

2020

B.Sc CHEMISTRY

Course Structure and Syllabus

(For the candidates admitted from the academic year 2020-2021 onwards)

CHOICE BASED CREDIT SYSTEM (CBCS)



THANTHAI HANS ROEVER COLLEGE(AUTONOMOUS)

(Approved by NAAC, Affiliated to Bharathidasan University)

ELAMBALUR, PERAMBALUR – 621 220



Thanthai Hans Roever College (Autonomous), Elambalur, Perambalur – 621220

B.Sc Chemistry – UG Course Structure under CBCS

(For the candidates admitted from the academic year 2020 – 2021 onwards)

Sem	Part	Course code	Title of the course	Hours/ week	Credit	Exam	CIA	ESE	Total
1	I	20UT1	Tamil – I (Ikkala Ilakiyam – Kavithai, Sirukathai, Urainadai, Ilakkiya Varalaru)	6	3	3	25	75	100
1	II	20UE1	Communicative English – I	6	3	3	25	75	100
1	III	20UCH1CC1	General Chemistry– I	5	5	3	25	75	100
1	III	20UCH1CP1	Volumetric Analysis Practical – I	3	3	3	40	60	100
1	III	20UPH1AC1	Physics – I	3	3	3	25	75	100
1	III	20UPH2AP1	Physics (Practical)	3	–	–	–	–	–
1	III	20UCH1PE1	Professional English for Physical Science – I	2	2	3	25	75	100
1	IV	20UVE	Value Education	2	2	3	25	75	100
		Total		30	21	–	–	–	700
2	I	20UT2	Tamil – II (Idaikkala Ilakiyam – Bakthi, Puthinam, Ilakkiya Varalaru)	6	3	3	25	75	100
2	II	20UE2	Communicative English – II	6	3	3	25	75	100
2	III	20UCH2CC2	General Chemistry – II	5	5	3	25	75	100
2	III	20UCH2CP2	Volumetric Analysis Practical – II	3	3	3	40	60	100
2	III	20UPH2AP1	Physics (Practical)	3	3	3	40	60	100
2	III	20UPH2AC2	Physics – II	3	2	2	25	75	100

2	III	20UCH2PE2	Professional English for Physical Science – II	2	2	3	25	75	100
2	IV	20UES	Environmental Studies	2	2	3	25	75	100
		Total		30	23	–	–	–	800
3	I	20UT3	Tamil – III (Kaapiya Ilakkiyam, Naadagam, Ilakkiya Varalaru)	6	3	3	25	75	100
3	II	20UE3	English – III	6	3	3	25	75	100
3	III	20UCH3CC3	General Chemistry – III	6	5	3	25	75	100
3	III	20UCH3CP3	Semimicro Analysis Practical – I	3	3	3	40	60	100
3	III	20UBO3AC3	Botany-I Morphology, Taxonomy, Anatomy and Embryology	4	2	3	25	75	100
3	III	20UBO4AP2	Morphology, Taxonomy, Anatomy And Embryology (P)	3	–	–	–	–	–
3	IV	20UCH3NME1	Chemistry in everyday life	2	2	3	25	75	100
		Total		30	18	–	–	–	600
4	I	20UT4	Tamil – IV (Pazhanthamizh Ilakkiyam, Ilakkiya Varalaru & Puthukkatturai)	6	3	3	25	75	100
4	II	20UE4	English – IV	6	3	3	25	75	100
4	III	20UCH4CC4	General Chemistry – IV	5	5	3	25	75	100
4	III	20UCH4CP4	Semi Micro Analysis Practical – II	3	3	3	40	60	100
4	III	20UBO4AC4	Thallophytes, Bryophytes, Pteridophytes, Gymnosperms and Plant Physiology	3	2	3	25	75	100
4	III	20UBO4AP2	Morphology, Taxonomy, Anatomy And Embryology (P)	3	3	3	40	60	100
4	IV	20UCH4NME2	Health Chemistry	2	2	3	25	75	100
4	IV	20UBT4SBE1	Ethno medicine	2	2	3	25	75	100
		Total		30	23	–	–	–	800

5	III	20UCH5CC5	Inorganic Chemistry – I	5	5	3	25	75	100
5	III	20UCH5CC6	Organic Chemistry – I	5	5	3	25	75	100
5	III	20UCH5CC7	Physical Chemistry – I	6	5	3	25	75	100
5	III	20UCH5CP5	Physical Chemistry Practical	3	3	3	40	60	100
5	III	20UCH5MBE1	Analytical Chemistry	5	4	3	25	75	100
5	IV	20UBT5SBE2	Pharmacognosy	2	2	3	25	75	100
5	IV	20UBT5SBE3	Herbs and drug action	2	2	3	25	75	100
5	IV	20USSD	Soft Skills Development	2	2	3	25	75	100
		Total		30	28	–	–	–	800
6	III	20UCH6CC8	Organic Chemistry – II	6	5	3	25	75	100
6	III	20UCH6CC9	Physical Chemistry – II	6	5	3	25	75	100
6	III	20UCH6CP6	Gravimetric & Organic Analysis Practical	6	5	6	40	60	100
6	III	20UCH6MBE2:1	Nuclear and industrial chemistry	6	5	3	25	75	100
		20UCH6MBE2:2	Agricultural Chemistry						
6	V	20UCH6MBE3:1	Food and pharmaceutical Chemistry	5	5	3	25	75	100
		20UCH6MBE3:2	Polymer Chemistry						
6	V		Extension Activities	–	1	–	–	–	–
6	V	18UGS	Gender Studies	1	1	3	25	75	100
		Total		30	27	–	–	–	600
Overall Total				180	140	–	–	–	4300

