spectroscopy 12 hrs.

1.1 Principles – Type of transitions - Woodward – Fieser rules as applied to conjugated dienes and α, β – unsaturated ketones.

1.2 Characteristic IR absorption frequencies of important functional groups – fingerprint region –The effect of intermolecular and intramolecular hydrogen bonding in IR.

1.3 Problems based on IR and UV spectra. Problems using Woodward – Fieser rules.

Unit II NMR Spectroscopy and Mass spectrometry 12 hrs.

2.1 Principles of nuclear magnetic resonance – chemical shift - shielding and deshielding of protons – spin-spin splitting of neighboring protons. Coupling constants and their application.

2.2 Applications of ^{1}H NMR in the structural determination of simple organic compounds.

2.3 Mass spectroscopy: Basic principles, molecular ion peak, base peak, isotopic peak, determination of molecular formula. Fragmentation patterns in hydrocarbons, alcohols, aldehydes, ketones, acids, halobenzenes.

2.4 Simple Combined problems using UV, IR, NMR, Mass spectra

Unit III Oxidation and reduction (12 Hrs)

3.1 Oxidation with Cr(VI) and Mn(VII) reagents, Oxidation by peracids and DMSO with oxalyl chloride

3.2 Catalytic hydrogenation and dehydrogenation

3.3 Reductions with LAH, $NaBH_4$,and DIBAL. Birch reduction

3.4 Hydroboration and oxidation of alkenes and alkynes.

Unit IV Pericyclic and Photochemical reactions 12 hrs.

4.1 Electrocyclic reactions of 4 and 6 pi - electron systems

4.2 Cycloaddition reactions – 2 + 2 and 4+2 additions

4.3 Sigmatropic rearrangements - 1,3; 1,5 and 3,3 sigmatropic rearrangements. Claisen and Cope rearrangements

4.4 Photochemical reactions of carbonyl compounds: Norrish type – I and II reactions

Unit V Heterocyclic compounds and Terpenoids 12 hrs.

5.1 Preparation, properties,and uses of furan, pyrrole, thiophene, pyridine,and piperidine. Comparative study of basicity of pyrrole, pyridine,and piperidine with amines.

5.2 Six-membered rings: synthesis and reactions of quinoline, isoquinoline,and indole. Skraup synthesis, Bischler – Napieralski and Fischer- Indole Synthesis.

5.3 Terpenoids: Classification, isoprene rule, isolation, the structures of geraniol, citral, menthol, α-pinene,and camphor. Structural elucidation of menthol.

5.4 Alkaloids: definition, occurrence, extraction of alkaloids from plants, structural elucidation of coniine, piperine.

Text Books:

1 Francis A.Carey, - Organic Chemistry- Tata McGraw Hill-1999.

2 M.K.Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co.

3 Morrison R T, Boyd R N and Bhattacharjee S K, Organic Chemistry, 7th Ed., (2009), Pearson New York

4 Paula Yurkanis Bruice - Organic Chemistry, Prentice Hall- 1999.

5 Finar. I. L. Organic chemistry, 6th edition, ELBS, 1990.

6 M.K.Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co.

7 O. P. Agarwal, Chemistry of organic natural products vol 2, Goel publishing house, 2002.

8 Gurdeep Chatwal, Chemistry of organic natural products, vol 2, Goel publishing house, 2002.

9 Bahl and Arun Bahl, Organic chemistry, S. Chand and sons, New Delhi,2005

10 William Kemp, Organic Spectroscopy, 3rd edition, sarmaha publishers, 2002

11 M. B,Smith, Organic Synthesis, McGraw Hill International edition 1994.

Reference Books:

1. Jerry March, Advanced organic chemistry, 4th edition, John Wiley and Sons, New York, 1992.
2. S. H. Pine, Organic chemistry, 5th edition, Mcgraw Hill international edition chemistry series, New York, 1987.
3. Seyhan. N. Ege, organic chemistry, structure and reactivity, 3rd edition, A.I.T.B.S., New Delhi,1998.
4. P. S. Kalsi, Spectroscopy, 2nd edition, Wiley eastern ltd, 1993.
5. Silverstein and Bassler, Spectrometric identification of organic compounds, John Wileyand sons.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester VI	Course code 19CH615	Title of the Paper INORGANIC CHEMISTRY - IV											Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	4	4	4	3	4	3	3	2	4	4	3	3.46
CO2	3	3	4	4	4	3	3	3	3	4	3	3	3	3.31
CO3	3	4	4	4	4	4	4	4	4	3	4	3	4	3.78
CO4	3	4	4	4	4	3	4	4	3	2	4	4	3	3.54
CO5	3	4	4	4	4	3	3	4	4	3	4	4	3	3.61
													Mean overall Score	3.54

Result: The Score for this Course is 3.54 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.SC(Chem)	INORGANIC CHEMISTRY - IV For the students admitted in the year 2019	19CH615
SEMESTER – VI		HRS/WK – 4
CORE – XIII		CREDIT- 4

Course outcome:

I. To understand the chemistry of f-block elements.

II. To gain Knowledge on basic concepts in Nuclear chemistry

III. To describe role of different metal ions in biological system and to recognize role of porphyrin ring in hemoglobin.

IV. To know about the bond between transition metal and carbon, ligands and to count total of electrons in organometallic compound.

V. To understand the catalytic process in organo metallic chemistry.

UNIT I - Chemistry of f-block elements & Nuclear Chemistry I [12 Hrs]

1.1 Chemistry of f-block elements; Occurrence, elements, oxidation states, magnetic properties, color and spectra - lanthanide contraction - causes, consequences and uses - comparison between 3d and 4f block elements - comparative account of lanthanides and actinides.

1.2 Nuclear Chemistry - Introduction of the nucleus - nuclear force acting between nucleons - N/P ratio, curves, stability belts – packing fraction – isotopes - isobars, isotones, and isomers. Natural radioactivity - Detection and measurement of radioactivity: cloud chamber and GM counter - radioactive series including neptunium series-group displacement law – the rate of disintegration and half-life period-average life period - Nuclear binding energy – Mass defect - simple calculations involving mass defect and binding energy per nucleon - magic number - liquid drop model - shell model.

UNITII - Nuclear Chemistry II [12 Hrs]

1.1 Artifical radioactivity-induced radioactivity-uses of radioisotopes-hazards of radiation-nuclear fission- nuclear fusion-thermonuclear reaction-energy source of the sun and stars.

1.2 Nuclear reaction: Types & reactions - cross-section, Q-value, threshold energy, compound nucleus theory, direct reaction; photonuclear reaction - Nuclear reactors: Breeder reactor and Fast breeder reactor - Particle accelerators - linear accelerators, cyclotrons, Synchrotrons.

UNIT III - Bioinorganic chemistry [12Hrs]

3.1 Bioinorganic chemistry: Role of metal ions in biological systems Heme proteins – Fe - transport and storage of Dioxygen, structure,and function of hemoglobin, myoglobin.

3.2 Zn - Carboxypeptidase, Carbonic anhydrase – Mg - chlorophyll. Co-VitaminB_{12} - Mo-Nitrogen fixation - $Na^+/K^+$and Ca^{2+}-pump.

UNIT IV - Organo Metallic Chemistry I [12 Hrs]

4.1 Organo Metallic Chemistry – Compounds with transition metals to carbon bonds – classification of ligands – nomenclature- 18 electron rule – Organometallic – metal alkyls – metal alkylidenes, metal alkylidynes.

4.2 Pi - Acceptor ligands, bonding, hybridizations, structures and properties of carbonyls of Ni, Cr, Fe, Co, Mn, W & V.

UNIT V - Organo Metallic Chemistry II [12 Hrs]

5.1. Organometallic Chemistry - Catalytic processes- Hydrogenation of olefin (Wilkinson's catalyst), Hydroformylation of olefins using cobalt catalysts (oxo process), oxidation of olefins to aldehydes (Wacker's process).

5.2. Polymerization of olefins (Zeigler-Natta catalyst); cyclo oligomerization of acetylene using nickel catalyst (Repee's catalyst); Polymer-bound catalyst-water gas shift reaction

Text Books:

1. H. J. Arnikar, Essentials Of Nuclear Chemistry, 4th edition, New Age International, New Delhi, 1995.
2. B.R.Puri.; L.R.Sharma, K.C. Kalia, Principles of Inorganic Chemistry, Lal Nagin Chandand co. Delhi 1996.
3. J. D. Lee, Concise Inorganic Chemistry, 5th edition, Blackwell Science, London 1996.
4. F. A. Cotton, G. Wilkinson, C. Murillo,and M. Bochman, Advanced Inorganic Chemistry, 6th edition., John Wiley, New York 1999.
5. R.Gopalan; V.Ramalingam, Concise coordination chemistry, Vicas publications.

Reference Books:

1. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3rd edition. W. H. Freeman and Co, London, 1999.
2. S. Glasstone, Source Book of Atomic Energy, 3rd ed, ELBS, 1986.
3. Keith F. Purcell. ; John C. Kotz, Inorganic Chemistry, W.B Saunder Company, 1977
4. Ivano. ; Harry B. Gray. ; Stephen J. Lippard.; Valentine, Bioinorganic Chemistry, 1st ed, University science book, 1998

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester VI	Course code CH616T	Title of the Paper THERMODYNAMICS OF IDEAL AND NON IDEAL SOLUTIONS										Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	4	3	3	2	3	4	3	3	3	3	3	3.07
CO2	3	4	3	4	2	2	3	4	3	3	3	4	4	3.23
CO3	3	4	3	4	3	3	3	4	3	3	3	4	4	3.38
CO4	3	4	3	3	2	2	3	4	3	3	4	3	4	3.15
CO5	3	4	3	3	3	2	3	4	3	3	4	4	4	3.30
												Mean overall Score		3.22

Result: The Score for this Course is 3.22 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.SC(Chem)	Thermodynamics of Ideal and non-Ideal solutions For the students admitted in the year 2018	CH616T
SEMESTER – VI		HRS/WK – 4
CORE – XIV		CREDIT - 4

Course outcome:

i. To learn partial molar properties of system, colligative properties and to acquire knowledge about the phase diagram of mixtures.

ii. To study the principle of chemical equilibrium and the response of equilibrium to the conditions.

iii. To acquire knowledge about hydrolysis of salt, common ion effect, acid base indicators and able to determine solubility product, pH of buffer solution and salt solution.

iv. To understand the interconversion of chemical energy and electrical energy, electrode reactions and working principle of battery

v. To relate the laws of thermodynamics with electrochemistry and to gain the knowledge about electrochemical cells.

UNIT I **[12 hrs]**

1.1 The properties of the mixture- thermodynamic description of mixture-measures of concentration –partial molar properties –spontaneous mixing-ideal solutions- Ideal – dilute Solutions.

1.2 Real solutions –Colligative properties-modification of boiling and freezing points-Osmosis.

1.3 Phase diagrams of the mixture- a mixture of volatile liquids-liquid – liquid phase diagrams-liquid -solidphase diagrams-ultra purity and controlled impurity. (Pages 111-142)

UNIT II **[12 hrs]**

2.1 The principle of chemical equilibrium-reaction Gibbs energy –a variation of ΔG with composition –reactions at equilibrium-standard reaction Gibbs energy.

2.2 The response of equilibria to the conditions- the presence of a catalyst – the effect of temperature- effect of compression. (Pages 143-166)

UNIT-III **[12 hrs]**

3.1 consequences of equilibrium-proton transfer equilibrium –Bronzed-Lowry theory – protonation and deprotonation- amphiprotic systems.

3.2 Salts in water- Acid-base titrations –buffer action-indictors –solubility constants – common -ion effect. (Pages 167-186)

UNIT-IV **[12 hrs]**

4.1 Electrochemistry –migration of ions- conductivity-specific, equivalent and molar conductance-ion mobility-Transport number and its determination (Hittorf's and moving boundary method).

4.2 Electrochemical cells-half reactions and electrodes –reactions at electrodes. (Pages 187-196)

4.3 Fuel cells (H_2-O_2 and hydrocarbon-O_2)-Batteries-Primary and Secondary batteries.

UNIT-V **[12 hrs]**

5.1 Electrochemical cells-varieties of cell- the cell reaction –the cell potential –cells at equilibrium –a standard potentials-the variation of potential with the pH-the determination of pH.

5.2 Applications of standard potential-the electrochemical series-the determination of thermodynamic functions. (Pages 197-214)

Text Book

P.W. Atkins.Elements of Physical chemistry. Oxford University Press.3rd edition.1990.

Further reading

1. J.Rajaram and J.C.Kuriacose,Thermodynamics For Students of Chemistry,Lal Nagin Chand,New Delhi, 3rd edition, 1986.
2. Puri and Sharma. Principles of physical chemistry. 40th edition.2003
3. Arun Bahl, B.S.Bahl and G.D.Tuli. Essentials of Physical Chemistry. 26th edition (revised multicolour). 2009

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester VI	Course code ECH617T	Title of the Paper Medicinal Chemistry											Hrs/ wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	4	5	3	4	4	4	4	4	4	4	4	4.0
CO2	3	4	4	4	4	4	3	4	4	4	4	3	3	3.69
CO3	4	4	4	4	3	4	3	3	3	4	4	3	3	3.54
CO4	3	3	4	4	4	4	3	3	4	4	4	3	3	3.54
CO5	3	3	4	4	4	4	4	3	4	4	4	3	3	3.61
													Mean overall Score	3.68

Result: The Score for this Course is 3.68 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

III B.SC(Chem)	MEDICINAL CHEMISTRY For the students admitted in the year 2016	ECH617T
SEMESTER – VI		HRS/WK – 4
ELECTIVE – II		CREDIT-3

Course outcome:

1. Students impart the knowledge in drug designing
2. Students acquire the knowledge of antibiotics
3. Students to get the knowledge about antineoplastic agents and cardiovascular drugs.
4. Students shall understand the chemistry of anti- infective drugs
5. Students acquire the knowledge of psychoactive drugs

UNIT-I DRUG DESIGN 12 Hrs

1.1 Development of new drugs– procedures followed in drug design–concepts of prodrugs and soft drugs–structure-activity relationship (SAR).

1.2 Theories of drug activity: Occupancy theory–rate theory–induced fit theory– Quantitative structure-activity relationship.

1.3 Concepts of drug receptors: Elementary treatment of drug-receptor interactions.

1.4 Introductions to pharmacokinetics and pharmacodynamics

UNIT-II ANTIBIOTICS 12 Hrs

2.1 Antibiotics Cell wall biosynthesis– inhibitors– β-lactum rings–antibiotics inhibiting protein synthesis.

2.2 SAR of penicillin G – penicillin V– chloramphenicol– ciprofloxacin– tetracycline – streptomycin.

UNIT-III ANTINEOPLASTIC AGENTS & CARDIOVASCULAR DRUGS 12 Hrs

Antineoplastic Agents

3.1 Introduction– cancer chemotherapy– special problems–the role of alkylating agents and antimetabolites in the treatment of cancer.

3.2 SAR of uracil– mustards– 6-mercaptopurine – Hormone and natural products.

Cardiovascular Drugs

3.4 Introduction – cardiovascular diseases–central intervention of cardiovascular output – Direct acting arteriolar dilators.

UNIT-IV ANTIINFECTIVE DRUGS 12 Hrs

4.1 Introduction and general mode of action. SAR of sulphonamides – nalidixic acid –amino salicylic acid – isoniazid-chloroquine.

UNIT-V PSYCHOACTIVE DRUGS-THE CHEMOTHERAPY OF MIND. 12Hrs

5.1. Introduction – neurotransmitters– CNS depressants– a generalanesthetic– mode of action of hypnotics– sedatives– anti-anxiety drugs– benzodiazepines– buspirone– neurochemistry of mental diseases.

5.2. Antipsychotic drugs– the neuroleptics– antidepressants– butyrophenones– serendipity and drug development– stereochemical aspects of psychotropic drugs.

TEXT BOOKS:

1. Introduction to medicinal chemistry, A.Gringuage, Wiley-VCH
2. Wilson and Gisvold's Text book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F.Dorge.
3. Medicinal Chemistry, Ashutosh Kar, New Age International (P) Ltd., 1996
4. Textbook of pharmaceutical chemistry, Jayashree Ghosh, S.Chand&Company Ltd., 1997

REFERENCE BOOKS:

1. An introduction to drug design, S.S.Pandeya and J.R.Dimmock, New Age international.
2. Burger's Medicinal Chemistry and Drug discovery, Vol-1(chapter-9 & 14), Ed. M.E.Wolff, John Wiley.
3. Goodman and Gilman's Pharmacological Basis of Therapeutics, McGraw-Hill.
4. The organic chemistry of drug design and drug action, R.B. Silverman, Academic press.
5. Strategies for Organic Drug synthesis and design, D. Lednicer, John Wiley.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester VI	Course code ECH617A	Title of the Paper AGRICULTURALCHEMISTRY										Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	3	3	2	4	3	3	4	2	3	3	3	3.07
CO2	3	3	3	2	3	2	2	3	3	4	2	3	4	2.84
CO3	3	3	3	3	4	4	3	3	3	2	4	3	4	3.23
CO4	3	3	3	3	2	4	3	3	3	3	3	2	3	2.92
CO5	4	4	3	2	3	3	4	4	3	3	2	3	3	3.15
CO6	3	4	3	2	4	3	3	4	3	3	3	4	4	3.31
													Mean overall Score	3.08

Result: The Score for this Course is 3.08 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

III B.SC(Chem)	AGRICULTURAL CHEMISTRY For the students admitted in the year 2017	ECH617A
SEMESTER – VI		HRS/WK – 4
ELECTIVE – II		CREDIT-3

Course outcome:

i. To give the students the importance of Agricultural chemistry and exposure.
ii. To find, analyze and find a suitable method to cultivate and promote agricultural methods.
iii. To learn about fertilizers and pesticides.
iv. To study the origin, characterisation and testing of soils
v. To understand ethical issues and responsibility of serving the society and the environment at large.
vi. To understand plant growth regulators.

UNIT 1: SOIL CHEMISTRY

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

UNIT 2: FERTILIZERS

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

UNIT 3: PESTICIDES -I

Insecticides: stomach and contact poisons. Plant derivatives:pyrethrins, Nicotine,and rotenoneSynthetic organic: carbophos, carbaryl, p-DCB, dimethoate, Butachlor, Endrin, Aldrin (Chemical name and uses). Rodenticides.

UNIT 4: PESTICIDES -II

Fungicides: Inorganic (Bordeaux mixture) and organic (dithiocarbamate). Industrial fungicides: creosote fractions.Herbicides and weedicides: Selective and non-selectiveIntenerated pest management. Sex attractants for insect control. Sustainable agriculture.