List of allied Courses

	Allied Course – I	Allied Course II
	Physics	Botany
	Language Part – I	4
	Language Part – II	4
	Core Paper	9
	Core Practical	6
	Allied Paper	4
	Allied Practical	2
	Non – Major Elective	2
	Skill Based Elective	3
	Major Based Elective	3
	Environmental Studies	1
	Value Education	1
	Soft Skill Development	1
	Gender Studies	1
	Professional English for Physical Science – I	2
	Extension Activities	1 (Credit only)

* for those who studied Tamil upto 10th +2 (Regular Stream)

+ Syllabus for other Languages should be on par with Tamil at degree level

those who studied Tamil upto 10th +2 but opt for other languages in degree level under Part I should study special Tamil in Part IV

** Extension Activities shall be out side instruction hours

Non Major Elective I & II – for those who studied Tamil under Part I

a) Basic Tamil I & II for other language students

- b) Special Tamil I & II for those who studied Tamil upto 10th or +2 but opt for other languages in degree programme

Note:

		Internal Marks	External Marks
S.NO	CONTENT	INTERNAL	EXTERNAL
1	Theory	25	75
2	Practical	40	60
3	Separate passing minimum is prescribed for Internal and External marks		

FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks] The passing minimum for Semester Examinations shall be 40% out of 75 marks [i.e. 30 marks]

FOR PRACTICAL The passing minimum for CIA shall be 40% out of 40 marks [i.e. 16 marks] The passing minimum for Semester Examinations shall be 40% out of 60 marks [i.e. 24 marks]

Mark distribution for Practical:

- 1 Aim, Apparatus required, Tabulation – 15 + Experimental work – 15 + Calculation – 15 + Result with accuracy – 10 + Record – 05 + Internal assessment – 40 (Lab Attendance – 10 + Assignment – 05 + Observation Note – 05 + Model Exam – 20)

- 2 Every student shall undertake an industrial visit as a part of the curriculum once in the course period, to industrial units and R and D centres, to give a stress on the applied aspects. Extension and extracurricular activities should also be carried outside the class hours.

NME Offered:

Sem	Part	Course code	Title of the course	Hours/ week	Credit	Exam	CIA	ESE	Total
III	IV	20UCH3NME1	Chemistry In Everyday Life	2	2	3	25	75	100
IV	IV		Health	2	2	3	25	75	100

		20UCH4NME2	Chemistry						
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SEMESTER – I

Course Code: 20UCH1CC1

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE-I. GENERAL CHEMISTRY-I

Objectives:

- To learn the shape of atomic orbitals, various type of quantum numbers bonding in chemical compounds and organic molecules and influences of bonding.
- To understand the electronic effects, bonding and its influences and Gaseous State and behavior of the gases.

Learning Outcomes:

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

- Gain knowledge about various quantum numbers and occupancy of electrons on various quantum levels ii) Understand how the concept of electro negativity and its variation over the periodic table can be used to rationalize the nature of the bonding in substances.
- i) Students gain knowledge about the common themes running through ionic and covalent chemical bonding. ii) Get idea behind the structure and bond type of simple inorganic molecules.
- Students learn about organic compound with various functional groups and naming of organic compounds.
- Students can gain the knowledge on hybridization and geometry of organic molecule and Electronic effects, bonding and its influences on organic molecules.
- Students can gain knowledge about ideal gas and real gas in concept of Gaseous State

UNIT I: Periodic Properties

Atomic orbitals - Quantum numbers- Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance - principles governing the occupancy of electrons in

various quantum levels- Pauli's exclusion principle - Hund's rule- Aufbau Principle, (n+1) rule- Stability of half-filled and completely filled orbitals- inert pair effect-Periodic properties - classification of elements as s, p, d and f-block elements- variation of atomic volume - atomic and ionic radii - ionization potential - electron affinity and electro negativity along period and groups - variation of metallic characters - Factors affecting the periodic properties. Periodic table anomalies and variations in atomic radius, ionic radius, electronic configuration, electron affinity and electro negativity, ionization energy and metallic character of elements along the group and periods and their influences on stability, colour, coordination number, geometry, physical and chemical properties.

UNIT II: Chemical Bonding

Ionic bond-Properties of ionic compounds, factors favoring the ionic compounds ionization potential - electron affinity - electronegativity- Lattice energy - Born-Haber Cycle -Pauling and Mulliken's scales of electronegativity- Polarizing power and Polarizability -Partial ionic character from electronegativity- Fajan's rules - Covalent bond - structure and bonding of homo and heteronuclear molecules - Hydrogen bonding - Its nature, types, effect on properties - Intermolecular forces - London forces and vander Waals forces-ion dipole-dipole interactions- VSEPR Theory - Principles and hybridization- Shapes of simple inorganic molecules (BeCl_2 , NH_3 , H_2O , PCl_5 , SF_6 , IF_7) -MO Theory -Bonding and antibonding orbitals - Applications of MO theory H_2 , He, N_2 , O_2 , HF and CO molecules - Comparison of VB and MO Theories.

UNIT III: Classification and Nomenclature

Nomenclature of organic compounds - **common name**, IUPAC naming of simple aliphatic compounds containing different functional groups - naming of aromatic compounds and alicyclic compounds. Bond - Types of bonds - homolytic and heterolytic fission of bonds- orbital overlap - sigma and pi bonds - hybridization and geometry of molecules methane, ethane, ethylene, acetylene and benzene.

Unit IV: Bonding in Organic Molecules

Hybridization and geometry - bond angle, bond length, bond strength of CH and CC bonds -Van der Waal's interactions, Inter & Intra molecular forces and their effects on physical properties - Electronic effects - inductive effect, resonance effect, drawing of resonance structures - conditions

for resonance - stability of resonance structures, hyper conjugation, electromeric effect, steric effect - steric overcrowding - steric inhibition of resonance - steric relief (with examples)- Dissociation of bonds -homolysis and heterolysis- radicals, carbocations, carbanions - electrophiles and nucleophiles.

Unit V: Gaseous State

States of Matter, Gaseous state - The gas constant R in different units - Deviation from ideal behaviour - van der Waals equation for real gases - critical phenomenon - PV isotherm of real gases-critical temperature - critical volume - molecular velocities - root, mean square, average and most probable velocities - Maxwell law for distribution of molecular speed (No need of derivation) - collision number and mean free path - collision diameter.

TEXT BOOKS

1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemist (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993).
2. Lee J.D., Concise Inorganic Chemistry, UK, Black well science (2006).

REFERENCE

1. Puri B.R., Sharma L.R., Pathania M.S., Principles of Physical Chemistry, (23rd edition) New Delhi, Shoban Lal, Nagin Chand & Co., (1993).
2. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976).
3. Bahl B.S. and Arun Bahl, Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (1997).

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc., Chemistry

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH1CC1	GENERAL CHEMISTRY – I					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓			✓	✓	✓	✓		✓	
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓		✓	✓	✓		✓	✓	✓	✓	
Number of Matches(✓) = 40 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
80	0	0	0	80	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-II

Course Code: 20UCH2CP1

Exam Hours: 3

Instruction Hours: 3

Internal Marks: 40

Credits: 3

External Marks: 60

CORE PRACTICAL-I.VOLUMETRIC ANALYSIS

Objectives:

- To learn the techniques of titrimetric analyses.
- Get knowledge about handling procedure of chemical balance.

Learning Outcomes:

- Students can learn about basic techniques of titrimetric analyses
- Known the handling procedure of chemical balance.
- Identify the materials suitable reagents.
- Have knowledge on properties of acid and base.
- Know the different methods of titration

Experiments:

1. Estimation of HCl by NaOH using standard H₂SO₄ solution.
2. Estimation of HCl by NaOH using standard oxalic acid solution.
3. Estimation of Na₂CO₃ by HCl using standard Na₂CO₃ solution.
4. Estimation of oxalic acid by KMnO₄ using standard oxalic acid solution.
5. Estimation of FeSO₄ by KMnO₄ using standard Mohr's salt solution.
6. Estimation of KMnO₄ by Thio using standard K₂Cr₂O₇ solution.
7. Estimation of Fe²⁺ ion by K₂Cr₂O₇ using standard Mohr's salt solution.
8. Estimation of CuSO₄ by thio using standard K₂Cr₂O₇ solution.
9. Estimation of Ca(II) by EDTA solution.
10. Estimation of As₂O₃ by I₂ solution using standard As₂O₃ solution.
11. Estimation of Total Hardness of Water (Demonstration only)

REFERENCES

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical
3. N.S. Ganapragasam and G. Ramamurthy, Organic Chemistry - Lab manual, S. Viswanathan Co. Pvt., 1998.

B.Sc., Chemistry

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH1CP1	VOLUMETRIC ANALYSIS					3	3			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓			✓	✓	
CO3	✓	✓			✓	✓	✓	✓		✓	
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓		✓	✓	✓		✓	✓	✓	✓	
Number of Matches(✓) = 38 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
11	7	0	0	4	64	0	0	36	Local
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - II

Course Code: 20UCH2CC2

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE-I. GENERAL CHEMISTRY-II

Objectives:

- To know about basic metallurgical processes and s-block elements, radioactivity and nuclear chemistry.
- To learn the preparation, properties and importance of aliphatic hydrocarbons, Chemistry of Benzene and Students can get knowledge about liquid state.

Learning Outcomes:

- Get knowledge about metallurgy and compounds, biological importance of some s block elements
- Gain knowledge about principles of radioactivity and nuclear chemistry
- Students gain knowledge on the preparation, properties and reactions of aliphatic compounds.
- Students can get knowledge of synthesis and properties of Benzene.
- Students can learn about the behavior of liquids and can solve the problems regarding molecular velocities.

Unit I: Metallurgy and s block elements

Occurrence of metals- steps involved in the metallurgical processes concentration of ore by froth floatation, gravity separation and magnetic separation processes. Calcination- roasting- smelting- aluminothermic process- Purification of metals by electrolysis and zone refining. Position of Hydrogen in the periodic table- isotopes of hydrogen- ortho and para hydrogen. sBlock elements- alkali metals-general characteristics , oxides, hydroxides, halides-Alkaline earth metals-general

characteristics - preparation of gypsum and its role in setting of cement – preparation and properties of plaster of paris.