UNIT – V: PLANT GROWTH REGULATORS

3-Indole acetic acid: NAPHTHALENE ACETIC ACID: Ethepon (2-chloroethyl phosphoric acid): Alar (succinic acid-2, 2-dimethylhydrazine :) their function.Plant hormones: Gibberlin, Cyclocel, Phosphon, dwarfing compound (CCC: 2-Chlorethyltrimethyl ammonium chloride). Defoliants

Textbooks:

1. G.T. Austin:Shreve's Chemical Process Industries, 5th edition, Mc-Graw-Hill, 1984
2. B.A. Yagodin (Ed). Agricultural Chemistry, 2 Volumes, Mir Publishers (Moscow), 1976.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester VI	Course code ECH618	Title of the Paper POLYMER CHEMISTRY											Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	4	3	4	2	3	4	3	3	3	4	4	3.30
CO2	2	3	4	3	3	2	2	3	4	3	3	4	4	3.07
CO3	2	3	4	3	3	2	3	4	4	4	4	4	4	3.38
CO4	3	3	3	3	2	2	3	4	4	3	4	4	4	3.23
CO5	3	3	3	4	3	2	2	3	3	4	4	4	4	3.23
													Mean overall Score	3.24

Result: The Score for this Course is 3.24 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

III B.SC(Chem)	POLYMER CHEMISTRY For the students admitted in the year 2014	ECH618
SEMESTER – VI		HRS/WK – 4
ELECTIVE – III		CREDIT- 3

Course outcome:

i. To know the concept of polymerization and types of polymers
ii. To understand the characteristics of polymers
iii. To acquire knowledge about the polymerization techniques and polymer processing
iv. To know the chemistry of individual polymers
v. To have an idea about the recent advances in polymer sciences

UNIT-I Basics 12Hrs

1.1. Importance of polymers. Basic concepts: Monomers–repeating units– degree of polymeriztation–Linear, branched and network polymers.

1.2. Classification of polymers: Polymerisation – condensation, addition, radical chain-ionic,and coordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems

UNIT-II Structure and properties 12 Hrs

2.1 Morphology and order in crystalline polymers – configurations of polymer chains Crystal structures of polymers.

2.2 Morphology of crystalline polymers: strain-induced morphology, crystallization,and melting–Crystalline melting point T_m. The glass transition temperature, T_g relationship between T_m and T_g.

UNIT-III Polymer Processing 12Hrs

3.1Plastics, elastomers,and fibers: Compounding–Processing techniques: Calendering–die casting–rotational casting–film casting–injection moulding–blow moulding–extrusion moulding–thermoforming–foaming–reinforcing and fiber spinning.

UNIT-IV Polymer Characterization 12Hrs

4.1Polydispersion: Average molecular weight concept–Number, weight and viscosity average molecular weights–Polydispersity and molecular weight distribution – The practical significance of molecular weight.

4.2Analysis and testing of polymers: Chemical analysis of polymers– spectroscopic methods–X-ray diffraction study–Thermal analysis and physical testing – tensile strength–Fatigue, impact–Tear resistance–Hardness and abrasion resistance.

UNIT-V Properties of Commercial Polymers 12Hrs

5.1 Polyethylene, Polyvinyl chloride, polyamides, phenolic resins, epoxy resins,and silicone polymers.

5.2 Functional polymers – fire retarding polymers and electrically conducting polymers. Biomedical polymers – contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

TEXTBOOKS:

1. Textbook of Polymer Science, F.W. Billmeyer Jr, Wiley
2. Polymer Science, V. R. Gowariker, N. V. Viswanathan,and J. Sreedhar, New Age International(P) Ltd., 2005

REFERENCE BOOKS:

1. Functional monomers and polymers, K. Takemoto, Y, Inaki,and R. M. Ottanbrite.
2. Physics and chemistry of polymers, J. M. G. Cowie, Blackie Academic,and Professional.

Relationship matrix for Course outcomes, Programme Outcomes and Programme Specific Outcomes

Semester VI	Course code ECH618A	Title of the Paper GREEN CHEMISTRY											Hrs/wk 4	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	4	4	3	5	4	4	3	5	4	5	5	4.15
CO2	4	4	3	4	3	4	4	4	4	5	4	4	4	3.92
CO3	3	3	3	3	4	4	4	4	3	5	4	4	4	3.69
CO4	4	4	4	4	3	4	3	3	3	4	4	4	5	3.77
CO5	4	3	4	4	3	3	3	3	3	4	4	4	4	3.54
													Mean overall Score	3.81

Result: The Score for this Course is 3.81 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

III B.Sc(Chem)	GREEN CHEMISTRY For the students admitted in the year 2017	ECH618A
SEMESTER – VI		HRS/WK – 4
ELECTIVE – III		CREDIT- 3

Course outcome:

1. Students learn the principles behind organic synthesis by Microwave-assisted synthesis and sonication method.
2. Students acquire the knowledge on green reactions.
3. Students understand the uses of green solvents.
4. Students learn the basics and Techniques to synthesize nanoparticles.
5. Students learn about Nano Materials and their Characterization.

UNIT-I Green Chemistry – Introduction:

1.1 Need for green chemistry – principles of green chemistry – atom economy- definition with an example (ibuprofen synthesis) – green oxidant – hydrogen peroxide.

1.2 Microwave-assisted organic synthesis – apparatus required – examples of MAOS (synthesis of fused anthroquinones, acetalization of a byproductof the sugar industry, 1, 3-dipolar cycloaddition of nitrones to fluorinated dipolarophiles, Leukart reductive amination of ketones) – advantages and disadvantages of MAOS.

1.3 Organic reactions by sonication method – apparatus required – examples of sonochemical reactions (Heck, Hundsdiecker and Wittig reactions).

UNIT-II Green Reactions:

2.1 Acetylation of primary amine, base-catalyzed aldol condensation (synthesis of dibenzalpropanone), halogen addition to C=C bond (bromination of trans-stilbene), [4+2] cycloaddition reaction (Diels-Alder reaction between furan and maleic acid).

2.2 Rearrangement reaction (benzyl-benzilic acid rearrangement), coenzyme catalyzed benzoin condensation (thiamine hydrochloride catalyzed the synthesis of benzoin, Pechmann condensation for coumarin synthesis (clay catalyzed solid state synthesis of 7-hydroxy-4-methylcoumarin).

2.3 Electrophilic aromatic substitution reactions (nitration of phenol, bromination of acetanilide) – green oxidation reactions (synthesis of adipic acid, preparation of manganese (III) acetylacetonate) – zeolite catalyzed Friedel-Crafts acylation.

UNIT-III Green Solvents:

3.1 Ionic liquids: simple preparation – types – properties and application – ionic liquids in organic reactions (Heck reaction, Suzuki reactions, epoxidation), industrial (battery) and analytical chemistry (matrices for MALDI-TOF MS, gas chromatography stationary phases – advantages and disadvantages.

3.2 Supercritical CO2 – preparation, properties and applications (decaffeination, dry cleaning) – environmental impact.

3.3 Diels-Alder reaction in water – catalysis in water (aerobic oxidation of alcohols catalyzed by Pd(II) / bathophenanthroline).

UNIT-IV Basics of Nanochemistry:

4.1 Definition, length scales,and importance of nanoscale and its technology – self-assembly of materials – self-assembly of molecules – porous solids, nanowires, nanomachines,and quantum dots.

4.2 Nanoparticles: Introduction – types of nanoparticles – preparation, properties,and uses of gold, silicon, silver, zinc oxide, iron oxide, alumina and titania nanoparticles.

4.3 Techniques to synthesize nanoparticles – top down and bottom up approaches – common growth methods.

UNIT-V Nano Materials and their Characterization:

5.1 Preparation, properties,and applications of carbon nanotubes, nanorods, nanofiberandnanoclay – toxic effects of nanomaterials.

5.2 Electron microscopes – scanning electron microscopes (SEM) – transmission electron microscopes (TEM) – scanning probe microscopy – atomic force microscopy (AFM) – scanning tunneling electron microscope (STEM) – basic principles only.

Books for Study:

1. Green Chemistry: Environmental Friendly Alternatives, Rs. Sanghi and M.M.Srinivatava, Narosa Publishing House, New Delhi.
2. Green Chemistry, V.K. Ahluwalia, Narosa, New Delhi (2011).
3. Nanotechnology, S.Shanmugam, MJP Publishers, Chennai. (2010).
4. A Handbook on Nanochemistry, Patrick Salomon, Dominant Publishers and Distributors, New Delhi.
5. Nanobiotechnology, S. Balaji, MJP Publishers, Chennai. (2010).

6. Nano: The Essentials, T. Pradeep, Tata Mc-Graw Hill, New Delhi (2007).

Books for Reference:

1. Methods and Reagents for Green Chemistry, P. Tundo, A. Perosa,and F. Zecchini, John Wiley & Sons Inc., New Jercy, (2007).
2. The Chemistry of Nanomaterial: Synthesis, Properties and Applications, Vol. I and II, CNR Rao, Springer (2006).
3. Nanotechnology: Basic Science and Emerging Technologies, Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Overseas Press (2005).
4. Nanochemistry, G. B. Segreev, Elsevier, Science, New York, (2006).

B.Sc(Chem)	BASIC CHEMISTRY FOR COMPETITIVE EXAMINATIONS	VACH01
VALUE ADDED COURSE		

Unit –I **(6 Hrs)**

Inorganic chemistry

Periodicity – Hunds rule – Aufbaua principle – Pauli principle – electronic configurations of s, p, d and f block elements – types of solvents – polarity of solvents – coordination compounds – definitions of terms – calculation of net charge – oxidation states both inorganic and coordination compounds – types of ligands

Unit – II **(6 Hrs)**

Analytical chemistry

Mole concept – molarity – molality – normality – mole fraction – parts by weight – parts by volume – parts per thousand – parts per million – definition and problems – application of law of normality on volumetric analysis – acid base – redox – and complexometric titrations – theories of indicators – Beer-Lambert law – definition for Hard water, soft water, desalination, demineralization, BOD and COD – distillation – steam distillation – vacuum distillation – brief introduction to column chromatography

Unit – III **(6 Hrs)**

Physical chemistry

Gaseous laws – Ideal and kinetic gas equations – equilibrium – equillibria involving physical processes – Henry's law – law of chemical equilibrium – effects of catalyst – Le Chatlier's principle – pH scale – common ion effect – redox reaction – assigning oxidation number – electrochemistry – Kohlrausches law and its applications – types of electrodes – Nernst equation and its applications – buffer solutions – types of buffer solutions

Unit – IV **(6 Hrs)**

Organic chemistry – I

Nomenclature of alkanes, alkenes, alkynes, cyclic compounds - aromatic compounds – reactions of alkanes – halogenation by free radical method – reactions of alkenes – electrophilic addition –

hydrogenation – halogenations – hydrohalogenation – reactions of alkynes – hydrogenation-halogenations – hydrohalogenation – cycloalkenes – angular strain theory – applications of SN1, SN2, SNi reactions – elimination reactions E1 and E2 – aromatic electrophilic substitution reactions

Unit – V **(6 Hrs)**

Applied chemistry

Soaps and Manufacture of soaps – Lubricants and mechanism of lubricants – Fertilizers and NPK fertilizers – advanced antibiotics – pharmacophea – antioxidants – chemotheraphy – radiotheraphy – soil chemistry – types of soils –

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Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes.

Semester II	Course code 19ACHZ201	Title of the Paper ALLIED CHEMISTRY FOR ZOOLOGY										Hrs/wk 5	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	3	4	3	3	4	3	4	3	4	4	3.54
CO2	3	3	4	3	3	2	3	3	4	4	3	4	4	3.31
CO3	3	3	4	3	4	2	3	4	4	4	4	4	4	3.54
CO4	3	4	3	3	4	2	3	4	3	3	4	4	4	3.38
CO5	3	3	3	4	3	3	3	3	4	4	4	4	4	3.46
Mean overall Score														3.45

Result: The Score for this Course is 3.45 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

I-B.Sc. (Zoology)	ALLIED CHEMISTRY FOR ZOOLOGY For the students admitted in the year 2019	19ACHZ201
SEMESTER-II		HRS/WK-5
ALLIED CHEMISTRY		CREDIT-4

Course outcome:

i. Students will learn the fundamental aspects of basic chemistry which will be useful for their study.
ii. Students will learn the purification techniques for the solid and liquid compounds.
iii. Students will learn the basic Chromatographic techniques for separation and extraction of chemical compounds.
iv. Students acquire the knowledge about basic spectroscopic techniques.
v. Students learn about the technology of water and various water treatment processes.

UNIT-I: BASIC CHEMISTRY

Chemical bonding –Types of Bonding - Structure of Amino acids - Zwitterion - Isoelectric Point - Structure of Proteins.Co-Ordination Chemistry: Definition of terms used - classification of ligands-Werner's theory - Biochemistryof Iron-Heme proteins - Structure and function of hemoglobin, myoglobin.IonicEquilibria - pH scale - Buffer solution - Types of Buffer Solution-Calculation of pH values of Buffer mixtures - Henderson equation

UNIT-II: PURIFICATION TECHNIQUES

Purification of solid compounds – Crystallisation - Fractional crystallization- Sublimation- Purification of liquids- Experimental techniques of distillation- Fractional distillation- Vacuum distillation- Steam distillation.

UNIT-III: SEPARATION AND EXTRACTION TECHNIQUES

Chromatography - Principles- Types - Principle and applications of Thin Layer Chromatography - Rf Value - Column chromatography - Ion Exchange Chromatography. Soxhlet Extraction - Principle and applications.

UNIT-IV: SPECTROSCOPY

General features of spectroscopy-units - Rotational spectroscopy-the rotational energy levels of molecules-rotational transitions - Vibrational spectroscopy – the vibrations of molecules –

transitions - UV-Visible Spectroscopy - Absorption Laws - Selection Rules - Types of Electronic transitions – chromophore-Auxochrome-Absorption bands and Intensity. Woodward-fiesher rules for calculating λ_{max} in Dienes and α, β-unsaturated carbonyl compounds.

UNIT-V: TECHNOLOGY OF WATER

Water quality parameters – COD, BOD, TDS – Hardness of water - Temporary and Permanent hardness - Estimation of hardness (EDTA method) - Water softening (Zeolite Method) - Demineralization of water (Ion Exchange Method) and Desalination (Reverse Osmosis Method).

Text Books:

1. P. S. Kalsi. Organic Reaction stereochemistry & Mechanism. 4th edition.New Age International publishers. 2006.
2. J. D. Lee, Concise Inorganic Chemistry, 5th edition, Blackwell Science, London 1996.
3. Puri and Sharma. Principles of physical chemistry. 40th edition.2003.
4. R. Gopalan, P.S. Subramanian & K. Rangarajan, Elements of analytical chemistry, Sultan Chand & Sons, 2003.
5. G.R. Chatwal & S.K. Anand, Instrumental Methods of Chemical Analysis, Sultan Chand & Sons, 1998.
6. C. N. Banwell. 1966, Fundamentals of Molecular Spectroscopy, McGraw Hill.
7. S. S. Dara, "A Text Book of Engineering Chemistry" fifth revised edition (1996) S Chand Companylimited New Delhi.

Reference Books:

2 F. A. Cotton, G. Wilkinson, C. Murillo,and M. Bochman, Advanced Inorganic Chemistry, 6th edition. John Wiley, New York 1999.
3 Raj.K. Bansal, Organic Reaction Mechanism, 3rd edition, Tata McGraw Hill, 1998.
4 Skoog and D. M. West, "Fundamentals of Analytical Chemistry", International edition, seventh edition (1996), Saunders College publishing Philadelphia, Halt, London.
5 Y.R.Sharma Elementary Organic Spectroscopy Principles and Chemical Applications S.Chand & Company Ltd; New Delhi 4th Revised Edition(2007)

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes.

Semester I	Course code ACH101T	Title of the Paper ALLIED CHEMISTRY - I										Hrs/wk 5	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	4	3	4	3	3	4	3	4	3	3	4	3.46
CO2	3	3	4	4	3	2	2	4	3	4	3	4	4	3.31
CO3	4	3	4	3	4	2	3	4	3	4	4	4	4	3.54
CO4	3	4	3	3	4	2	3	4	4	3	4	4	4	3.46
CO5	3	4	3	3	3	3	2	3	4	4	3	4	4	3.31
Mean overall Score														3.42

Result: The Score for this Course is 3.42 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs \& PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

I B.Sc. (Biochemistry)	ALLIED CHEMISTRY – I	ACH101T
SEMESTER – I	For the students admitted in the	HRS/WK – 5
ALLIED-I	year 2014	CREDIT – 3

Course outcome:

i. To introduce the basic concepts of organic chemistry and chemical bonding.
ii. Students will learn the fundamental aspects of co-ordination chemistry and bio-inorganic chemistry.
iii. To study few basic and important concepts of physical chemistry.
iv. Students acquire knowledge about the basics of pharmaceutical chemistry and learn about few drugs.
v. Students learn some applied chemistry methods such as polymer chemistry and Biofuels.

UNIT I ORGANIC CHEMISTRY (12 Hrs)

1.1 Chemical bonding –Types of Bonding-Bonding in Carbohydrates and Proteins-Structure of Amino acids-Zwitter ion-Isoelectric Point – Structure of Proteins.

1.2 Stereoisomerism - Types, causes of optical activity of Lactic Acid & Tartaric acid – Racemisation - Resolution, Geometrical isomerism – Maleic acid &Fumaric acid.

1.3 Oxidation-Reduction reactions- selectivity in Oxidation and Reduction Reactions.

UNIT II INORGANIC CHEMISTRY (12 Hrs)

2.1 Co-Ordination Chemistry: Definition of terms used-classification of ligands-Werner's theory

2.2 Biochemistryof iron--Heme proteins-Nature of Heme-Dioxygen Binding-Iron storage and Transport- Structure and function of hemoglobin, myoglobin.

2.3 BioChemistry of other metals- Zn-CarboxypeptidaseA, Carbonic anhydrase - Mg-chlorophyll.Co-VitaminB_{12}

UNIT III PHYSICAL CHEMISTRY (12 Hrs)

3.1 Thermochemistry-Units of Energy changes-Exothermic and Endothermic reactions-Heat of reaction- Different types of the heat of reaction

3.2 IonicEquilibria-pH scale-Buffer solution-Types of Buffer Solution-Calculation of pH values of Buffer mixtures-Henderson equation

3.3 Acid-Basecatalysis-Bronsted relation-Enzyme catalysis-Michales-Menton equation-Influence of pH and temperature.

UNIT IV PHARMACEUTICALCHEMISTRY (12 HRS)

4.1 Development of new drugs-Drug and Disease-Structure and activity-Additives and their role-Human Gene therapy- Animal and Synthetic Biotechnology

4.2 Mode of action and uses of sulpha drugs - Prontosil, sulphadiazine,and sulphafurazole. Definition and one example of analgesics, antipyretics, tranquilizers, sedatives, local and general anesthetics.

UNIT V APPLIED CHEMISTRY

5.1 Macromolecules-Classification of Polymers-Chemistry of polymerization-Addition

5.2 Polymerisation-Condensation Polymerisation-Coordination Polymerisation-Dendrimers-Biopolymers

5.3 Bio fuels-First generation of Bio fuels-Second generation of Bio fuels-Sustainable Bio Fuels-Calorific value of food and fat.

Text Books

1. J. D. Lee, Concise Inorganic Chemistry, 5th edition, Blackwell Science, London 1996.
2. P. S. Kalsi. Organic Reaction stereochemistry & Mechanism. 4thedition. New Age International publishers. 2006.
3. Puri and Sharma. Principles of physical chemistry. 40th edition.2003
4. I. L. Finar, Organic chemistry, 6th edition, ELBS, 1990
5. G.R.Chatwal,Pharmaceutical Chemistry Organic (vol II), Himalaya Publishing House, Second Revised Edition 1997
6. Polymer Science, V. R. Gowariker, N. V. Viswanathan,and J. Sreedhar, Wiley Eastern
7. J.Rajaram and J.C.Kuriacose,Thermodynamics For Students of Chemistry,Lal Nagin Chand,New Delhi, 3rd edition, 1986.