Unit II: Radioactivity and Nuclear chemistry

Radioactive Radiations, Laws of Radioactivity-Units of Radioactivity-Alpha Decay, Radiations emitted by radioactive substances, the half- life period, radioactive equilibrium, Soddy- Fajan group displacement law- Theory of radioactivity, N/P ratio, **packing fraction**. Isotopes- isobars and isotones- Applications of radio activity - Nuclear forces - packing fraction - mass defect - binding energy - Nuclear fission , atom Bomb and nuclear reactors - Nuclear fission, fusion reaction in the sun, Hydrogen bomb.

UNIT III: Aliphatic Compounds

Alkanes - preparations, physical properties, reactions, reactions with radical mechanism for substitution reaction - cracking - Alkenes: Preparation from alcohol, haloalkane, dihaloalkanes and alkynes - reactions of alkenes - mechanisms involved in addition of hydrogen, halogen, hydrogen halide, hypohalous acid, water, hydroboration, hydroxylation, ozonolysis and epoxidation - peroxide effect - allylic substitution, oxidation by KMnO_4 and polymerization - Application in the synthesis of following molecules - Dibenzyl (from toluene)-cis and trans 2-butene, propanal and 1-methyl cyclohexanol. Alkynes: preparation, reactions - addition of hydrogen, halogen, hydrogen halide, water, HCN , CH_3COOH , hydroboration - dimerisation and cyclisation - acidity of terminal alkynes.

Unit IV: Chemistry of Benzene

General methods of preparation of benzene - molecular orbital picture - aromatic character - anti **aromatic –non aromatic** Huckel's rule of aromaticity (Benzenoid and nonbenzenoid compounds) - Aromatic Electrophilic substitution Reactions of benzene- General Mechanism - Mechanism of Nitration, sulphonation, halogenations, Friedel-Craft's Alkylation and Acylations- Orientation and reactivity of mono- and di-substituted benzenes.

UNIT V: Liquid State

Properties of liquids, vapour pressure, measurement of vapour pressure, heat of vapourization, Trouton's rule, surface tension, measurement of surface tension, surface tension and vapour pressure. -Viscosity determination of viscosity, variation of viscosity with temperature and pressure, liquid crystals - definition, classification, structure, properties and applications. Colloids- types of colloidal systems, Electrical properties-Electrophoresis-Electroosmosis, protection of colloids - Gold number - Theories of protection - stabilities of Sols, **entropy properties of liquid.**

TEXT BOOK

1. P. L. Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised Edition (2007), Sultan Chand & Sons, New Delhi.
2. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi.

REFERENCES

1. R. D. Madan, "Modern Inorganic Chemistry", 2nd Edition (2008), S. Chand and Company Ltd., New Delhi.
2. B.S. Bahl and Arun Bahl, "Advanced Organic Chemistry," S. Chand and Company Ltd., New Delhi.
3. B. R. Puri and Sharma, "Principles of Physical Chemistry", Meerut Publications, Meerut.

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc., Chemistry

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH2CC2	GENERAL CHEMISTRY – II					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓			✓	✓	
CO3	✓	✓			✓	✓	✓	✓		✓	
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =40 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
63	0	0	0	63	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-II

Course Code: 20UCH2CP1

Exam Hours: 3

Instruction Hours: 3

Internal Marks: 40

Credits: 3

External Marks: 60

CORE PRACTICAL-I.VOLUMETRIC ANALYSIS

Objectives:

- To learn the techniques of titrimetric analyses.
- Get knowledge about handling procedure of chemical balance.

Learning Outcomes:

- Students can learn about basic techniques of titrimetric analyses
- Known the handling procedure of chemical balance.
- Identify the materials suitable reagents.
- Have knowledge on properties of acid and base.
- Know the different methods of titration

Experiments:

1. Estimation of HCl by NaOH using standard H₂SO₄ solution.
2. Estimation of HCl by NaOH using standard oxalic acid solution.
3. Estimation of Na₂CO₃ by HCl using standard Na₂CO₃ solution.
4. Estimation of oxalic acid by KMnO₄ using standard oxalic acid solution.
5. Estimation of FeSO₄ by KMnO₄ using standard Mohr's salt solution.
6. Estimation of KMnO₄ by Thio using standard K₂Cr₂O₇ solution.
7. Estimation of Fe²⁺ ion by K₂Cr₂O₇ using standard Mohr's salt solution.
8. Estimation of CuSO₄ by thio using standard K₂Cr₂O₇ solution.
9. Estimation of Ca(II) by EDTA solution.

10. Estimation of As₂O₃ by I₂ solution using standard As₂O₃ solution.
11. Estimation of Total Hardness of Water (Demonstration only)

REFERENCES

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
2. B.S. Furniss, A.J. Hannaford, P.W. G. Smith, A.R. Tatchell, Vogel's Text Book of Practical
3. N.S. Ganapragasam and G. Ramamurthy, Organic Chemistry - Lab manual, S. Viswanathan Co. Pvt., 1998.