Reference Books:

1. F. A. Cotton, G. Wilkinson, C. Murillo,and M. Bochman, Advanced Inorganic Chemistry, 6th edition., John Wiley, New York 1999.
2. Textbook of Polymer Science, F.W. Billmeyer Jr, Wiley
3. J.E. Huheey, Inorganic Chemistry, 5thEdn., Harper International.1993.
4. Raj.K. Bansal,Organic Reaction Mechanism, 3rd edition, Tata McGraw Hill, 1998

Relationship matrix for Course outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Course code ACH202T	Title of the Paper ANALYTICAL CHEMISTRY											Hrs/wk 5	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	4	4	3	3	4	4	4	4	5	4	5	3.92
CO2	4	5	4	5	4	2	4	4	3	4	5	4	5	4.07
CO3	3	3	4	3	3	3	3	4	3	3	4	4	5	3.46
CO4	4	5	4	4	4	3	3	4	3	4	4	5	5	4.0
CO5	4	3	3	4	4	3	4	4	3	4	4	4	5	3.77
													Mean overall Score	3.84

Result: The Score for this Course is 3.84 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I B.Sc (Biochemistry)	ANALYTICAL CHEMISTRY For the students admitted in the year 2014	ACH202T
SEMESTER – II		HRS/WK – 5
ALLIED-II		CREDIT – 3

Course outcome:

1. Students learn various crystallization and distillation methods involved in the purification of solid and liquid chemicals.
2. Students acquire the knowledge of various chromatographic separation techniques.
3. Students learn various analyzing abilities of Polarography, Polarimetry and Cyclic Voltammetry.
4. Students learn various Spectroscopic techniques.
5. Students learn the concepts of analysis, estimations and purification of water.

UNIT I PURIFICATION TECHNIQUES

Purification of solid compounds- Crystallization- Fractional crystallization- Sublimation- Purification of liquids- Experimental techniques of distillation- Fractional distillation- Vacuum distillation- Steam distillation

UNIT II SEPARATION TECHNIQUES

Chromatography – Types - Column chromatography – TLC - Ion Exchange Chromatography

UNIT III INSTRUMENTAL ANALYSIS

Polarography – Principle – Instrumentation - Application of Polarography Cyclic voltammetry – Principle – Instrumentation - Application of CV Polarimetry – Principle - Instrumentation-Application –Estimation of Glucose

UNIT IV SPECTROSCOPY

General features of spectroscopy-units Rotational spectroscopy-the rotational energy levels of molecules-rotational transitions Vibrational spectroscopy – the vibrations of molecules – transitions- UV-Visible Spectroscopy-Absorption Laws-Selection Rules-Types of Electronic transitions – chromophore-Auxochrome-Absorption bands and Intensity.Woodward-Fieser rules for calculating λ_{max} in Dienes and α,β-unsaturated carbonyl compounds.

UNIT V TECHNOLOGY OF WATER

Water quality parameters-Temporary and Permanent hardness-Estimation of hardness (EDTA method) - Water softening (Zeolite) - Demineralization (Ion Exchange) and desalination (RO)

Text Books:

1. R. Gopalan, P.S. Subramanian & K. Rangarajan, Elements of analytical chemistry, Sultan Chand & Sons, 2003.
2. G.R. Chatwal & S.K. Anand, Instrumental Methods of Chemical Analysis, Sultan Chand & Sons, 1998
3. C. N. Banwell. 1966, Fundamentals of Molecular Spectroscopy, McGraw Hill.
4. S. S. Dara, "A Text Book of Engineering Chemistry" fifth revised edition (1996) S Chand company limited New Delhi.

Reference Books

1. A. Skoog and D. M. West, "Fundamentals of Analytical Chemistry", International edition, seventh edition (1996), Saunders College publishing Philadelphia, Halt, London.
2. Y.R.Sharma Elementary Organic Spectroscopy Principles and Chemical Applications S.Chand&Company Ltd; New Delhi4th Revised Edition(2007)

Relationship matrix for Course outcomes, Programme Outcomes and Programme Specific Outcomes

Semester III	Course code ACH301S	Title of the Paper ALLIED CHEMISTRY FOR PHYSICS										Hrs/wk 5	Credits 3
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	4	4	3	3	4	4	5	4	4	4	4	3.84
CO2	2	5	3	4	3	3	4	4	4	3	4	4	5	3.69
CO3	3	3	3	3	2	3	4	4	3	3	3	4	4	3.23
CO4	2	4	3	4	3	3	4	4	4	4	4	4	4	3.62
CO5	2	4	3	3	3	3	4	3	3	3	4	4	3	3.38
												Mean overall Score		3.55

Result: The Score for this Course is 3.55 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

II B.Sc. PHYSICS	ALLIED CHEMISTRY FOR PHYSICS For the students admitted in the year 2011	ACH301S
SEMESTER – III		HRS/WK – 5
ALLIED CHEMISTRY		CREDIT – 3

Course outcome:

1. Students learn the basic concepts and applications in nuclear chemistry.
2. Students understand some important concepts in spectroscopy and the properties of dilute solutions.
3. Students learn the concepts in solid state chemistry.
4. Students learn the concepts of acid base titrations and basic principles and uses in conductometry, Amperometry and Voltametry.
5. Students understand the superconductors & electrode reactions.

UNIT-I NUCLEAR CHEMISTRY (12 Hrs)

Atom - classification of nuclides, nuclear stability, magic number, Radioactive elements, Decay kinetics, Photonuclear reaction, nuclear fission and fusion, Nuclear Reactor – Detectors - Application of Radioactivity.

UNIT-II SPECTROSCOPY & PROPERTIES OF DILUTE SOLUTIONS (12 Hrs)

Spectroscopy – Types, electromagnetic radiation, characteristics of electromagnetic radiation, electromagnetic spectrum, absorption & emission spectra.IR: Types of vibration, selection rule - UV: Electronic energy levels - electronic transition & selection rule – Beer-Lambert law, chromophores, auxochrome - Bathochromic shift, Hypsochromic shift. Colligative properties Lowering of Vapour pressure, Raoult's law, Osmosis, derivation of osmotic pressure, reverse osmosis, elevation of boiling point, determination of molar mass, freezing point depression, and cryoscopic constant, Vant - Hoff factor.

UNIT-III INORGANIC & SOLID STATE CHEMISTRY (12 Hrs)

Bragg's equation – Principles of X-ray diffraction – Comparison of X-ray, electron and neutron diffraction. Crystal lattices – laws of crystallography – elements of symmetry – crystal systems – unit cell, space lattices – Bravis lattice – Miller Indices - ionic crystal structures of simple inorganic compounds.

UNIT IV ANALYTICAL CHEMISTRY (12 Hrs)

Acid, base titrations, complexation, precipitation and redox titrations, voltammetry, amperometry and conductometry, basic principle and uses.

UNIT V MATERIAL SCIENCE AND ELECTRODICS (12 Hrs)

Material Science: Superconductivity -characters of Superconductors- types of Superconductors- application of Superconductors.

Electrodics: Types of electrodes and cells – Nernst equation - EMF measurements and its application - principles of chemical and electrochemical corrosion - corrosion control.

Text Books:

1. H.J. Arnikar, Essentials of Nuclear chemistry, New Age International (P) Ltd. 4th edition, 2003.
2. S. Glasstone, Principles of electrochemistry, Oxford University Press, 3rd edition, 2004.
3. P.S. Kalsi, Spectroscopy of Organic Compounds, New Age International (P) Ltd. 5th edition, 2004.
4. A.G. West, Solid Chemistry, New Age International (P) Ltd, 2003.

Reference Books:

4. P.W. Atkins, The elements of Physical chemistry, Oxford University Press, 3rd edition, 2004.
5. D.A. Skoog, D.M. West, F.J. Holler & S.R. Crouch, Fundamentals of Analytical chemistry, Thomson. Brooks / Cole, 2004.
6. D.F.Shriver and P.W.Atkins, Inorganic chemistry, Oxford University Press, 3rd edition, 2002.

Question paper pattern for under graduate

Continuous internal assessment (CIA) (25 marks)

Two internal Examinations	10 marks
Assignment / Seminar	10 marks
Attendance	5 marks
Total	**25 marks**

External Examination (75 marks)

Question Pattern

Time: 3 Hours **Max. Marks: 75**

SECTION – A (20 x 1 = 20)

Answer **ALL** the Questions

I. Choose the correct answer	(10 x 1 = 10)
II. Fill up the blaks	(5 x 1 = 5)
III. Match the following	(5 x 1 = 5)

SECTION -B (10 x 2 = 20)

Answer any **Ten** out of **Twelve**

SECTION –C (5x 7 = 35)

Answer **Five out of Seven**

(Each question should contain a maximum of two sub divisions)

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)
CUDDALORE-1

PG & RESEARCH DEPARTMENT OF CHEMISTRY
M.Sc. and M.Phil.
SYLLABUS 2019-2020

Meeting of the board of studies for PG
Department of Chemistry

Date: 15.03.2019

Minutes:

The meeting of the board of studies for M.Sc., of Chemistry Department was held in the Chemistry department, St. Joseph's College of Arts and Science (Autonomous). Cuddalore, on 15.03. 2019 at 1.00 pm.

CHAIRMAN
Mr. T. Antony Sandosh
Head, PG and Research Department of Chemistry
St. Joseph's College of Arts and Science (Autonomous),
Cuddalore.

UNIVERSITY NOMINEE
Dr. M. Sekar
Associate Professor
Department of Chemistry
Government Arts college,
C. Mutlur
Chidambaram.

SUBJECT EXPERT
Dr.C.Palanivel
Assistant Professor
Department of Chemistry
Government Arts college,
C. Mutlur
Chidambaram.

ALUMNI
Dr.V.Selvaraj
Asst. Professor,
Anna University,
Villupuram.

INDUSTRIAL EXPERT
Mr.P.Harinarayanan.

Manager, STRIDE SHASUN,
SIPCOT, Cuddalore.

MEMBERS

Dr. V. Periyanayagasamy	Asst. Professor
Mr. A. Amalorpavadoss	Asst. Professor
Mr. M. Sebastian Marianathan	Asst. Professor
Mr. G. Anand	Asst. Professor
Ms. B. Christina	Asst. Professor
Mr. S.Richard Rajkumar	Asst. Professor
Mr. F.Paul Arokiadoss	Asst. Professor

The existing curriculum for PG Chemistry was taken for discussion. After discussion, it was concluded that the existing curriculum can be retained with a few changes.

PG – ORGANIC CHEMISTRY

ORGANIC CHEMISTRY – I (PCH701S) In Unit-I, The topics were rearranged and Felkin Ahn Modification of Cram's rule was included. In Unit – II, Kinetic and Nonkinetic methods for determining Reaction mechanism were specified.In Unit-V, Quinines was changed into Quinones. Reduction with Hydrazines was removed as it is being a repetition. Textbooks and Reference books were also changed. Changes included in Course outcome.

In **ORGANIC CHEMISTRY – II (PCH 805S) –**Confirmations and mechanism were changed into Confirmation and stability in Unit – I. Course outcome was modified. Text and Reference books were changed.

In **ORGANIC CHEMISTRY – III (PCH909S) -** Units were reorganized. Textbooks and references were changed.

In **ORGANIC CHEMISTRY – IV (SYNTHETIC ORGANIC CHEMISTRYAND CHEMISTRY OF NATURAL PRODUCTS – PCH1013S)** Textbooks and references were changed.

In **Elective: REAGENTS AND NAMING REACTIONS (EPCH808Q)-**Unit -III was completely changed with Pd catalyzed coupling reactions. Text and reference books were changed. Textbooks and references were changed.

In **PHYSICAL METHODS IN ORGANIC CHEMISTRY (EPCH 912S):**
In Unit-V, the topic SEFT was removed.

PG – INORGANIC CHEMISTRY

In the course **Inorganic Chemistry-I (PCH702S)**, the topics, Facial and meridonial isomers, Numerical problems on isomerism were added in Unit – I. In Unit – II, the topics, the consequences of CFSE and factors affecting CFSE, Spinels & inverse spinels and Jahn-Teller distortion were added. In Unit – III the topic Job's method was added. In unit – IV the topics, klado& hypo boranes, Classification of ionic clusters of main group elements were added.

The topics, Compounds of iron-sulfur proteins and Nitrogenase model compounds in unit - IV of **PCH806T** were deleted.

In the Unit – I of **PCH910S**, the topic Carbenes Fischer and Schrock carbenes were added andUnit-III and Unit - V were reorganized.

In **Inorganic Chemistry-IV PCH1014S**, Unit – III was renamed as Organometallic Chemistry – III by adding the new topics Monsanto acetic acid synthesis, Water gas shift reaction, Fischer Tropsch synthesis – Parallels between main group and binary carbonyl complexes – The isolobal analogy – Isolobal analogy CH_4 , CH_3, CH_2, CH, C, CH_4^+ CH_3^+, CH_2^+, CH^+, CH_3^-, CH_2^-, CH^- fragments with metallic carbonyls – Extension of isolobal analogy. In the course **Inorganic Chemistry Practical (PCHP305S)**, the experiment part "Preparation" was removed.

PHYSICAL CHEMISTRY

In **Quantum Mechanics and Molecular structure (PCH703T)**, Unit-I, Elements of Classical mechanics- Newton's equation of motion- Lagrange's equation of motion – Rayleigh-JeansMax Planck radiation law was added and inadequacy of Classical theory were removed. In Unit-II, Solution of the Schrodinger equation –Ladder Operator method was added. In Unit-III, Approximation methods, Zeeman and Stark's effect was included. The book A.B. Sannigrahi, Quantum Chemistry, Books and Allied (P) Ltd, 2nd edition, 2010 was made as the textbook.

In PG physical chemistry practical-I, **PCHP203**, it was discussed and decided to add the following experiments, Kinetics of decomposition of sodium thiosulphate using Hydrochloric acid, Construction of phase diagram for Three component system (KCl-Glucose-Water), (Chloroform-Acetic acid-Water).

In **PCH1015T, Unit-III**, Butler-Volmer equation and their applications in electrode reactions and overvoltage and corrosion were added.

M.Sc. CHEMISTRY

CURRICULUM DESIGN TEMPLATE FROM 2019

Sem	Subject Title	Subject Codes	Hrs	Cr	Exam. Hrs
I	(MAIN-I) ORGANIC CHEMISTRY-I	**19PCH11**	4	5	3
	(MAIN-II) INORGANIC CHEMISTRY-I	**19PCH12**	4	5	3
	(MAIN-III)QUANTUM MECHANICS AND MOLECULAR STRUCTURE	**19PCH13**	4	5	3
	(ELECTIVE – 1) : BIO-INORGANIC AND SUPRAMOLECULAR CHEMISTRY **(OR)** HETEROCYCLICS AND NATURAL PRODUCTS	EPCH704T EPCH704A	4	4	3
	Total			**19**	
II	(MAIN-IV) ORGANIC CHEMISTRY-II	**19PCH21**	4	5	3
	(MAIN-V) INORGANIC CHEMISTRY-II	**19PCH22**	4	5	3
	(MAIN-VI) GROUP THEORY AND ITS APPLICATIONS IN SPECTROSCOPY	PCH807T	4	5	3
	(ELECTIVE – II): REAGENTS AND NAMING REACTIONS (OR) NUCLEAR AND RADIOCHEMISTRY	**19EPCH24** EPCH808A	4	5	3
	(PRACTICAL-I) ORGANIC CHEMISTRY PRACTICAL-I	PCHP201	4	2	6
	(PRACTICAL-II)INORGANIC CHEMISTRY PRACTICAL-I	PCHP202S	4	2	6
	(PRACTICAL-III)PHYSICAL CHEMISTRY PRACTICAL-I	**19PCHP23**	4	2	6
	Total			**26**	
III	(MAIN-VII) ORGANIC CHEMISTRY-III	**19PCH31**	4	4	3
	(MAIN-VIII) INORGANIC CHEMISTRY –III	**19PCH32**	4	4	3
	(MAIN-IX)STATISTICAL THERMODYNAMICS AND ITS APPLICATIONS	PCH911S	4	4	3
	(ELECTIVE – III): PHYSICAL METHODS IN ORGANIC CHEMISTRY (OR) BIOORGANIC CHEMISTRY	**19EPCH34** EPCH912A	4	4	3
	HUMAN RIGHTS	ECHR901S	2	1	3
	(PRACTICAL-IV)ORGANIC CHEMISTRY PRACT	PCHP304T	4	2	6
	(PRACTICAL-V)INORGANIC CHEMISTRY PRACTICAL -II	PCHP305S	4	2	6
	(PRACTICAL-VI)PHYSICAL CHEMISTRY PRACTICAL -II	PCHP306	4	2	6
	Total			**23**	
IV	(MAIN-X) ORGANIC CHEMISTRY –IV	**19PCH41**	4	4	3
	(MAIN-XI) INORGANIC CHEMISTRY –IV	**19PCH42**	4	4	3
	(MAIN-XII)REACTIONKINETICS,ELECTRODE KINETICS,AND PHOTOCHEMISTRY	**19PCH43**	4	4	3

	PROJECT	JPCH1016		9	
	SEMINAR&PAPER PRESENTATION	JPCH1017		1	
	Total			**22**	
	TOTAL CREDITS			**90**	

(POST GRADUATION) PROGRAMME OUTCOMES

PO1. The Students are groomed to acquire professional skills in their respective domains.

PO2. The Students are encouraged to climb the academic ladder by pursuing Research Programme.

PO3.The Inherent Skills of the Students are transformed into Employability and Entrepreneurial Opportunities.

PO4. Graduates are trained to keep in pace with the rapidly changing technological frontiers.

PO5. The Students evolve into intellectually, ethically and socially ideal citizens of the Nation.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

M.Sc., Chemistry

PSO1. Acquires knowledge about all basic concepts of all the elements of chemistry

PSO2. Excel as academicians and research oriented skills to pursue Ph.D programme targeted approach of CSIR – NET examination.

PSO3. Shine in Discipline specific competitive exams conducted by service commission

PSO4. Unique employment in Research & Development department of chemical industries & Allied Division

PSO5. Professionally competent to take up careers in academics, health care and service industry

PSO6. Immense job convenience at all level of chemical and its related industries.

PSO7. A research oriented learning that develops analytical and integrative problem-solving approaches.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester I	Course code 19PCH11	Title of the Paper ORGANIC CHEMISTRY – I											Hrs/wk 4	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	4	4	4	4	3	3	3	4	4	4	4	3.79
CO2	4	4	4	4	4	4	3	3	3	4	4	4	4	3.79
CO3	4	3	3	4	3	4	3	3	3	4	4	4	4	3.54
CO4	3	3	4	4	3	4	3	3	3	4	4	4	4	3.54
CO5	3	3	4	4	3	4	3	3	3	4	4	4	4	3.54
													Mean overall Score	3.64

Result: The Score for this Course is 3.64 (High Relationship)

Note:

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I M.SC(Chem)	ORGANIC CHEMISTRY – I For the students admitted in the year 2019	19PCH11
SEMESTER - I		HRS/WK – 4
CORE – 1		CREDIT-5

Course outcome:

1. Understanding of the concepts involved in stereochemistry and the ability to solve the problems based on stereochemistry**.**
2. Understanding of the principles of reaction mechanism and the ability to arrive at reasonable mechanisms for organic reactions**.**
3. Knowledge of the reactive intermediates such as Benzynes, Free radicals, Carbenes and Nitrenes and the reactions involving these intermediates.
4. Knowledge of reactions involving Carbocations, Carbanions and the ability to apply it in organic synthesis.
5. A sound knowledge of Oxidising and reducing agents and the ability to apply them in Organic synthesis.

Unit I: STEREOCHEMISTRY -I (12 hrs)

Basic principles of stereochemistry – Interconversion of Sawhorse, Newman,and Fischer projections. R, S notation of biphenyls, allenes,molecules with one and two asymmetric centers. Erythro and threo notations. Asymmetric synthesis. Geometrical isomerism, E, Z - nomenclature of olefins, Geometrical and optical isomerism of disubstituted cyclopropane, cyclobutane, and cyclopentane. Cram's rule and Felkin- Ahn Modification.Stereospecific andstereoselective reactions.

Unit II PHYSICAL ORGANIC CHEMISTRY (12 hrs)

Introductory physical organic chemistry: Acids and Bases, HSAB, the equilibrium constant, thermodynamic effect, kinetic effects – thermodynamic and kinetic control of organic reactions. Hammond postulate, Curtin – Hammett principle. Hammett equation – Application to organic reactions. Methods of determining reaction mechanism –Non-kinetic methods- Product analysis; Determination of the presence of intermediates-isolation, detection, trapping; cross-over experiments, isotopic labeling and isotope effects,

stereochemical evidences. Kinetic methods - the relation of the rate with the mechanism of the reaction.

UNIT – III REACTIVE INTERMEDIATES (12 hrs)

Structure, reactivity, formation, stability,and reactions involving free radicals, benzynes, carbenes and nitrenes. Long and short-lived free radicals. Addition of free radicals to olefinic double bonds. Aromatic radical substitutions: Decomposition of diazocompounds, phenol – coupling, sandmeyer reaction, Gomberg reaction, Pschorr reaction, Ullmann reaction, Hunsdiecker reaction.

UNIT IV MOLECULAR REARRANGEMENTS (12 hrs)

Structure, reactivity, formation, stability and the following rearrangements involving carbocations and carbanions: Wagner – Meerwein, Pinacol – Pinacolone, Tiffeneau-Demjanov, Beckmann, Dienone – phenol, Favorski, Wittig, Neber, Stevens and Sommelet-Houser rearrangements. Hofmann, Curtius, Lossen, Schmidt and Wolff Rearrangements.

Unit V OXIDATION AND REDUCTION (12 hrs)

Mechanism – study of the following oxidation reactions–oxidation of alcohols with Cr(VI)and Mn reagents – oxidation of methylene to carbonyl, oxidation of aryl methanes – Etard reaction – Formation of C = C bonds- Wittig reaction, Formation of C – C bonds by dehydrogenation, dehydrogenation by Quinones, $Hg(OAc)_2$ and $Pb(OAc)_4$. Formation of C – C bond by phenol coupling and acetylene coupling – allylic oxidation-SeO_2, oxidation of alcohols, glycols, halides and amines to aldehydes and ketones, oxidation of Olefinic double bonds and unsaturated carbonyl compounds – oxidative cleavage of C – C bond. Synthetic importance of Clemmensen and wolf-Kishner reductions – modification of Wolf-Kishner reduction – Birch reduction, MPV reduction. Catalytic hydrogenation and Sommelet reaction. Reduction with $LiAlH_4$, $NaBH_4$, tritertiarybutoxyaluminium hydride, Sodium cyanoborohydride,and trialkyl tin hydride.

Text Books:

1. J. March and M. Smith, *Advanced Organic Chemistry*, 5th ed., John-Wiley and Sons. 2001.
2. P. S. Kalsi, *Stereochemistry of carbon compounds*, 8thedn, New Age International Publishers, 2015.
3. E. L. Eliel “Stereochemistry of carbon compounds”, John Wiley, 1997.

4. P. Y.Bruce, *Organic Chemistry*, 7th edn. Prentice Hall, 2013.
5. F. A. Carey and R. J. Sundberg, Advanced organic chemistry, Plenum publishers Ltd. 2000.
6. Clayden, Greeves, Warren, Wothers, Organic chemistry, Oxford University Press.

Reference Books:

1. R.O.C. Norman, J.M. Coxon, Principles of organic synthesis, ELBS publications, 1994.
2. Seyhan Ege, Organic Chemistry, AITBS, 2001.
3. Michael Smith, Organic Synthesis, McGraw Hill, 1996.
4. W. Carruthers, J.Coldham, Modern methods of Organic synthesism IV edition, Academic Press, 1989.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester I	Course code 19PCH12	Title of the Paper INORGANIC CHEMISTRY - I										Hrs/wk 4	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	2	3	2	3	3	2	4	3	4	3	3	4	2	2.92
CO2	2	3	3	3	3	4	3	3	4	4	3	4	3	3.23
CO3	2	3	3	3	2	3	3	3	4	3	4	4	4	3.15
CO4	3	2	3	3	2	3	3	4	3	3	3	4	2	2.92
CO5	3	3	3	2	3	2	3	3	3	4	3	3	3	2.92
												Mean overall Score		3.09

Result: The Score for this Course is 3.09 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I M.Sc (chem)	INORGANIC CHEMISTRY – I For the students admitted in the year 2019	19PCH12
SEMESTER – I		HRS/WK – 4
CORE - II		CREDIT – 5

Course outcome:

i. To know about the various types of isomerism existing in complexes.
ii. To learn the concepts of CFT and the applications of macrocyclic ligands
iii. To interpret the stability of various complexes
iv. To acquire the knowledge about the molecular polyhedral and clusters
v. To learn about poly acids and inorganic polymers

Unit- I Isomerism in Coordination Complexes [12 Hrs]

1.1 Isomerism in complexes-ionization isomerism, hydrate isomerism, linkage isomerism, ligand isomerism, Coordination isomerism and polymerization isomerism

1.2 Numerical problems on isomerism of the complexes – Geometrical and optical isomerism in 4 and 6 coordinated complexes. Chirality and nomenclature of chiral complexes.

Unit – II – Macrocyclic Ligands and CFT [12 Hrs]

2.1 Crystal field theory- Splitting of d-orbitals in octahedral, tetrahedral and square planar complexes- crystal field stabilization energy-calculation of CFSE in octahedral complexes-

2.2 Consequences of CFSE – factors affecting CFSE - low spin and high spin complexes-explanation of magnetic properties and color of complexes using CFT – Jahn-Teller distortion and its consequences

Unit-III – Thermodynamic and Kinetic stability of Complexes [12 Hrs]

3.1 Metal-Ligand Equilibria in Solution: Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with reference to the nature of metal ion and ligand, chelate effect and its thermodynamic origin.

3.2 Determination of stability constants by Potentiometric, Polarography and Spectrophotometric techniques – Jobs method

Unit - IV Molecular Polyhedra: Boron hydrides and Metal Clusters[12 Hrs]

4.1 Classification of boranes, carboranes, hydroborate ions, carboranes, metallacarboranes and ionic clusters of main group elements as closo, Nido, arachno, hypo,klado – STYX numbers

4.2 Metal Clusters: Structure and bonding of binuclear compounds – $Re_2Cl_8^{2-}$ and $Mo_2Cl_8^{2-}$ - structures of three-atom clusters – $Re_3Cl_{12}^{3-}$ and $Fe_3(CO)_{12}$ – Four atom tetrahedral clusters – $Co_4(CO)_{12}$ and $Ir_4(CO)_{12}$ - Six atom clusters $Rh_6(CO)_{16}$ – determination of number of metal-metal bonds in polynuclear carbonyls

Unit - V Polyacids and Inorganic polymers [12 Hrs]

5.1 Polyacids: Isopolyacids and hetereopolyacids of vanadium, chromium, molybdenum,and Tungsten.

5.2 Inorganic Polymers: Silicates – structure, properties and applications – polysulphur – nitrogen compounds and poly-organophosphazenes.

Text Books:

1. J.E. Huheey, Inorganic Chemistry, 5thEdn., Harper International.1993.
2. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5thEdn., John Wiley.1985.
3. M.F.Purcell, J.C.Kotz, Inorganic Chemistry,Saunder, 1977.
4. R. Gopalan, V.Ramaligam, Concise Co-ordinationChemistry, 2 nd Ed, Vikas publisihing house, 2008.

Reference Books

1. B.Douglas, D.McDaniel, J.Alexander, Concepts,and Models of Inorganic Chemistry, 3rdEdn., John Wiley,2001.
2. J.D.Lee, A New Concise Inorganic Chemistry, 3rdEdn., ELBS, 1987.
3. W.L.Jolly, Modern Inorganic Chemistry, 2ndEdn., McGraw-Hill,1991.
4. N.N.Greenwood,A.Earnshaw, Chemistry of the Elements, 2ndEdn.,BH,1997.
5. D.F.Shriver, P.W.Atkins, C.H.Langford, 3rd Edn. Inorganic Chemistry, ELBS.1999

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester I	Course code 19PCH13	Title of the Paper Quantum mechanics and Molecular structure										Hrs/wk 4	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	3	3	2	4	3	5	3	2	4	4	4	3.30
CO2	3	5	4	4	3	4	4	4	3	3	3	4	3	3.61
CO3	4	4	4	4	3	4	4	3	3	3	3	3	4	3.54
CO4	4	4	3	4	3	3	4	2	4	3	3	3	4	3.38
CO5	4	4	4	3	3	4	4	3	4	3	3	3	4	3.54
												Mean overall Score		3.47

Result: The Score for this Course is 3.47 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

I M.Sc (chem)	Quantum mechanics and Molecular structure For the students admitted in the year 2019	19PCH13
SEMESTER - I		HRS/WK – 4
CORE – III		CREDIT- 5

Course outcome:

1. Students learn the elements of classical mechanics, quantum mechanical postulates and Schrodinger equations.

2. Students acquire the knowledge about the solution of Schrodinger equation, quantum numbers and their physical significance.

3. Students learn the knowledge of approximation methods and the concept of hybridization.

4. Students learn the knowledge of Empirical MO theory.

5. Students understand the Basics of Popular quantum chemical calculations and Semi-empirical methods.

Unit I Quantum Chemistry I [12 Hrs]

1.1 Elements of Classical mechanics- Newton's equation of motion- Lagrange's equation of motion –Rayleigh-Jeans- Max Planck radiation law – Bohr's quantum theory and subsequent developments – the Compton effect – wave-particle duality – uncertainty principle.

1.2 Wave equation for electrons – quantum mechanical postulates – the operators – Hermitian property.

1.3 Schrodinger equation – elementary application of Schrodinger's equation – the particle in a box (one, two and three-dimensional cases)

Unit II Quantum Chemistry II [12 Hrs]

2.1 The harmonic Oscillator - Solution of the Schrodinger equation –Ladder Operator method – the rigid rotor – particle in a ring Schrodinger equation for the hydrogen atom (no derivation is required) and the solution.

2.2 The origin of quantum numbers (angular momentum and spin) – their physical significance.

Unit – III Quantum Chemistry [12 Hrs]

3.1 Approximation methods – perturbation and variation methods – application to hydrogen (Zeeman and Stark's effect was included), helium atoms – R.S. Coupling and term symbols for atoms in the ground state.

3.2 Born Oppenheimer approximation – valence bond theory for Hydrogen molecule – LCAO – MO theory for diatomic and polyatomic molecules.

3.3 The concept of hybridization – Huckel theory for conjugated molecules (ethylene, butadiene,and benzene)

Unit IV Empirical MO theory [12 Hrs]

4.1 The simple Huckel method – Assumptions – Determinant, Energies and wave functions – Extended Huckel method – overlap – population analysis.

4.2 FMO theory – Interaction and Walsh diagrams- examples benzene,naphthalene, butadiene,andcyclobutadiene.

Unit V

5.1 Basics of Popular quantum chemical calculations: Hamiltonian and wave functions – Roothan's equations.

5.2 Semi-empirical methods – slater orbital and HF- SCF methods.

Text Books:

A.B. Sannigrahi, Quantum Chemistry, Books and Allied (P) Ltd, 2nd edition, 2010.

Further reading:

1. R. K. Prasad, Quantum Chemistry, Wiley Eastern, New Delhi, 2nd edition,1992.

2. P.W. Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford 3rd edition, 1983

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester I	Course code EPCH 704T	BIOINORGANIC AND SUPRAMOLECULAR CHEMISTRY For the students admitted in the year 2011												Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	4	3	4	3	4	4	4	4	4	4	4	3	3.69	
CO2	3	3	3	3	3	3	3	3	4	3	3	4	4	3.23	
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53	
CO4	3	3	3	3	3	3	3	4	4	3	4	4	4	3.38	
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38	
													Mean overall Score	3.44	

Result: The Score for this Course is 3.44 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I M.Sc (chem)	BIOINORGANIC AND SUPRAMOLECULAR CHEMISTRY For the students admitted in the year 2011	EPCH704T
SEMESTER - I		HRS/WK – 4
ELECTIVE – 1		CREDIT- 4

Course outcome:

CO1: Students learn about metal storage, transport and biomineralisation

CO2: Students understand various enzymes and their importance in biological process

CO3: Students become familiar with metal-genetic molecular interactions

CO4: Students learn interaction, recognitions in supramolecular chemistry

CO5: Students understand supramolecular devices

Unit – I

Metal Storage Transport and Biomineralization. Ferritin, Transferrin, and siderophores

Calcium in biology - Calcium in living cells, transport and regulation, molecular aspects of intramolecular processes, extracellular binding proteins

Unit – II

Metalloenzymes – zinc enzymes – carboxypeptidase and carbonic anhydras. Iron enzymes – catalase, peroxidase and cytochrome P – 450. Copper enzymes – superoxide dismutase. Molybdenum oxatransferase enzymes – xanthine oxidase. Coenzyme vitamin B_{12}

Unit – III

Metal-Nucleic Acid Interactions: Metal ions and metal complex interactions. Metal complexes – nucleic acids – binding of cisplatin with DNA

Metals in Medicine: Metal deficiency and disease, toxic effects of metals, metals used for diagnosis and Chemotherapy with particular reference to an anticancer drug.

Unit – IV Supramolecular Chemistry – I

Concepts, Nature of Supramolecular interactions, preorganization and complementarity-design principles.

Molecular recognition: - Spherical and tetrahedral recognition–Recognition of ammonium ions, neutral molecules.

Molecular receptors – Cation binding hosts-Crown ethers, Cryptands, Calixarenes - design principles -

Anion receptors – the shape of anions - Recognition of anionic substrate.

Co-receptor molecules - dinuclear and polynuclear metal ion cryptates - ditopic, heterotopic co-receptors - multiple recognition in metalloreceptors.

Unit – V Supramolecular Chemistry – II

Supramolecular devices: Light Conversion and Energy Transfer Devices, Photoinduced Electron Transfer Devices

Molecular wires, switchable molecular wires, photoswitching devices.

Supramolecular racks, ladders, grids.

Supramolecular chemistry in biology.

Text Books:

1. Asim K. Das, Bioinorganic Chemistry, Vikas.
2. J.E.Huheey, Inorganic Chemistry, 5th edition, Harper international, 1993.
3. Ivano Bertini, Harry. B.Gray, J. Lippard, Valentine, Bioinorganic chemistry, 1998.
4. P.S. Kalsi, Bioinorganic and Supramolecular chemistry, 2007.

Reference Books:

1. J.L. Atwood, J.E.D. Davies, D.D. Mac Nicol, F. Vogtle, J.M. Lehn, Comprehensive Supramolecular Chemistry, Pergamon, 1996.
2. Albert L. Lehninger, David Lee Nelson, Michael M. Cox, Principles of Biochemistry, 4th Ed, 2005
3. R.W. Hay, Bioinorganic chemistry, Ellis Harwood, 1987.
4. J. M. Lehn, Supramolecular Chemistry, Concepts and perspectives, VCH, 1995.
5. J. W. Steed, J.L. Atwood, Supramolecular Chemistry, AConcise Introduction, John Wiley, 2000.

Relationship matrix for Course outcomes, Programme Outcomes and Programme Specific Outcomes

Semester I	Course code EPCH704A	Title of the Paper HETEROCYCLICS AND NATURAL PRODUCTS											Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	4	4	4	4	4	4	4	4	4	4	4	3.92
CO2	4	4	4	3	4	4	4	3	3	3	4	3	4	3.62
CO3	3	3	3	3	3	4	3	3	3	3	4	3	4	3.23
CO4	4	4	3	3	3	4	3	2	3	4	3	3	3	3.23
CO5	3	3	3	3	3	4	3	3	3	3	4	2	2	3.0
													Mean overall Score	3.4

Result: The Score for this Course is 3.4 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

I M.Sc (chem)	HETEROCYCLICS AND NATURAL PRODUCTS For the students admitted in the year 2017	EPCH704A
SEMESTER - I		HRS/WK – 4
ELECTIVE – 1		CREDIT- 4

Course outcome:

1. Students understand the Nomenclature, synthesis of few heterocyclic chemicals.
2. Students acquire the knowledge about the Occurrence, isolation, classification, functions and general properties of alkaloids.
3. Students learn the structural elucidation and general properties of terpenes.
4. Students understand the Nomenclature and classification of steroids and steroidal alkaloids.
5. Students get the in depth knowledge on Anthocyanins.

UNIT - 1: HETEROCYCLIC CHEMISTRY: (15h)

1.1 Nomenclature – reactivity – aromaticity – spectralproperties.

1.2 Elementary study of the following systems only – indole, isoindole – oxazole, imidazole, thiazole, pyridines, pyrimidine, pyridazine, pyrazine, chromans, chromones, coumarins, carbazoles, uracil, uric acid, xanthones,andflavonoids.

Synthesis and reactions of 5 membered (pyrrole, thiophene, furan) and 6 membered heterocyclic compounds (pyridine), fused rings (quinoline and isoquinoline)

UNIT - 2: ALKALOIDS (10h)

2.1 General methods of structural elucidation of alkaloids -a general survey.

2.2 The structural elucidation of Belladine, Papaverine, Cocaine, Atropine, Heptaphylline, Peepuloidin, Morphine.

Occurrence, isolation, classification, functions and general properties of alkaloids.

UNIT - 3: TERPENES (6h)

3.1 General methods of determination of structure.

3.2 Structural elucidation of Camphor, Cadinene, Vitamin A, Abietic acid, Gibberellic acid, Zinziberine and Squalene

Occurrence, isolation, classification, functions and general properties of terpenes.

UNIT 4: STEROIDS (6h)

4.1 Conformations of steroids - molecular rearrangements (acid and base catalyzed, photochemical).

4.2 Synthesis of steroids – ring forming reaction and control of ring junction stereochemistry.

4.3 Synthesis of cholesterol, androgens, oestrone, progesterone,andcortisone. (questions on complete synthesis is not included for examination)

Nomenclature and classification of steroids, steroidal alkaloids

UNIT - 5: ANTHOCYANINS (8h)

5.1 General nature of anthocyanins – the structure of the anthocyanidins

5.2 General methods of synthesizing anthocyanidins.

5.3 Structural elucidation of cyanidin chloride, pelargolidin chloride.

5.4 Flavones – flavonols – isoflavones.

5.5 Biosynthesis of flavonoids – depsides – tannins.

Synthesis of delphinidin chloride, peonidin chloride, malvidin chloride, and quercetin.

TEXTBOOKS

1. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 1, Goel Publishing House, Meerut, 1997.