SCHEME OF VALUATION	
CRITERIA	MARKS
Record	5
Tabulation	10
Procedure writing	10
RESULTS	
< 1 %	35
1 – 2%	30
2 – 3%	25
3 – 4%	15
>4%	10

B.Sc., Chemistry

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
I	20UCH1CP1	VOLUMETRIC ANALYSIS	3	3
Course	Programme Outcomes(POs)		Programme Specific Outcomes(PSOs)	

Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓		✓
CO2	✓	✓	✓	✓	✓	✓			✓	✓
CO3	✓	✓			✓	✓	✓	✓		✓
CO4	✓	✓	✓	✓	✓		✓			✓
CO5	✓		✓	✓	✓		✓	✓	✓	✓
Number of Matches(✓) = 38 Relationship: High										

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
11	7	0	0	4	64	0	0	36	Local
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - III

Course Code: 20 UCH3CC3

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE-III. GENERAL CHEMISTRY-III

Objectives:

- To understand the characteristics about the Boron, Carbon family and Nitrogen and Oxygen Group Elements.
- To understand the nature of Alicyclic Compounds , colloids, nano materials and Solid state

Learning Outcomes:

- Students can learn about the p-block elements, Boron and Carbon family.
- Students can learn about the p-block elements, Nitrogen & Oxygen family.
- Students can get knowledge of synthesis, reactions, and importance of alicyclic compounds.
- Learn the chemistry of colloids and Nano materials.
- Students gain knowledge about Solid state and properties.

UNIT I: Boron and Carbon Group Elements

Boron family - Comparative study of boron family elements, **Clathrates** - compounds of boron - diborane structure discussion - borax - boron nitride - boron carbide and borazole. Carbon family - Comparative study of carbon family elements and their compounds (hydrides, halides and oxides). Chemistry of cyanogens - Hydrocyanic acid - cyanic acid - thiocyanic acid - ammonium thiocyanate and carbon disulphide - structure of diamond and graphite.

UNIT II: Nitrogen and Oxygen Group Elements

Nitrogen family - Comparative study of nitrogen family elements and their compounds (oxides, halides, hydrides and oxyacids) - Chemistry of hydrazine, hydrazoic acid, hydroxyl amine and sodium bismuthate - Non aqueous solvents - classification - liquid ammonia as a solvent- Preparation - properties and uses of PH_3 , P_2O_5 and H_3PO_4 -Oxygen family - comparative study -

oxygen fluorides-Ozone - preparation-properties structural elucidation and uses - Green House effect - ozone hole and protection of ozone layer. Thionic acids - their preparation - properties - uses and structures - sodium hyposulphite and sodium thiosulphate - preparation - properties - uses.

UNIT - III: Alicyclic Compounds

Cycloalkanes: Preparation (small, medium & large ring compounds) - reactions -cycloaddition, dehalogenation, pyrolysis of calcium salt of dicarboxylic acid - Wurtz reaction-stability of cycloalkanes - Baeyer's strain theory-Cycloalkenes: Preparation and reactions of cycloalkenes - Preparation of conjugate dienes - reactions - 1,2 and 1,4 addition, polymerization and Diels-Alder reaction - Application in the synthesis of following molecules - trans 2-chlorocyclopentanol, trans-2 methylcyclopentanol, cis and trans 1,2 cyclohexanediol, cyclohexene, 2,3-butanedione and adipic acid.

UNIT IV: COLLOIDS AND NANOMATERIALS

Colloids - Distinguishing characteristics of colloids, suspensions and solutions- Types of colloidal dispersions-Optical properties-Tyndall effect- Kinetic properties - Brownian motion-Electrical properties-Helmholtz and diffuse double layers - electro kinetic or zeta potential - electrophoresis and its applications Coagulation - methods of coagulation - Hardy Schultz law - Hofmeister series - Protective colloids - protective action - gold number - applications- Emulsions - classification, preparation, Gels - preparation - properties (thixotropy, syneresis and imbibition). Nanomaterials-introduction-self-assembly - materials and molecules -self assembled mono layers- nano wires-types of nano particles- pure gold, silver and cobalt-metal oxides- alumina and titania- synthesis by physical vapor deposition method-reduction method.

Unit V: Solid state

Solid state - crystalline and amorphous solids, isotropic and anisotropic solids. Crystal systems (Cubic system only) space lattice and unit cell. Seven crystal systems - crystal structure of NaCl, CsCl. Packing in crystals - hcp, ccp, bcc. Bravais lattice - law of rational indices, Weiss indices and Miller indices. X- ray diffraction - Derivation of Bragg's equation - Determination of crystal structure - Laue's powder method. Adsorption on solids - Chemisorptions and physisorptions, potential energy diagrams - Freundlich, Langmuir, and BET adsorption isotherms (No Derivation).

TEXT BOOK:

1. J. D. Lee, Concise Inorganic Chemistry, 5th Ed., Blackwell Science, London, 1996.
2. B.S. Bahl and Arun Bahl, "Advanced Organic Chemistry," S .Chand and Company Ltd.,

REFERENCES:

1. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3rd Ed., W. H. Freeman and Co, London, 1999.
2. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992.
3. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 46th Edition, Vishal Publishing Company, New Delhi, 2013.

4.