2. O. P. Agarwal, Chemistry of Organic Natural Products, Vol. 2, Goel Publishing House, Meerut, 1997.

3. I. L. Finar, Organic Chemistry Vol-2, 5th edn, Pearson Education Asia, 1975.

REFERENCE BOOKS

4. T.L. Gilchrist, Heterocyclic Chemistry, Longman Scientific and Tech, 1985

5. I. L. Finar, Organic Chemistry Vol-1, 6th edn, Pearson Education Asia, 2004.

6. Pelletier, Chemistry of alkaloids, Van Nostrand Reinhold Co, 2000.

7. Shoppe, Chemistry of the steroids, Butterworthes, 1994.

Relationship matrix for Course outcomes, Programme Outcomes and Programme Specific Outcomes

Semester II	Course code 19PCH21	ORGANIC CHEMISTRY – II For the students admitted in the year 2019												Hrs/wk 4	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	4	3	4	3	4	4	4	4	4	4	4	3	3.76	
CO2	4	3	3	3	3	3	3	3	4	3	3	4	4	3.30	
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53	
CO4	4	3	3	3	3	3	3	4	4	3	4	4	4	3.46	
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38	
													Mean overall Score	3.48	

Result: The Score for this Course is 3.48 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

I M.Sc (chem)	ORGANIC CHEMISTRY - II For the students admitted in the year 2019	19PCH21
SEMESTER – II		HRS/WK – 4
CORE– IV		CREDIT- 5

Course Outcomes:

At the end of the Course the students should be able to exhibit

CO1: Knowledge pertaining to stereochemistry
CO2: Aliphatic electrophilic and nucleophilic substitution reaction mechanisms
CO3: Addition and elimination reactions
CO4: Aromatic electrophilic substitution reactions
CO5: Aromatic nucleophilic substitution reactions

UNIT–I:STEREOCHEMISTRY–II 12 Hrs.

Conformations of some simple 1,2 – disubstituted ethane derivatives.

Conformational analysis of disubstituted cyclohexanes and their stereochemical features. Conformation and reactivity of substituted cyclohexanol(oxidation and acylation), cyclohexanone.(reduction) and cyclohexane carboxylic derivatives (esterification and hydrolysis). Conformations and Stability of - cis and trans Decalins -9 – methyl decalin.

UNIT – II: ALIPHATIC NUCLEOPHILIC AND ELECTROPHILIC SUBSTITUTION 12 Hrs.

Substitution at saturated reaction center (carbon). SN1, SN2,SNi mechanisms –

Reactivity, structural and solvent effects. Neighbouring group participation – substitution in Norbornyl and bridgehead systems – Substitution at carbon doubly bonded to oxygen. Alkylation and acylation of active methylene carbon compounds, hydrolysis of esters. SE1, SE2, SEi mechanisms – reactivity. Hell-Volhard-Zelinsky reaction, Stork – enamine reaction. Decarboxylation of aliphatic acids.

UNIT – III ADDITION AND ELIMINATION REACTIONS 12 Hrs

Electrophilic, nucleophilic and free radical mechanisms of addition to carbon-carbon multiple bonds – isolated and conjugated multiple bonds. Hydration, hydroxylation, hydroboration. Stereochemical aspects to be studied wherever applicable.Nucleophilic addition reactions of carbonyl compounds: Aldol, Perkin, Stobbe, Claisen, Dieckmann,Benzoin condensation. Mannich, Reformatsky, Grignard, Robinson Annulation and Shapiro reactions.

Elimination reactions: E1, E2,and E1CB mechanism. Hofmann and Saytzeff rules. Dehydration, dehydrohalogenation,and dehalogenation. Stereochemistry of E2 elimination in cyclohexane systems. Mechanism of pyrolytic eliminations. Chugaev and Cope eliminations

UNIT – IV AROMATIC ELECTROPHILIC SUBSTITUTION 12 HRS

The arenium ion mechanism – Orientation and reactivity – typical reactions – nitration, halogenation, alkylation, acylation,and diazonium coupling. Reimer- Tiemann, Vilsmeyer-Hack, Gattermann, Kolbe reactions. Synthesis of di- and trisubstituted benzenes. Electrophilic substitution of furan, pyrrole, thiophene,and pyridine- N- oxide.

UNIT – V AROMATIC NUCLEOPHILIC SUBSTITUTION 10 HRS

Methods for the generation of benzyne intermediate and reactions of aryne intermediate. Nucleophilic substitution involving diazonium ions. Aromatic nucleophilic substitution of activated halided. Zeigler alkylation. Chichibabin reaction. Problems.

Textbooks

1. J. March and M Smith, *Advanced Organic Chemistry*, 5thed., John-Wiley and sons, 2001.
2. I. L. Finar, *Organic Chemistry* Vol-1, 6thedn., Pearson Education Asia, 2004.
3. F. A. Carey and R. J. Sundberg, *Advanced Organic Chemistry*, Part A and B, 5thed., Kluwer Academic/Plenum Publishers, 2008.
4. S.M.Mukherji and S.P.Singh, *Reaction Mechanism in Organic chemistry*, 3rd ed., Macmillan India Ltd. 1984.
5. Clayden, Greeves, Warren, Wothers, Organic Chemistry, Oxford Univ Press.
6. P.S. Kalsi Stereochemistry, conformation,and mechanism, 6th edition, New Age International (P) Ltd. 2005.

References

1. S. H. Pine, *Organic Chemistry*, 5thedn, McGraw HillInternational Edition,1987.
2. L. F. Fieser and M. Fieser, *Organic Chemistry*, Asia Publishing House, Bombay, 2000.
3. E.S. Gould, *Mechanism and Structure in OrganicChemistry*, Holt, Rinehart and Winston Inc., 1959.
4. T. H. Lowry K. S. Richardson, Harper,and Row,*Mechanism,and theory in organic chemistry*, 2nd, NewYork, 1981.
5. R.O.C. Norman, J.M. Coxon, Principle of Organic Synthesis, ELBS Publications,1994.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester II	Course code 19PCH22	Title of the Paper INORGANIC CHEMISTRY - II											Hrs/wk 4	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	2	3	2	3	3	2	4	3	4	3	3	4	2	2.92
CO2	2	3	3	3	3	4	3	3	3	3	3	3	3	3.00
CO3	2	3	3	3	2	3	4	4	4	3	4	4	4	3.30
CO4	3	2	3	3	2	3	4	4	3	3	4	4	2	3.07
CO5	3	3	3	2	3	3	3	3	3	3	3	3	3	2.92
													Mean overall Score	3.04

Result: The Score for this Course is 3.04 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

I M.Sc (chem)	INORGANIC CHEMISTRY – II For the students admitted in the year 2019	19PCH22
SEMESTER - II		HRS/WK – 4
CORE – V		CREDIT- 5

Course outcome:

i. To learn about the MO theory of complexes
ii. To interpret the electronic spectra of various complexes
iii. To learn the fundamental concepts of nanotechnology and about the Lanthanides and actinides
iv. To appreciate the applications of metal ions in biological systems.
v. To understand the theory behind the nuclear reactions and their appliccations

Unit-I **[12 Hrs]**

MO theory of Complexes and Chemistry of Lanthanides and Actinides

1.1 Metal-Ligand Bonding: Limitation of crystal field theory, Molecular Orbital Theory, Evidence of metal-ligand covalency, TASO-MO concepts of Oh and Td complexes, MO energy level diagrams of sigma- and pi-bonding in Oh complexes, nature of metal-ligand pi-bonds, evidence for pi-back bonding, spectrochemical series, and pi-acceptor series. Jahn-Teller Effect and its consequences.

1.2 The Chemistry of Lanthanides and Actinides: oxidation state, spectral & magnetic characteristics, coordination numbers, stereochemistry, lanthanide contraction-causes, consequences - comparison between 3d and 4f block elements - comparative account of lanthanides and actinides - nuclear and non-nuclear applications.

Unit-II Electronic Spectra of Transition Metal Complexes **[12 Hrs]**

2.1 Electronic Spectra of Transition Metal Complexes: Spectroscopic ground states, correlation, Orgel and Tanabe-Sugano diagrams for transition metal complexes (d^1-d^9 states), Nephelauxetic effect - calculations of Dq, B,and β parameters.

2.2 Charge Transfer spectra – Comparison of CT and d-d spectra.

Unit-III - Nanotechnology **[12 Hrs]**

3.1 Nanotechnology – Introduction – preparatory methods – chemicals methods, thermolysis, and pulsed laser method – Microwave Synthesis -Basic concepts of

Nanoscience and technology – Quantum wire – Quantum well – Quantum dot – Properties and technological advantages of Nanomaterials – Carbon Nanotubes and applications – Principles of SEM, TEM and AFM.

3.2 Biomedical applications of nanotechnology.

Unit-IV - Bioinorganic Chemistry [12 Hrs]

4.1 Bioinorganic Chemistry: Metal Ions in Biological Systems: Essential and trace metals.Na^+/K^+ Pump, Role of metals ions in biological processes, Transport and Storage of Dioxygen: Heme proteins and oxygen uptake, structure and function of hemoglobin, myoglobin, hemocyanins,and hemerythrin,

4.2 Electron Transfer in Biology: Structure and function of metalloproteins in electron transport processes – cytochromes and iron-sulphur proteins – Nitrogenase: Biological nitrogen fixation, molybdenum nitrogenase.

Unit-V - Nuclear Chemistry [12 Hrs]

5.1 Nuclear Chemistry: Modes of Radioactive Decay: Orbital electron capture: nuclear isomerism, internal conversion, detection and determination of activity by cloud chamber, nuclear emulsion, bubble chamber, G.M., Scintillation,and Cherenkov counters. Nuclear Reaction: Types, reactions, cross section, Q-value, threshold energy, compound nucleus theory: high energy nuclear reaction, nuclear fission and fusion reactions as energy sources; direct reactions; photonuclear and thermonuclear reaction.

5.2 Stellar Energy: Synthesis of elements - hydrogen burning, carbon burning, the e, x, r, p and x processes. Nuclear Reactors: fast breeder reactors, particle accelerators, linear accelerators, cyclotron,and synchrotron. Radio Analytical Methods: Isotope dilution analysis, Radiometric Titrations, Radioimmunoassay, Neutron activation analysis.

Text Books:

1. J.E. Huheey, Inorganic Chemistry, 5thEdn., Harper International.1993.
2. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5thEdn., John Wiley.1985.
3. M.F.Purcell, J.C.Kotz, Inorganic Chemistry,Saunder, 1977.
4. Mick Wilson, Kamali Kannangara, Michells Simmons and Burkhard Raguse, “Nano Technology – Basic Science and Emerging Technologies”, 1st edition, Overseas Press,New Delhi,2005.
5. Arnikar, Essentials of Nuclear Chemistry, 2ndEdn., Sulthan & Chand Publishers, 1991.

6. R.W.Hay, Bioinorganic chemistry, Ellis Harwood, 1987.
7. A.K.Das, Inorganic Chemistry

Reference Books

1. Mich Wilson, Kamali Kanengara, Geoff Smith, Michelle Simmons,andBurkherd Raguk, Nanotechnology Basic Science and Energy Technologies, Overseas press (I), N.D.2005.
2. R.W.Hay, Bio-Inorganic Chemistry, Ellis Horwood, 1987.
3. Lehninger, Principles of Biochemistry, Van Eikeren, 1982.
4. T.M.Loehr, Iron carriers,and Iron proteins, VCH, 1989.
5. Gladstone, Sourcebook of Atomic Energy, 3rd Edn. ELBS, 1986.
6. N.N.Greenwood,A.Earnshaw, Chemistry of the Elements, 2nd Edn.BH,1997.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester II	Course code PCH807T	Group theory and its applications in Spectroscopy For the students admitted in the year 2014												Hrs/wk 4	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	3	3	4	4	4	4	4	5	4	5	3	4	5	4.00	
CO2	4	4	5	4	4	3	3	4	4	4	4	3	4	3.84	
CO3	3	4	4	5	5	3	4	4	4	3	5	4	4	4.00	
CO4	3	4	3	4	4	4	4	4	4	4	4	3	4	3.76	
CO5	4	3	3	3	4	4	4	4	4	5	3	3	4	3.69	
													Mean overall Score	3.85	

Result: The Score for this Course is 3.85 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I M.Sc (chem)	Group theory and its applications in Spectroscopy For the students admitted in the year 2014	PCH 807T
SEMESTER - II		HRS/WK – 4
CORE - VI		CREDIT-5

Course outcome:

i. To study the elements of group theory and the application of group theory.
ii. To study the different types of molecular spectroscopy
iii. To study about the various spectroscopy in molecular level.
iv. To understand about the normal modes and vibrational analysis.
v. To study about the various types of NMR spectroscopy and its importance.

Unit I Group theory [12 Hrs]

Symmetry elements and symmetry operations – group multiplication table – subgroups, similarity transformation,and classes – identifications of symmetry operations and determination of point groups.

Reducible and irreducible representations – direct product representation.

Unit II Applications of Group theory [12 Hrs]

Orthogonality theorem and its consequences – construction of character table for C_2V and C_3V – hybrid orbital in nonlinear molecules (CH_1, XeF_4, BF_3, SF_6,and NH_3).

Determination of representations of vibrational modes in nonlinear molecules (H_2O, CH_4, BF_3,and NH_3).

Symmetry selection rules of infrared and Raman spectra – application of group theory for the electronic spectra of ethylene and formaldehyde.

Unit III Properties of Molecules [12 Hrs]

Normal modes – Vibrational Analysis and Characterization of Stationary points – Electrical Properties - dipole moments, optical activity, polarizability.

Magnetic properties NMR chemical shifts, shielding, spin-spin coupling,and hyperfine interactions.

Unit IV Spectroscopy – I [12 Hrs]

Interaction of matter with radiation – Einstein theory of transition Probability – Rotational spectroscopy of a rigid rotator – diatomic and polyatomic molecules.

Vibrational spectroscopy – harmonic oscillator – anharmonicity – vibrational spectra of polyatomic molecules – vibrational frequencies – group frequencies – vibrational coupling overtones – Fermi resonance- Raman Spectra.

Electronic spectra of polyatomic molecules – group symmetry of molecules and selection rules – types of transition – solvent effects.

Unit – V Spectroscopy – II [12 Hrs]

Resonance spectroscopy – Zeeman effect – the equation of motion of spin in magnetic fields – chemical shift – spin-spin coupling.

Calculation of coupling constants - ^{13}C, ^{19}F, ^{31}P NMR spectra – applications – a brief discussion of Fourier transformation in resonance spectroscopy. Splitting of spin energy level in the magnetic field – quantum mechanical treatment.

Text Book

1. C. N. Banwell. 1966, Fundamentals of Molecular Spectroscopy, McGraw Hill.
2. K. V. Raman,Group Theory and its Applications to Chemistry, Tata Mcgraw Hill publishing.Co. 5th edition, 1990.

Further reading

Bhattacharaya. Group Theory and its Applications

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester II	Course code 19EPCH24	Title of the Paper REAGENTS AND NAMING REACTIONS											Hrs /wk 4	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	4	3	4	3	3	4	3	3	3	4	4	3.46
CO2	4	3	4	3	3	4	3	3	4	3	3	4	4	3.46
CO3	3	4	4	4	3	3	3	4	4	4	4	4	4	3.69
CO4	4	4	3	3	4	3	3	4	4	3	4	4	4	3.62
CO5	3	4	3	4	4	4	3	3	3	4	4	4	4	3.62
Mean overall Score														3.57

Result: The Score for this Course is 3.57 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

I M.Sc (Chem)	REAGENTS AND NAMING REACTIONS For the students admitted in the year 2019	19EPCH24
SEMESTER - II		HRS/WK – 4
ELECTIVE – 2		CREDIT- 5

Course outcome:

i. Students understand the importance of stereochemical aspects of structure and properties
ii. Students learn the overview of the organic reaction mechanisms.
iii. Students learn the chemistry of organometallic compounds and its organic reactions.
iv. Students understand the concept of photochemical reaction and its applications.
v. Students are motivated to know the concept of green chemistry

Unit I STEREOCHEMISTRY AND CONFORMATIONAL ANALYSIS [12 HRS]

Recognition of chiral structures – R & S, E & Z nomenclature,(including allene,biphenyl& spiranes), diastereoisomerism in acyclic systems. Conformational analysis of simple cyclic and acyclic systems & their effect on the reaction. Interconversion of Fischer, Newman,and Sawhorse projections. Asymmetric synthesis - newer methods. Enantiotopic and diastereotopic ligands and faces.

Unit II COMMON ORGANIC REACTION MECHANISMS [12 HRS]

Methods of determining reaction mechanism – reactive intermediates – carbocations, carbanions, carbenes, nitrenes, arynes,and free radicals. Nucleophilic and electrophilic substitutions and additions to multiple bonds. Elimination Reactions. Kinetic isotope effects. Hammett equation – Neighbouring group participation.

Unit III PALLADIUM-CATALYSED COUPLING REACTIONS AND SELECTIVE NAME REACTIONS [12 HRS]

Palladium-catalyzed Coupling Reactions: Heck, Suzuki, Stille, Sonogashira, Kumuda, Buchwald- Hartwig, Negishi,and Himaya.

Favorskii, Stork – enamine, Mannich, Michael, Baeyer – Villiger, Shapiro, Hoffmann – Loffler – Freytag reactions. Routine functional group transformations. Oppenaur Oxidation, Meerwein - Ponndorf – Verley, Simmons – Smith reaction.

Unit IV REAGENTS IN ORGANIC SYNTHESIS & PHOTOCHEMISTRY [12 HRS]

Uses of complex metal hydrides, Gilman's reagent, LDA, DCC, 1,3-dithiane, trimethylsilyl

iodide, tri-n-butyl tin hydride, osmium tetroxide, SeO2, DDQ, Peterson's synthesis, Wilkinson's catalyst, Baker's yeast, Merrifield resin.

Alpha cleavage given by cyclobutanones - beta cleavage reactions, the formation of photoenols and photoenolization, intermolecular hydrogen transfer &intermolecular photo reduction - Photo rearrangements:photo rearrangements of beta-gamma unsaturated ketones, 1,2 acyl shift - 1,3 acyl shift, aza di-pi methane rearrangement

Unit V GREEN CHEMISTRY [12 HRS]

Green Chemistry – Genesis and concept of Green Chemistry, Principles, Strategies

Alternative Techniques in Organic Synthesis

Use of microwave, ultrasound, ionic liquids, super-critical solvents in organic synthesis; Multi-component reactions

Text Books :

1. P. S. Kalsi. Organic Reaction stereochemistry & Mechanism. 4th edition. New Age International publishers. 2006.

2. Clayden, Greeves, Warren, Wothers. Organic chemistry. Oxford University Press. 2001.
3. Jerry March. Advanced organic chemistry. 4th edition. Wiley Interscience publications. 1999.
4. Paula Yurkanis Bruice. Organic chemistry. 3rd edition Pearson Education Inc. 2001.
5. Peter Sykes. A guide book to the mechanism in organic chemistry. Orient Long mann. 2002
6. Paul T. Anastas, John C. Warner, **Green Chemistry: Theory and Practice**, Oxford University Press, 2000

7. V. K. Ahluwalia and M.Kidwai, New Trends in Green Chemistry, Kluwer Academic Publishers,1st edition, 2004

Reference Books:

1. Seyhan Ege. Organic Chemistry. 3rd edition. D. C. Health & company.

2. Raj. K. Bansal. Organic Reaction Mechanism. 3rd edition Tata Mc. Graw Hill.

3. V. K. Ahluwalia, R. K. Parashar. Organic Reaction Mechanism. 3rd edition. Narosa Publishing House.

4. Coxon, Halton; organic photochemistry, Cambridge university press, 1987

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester II	Course code EPCH 808A	NUCLEAR AND RADIOCHEMISTRY For the students admitted in the year 2017											Hrs/wk 4	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	3	4	3	4	4	4	4	4	4	4	3	3.69
CO2	3	3	3	3	3	3	3	3	4	3	3	4	4	3.23
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53
CO4	3	3	3	3	3	3	3	4	4	3	4	4	4	3.38
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38
													Mean overall Score	3.44

Result: The Score for this Course is 3.44 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

I M.Sc (Chem)	NUCLEAR AND RADIOCHEMISTRY For the students admitted in the year 2017	EPCH 808A
SEMESTER - II		HRS/WK – 4
ELECTIVE – 2		CREDIT- 5

Course outcome:

i. Students understand subatomic particles and nuclear models.
ii. Students learn different decays and detectors in nuclear chemistry.
iii. Students acquire disintegration processes, nuclear reactions and fission.
iv. Students learn about the radiation safety
v. Students understand the fundamentals and the applications of radioactivity in medicine for diagnosis and therapy (nuclear medicine).

UNIT - 1: THE NUCLEUS

1.1 Radius of atomic nuclei: binding energy of nuclei, the force between nucleons.

1.2 Nuclear moment: nuclear angular momentum, nuclear magnetic dipole moment, electric quadrupole moment - NQR

1.3 Nuclear models: liquid drop model, nuclear shell model, fermi gas model.

The subatomic particles: electron, proton, neutron, antiproton, positron, meson, quacks. Mass of nuclei: isotopes, isobars, mass spectrometry- identification of isotopes.

UNIT - 2: RADIOCHEMISTRY

2.1 Alpha decay: theory of emission, alpha-ray energy spectra.

2.2 Beta-decay: decay theory, electron capture, double beta decay.

2.3 Gamma ray: theory of emission, internal conversion, the Auger effect, nuclear resonance absorption. Principles of Mossbauer spectroscopy.

2.4 Geiger counters, scintillation counters, proportional counters,
semiconductor detectors.

2.5Radioactive series decay: radioactive series growth and decay, determination of half - lives.

UNIT - 3: NUCLEAR REACTION

3.1 Types of nuclear reactions: reaction cross sect ion-compound nucleus theory, highenergy nuclear, direct nuclear , photonuclear and thermonuclear reactions.

3.2 Source of nuclear bombarding particles: Charged particle accelerators, gamma ray, Xrayand neutron sources.

3.3 Fission: Fission products and Fission yield curve, Fission energy, the theory of nuclearfission, nuclear reactor,breeder reactor - nuclear reactors in India. Fusion reactionshydrogenbomb and energy of the sun.

3.4 Transuranium elements: Synthesis, separation,and properties of transuranium elements.

3.5 Reprocessing of spent fuels. Solvent Extraction - Specific sequestering agents for transuranium elements.

Nuclear reactions – one example for each category.

UNIT - 4: RADIATION CHEMISTRY

4.1 Interaction of radiation with matter: range of alpha, beta,and gamma radiations, radiation dosimetry.

4.2 Radiolysis of water: Mechanism-hydrated electron.

4.3 Radiation safety precaution: Safety standards and safe-working methods.

UNIT - 5: ANALYTICAL METHOD IN NUCLEAR CHEMISTRY

5.1 Radioisotopes: Co-precipitation, ion-exchange, solvent extraction – as a tracer, Synthesis of labeled compounds (any two), isotopic dilution andradiopharmaceuticals.

5.2 Neutron activation analysis, positron annihilation and autoradiography.

Dating of objects and mechanistic study.

TEXTBOOKS

1. H. J. Arnikar, “Essentials of Nuclear Chemistry”, Wiley Eastern Ltd., New Delhi (1982)
2. A.K. Srivastava and P. Jain, “Essential of nuclear Chemistry”, S.Chand, N.Delhi, 1989
3. G.R. Choppin, “Radiochemistry and Nuclear chemistry”, 2002.

I M.Sc (chem)	ORGANIC CHEMISTRY PRACTICAL – I	PCH P201
SEMESTER – I&II		HRS/WK – 4
CORE PRACTICAL –1	For the students admitted in the year 2008	CREDIT – 2

(Total Marks: 100 External Marks: 60 & Internal Marks: 40)

Course outcome:

1. Students learn the Identification of Compounds in a two-component mixture.
2. Students learn the preparation of some organic compounds.

I. Identification of Compounds in a two-component mixture and Preparation of their derivatives and Determination of Boiling Points and Melting Points for Compounds and Melting Point for their derivatives.

II. Organic Preparations (Any Six from the followings)

1 Anthraquinone from Anthracene
2. Benzhydrol from Benzophenone
3. Methyl Orange from Sulphanilic Acid
4. p-Nitrobenzoic acid from p-Nitrotoluene
5. m-Nitroaniline from m-Dinitrobenzene
6. Diphenylmethane from Benzylchloride
7. p-Chlorotoluene from p-Toluidine
8. 1,2,3,4-Trtrahydrocarbazole from Cyclohexanone
9. Preparation of o-Benzyl Benzoic Acid

Quantum of marks in respect of Practical Examinations :

Qualitative Organic Analysis	: 30 Marks
Preparation	: 15 Marks
Record	: 5 Marks
Practical Viva	: 10 Marks
Total	: 60 Marks

Books Recommended:

1. Vogel, ATextbook of Practical Organic Analysis, ELBS.
2. Raj K. Bansal, Laboratory Manual of Organic Chemistry, Wiley Eastern Ltd.
3. Mann and Saunders, Laboratory Manual of Organic Chemistry.

I M.Sc (chem)	INORGANIC CHEMISTRY PRACTICAL-I For the students admitted in the year 2014	PCHP202S
SEMESTER – II I&II		HRS/WK – 4
CORE PRACTICAL –2		CREDIT – 2

Course outcome:

i. To improve the skill in quantitative estimation of metal ions by complexometric titration.

ii. To identify the metal ions qualitat ively in a mixture of metal ions.

iii. To improve the skill in the synthesis of inorganic complexes.

1. Semimicro qualitative analysis of mixture containing two common and two rare cations. The following are the cations to be included- W, Se, Te, Mo, Ce, Th, Ti, Zr, V,U, Li.
2. Complexometric titrations (EDTA method) – Estimation of Ca, Mg and Zn.
3. Preparation of the following

   2.1 Potassium tris(oxalato)aluminate(III)hydrate

   2.2 Sodium bis(thiosulphato)cuprate(II)

   2.3 Tris(thiourea)copper(I) sulphate

   2.4 Diisothiocyanatodipyridine manganese(II)

   2.5 Tetramminecopper(II) sulphate

I M.Sc (chem)	INORGANIC CHEMISTRY PRACTICAL-I	PCHP202S
SEMESTER – II I&II	For the students admitted in the year 2014	HRS/WK – 4
CORE PRACTICAL –2		CREDIT – 2

Continuous internal assessment (CIA) (40 marks)

Based on the periodical evaluation of record and experiments assessed by the staff in charge.

External examination (60 marks)

6 Hrs. Exam **Total Marks: 60**

1. a) Qualitative analysis (semimicro)(:Mix of 4 radicals anions)
   (2 rare +2 common cations) 20 Marks
2. (a) Preparation 10 Marks
   (b) EDTA (complexometric tiration) 20 Marks
3. (a) Practical Record Note Book 5 Marks
   (b) Pratical Viva-Voce 5 Marks

I M.Sc (chem)	PHYSICAL CHEMISTRY PRACTICAL - I	19PCHP23
SEMESTER – I & II		HRS/WK – 4
CORE PRACTICAL -3	For the students admitted in the year 2019	CREDIT-2

Course outcome:

Students learn the Experiments in Thermodynamics, colligative properties, phase rule,Surface Phenomenon, chemical equilibrium,and chemical kinetics. Typical examples are given and a list of experiments is also provided from which suitable experiments can be selected as convenient.

1. Verification of Arrhenius equation
2. Determination of activity and activity coefficient fromfreezing point depression method.
3. Construction of vapour pressure curves for different types of solutions.
4. Molecular modeling
5. Simulations to find out the symmetry of the molecule
6. Simulations to find vibrational modes and verification by using group theory.
7. Effect of the ionic strength of solvents and solutions.
8. Phase diagram construction involving two-component systems.
9. Adsorption isotherm
10. Reaction rate and evaluation of other kinetic parameters using polarimetry, analytical techniques,and conductometry.

DETAILS OF LIST OF EXPERIMENTS FOR PHYSICAL CHEMISTRY PRACTICAL–I

1. Determine the temperature coefficient and energy of activation of hydrolysis of ethyl acetate.
2. Study the inversion of cane sugar in the presence of acid using polarimeter.
3. Study the effect of ionic strength on the rate of saponification of an ester.
4. Study the salt effect, solvent effect on the rate law of alkaline hydrolysis of crystal violet.
5. Determine the molecular weight of benzoic acid in benzene and find the degree of association.
6. Determine the activity coefficient of an electrolyte by freezing point depression method.

7. Study the phase diagram from toluidine and glycerine system.
8. Construct the boiling point composition diagram for a mixture having a maximum boiling point and minimum boiling point.
9. Determine the partial molal volume of glycine/methanol/formic acid/sulphuric acid by the graphical method and by determining the densities of the solutions of different compositions.
10. Determine the strength of hydrogen bond in solutions.
11. Kinetics of decomposition of sodium thiosulphate using Hydrochloric acid,
12. Construction of phase diagram for three component system (KCl-Glucose-Water), (Chloroform-Acetic acid-Water).

Scheme of evaluation: (total = 60 marks)

Aim & short procedure	– 10
Record	– 5
Spectral interpretation	– 10
Experiment & manipulation	- 25
Viva voce	– 10
Total	- 60

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester III	Course code 19PCH31	Title of the Paper ORGANIC CHEMISTRY - III										Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	4	3	4	3	3	4	3	3	3	4	4	3.38
CO2	3	3	4	3	3	2	4	3	4	3	3	4	4	3.31
CO3	3	3	4	3	3	3	4	4	4	4	4	4	4	3.62
CO4	3	3	3	3	2	3	3	4	4	3	4	4	4	3.31
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38
Mean overall Score														3.40

Result: The Score for this Course is 3.40 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

II M.Sc (chem)	ORGANIC CHEMISTRY – III For the students admitted in the year 2019	19PCH31
SEMESTER – III		HRS/WK – 4
CORE – VII		CREDIT-4

Course outcome:

i. Students understand stereo chemical implications of pericyclic reaction in organic synthesis.
ii. Students understand the structural and stereochemical implications on photochemical reactions
iii. Students get learnt the concept of aromatic character in some molecules
iv. Students learn the applications of various reaction in organic synthesis.
v. Students understand stereo chemical implications of pericyclic reaction in organic synthesis.

Unit – I PERICYCLIC REACTIONS (12 hrs)

Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3 – butadiene, 1,3,5 – hexatriene and allyl system. Classification. Electrocyclic reactions – cycloadditions and cheletropic reactions. Sigmatropic rearrangements – Woodward – Hoffmann rules and correlation diagrams.Claisen and Cope rearrangements. Fluxional tautomerism,Ene reaction, Applications of concerted reactions in organic synthesis.

Unit – II ORGANIC PHOTOCHEMISTRY (12 hrs)

Introduction to organic photochemistry, Photochemical excitations, Fate of the excited molecules, Jablonski diagram, Study of photochemical reactions of alkenes, dienes, aromatic, carbonyl and conjugated systems, Norrish Type-I and IIreactions, Paterno- Buchi reaction, Di-pi-methane rearrangement, Applications of photochemical reactions in Organic Synthesis.

Unit III AROMATICITY (12 hrs)

Aromaticity of benzenoid, heterocyclic and non benzenoid compounds, Huckel's rule – Aromatic systems with pi electron numbers other than six – non aromatic (cyclooctatetraene etc,) and antiaromatic system (cyclobutadiene etc.) – system with more than 10 pi electrons – Annulenes up to C18 (synthesis of all these compounds is not expected)

Unit – IV REAGENTS IN ORGANIC SYNTHESIS (12 hrs)

Applications of the following reagents in organic synthesis:AIBN, 9-BBN, DCC, CAN,PCC, Crown ethers, LDA, Lindlar's catalyst, Gilman's reagent, 1,3-Dithiane-Umpolung, Trimethylsilyl iodide, Phase transfer catalysts, Wilkinson's catalyst, Baker yeast, Organo transition metal reagents. Applications of reagents containing silicon, Phosphorus, Sulphur, selenium, palladium, rhodium, and titanium reagents in organic synthesis.

Unit - V SELECTIVE NAME REACTIONS AND THEIR APPLICATIONS IN ORGANIC SYNTHESIS (12 hrs)

Michael addition, Mannich reaction,Sharpless asymmetric epoxidation, Hofmann – Loffler – Freytag reaction, Knoevenagel reaction, Peterson Olefination reaction, Skraup reaction, Barton reaction, Reformatsky reaction,Von Richter reaction, Prevost reaction and Woodward modification of the Prevost reaction.

Text Books:

1. Jagdamba Singh,Jaya Singh, Photochemistry and Pericyclic Reactions,New Age International Publishers, 1st edi, 2017
2. S. M. Mukherji, "Pericyclic reactions", Mac Millan, India
3. F. A. Carey and R. J. Sundberg, Advanced organic chemistry, Plenum publishers Ltd. 2000.
4. Clayden, Greeves, Warren, Wothers, Organic Chemistry, Oxford Univ Press.

Reference Books:

1. R.O.C. Norman, J.M. Coxon, Principles of organic synthesis, ELBS publications, 1994.
2. C. K. Ingold, Structure and Mechanism in Organic chemistry, Cornell Univ. Press.
3. Michael Smith, Organic Synthesis, McGraw Hill, 1996.
4. W. Carruthers, J.Coldham, Modern methods of Organic synthesism IV edition, Academic press, 1989.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester III	Course code 19PCH32	Title of the Paper INORGANIC CHEMISTRY – III											Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	3	3	4	4	4	3	3	3	4	3	3.46
CO2	4	4	4	3	3	3	3	3	4	4	4	3	4	3.54
CO3	4	3	3	3	3	4	4	4	4	3	3	4	4	3.54
CO4	4	4	3	3	3	3	3	3	4	3	4	4	4	3.46
CO5	4	4	4	3	3	3	4	4	4	4	4	4	3	3.69
													Mean overall Score	3.54

Result: The Score for this Course is 3.54 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

II M.Sc (chem)	INORGANIC CHEMISTRY – III For the students admitted in the year 2019	19PCH32
SEMESTER – III		HRS/WK – 4
CORE – VIII		CREDIT-4

Course outcome:

i. To understand the bonding nature of the metal complexes and the reaction mechanisms of the metal complexes.
ii. To learn the catalytic behavior of the metal complexes.
iii. To gain knowledge in isolable analogy of the metal carbonyls.
iv. To understand the EPR and photo electron spectra and the theories behind them.
v. To describe ^{31}P, ^{19}F NMR, and the principles, applications of NQR Mossbauer Spectroscopy.

Unit-I Organometallic Chemistry – I [12 Hrs]

1.1 Organometallic Chemistry: Carbon σ donors: Alkyls and aryls - metalation reactions - Bonding in carbonyls and nitrosyls – Metal carbene (Fisher & Schrock) and carbyne complexes - Carbon π donors: olefins, acetylene and π-allyl systems - cyclic π donors - synthesis structure and bonding in ferrocene

1.2 Organometallic Reaction: Association, substitution, addition and elimination, ligand protonation, electrophilic and nucleophilic attack on ligands. carbonylation and decarbonylation, oxidative addition, reductive elimination,and fluxionality.

Unit-II - Organometallic Chemistry – II [12 Hrs]

2.1 Organometallic Chemistry - Catalysis: Hydrogenation of olefins (Wilkinson's catalyst), hydroformylation of olefins using cobalt catalyst (oxo process), oxidation of olefins to aldehydes (Wacker process).

2.2 Polymerization of Olefins: Polymerization (Zeigler – Natta Catalyst); cyclo oligomerization of acetylene using nickel catalyst (Repee's Catalyst); polymer- bound catalysts

Unit-III - Organometallic Chemistry – III [12 Hrs]

3.1 Monsanto acetic acid synthesis, water gas shift reaction, Fischer Tropsch synthesis – Olefin metathesis ROM & RCM

3.2 Parallels between main group and binary carbonyl complexes – the isolable analogy – isolable analogyCH_4, CH_3, CH_2, CH, C, CH_4^+ CH_3^+, CH_2^+, CH^+, CH_3^-, CH_2^-, CH^- fragments with metallic carbonyls – an extension of the isolobal analogy

Unit-IV- Inorganic Spectroscopy - I [12 Hrs]

4.1 EPR Spectra: Hyperfine splitting: hyperfine splitting in isotropic systems involving one nucleus and more than one nucleus, hyperfine splitting caused by quadrupole nuclei. g value and the factors affecting g values, anisotropy in g-value, factors causing anisotropy.

4.2 EPR spectra of systems with more than one unpaired electrons: zero-field splitting, causes of ZFS, McConnel's equation, Krammer's theorem. ESR of transition metal complexes of copper, manganese and Vanadyl ions. ESR spectrum of simple organic free radicals.

4.3 Photoelectron spectroscopy (UV and X-ray) – photoelectron spectra of O_2 and N_2 molecules – Koopman's theorem, chemical shift,and correlation with electronic charges.

Unit-VInorganic Spectroscopy -II [12 Hrs]

5.1 Inorganic Spectroscopy: ^{31}P ,^{19}F NMR spectrum of HPF_2, P_4S_3, TiF_4, BrF_5, $SIF_6^{2-,}$ NF_3, ClO_4^-, $P_4N_4Cl_4F_2$, ClF_3 Phosphorous and Hypophosphorous acid systems - shift reagents.

5.2 NQR - Principles and applications of NQR - Mossbauer spectra – Principle, chemicals shift, Doppler shift - Mossbauer spectra of Fe and Sn systems.

5.3 Inorganic Spectroscopy: Applications to inorganic systems of the following: ultraviolet, visible, infra-red and Raman spectra of metal complexes, organometallic and simple inorganic compounds.

Text Books:

1. J.E. Huheey, Inorganic Chemistry, 5thEdn. Harper International.1993.
2. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5thEdn. John Wiley.1985.
3. M.F.Purcell, J.C.Kotz, Inorganic Chemistry,Saunder, 1977.
4. R.S.Drago, Physical Methods in Inorganic Chemistry, 2nd Edn, ELBS, 1985.
5. Gary L. Meisler, Donald A. Torr, Inorganic chemistry, 3rd Edition, Pearson, 2017

Reference Books:

1. P.Powell, Principles of Organometallic Chemistry, 2nd Edn. ELBS,1991.
2. R.S.Drago, Physical methods in Spectroscopic Techniques, 2nd Edn, ELBS, 1985.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester III	Course code PCH 911S	Title of the Paper Statistical thermodynamics and its applications										Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)						Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	2	3	3	4	3	4	3	2	3	3	3	4	3	3.07
CO2	3	4	3	3	3	4	4	3	3	3	3	3	3	3.23
CO3	2	4	3	3	3	3	3	2	3	3	3	3	3	2.92
CO4	4	4	4	3	3	4	4	4	4	3	3	4	3	3.61
CO5	4	4	3	3	2	4	4	3	3	3	3	4	3	3.30
												Mean overall Score		3.22

Result: The Score for this Course is 3.22 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

II M.Sc (chem)	Statistical thermodynamics and its applications For the students admitted in the year 2014	PCH 911S
SEMESTER – III		HRS/WK – 4
CORE – IX		CREDIT-4

Course outcome:

i. To understand the average behavior of large group of individual particles and to know the probabilities about microstates of the system.
ii. To develop a vast knowledge in the interpretation of partition function and to relate partition function and thermodynamic function.
iii. To get acquainted with the concept of statistical mechanics of ensemble.
iv. To study Partial molar properties and thermodynamics of real gases.
v. To give the concept of thermodynamics of ideal and non ideal binary solutions with problem solving skill.