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc., Chemistry

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
I	20UCH3CC3	GENERAL CHEMISTRY –					3	5				
		III										
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		
CO1	✓	✓	✓		✓	✓	✓	✓		✓		
CO2	✓		✓	✓	✓	✓			✓	✓		
CO3	✓	✓		✓	✓		✓	✓				
CO4	✓	✓	✓	✓	✓		✓			✓		
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		

Number of Matches(✓) =38 Relationship: High

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
98	0	0	0	98	0	0	0	100	Global

Local-Green; Regional-Pink; National-Blue; Global-Brown

SEMESTER – III

Course Code: 20UCH4CP3

Instruction Hours: 3

Credits: 3

Exam Hours: 3

Internal Marks: 25

External Marks: 75

SEMIMICRO ANALYSIS PRACTICAL – I

Objectives:

- To learn the techniques of semi micro qualitative analysis of inorganic salt mixtures.
- To understand the reaction problem

Course Outcomes:

- Students can learn about the Qualitative Analysis.
- Students can learn about the Simple anions and Interfering anions.
- Students can get knowledge of separation techniques.
- Learn the different reaction techniques.
- Students gain knowledge about sample report.

Inorganic Qualitative Analysis

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion.

Simple anions:

Carbonate, nitrate, sulphate, sulphide, sulphite, chloride and bromide.

Interfering anions:

Borate, fluoride, oxalate, phosphate, arsenite and chromate.

Cations:

Group I cations: Lead, silver, mercurous.

Group II cations: Mercuric, copper, cadmium, bismuth, antimony, tin.

Group III cations: Aluminium, ferrous, ferric, chromium.

Group IV cations: Cobalt, nickel, manganese, zinc.

Group V cations: Barium, strontium, calcium

Group VI cations: Magnesium, ammonium.

TEXT BOOK :

1. Vogel's Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London, 1974.
2. Joseph Lagowski and C. Sorum, Introduction to Semimicro Qualitative Analysis , 26 October 2004

REFERENCES

1. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai, 1974.
2. Dr. Mohammad Idrees and Dr. Naqui J. Siddiqui, Assistant Professor in Chemistry, Government Institute of Science, Nagpur ,semi micro qualitative analysis of inorganic cation mixture.
3. S N Lal, Modern Textbook of Chemistry Practicals, Swastik Publishers & Distributors

SCHEME OF VALUATION	
CRITERIA	MARKS
Record	5
Aim and tabulation	5
4 – radicals with correct procedure	50
3 – radicals with correct procedure	35
2 – radicals with correct procedure	25
1 – radical with correct procedure	15
spotting	10

B.Sc., Chemistry

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course				Hours	Credits				
I	20UCH4CP2	SEMIMICRO ANALYSIS PRACTICAL				3	3				
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓			
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =41 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
7	0	0	0	7	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-III

Course Code: 20UCH3NME1

Exam Hours: 3

Instruction Hours: 2

Internal Marks: 25

Credits: 2

External Marks: 75

NME -I. CHEMISTRY IN EVERYDAY LIFE

Objectives:

- To learn the water, agricultural, food and materials chemistry
- To understand the importance of food storage and usage in gasmitics

Learning Outcomes:

- Brings about the importance of Characteristics of water, soft water and hard water.
- Students can gain knowledge on Plant nutrients and fertilizers.
- They know the food classification and functions.
- Students can learn the Cosmetics and its function.
- Clearly brings knowledge on Polymers, Fibers, Dyes and Dyeing process.

UNITI: Water Chemistry

Water, Characteristics of water-**pH- conductance**-affects the pH - soft water and hard water-

Removal of hardness -Purification of water by ion exchange and reverse -osmosis methods- Water pollution: Sources and effects of water pollution (Domestic, Industrial,Agricultural),

Eutrophication-acid behavior -base behavior- in aquatic systems-

Heavy metals such as Hg, Cr, Cd, Zn, Cu and metals like Pb, As, Ba, Temperature, Radio activity-synthetic detergents etc,).

UNITII: Agricultural Chemistry

Plant nutrients-**micronutrient**-**macronutrient**- Requisites of good fertilizers, Effect of Nitrogen on plant growth, deficiency, symptoms - examples for nitrogenous fertilizers- Effect of Phosphorous on plant growth- deficiency, symptoms , examples for phosphatic fertilizers-Effect of potassium on plant growth, deficiency, symptoms, examples for potassium fertilizers -Functions of secondary and micronutrients.

UNITIII: Food Chemistry

Food, classification and functions, Digestion in mouth, stomach and intestine, Absorption, spoilages, preservation techniques (canning, dehydration, freeze-drying, salting, pickling, pasteurizing, fermenting and carbonating)-Food additives, colouring (Natural and synthetic colours)-List of permitted colours (Curcumin, Flavours, Flavouring agents -Anti oxidants, Emulsifiers, Acidulants and beverages- Soft drinks aerated water (ingredients and side effects).

UNIT IV: Cosmetic and other Materials

Cosmetics -Face powder -constituents, uses, side effects- Nail polish, hair dye -composition and side effects-Tooth powder -composition and manufacture-Lotions-Cleaning agents: Soaps- types and cleaning action -detergents -types -merits and demerits of soap and detergents -chemical definitions of shampoo, washing powder and bleaching powder.