Unit I Statistical thermodynamics I [12 Hrs]

Objectives of statistical thermodynamics – the concept of thermodynamics and mathematical probabilities – distribution of distinguishable and nondistinguishable particles.

Maxwell Boltzmann, Fermi – Dirac,andBose-Einstein statistics – comparison and applications – modes of contribution to energy – Ortho and Parahydrogen – radiation law – an electron in metals.

Unit II Statistical thermodynamics II [12 Hrs]

The partition function –Boltzmann distribution –the interpretation of the partition function – examples of the partition function.

Partition function evaluation of translational, vibrational and rotational partition functions for mono, diatomic and polyatomic ideal gases.

Thermodynamic functions in terms of partition functions, isotope exchange and dissociation of diatomic molecules – application of partition functions to heat capacities of ideal gases – nuclear partition function – Einstein and Debye models.

Unit III Statistical thermodynamics III [12 Hrs]

Statistical mechanics of ensemble – thermodynamic functions of the ensemble- canonical ensemble- properties of the canonical ensemble- grand canonical ensemble- microcanonical ensemble.

Unit IV Thermodynamics I [12 Hrs]

Partial molar properties – Partial molar free energy (Chemical Potential) – Partial molar volume and Partial molar heat content – Their significance and determination of these quantities - Variation of chemical potential with temperature and pressure.

Thermodynamics of real gases – gas mixture – definition of fugacity – determination of fugacity – a variation of fugacity with temperature and pressure.

Unit V Thermodynamics II [12 Hrs]

Thermodynamics of ideal and nonideal binary solutions – dilute solutions.

Excess function for non ideal solutions and their determination – the concept of activity and activity coefficients – determination of standard free energies – choice of standard states – determination of activity and activity coefficients for electrolytes by EMF vapour pressure measurements.

Gibbs Duhem equation and solubility product method – Thermodynamic equilibrium – Three component system.

Text Books:

1. M.C. Gupta. Statistical thermodynamics. 2nd edition.
2. Rajaram and J.C. Kuriacose, Thermodynamics For Students Of Chemistry, New Delhi: Lal Nagin Chand, 3rd editon1986.

Further reading;

P.W. Atkins, Molecular Quantum Mechanics, Oxford University Press, Oxford 3rd edition, 1983.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester III	Course code 19EPCH34	Title of the Paper PHYSICAL METHODS IN ORGANIC CHEMISTRY											Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	4	3	4	3	4	4	3	3	4	4	4	3.54
CO2	3	3	4	3	3	4	4	3	4	3	4	4	4	3.54
CO3	3	3	4	3	3	3	4	4	4	4	4	4	4	3.62
CO4	3	4	3	3	4	3	4	4	4	3	4	5	4	3.69
CO5	3	3	3	4	3	3	4	3	3	4	4	4	4	3.46
													Mean overall Score	3.51

Result: The Score for this Course is 3.51 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

II M.Sc (chem)	PHYSICAL METHODS IN ORGANIC CHEMISTRY For the students admitted in the year 2019	19EPCH34
SEMESTER - III		HRS/WK – 4
ELECTIVE - 3		CREDIT-4

Course outcome:

i. Students learn concepts and applications of UV-Vis spectroscopy.

ii. Students get learnt the concept IR spectroscopy and are able to find out the IR stretching frequency of organic functional groups.

iii. Students get to know the instrumentation, ionization techniques and fragmentation patterns, of chemical compounds using mass spectrometry

iv. Students learn and understand the concepts of ^{1}H NMR spectroscopy and its applications.

v. Students learn the principles, techniques and applications of ^{13}C NMR spectroscopy for the structural elucidation.

UNIT – I UV – VISIBLE SPECTROSCOPY (12 hrs)

Electronic transitions – Beer-Lambert's law,the effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes. Woodward-Fieser rulesfor conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic and heterocyclic compounds. Octant rule, Applications of ORD and CD to stereochemicalassignments.

UNIT – II INFRARED SPECTROSCOPY (12 hrs)

Instrumentation and sample handling. Vibrational frequencies of different functional groups. Effect of hydrogen bonding and solvent on vibrational frequencies, overtones,combination bands,and Fermi resonance. FT – IR. IR of gases,solids and polymeric materials.

UNIT – III MASS SPECTROMETRY (12 hrs)

Introduction, ion production – EI, CI, FD and FAB, factors affecting fragmentation, ion analysis, ion abundance. Mass spectral fragmentation of organic compounds, of common functional groups, molecular ion peak, base peak, and isotope peaks, metastable peak, McLafferty rearrangement. Nitrogen rule. High-resolution mass spectrometry. Examples of mass spectral fragmentation of organic compounds with respect to their structure determination.

UNIT – IV ^{1}H -NMR SPECTROSCOPY (12 hrs)

Basic principles. Macroscopic magnetization. General introduction to NMR techniques – CW and FT NMR techniques, magnetic anisotropy,^{1} H NMR spectral parameters – chemical shift, coupling constant, factors affecting chemical shift. Karplus equation. Proton NMR spectra of simple organic molecules. Simplification of complex spectra. Nuclear Overhauser effect (NOE). Identification of Homotopic, diastereotopic and enantiotopic protons.

UNIT – V ^{13} C NMR SPECTROSCOPY (12 hrs)

^{13}C NMR – proton decoupled and off-resonance spectra. Factors affecting ^{13}C chemical shift – electronegativity. ^{13}C NMR spectra of simple organic molecules. DEPT spectra. 2D NMR techniques^{1}H COSY, ^{13} C COSY spectra.

Text Books:

1. R.M. Silverstein, G.C. Bassler,and T.C. Morrill, Spectrometric Identification of Organic compounds, John Wiley.,1997
2. D.H. Williams, I. Fleming, Spectroscopic Methods in Organic Chemistry, Tata McGraw – Hill, 1998.
3. W. Kemp, Spectroscopy, Macmillan Ltd., 1994.

References:

1. J. R. Dyer, Application of spectroscopy of Organic Compounds, Prentice Hall.
2. Jagmohan, Spectroscopy of Organic compounds, Narosa Publications.
3. Pavia, Lampman and Kriz, Introduction to Spectroscopy, 3rd edition, Brooks/Cole Pubs. Co.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester III	Course code EPCH912A	BIOORGANIC CHEMISTRY For the students admitted in the year 2017											Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	3	3	4	4	4	4	4	4	3	3	3	4	3.53
CO2	4	4	4	3	3	4	3	4	4	3	4	4	5	3.76
CO3	4	4	3	3	4	4	4	3	3	4	5	4	3	3.69
CO4	4	3	3	3	4	5	4	3	3	3	4	4	5	3.69
CO5	4	3	3	3	3	4	4	4	4	4	5	3	4	3.69
													Mean overall Score	3.67

Result: The Score for this Course is 3.67 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

II M.Sc (chem)	BIOORGANIC CHEMISTRY For the students admitted in the year 2017	EPCH 912A
SEMESTER – III		HRS/WK – 4
ELECTIVE – 3		CREDIT-4

Course Outcome:

i)To study about the classification and biological role of carbohydrates.

ii)To study about the types of amino acids and its metabolism, proteins types

iii)To study about various types of lipids and its metabolism.

iv)To understand about structure and function of DNA , RNA

v)To know about the vitamins types and its biological role.

UNIT I - CHEMISTRY AND METABOLISM CARBOHYDRATES

Definition, classification and biological role of carbohydrates.Monosaccharides Linear and ring structures (Haworth formula) of ribose, glucose, fructose,and mannose (structural determination not required) physical and chemical properties of glucose and fructose.Disaccharides: Ring structures (Haworth formula) - occurrence, physical and chemical properties of maltose, lactose and sucrose.Polysaccharides: Starch, glycogen,and cellulose - structure and properties.Glycolysis of carbohydrates.

UNIT II - CHEMISTRY AND METABOLISM OF AMINO ACIDS AND PROTEINS

Amino acids: Various classifications, essential amino acids, physical properties (amphoteric nature and isoelectric point) and reactions.

Proteins: Classifications (based on shape, composition,and solubility), physical properties.

Primary structure - End group analysis (N- terminal analysis- Edman's method, dansyl chloride method; C - terminal analysis- hydrazinolysis and biochemical methods)

Biological functions of proteins, Deamination, transamination reactions, Urea cycle.

UNIT III - CHEMISTRY AND METABOLISM OF LIPIDS :

Definition, classification- simple lipids (fatty acids), compound lipids and derived lipids. Properties: saponification number, Acetyl number.

Sterols: Cholesterol (structure not needed), biological importance and chemical properties. Bile acids- functions. Biological functions of lipids.

UNIT IV - NUCLEIC ACIDS :

Purine and pyrimidine bases, nucleosides, nucleotides, polynucleotides, DNA structure - various types, RNAstructure - various types.

Biological functions of DNA and RNA, Genetic code.

UNIT V - VITAMINS:

Vitamins: Definition, classification- water-soluble vitamins (B_v B_2, B_3, B_6, B_{12} and vitamin-C) and fat-soluble vitamins (A, D, E and K) - occurrence, structure, deficiency diseases, biochemical rules,and daily requirements

SUGGESTED REFERENCE BOOKS:

1. Biochemistry C.B. Powar and G.R. Chatwal.
2. Elements of Biochemistry Ragunatha Rao
3. Essential Biochemistry U. Sathyanarayanan
4. Essential Biochemistry J.L. JAIN

II M.Sc (chem)	ORGANIC CHEMISTRY PRACTICALS –II For students admitted in the year 2016	PCH P304T
SEMESTER – III		HRS/WK – 4
PRACTICAL-IV		CREDIT-2

(External Marks : 60 & Internal Marks : 40)

Course outcome:

1. Students learn the Quantitative Organic analysis.
2. Students learn the double stage organic compound preparation.

1.a)Preparation of organic compounds involving two stages.

b) Spectral interpretation of organic molecules.

2. Quantitative Organic analysis

i) Estimation of Phenol

ii) Estimation of Aniline

iii) Estimation of Glucose

Quantum of marks in respect of the Practical Examinations:

1. Preparation and spectral interpretation (15 +10)	25 marks
2.Estimation	25 marks
3. Viva-voce	5 marks
4. Record	5 marks
Total	60 marks.

BOOKS RECOMMENDED:

1. Mann and Saunders, Laboratory Manual of Organic Chemistry.
2. Vogel's Quantitative Organic Analysis.
3. R.M. Silverstein, G.C. Bassler,and T.C. Morrill, Spectrometric Identification of Organic compounds, John Wiley.,1997
4. D.H. Williams, I. Fleming, Spectroscopic Methods in Organic Chemistry, Tata McGraw – Hill, 1998.

II M.Sc (chem)	**INORGANIC CHEMISTRY PRACTICALS –II For the students admitted in the year 2019**	**19PCHP32**
SEMESTER – III		**HRS/WK – 4**
PRACTICAL-5		**CREDIT-2**

Course outcome:

i. To improve the skill in quantitativeestimation of metal ions by colorimetry.

ii. To identify the methodology to estimate a metal ion in the presence of another metal ion.

iii. To improve the skill in the synthesis of inorganic compounds.

1. Spectral interpretation of some inorganic compounds
2. Colorimetric estimation of metal ions (Fe,Cu,Ni)
3. Estimation of metal ions by Gravimetric and Volumetric analysis(Cu,Ni,Zn,Fe)

II M.Sc (chem)	INORGANIC CHEMISTRY PRACTICALS –II For the students admitted in the year 2019	19PCHP32
SEMESTER – III		HRS/WK – 4
PRACTICAL-5		CREDIT-2

EVALUATION PATTERN

Continuous internal assessment (CIA) (40 marks)

Based on the periodical evaluation of record and experiments assessed by the staff in charge

External Examination (60 marks)

Duration: 6 Hrs **Total Marks: 60**

1. Estimation of metal ions by Volumetric & Gravimetric method - 20 marks
2. Estimation of metal ions by photo colorimetric method - 15 marks
3. Preparation of complex - 10 marks
4. Spectral interpretation - 10 marks
5. Viva voce - 5 marks
6. Record - 10 marks

II M.Sc (chem)	PHYSICAL CHEMISTRY PRACTICALS – II For the students admitted in the year 2014	PCH P306
SEMESTER – III		HRS/WK – 4
PRACTICAL-6		CREDIT-2

Course Outcome:
Students learn various experiments in Conductometry, Potentiometry and Pulse polarography,

I. **Pulse Polarography.**

1. Determination of Half wave potential of Cd ion in KCl.
2. Determination of Half wave potential of Zn & Mn.
3. Determination of Pb and Cu in Steel.
4. Determination of Ni, Zn,and Fe.
5. Analysis of Cu based Alloys.
6. Stability constants for complexes (Pb Oxalate complexes).

II. **UV- Visible Spectrophotometer**

1. Determination of concentration of Potassium Nitrate.
2. Determination of molar extinction coefficient of Potassium dichromate and Potassium permanganate.
3. Determination of concentration of para paracetamol in the antipyretic drug.

III. **Nephelometer**

1. Nephelometric determination of Sulphate.
2. Nephelometric determination of Phosphate.

IV. Conductometric Titrations.

1. Determination of strength of weak acid (CH_3COOH Vs NaOH)
2. Determination of strength of strong acid (HCl Vs NaOH).
3. Determination of strength of a mixture of acids (HCl+CH_3COOH Vs NaOH)
4. Determination of Endpoint in the Precipitation titration (KCl Vs $AgNo_3$)
5. Verification of Ostwald's dilution law.
6. Verification of Onsager's equation.

V. Potentiometric Titrations.

1. Determination of pH of the buffer using Quinhydrone electrode.
2. Determination of pKa of weak acid using Std. NaOH solution.
3. Determination of strength of FAS using Redox titration (FAS Vs $KMnO_4$).

4. Determination of Single Electrode potential.
5. Determination of strength of strong acid (HCl Vs NaOH).
6. Determination of strength of weak acid (CH_3COOH Vs NaOH)
7. Determination of Endpoint in the Precipitation titration (KCl + KI Vs $AgNo_3$)

VI. **Computational Chemistry.**

1. Computing atomic charges for H_2O molecule by AIM method.
2. Computing molecular orbital coefficients of 1,3-cyclobutadiene by HF method.
3. Geometry optimization of H_2O by HFSCF method.

Scheme of evaluation: (total = 60 marks)

Aim & short procedure	– 10
Record	– 5
Experiment & manipulation	- 35
Viva voce	– 10
Total	- 60

Semester IV	Course code 19PCH41	ORGANIC CHEMISTRY - IV SYNTHETIC ORGANIC CHEMISTRY AND CHEMISTRY OF NATURAL PRODUCTS For the students admitted in the year 2019										Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	5	5	4	5	3	4	4	4	4	4	4	4	4	4.1
CO2	4	4	4	4	5	4	4	4	4	4	4	4	4	4.0
CO3	5	5	4	4	5	4	5	5	5	4	5	4	4	4.5
CO4	5	5	4	5	4	5	5	5	5	4	5	4	4	4.6
CO5	4	4	4	4	4	5	5	5	5	4	5	4	4	4.3
												Mean overall Score		4.3

Result: The Score for this Course is 4.3 (Very High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

II M.Sc (chem)	ORGANIC CHEMISTRY - IV	19PCH41
SEMESTER - IV	SYNTHETIC ORGANIC CHEMISTRY AND	HRS/WK – 4
CORE – X	CHEMISTRY OF NATURAL PRODUCTS For the students admitted in the year 2019	CREDIT-4

Course Outcomes:

CO1: Knowledge pertaining Alkaloids and Bioorganic chemistry

CO2: proteins peptides and their structures

CO3: Modern synthetic methods, reactions,and reagents

CO4: Knowledge pertaining toReterosynthesis

CO5: Advanced programming techniques using pointers, files and graphics concepts.

UNIT – I: ALKALOIDS AND BIOORGANIC CHEMISTRY

Total synthesis of quinine, morphine, reserpine, cocaine, hygrine,and reticulene

Nucleic acids: Types of nucleic acids – DNA & RNA polynucleotide chain. Components – Structure and role of (genetic code) DNA and RNA (Nucleotides only).

UNIT – II: PROTEINS

Peptides and their synthesis – synthesis of tripeptide. Merrifield synthesis, End group analysis of peptides, Primary,Secondary and tertiary structure of proteins, Determination ofthe tertiarystructure of proteins.

UNIT – III: MODERN SYNTHETIC METHODS, REACTIONS,AND REAGENTS

Principles and synthetic processes involving phase transfer catalysis, (Nitriles from Alkyl halides, Alcohol from Alkyl halides) Polymer-supported reagents(Synthesis of oligosaccharides), (Microwave-assisted Organic synthesis – Esterification, deacetification,and hydrolysis)Synthesis of simple organic molecules using standard reaction like acetylation,alkylation of enamines and active methylene compounds, Grignard reactions, Phosphorus and sulphur ylides,Protection and deprotection of functional groups(R-OH, R-CHO, RCO-R , R-NH_2 and R-COOH).

UNIT-IV:

PLANNING ORGANIC SYNTHESIS AND RETROSYNTHETIC ANALYSIS

An introduction to retrosynthesis – Synthon, Synthetic equivalent, Target molecule, Functional group interconversion – Disconnection approach – One group disconnection – Disconnection of simple alcohols, olefins and ketones – Logical and illogical disconnections, Two group disconnection –1,2 – 1,3 – 1,4 – 1,5 and 1,6 – dioxygenated skeletons and dicarbonyls. Retro Diels – Alder reactions.(Synthesis of the following target molecules: cyclohex-3-ene carbaldehyde, 1-phenylpentan-3-one,1-bromo-3-methylbut-2-ene,(E)-3-(4-nitrophenyl)acrylaldehyde,Pentane-2,4- dione,ethyl-2-oxocyclopentane carboxylate,nonane-3,7-dione, 2-amino-3-methyl butanoic acid,2,3-dimethylbutane-2,3-diol)

UNIT- V: HETEROCYCLES, VITAMINS,AND STEROIDS

Imidazole, Oxazole, Thiazole, Flavones, isoflavones, anthocyanins, pyrimidines (cytosine and L uracil only) and purines(adenine, Guanine only). Synthesis of parent and simple alkyl or aryl substituted derivatives are expected. Synthesis of vitamin A1 (Reformatsky and Wittig reaction methods only). Conversion of cholesterol to progesterone, estrone,and testosterone.

Textbooks

1. T. K Lindhorst, *Essentials of Carbohydrate Chemistryand Biochemistry*, Wiley VCH,North America, 2007.
2. G. K. Chatwal, *Organic Chemistry on Natural Products,*Vol. 1, Himalaya Publishing House, Mumbai, 2009.
3. G. K. Chatwal, *Organic Chemistry on Natural Products,Vol. 2*, Himalaya Publishing House, Mumbai, 2009.
4. O. P. Agarwal, *Chemistry of Organic Natural Products,Vol. 1,* Goel Publishing House, Meerut, 1997.
5. O. P. Agarwal, *Chemistry of Organic Natural Products,Vol. 2,* Goel Publishing House, Meerut, 1997.
6. I. L. *Finar, Organic Chemistry Vol-2, 5thed., Pearson* Education Asia, 1975.
7. Workbook for organic synthesis, The disconnection approach by Stuart Warren, John Wiley & Sons (Asia) Pvt. Ltd.,

References

1. Pelletier, *Chemistry of alkaloids*, Van NostrandReinhold Co, 2000.
2. Shoppe, *Chemistry of the steroids*, Butterworthes, 1994.

3. I. A. Khan, and A. Khanum. Role of Biotechnology in medicinal&aromatic plants, Vol 1 and Vol 10, Ukkaz Publications, Hyderabad, 2004.
4. M. P. Singh. and H. Panda, Medicinal Herbs with their formulations, Daya Publishing House, Delhi, 2005.
5. Guidebook to organic synthesis by Ramond K. Mackie and David M. Smith, ELBS Publication.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester IV	Course code 19PCH42	Title of the Paper INORGANIC CHEMISTRY – IV										Hrs/ wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	4	3	3	4	4	4	4	3	4	3	3	3.61
CO2	3	3	3	3	3	3	3	4	3	4	4	3	3	3.23
CO3	4	4	4	3	3	4	4	4	3	3	3	3	3	3.46
CO4	3	3	4	3	3	4	3	3	3	3	3	3	3	3.15
CO5	4	4	4	4	3	4	3	3	4	4	4	4	4	3.78
													Mean overall Score	3.45

Result: The Score for this Course is 3.45 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs =	Mean Overall Score for COs =
$\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	$\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

II M.Sc (chem)	INORGANIC CHEMISTRY – IV For the students admitted in the year 2019	19PCH42
SEMESTER – IV		HRS/WK – 4
CORE – XI		CREDIT-4

Course outcome:

i. To learn about the reaction mechanisms of transition metal complexes.
ii. To acquire the knowledge of photochemistry.
iii. To describe about the electron transfer reactions.
iv. To gain knowledge on solid state chemistry.
v. To describe electronic and magnetic properties of molecules.

Unit-I: Reaction mechanism of Transition metal complexes-I [12 Hrs]

1.1 Energy profile of a reaction, inert and labile complexes, substitution reactions of octahedral complexes-, acid hydrolysis, base hydrolysis, conjugate base mechanism, anation reactions.

1.2 Synthesis of Platinum & Cobalt complexes by substitution reactions.

Unit-II: Reaction mechanism of Transition metal complexes-II [12 Hrs]

2.1 Substitution reactions in square planar complexes, mechanism of Substitution reactions-Trans effect – theories of Trans effect. Reactivity of platinum complexes, influences of entering, leaving and other groups and a central metal ion.

2.2 Inorganic Photochemistry: photo-substitution, photo redox &isomerization process, application of metal complexes in solar energy conversion.

Unit-III: Electron transfer reactions [12 Hrs]

3.1Electron transfer reactions: Outer and Inner sphere processes, atom transfer reaction. Formation and rearrangement of precursor complexes, the nature of binding ligand, successor complexes, Marcus theory.

3.2 Complementary, Non-complementary and two-electron transfer reactions.

Unit-IV: Solid State Chemistry - I [12 Hrs]

4.1Solid state reactions: General principles, coprecipitation as a precursor to solid state reactions, kinetics of solid state reactions – types of the void – types of crystal structures – NaCl, Rutile, Wurtzite, Zincblende and CaF_2

4.2Crystal defects and nonstoichiometry: perfect and imperfect crystals,intrinsic and extrinsic defects – point defects, line and plane defects, – Schottky defects and Frenkel defects.

Thermodynamics of Schottky defects and Frenkel defectformation, colour centers, nonstoichiometry defect.

Unit- V Solid State Chemistry – II [12 Hrs]

5.1Electronic Properties and Band Theory, the band structure of metals, insulators, and semiconductors. , intrinsic and extrinsic semiconductors, doping semiconductors, superconductors – theories and applications

5.2Optical properties- Optical reflectance, photoconduction- photoelectric effects Magnetic properties- Classification of materials: para, dia, Ferro,Ferri,antiferromagnetism - Magnetic Susceptibility and measurements – Guoy method, Faraday method, VSM, and their applications – magnetic domains, hysteresis.

Text Books:

1. J.E. Huheey, Inorganic Chemistry, 5th Edn. Harper International.1993.
2. M.F.Purcell, J.C.Kotz, Inorganic Chemistry,Saunder, 1977.
3. W.R.West, Solid State Chemistry and its Applications, John Wiley and Sons, New York, 1984.

Reference Books:

1. G.J.Ferraudi, Inorganic Photochemistry, 1973.
2. A.W.Adamson, E.D.Fleishcer, Concepts in Inorganic Photochemistry, 1963.
3. L. E. Smart, E. A. Moore, Solid State Chemistry – An introduction 3rd ed, Taylor and Francis group 2005.
4. F.A.Cotton, G.Wilkinson, Advanced Inorganic Chemistry, 5th Edn. John Wiley.1985.
5. H.V.Keer, Principles of Solid State, Wiley Eastern Limited, 1993.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester IV	Course code 19PCH43	Reaction kinetics, Electrode kinetics,andPhotochemistry For the students admitted in the year 2019												Hrs/wk 4	Credits 4
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs	
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8		
CO1	4	4	4	3	3	5	4	3	4	3	3	3	4	3.61	
CO2	3	3	4	4	4	4	5	4	4	3	4	5	4	3.46	
CO3	3	4	4	4	4	5	5	4	4	3	3	4	5	4.00	
CO4	4	4	3	4	4	4	4	3	3	5	3	4	3	3.69	
CO5	3	4	4	4	4	3	3	3	4	4	4	4	4	3.69	
													Mean overall Score	3.69	

Result: The Score for this Course is 3.69 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

II M.Sc (chem)	Reaction kinetics, Electrode kinetics,andPhotochemistry For the students admitted in the year 2014	19PCH43
SEMESTER - IV		HRS/WK – 4
CORE – XII		CREDIT-4

Course Outcome:

i. To study the chemical potential and its significance.
ii. To study the effect of temperature on the reaction rate.
iii. **To** study the different types of Enzyme catalysis and Kinetics of complex reactions.
iv. To understand about the kinetics of unimolecular and bimolecular photo physical processes.
v. Tostudy about types of photochemical reactions and radiation chemistry

Unit I Chemical Kinetics I [12 Hrs]

1.1 Effect of temperature on reaction rates – collision theory of reaction rate – molecular beams – collision cross sections – effectiveness of collisions – probability factor.

1.2 Potential energy surfaces – partition function and activated complex – erying equation – estimation of free energy, enthalpy,and entropy of activation and their significance.

1.3 Reactions in solutions – the effect of pressure, dielectric constant and ionic strength on reactions in solutions – kinetic isotope effects.

1.4 Acid-base catalysis – mechanism of acid-basecatalyzed reactions – Bronsted catalysis law.

Unit II Chemical Kinetics II [12 Hrs]

2.1 Kinetics of complex reactions, reversible reactions, consecutive reactions, parallel reactions, chain reactions – general treatment of chain reactions – chain length – rice Herzfeld mechanism – explosion limits.

2.2 Catalysis by enzymes – the rate of enzyme reactions – the effect of substrate concentration, pH and temperature on enzyme-catalyzed reactions – Inhibition of enzyme-catalyzed reactions.

2.3 Study of surfaces – Langmuir and BET adsorption isotherms – the study of the kinetics of surface reactions – catalytic by metals, semiconductor oxides – mechanism of heterogeneous catalytic reactions – the absorption coefficient and its significance.

2.4 Study of fast reactions – relaxation methods – temperature and pressure jump methods – stopped the flow and flash photolysis methods.

Unit – III Electrode Kinetics [12 Hrs]

3.1 Mean ionic activity and mean ionic activity coefficient – concept of ionic strength, Debye- Huckel theory of strong electrolytes – activity coefficient of strong electrolytes – determination of activity coefficient by electrical method – Debye – Huckel limiting law qualitative and quantitative verification – limitation of Debye Huckel limiting law at appreciable concentrations of electrolytes – Huckel equation – Debye – Huckel – Bronsted equation.

3.2 Electrode-electrolyte interface – adsorption at the electrified interface – electrified double layer – an electrocapillary phenomenon – Lipmann equation – the structure of double layers – Helmholtz – Perrin, Guoy – Chapman and Stern model of electrical double layers. Butler-Volmer and Tafel equation- applications in electrode reactions, overvoltage,and corrosion.

3.3 Irreversible thermodynamics – forces and fluxes – linear force – flux relation – phenomenological equations – Onsager's theorem diffusion – electrokinetic phenomena – membrane potential.

Unit IV Photochemistry – I [12 Hrs]

4.1 Absorption and emission of radiation – Franck – Condon Principle – decay of electronically excited states – Jablonski diagram – radiative and nonradiative processes – fluorescence and phosphorescence – spin forbidden radiative transition – internal conversion and intersystem crossing – energy transfer process.

4.2 Kinetics of unimolecular and bimolecular photophysical processes – excimers and exciplexes – static and dynamic quenching – Stern Volmer analysis.

Unit V Photochemistry II [12 Hrs]

5.1 Experimental methods – quantum yield and lifetime measurements – steady state principle – quantum yield and chemical actinometry.

5.2 Kinetics of photochemical reactions: hydrogen and halogen reactions, photoredox, photo substitution, photoisomerization,and photosensitized reactions – photovoltaic and photogalvanic cells, photo-assisted electrolysis of water, and aspects of solar energy conversion.

5.3 Radiation chemistry – Interaction of high energy radiation with matter – primary and secondary processes – G value – radiolysis of water – hydrated electron.

Textbooks

1. J.Rajaram and J.C.Kuriacose, kinetics and mechanism of chemicaltransformation. India: Macmillan India Ltd. 1993.
2. K.K. Rohatgi Mukherjee, Fundamentals of Photochemistry, Wiley Eastern Ltd, 1978.

Further reading:

K.J. Laidler, Chemical Kinetics. New York: Harpet and Row, 2nd Indian edition.., 1987.

Question paper pattern for Post graduate

Continuous internal assessment (CIA) (25 marks)

Two internal Examinations	10 marks
Assignment / Seminar	10 marks
Attendance	5 marks
Total	**25 marks**

External Examination (75 marks)

Question Pattern

Time: 3 Hours **Max. Marks: 75**

SECTION – A (20 x 1 = 20)

Answer **ALL** the Questions

I. Choose the correct answer	(10 x 1 = 10)
II. Fill up the blaks	(5 x 1 = 5)
III. Match the following	(5 x 1 = 5)

SECTION -B (10 x 2 = 20)

Answer any **Ten** out of **Twelve**

SECTION –C (5x 7 = 35)

Answer **Five out of Seven**

(Each question should contain a maximum of two sub divisions)

St. Joseph's College of Arts and Science (Autonomous) - Cuddalore

Meeting of the board of studies for M.Phil

Department of Chemistry

Date: 15.03.2019

Minutes:

The meeting of the board of studies for M.Phil., of Chemistry Department was held in the Chemistry department, St. Joseph's College of Arts and Science (Autonomous). Cuddalore, on 15.03.2019 at 2.30 pm

CHAIRMAN
Mr.T. Antony Sandosh
The Head of the Department
PG and Research Department of Chemistry
St. Joseph's College of Arts and Science (Autonomous),
Cuddalore.

UNIVERSITY NOMINEE
Dr. M. Sekar
Associate Professor
Dept. of Chemistry
Govt. Arts college,
B. Mutlur
Chidambaram.

SUBJECT EXPERT
Dr.C.Palanivel
Assistant Professor
Dept. of Chemistry
Govt. Arts college,
B. Mutlur, Chidambaram.

ALUMNI
Dr.V.Selvaraj
Asst. Professor,
Anna University,
Villupuram.

INDUSTRIAL EXPERT
Mr.P.Harinarayanan.
Manager, STRIDE SHASUN,
SIPCOT, Cuddalore.

MEMBERS

Dr. V. Periyanayagasamy	Asst. Professor
Mr. A. Amalorpavadoss	Asst. Professor
Mr. M. Sebastian Marianathan	Asst. Professor
Mr. G. Anand	Asst. Professor
Ms.B. Christina	Asst. Professor
Mr. S.Richard Rajkumar	Asst. Professor
Mr. F.Paul Arokiadoss	Asst. Professor

The existing curriculum for M.Phil Chemistry was taken for discussion and it was concluded to retain the existing syllabus without any changes.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester I	Course code MPCH101	Title of the Paper RESEARCH METHODOLOGY											Hrs/wk 7	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)								Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	3	4	3	4	3	4	4	4	4	4	4	4	3	3.69
CO2	3	3	3	3	3	3	3	3	4	3	3	4	4	3.23
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53
CO4	3	3	3	3	3	3	3	4	4	3	4	4	4	3.38
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38
													Mean overall Score	3.44

Result: The Score for this Course is 3.44 (High Relationship)

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = $\frac{\text{Total of Values}}{\text{Total of POs\&PSOs}}$	Mean Overall Score for COs = $\frac{\text{Total of Mean Scores}}{\text{Total number of COs}}$

M.Phil (Chem)	RESEARCH METHODOLOGY	MPCH 101
SEMESTER - I		HRS/WK – 7
CORE – I		CREDIT- 5

Course Outcome:

1. Scholars learn the meaning, objective and problems in Research.

2. Scholars acquire the basic principles of experimental designs.

3. Scholars get to know about Data collection methods for documentation and presentation.

4. Scholars learn data analysis, types and sources of errors and determination of control errors.

5. Scholars learn essentials of a scientific report.

UNIT-1 RESEARCH METHODOLOGY.

Meaning of research – the objective of research – motivation of research – approaches,and significance – methods versus methodology – research in scientific methods – research process – criteria for good research – problem encounters by research in India – funding agencies.

UNIT-II RESEARCH DESIGN

Research problem: selecting the problem – the necessity of defining the problem – techniques involved in defining the problem – research design – needs and features of good design – different research design – basic principles of experimental designs.

UNIT-III DATA COLLECTION AND DOCUMENTATION

Data collection methods – data types – processing and presentation of data- techniques of ordering data – the meaning of primary and secondary data – the uses of computers in research – the library and internet – uses of search engines – virtual libraries – common software for documentation and presentation.

UNIT-IV DATA AND ERROR ANALYSIS

Statistical analysis of data – standard deviation – correlation – comparison of sets of data – chi-squared analysis for data – characteristics of probability distribution – binomial, Poisson

and normal distribution – the principle of least square fittings – curve fitting – measurement of errors – types and sources of errors – determination of control errors.

UNIT-V RESEARCH COMMUNICATION

Meaning of research report – logical format for writing and paper – essential of a scientific report: abstract- introduction, review of the literature – materials and methods and discussion – write up steps in drafting report – effective illustrations: tables and figures – reference styles: Harvard and Vancouver systems.

Textbooks:

1. Research Methodology, methods,and techniques-C.R.Kothari-Wishwa Prakasam publications, II Edition.
2. Research: An Introduction-Robert Ross-Harper and Row Publications.
3. Research methodology-P.Saravanavel-Kitlab Mahal, Sixth edition.
4. A Hand Book of Methodology of Research-Rajammal P.A.Devadass-Vidyalaya press.
5. N.Subramanian, Introduction to Computer.

Reference books:

1. G.W.Secdecor and W.Cocharan, Statistical methodsOxford and IBH, New Delhi.
2. Santosh Gupta, Research methodology methods,and statistical techniques.
3. S.P.Gupta, Statistical Methods-
4. Scientific social surveys and research-P.Young-Asia publishers, Bombay.
5. How to write and publish a scientific paper –R.A. Day Cambridge University Press.
6. Thesis and assignment writing-Anderson-Wiley Eastern Ltd.

Relationship matrix for Course outcomes, Programme outcomes and Programme Specific Outcomes

Semester I	Course code MPCH102	Title of the Paper ADVANCED CHEMISTRY										Hrs/wk 7	Credits 5
Course Outcomes (COs)	Programme Outcomes (POs)					Programme Specific Outcomes (PSOs)							Mean Score of COs
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	
CO1	4	4	3	4	3	4	4	4	4	4	4	4	3	3.76
CO2	4	3	3	3	3	3	3	3	4	3	3	4	4	3.30
CO3	3	3	4	3	3	3	3	4	4	4	4	4	4	3.53
CO4	4	3	3	3	3	3	3	4	4	3	4	4	4	3.46
CO5	3	3	3	4	3	3	3	3	3	4	4	4	4	3.38
												Mean overall Score		3.48

Result: The Score for this Course is 3.48 (High Relationship)

This Course is having **HIGH** association with Programme Outcome and Programme Specific Outcome

Mapping	1-20%	21-40%	41-60%	61-80%	81-100%
Scale	1	2	3	4	5
Relation	0-1.0	1.1-2.0	2.1-3.0	3.1-4.0	4.1-5.0
Quality	Very poor	Poor	Moderate	High	Very High

Values Scaling:

Mean Score of COs = Total of Values / Total of POs&PSOs	Mean Overall Score for COs = Total of Mean Scores / Total number of COs

M.Phil (Chem)	ADVANCED CHEMISTRY	MPCH 102
SEMESTER – I		HRS/WK – 7
CORE – II		CREDIT- 5

Course Outcome:

1. Scholars learn the instrumental methods of GC- HPLC, CV, Polarography and Amperometry.
2. Scholars understand the Principles and applications in structural elucidation.
3. Scholars learn the Applications of UV-Visible, IR, NMR in Organic molecules.
4. Scholars learn the Applications of UV-Visible, IR, NMR, Mossbauer and ESR spectrometry in the determination of structures of inorganic molecules.
5. Scholars learn the concept of point groups and retro synthesis.

UNIT-I INSTRUMENTAL METHODS OF ANALYSIS

Atomic absorption and emission spectroscopy, chromatography: GC - HPLC, electroanalytical methods: coulometry cyclic voltammetry, polarography, amperometry,and ion selective electrodes.

UNIT-II SPECTROSCOPY

Principles and applications in structural elucidation

Rotational – diatomic molecules – isotopic substitution and rotational constants. Vibrational – diatomic molecules – linear triatomic molecules – specific frequencies of functional groups in polyatomic molecules. Electronic – singlet and triplet states – np* and pp*transitions – application to conjugated double bonds and conjugated carbonyls – Woodward-Fieser rules – charge transfer spectra.nuclear magnetic resonance – basic principle – chemical shift – spin-spin interaction and coupling constant. Mass spectroscopy – parent peak, base peak – metastable peak – MCLafferty rearrangement.

UNIT-III

Applications of UV-Visible, IR, NMR – COSY, NOESY, HMBC, HSQC and mass spectrometry in the determination of structures of organic molecules.

UNIT-IV

Applications of UV-Visible, IR, NMR, Mossbauer and ESR spectrometry in the determination of structures of inorganic molecules – a variation of optical activity with wavelength – optical rotatory dispersion and circular dichroism curves and their application in determining the configuration and conformation of different inorganic compounds and conformational analysis.

UNIT-V

Symmetry elements – point groups – optical activity – its origin – atomic and conformation asymmetry – a variation of optical activity with wavelength. Retrosynthesis – synthons – synthetic equivalents – GI – target molecules – retrosynthesis of molecules (cubane, ciprofloxacin)

Textbooks:

1. H.H.Willand, L.L. Merrit and J.A.Dean, Instrumental Methods of Analysis-D.Ven. Nostrand& Co.
2. H.A. Strobel, Chemical Instrumentation, Addition-Wesley publishing & Co.
3. R.S.Drago, Physical Methods in Inorganic Chemistry
4. R.S.Drago, Physical Methods in Chemistry.

Reference books:

1. C.N.Banwell, Fundamentals of Molecular Spectroscopy, 1996, McGraw Hill.
2. William Kemp, Organic Spectroscopy, Macmillan Ltd, 1994.
3. R.M.Silverstein, G.C.Basler,and T.C.Morril Spectrometric Identification of Organic Compounds, - John Wiley-1997.
4. Stuart Warren -Designing Organic Synthesis

Question paper pattern FOR M.Phil (Semester)

Internal – 25 Marks

External – 75 Marks

Section A (5×6=30 marks) either or type

Section B (3×15=45 marks) three out of six

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