UNIT V: Material Chemistry

Polymers: Explanations, uses and examples for thermo setting and thermo plastic polymers - Vulcanization of rubber-Fibers: Natural fibers (cellulosic and proteinous) -Semi synthetic (Rayon) Synthetic fibers (Poly ester, Nylon and Acrylic) -Pretreatment of fibers (Sizing, Desizing- Bleaching)-Dyes and Dyeing process: Difference between dye and pigment - Witt's colour theory-classification of dyes based on application (Direct, Vat, Acid, Reactive, Mordant and Disperse).

TEXT BOOK:

1. Jayashree Gosh, "Text book of Pharmaceutical Chemistry" New Delhi, S. Chand & Company Ltd.,(2003).
2. Alex Ramani, "Food Chemistry", MJP publishers (2009), Chennai.

REFERENCES:

1. K. Kumarasamy, A. Alagappa Moses and M. Vasanthi, "Environmental studies",
2. K. Bagavathi Sundari, "Applied Chemistry" MJP Publishers, (2006) Chennai.
3. Hesse P.R, A text book of soil chemical analysis John Murray, New York, 1971.

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc., Chemistry

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
I	20UCH3NME1	CHEMISTRY IN EVERYDAY LIFE	3	2						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓	✓	✓		✓	✓	✓	✓		✓
CO2			✓	✓	✓	✓			✓	✓
CO3		✓		✓	✓		✓	✓		
CO4	✓	✓	✓	✓	✓		✓			✓
CO5	✓	✓			✓	✓	✓	✓	✓	✓
Number of Matches(✓) =34 Relationship: Moderate										

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %	
	Local	Regional	National	Global	Local	Regional	National	Global		
50	0	0	0	50	0	0	0	100	Global	
Local-Green; Regional-Pink; National-Blue; Global-Brown										

SEMESTER - IV

Course Code: 20 UCH4CC4

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 5

External Marks: 75

GENERAL CHEMISTRY-IV

Objectives:

- To study the preparation and chemical reactions of alkyl and aryl halides and gain knowledge towards Acid Base chemistry and non-aqueous solvents and Quantum Chemistry.
- To study the preparation and properties of alcohols, Phenols Ethers and epoxides: study the Chemical Kinetics

Learning Outcomes:

- Important Name Reactions with mechanism involved in both the preparations
- Students can gain the knowledge about the Acid-base chemistry.
- The reactions of Alcohols, Phenols Ethers and Epoxides with mechanisms can be well understood
- Students can acquire knowledge about Chemical Kinetics
- Students can gain the knowledge about Quantum Chemistry

UNIT I: Halogen Family and Zero Group Elements

Comparative study of halogens and their compounds - oxides and oxy acids of halogens (structure only) **electronegativity-periodic tendency** - estimation of available chlorine in bleaching powder - basic properties of halogens. Interhalogen compounds - preparation, properties and uses - pseudo halogens - preparation, properties and uses of cyanogens and thiocyanogen - comparison with halogens. Zero group - position in the periodic table - isolation of noble gases from the atmosphere and uses - compounds of xenon - XeF_2 , XeF_4 , XeF_6 , XeO_3 , XeOF_4 - structure and uses.

UNIT II: Protic & Aprotic solvents

Non aqueous solvents: Classification of solvents - General properties of ionizing solvents-chemical reactions- Water, liquid ammonia, liquid SO_2 , Liq. N_2O_4 , liq. H_2S , liq. HF , liq. HCN , acetic acid, liq. BrF_3 and oxyhalides as solvents-Acid Base Chemistry- Theories of acids and bases - Arrhenius, Bronsted-Lowry theory proton donor - acceptor system-Theory of solvent system, Lewis-electron dot system and HSAB principle Usanovich concept-Acid-base Lux Flood Equilibria: pH of strong and weak acid solutions- Buffer solutions- Henderson equations- Preparation of acidic and basic buffers- Relative strength of acids and bases from K_a and K_b values.

Unit III: Chemistry of Alcohols, Phenols and Ethers

Nomenclature **IUPAC and Common** - laboratory preparation of alcohols - industrial source of alcohols - physical properties - chemical properties - uses - chemistry of glycols and glycerols - uses - preparation of phenols including di and tri hydric phenols - physical and chemical properties - uses - aromatic electrophilic substitution mechanism - theory of orientation and reactivity, laboratory preparation of ethers, epoxides - physical properties - chemical properties - uses - introduction to crown ethers - structures - applications.

UNIT IV: Chemical Kinetics

Rates of reaction, rate laws, rate constants, order and molecularity of reactions. Rate equations for zero, first, second and third order reactions- Derivation of rate constants for first, second order reactions. Fractional order reactions - examples, half-life period, pseudo-first order reactions – examples- Methods of determining the order of reactions- Integration, graphical, half-life and Ostwald's isolation methods-Temperature dependence of reaction rates - Arrhenius parameters and calculations.

Unit V: Basic Quantum Chemistry

CGS and SI units - Basic units - derived units - subsidiary units - dimensional analysis - Quantum theory and atomic spectra - Bohr's model of atom - Limitations of Bohr model - Sommer field's model - photo electric effect -Compton effect - de Broglie equation - Davisson and Germer experiment - Heisenberg's uncertainty principle - Schrödinger's wave equation (statement only)

Particle in a box- Eigen values - Eigen function - Significance of Ψ and Ψ^2 - Radial and angular distribution function - Concept and Shapes of orbitals.

TEXT BOOK :

1. P. L. Soni, Mohan Katyal, "Text book of Inorganic Chemistry", 20th Revised edn., (2007), Sultan Chand & Sons, New Delhi.
2. B.S.Bahl and ArunBahl, "Advanced Organic Chemistry," S.Chand and Company Ltd., New Delhi.

REFERENCES:

1. R. D. Madan, "Modern Inorganic Chemistry", 2nd edn., (2008), S. Chand and Company Ltd., New Delhi.
2. K.S.Tewari and N.K.Vishnoi, "A Text book of Organic Chemistry", (2006), 3rd edition, Vikas Publishing House Pvt. Ltd.
3. D.N.Bajpai, "Advanced Physical Chemistry", S. Chand and Company Ltd., New Delhi.

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc., Chemistry

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20 UCH4CC4	GENERAL CHEMISTRY – IV					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3		✓		✓	✓		✓	✓			
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =40 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
80	0	0	0	80	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-IV

Course Code: 20UCH4CP2

Exam Hours: 3

Instruction Hours: 3

Internal Marks: 25

Credits: 3

External Marks: 75

SEMIMICRO ANALYSIS PRACTICAL

Objectives:

- To learn the techniques of semi micro qualitative analysis of inorganic salt mixtures.
- To understand the reaction problem

Learning Outcomes:

- Students can learn about the Qualitative Analysis.
- Students can learn about the Simple anions and Interfering anions.
- Students can get knowledge of separation techniques.
- Learn the different reaction techniques.
- Students gain knowledge about sample report.

Inorganic Qualitative Analysis

Analysis of a mixture containing two cations and two anions of which one will be an interfering ion.

Simple anions:

Carbonate, nitrate, sulphate, sulphide, sulphite, chloride and bromide.

Interfering anions:

Borate, fluoride, oxalate, phosphate, arsenite and chromate.

Cations:

Group I cations: Lead, silver, mercurous.

Group II cations: Mercuric, copper, cadmium, bismuth, antimony, tin.

Group III cations: Aluminium, ferrous, ferric, chromium.

Group IV cations: Cobalt, nickel, manganese, zinc.

Group V cations: Barium, strontium, calcium

Group VI cations: Magnesium, ammonium.

TEXT BOOK :

1. Vogel's Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London, 1974.
2. Joseph Lagowski and C. Sorum, Introduction to Semimicro Qualitative Analysis , 26 October 2004

REFERENCES

1. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai, 1974.
2. Dr. Mohammad Idrees and Dr. Naqui J. Siddiqui, Assistant Professor in Chemistry, Government Institute of Science, Nagpur ,semi micro qualitative analysis of inorganic cation mixture.
3. S N Lal, Modern Textbook of Chemistry Practicals, Swastik Publishers & Distributors

SCHEME OF VALUATION	
CRITERIA	MARKS
Record	5
Aim and tabulation	5
4 – radicals with correct procedure	50
3 – radicals with correct procedure	35
2 – radicals with correct procedure	25
1 – radical with correct procedure	15
spotting	10

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course				Hours	Credits				
I	20UCH4CP2	SEMIMICRO ANALYSIS PRACTICAL				3	3				
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓			
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =41 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
7	0	0	0	7	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - IV

Course Code: 20UCH4NME2

Exam Hours: 3

Instruction Hours: 2

Internal Marks: 25

Credits: 2

External Marks: 75

HEALTH CHEMISTRY

Objectives:

- To understand the chemistry behind drugs, enzymes and diseases
- To enable the students to acquire knowledge about drugs, Body Fluids and applications.

Learning Outcomes:

- Brings about the importance of remedies and sanitation.
- Students can gain knowledge on drugs and applications.
- They know the Body Fluids and its important.
- Students can learn the Enzymes and Hormones.
- Clearly brings knowledge on Common Diseases and remedies.

UNIT I: Health

Definition, Food-classification of food- digestion- Food-Pyramid – Health- Hygiene- mal- under-over nutrition- their causes - remedies- sanitation.

UNIT II: Drugs

Drugs - Types of drugs-depressant- anticonvulsant- narcotics- antipyretics- antibiotics- anti-septics- analgesics- muscle- relaxants - cardio-vascular - vaso-depressants- steroids (Only Applications).

UNIT III: Body Fluids

Blood -volume- groups-coagulation- blood -pressure- anaemia- blood- sugar- haemoglobin- -Chemistry of urine.

UNIT IV: Enzymes and Hormones

Types of enzymes, enzyme -action- Characters of -hormones- action- examples of essential- hormones.

UNIT V: Common Diseases

Common -diseases -**Diabetes- Depression- anxiety**-Jaundice, vomiting, fever- night blindness- ulcer- diabetes.

TEXT BOOK:

1. Alex V Ramani, Food Chemistry, MJP Publishers, Chennai, 2009
2. Jayashree Ghosh, A Text book of Pharmaceutical Chemistry, S. Chand and Co.Ltd, 1999.

REFERENCES:

1. Deb A C, Fundamentals of Biochemistry, New Central Book Agency, Calcutta, 1994.
2. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing House, New Delhi, 2003.
3. Ashutosh Kar, Medicinal Chemistry, Wiley Easterns Limited, New Delhi, 1993.

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH4NME2	HEALTH CHEMISTRY					3	2			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO3				✓	✓		✓	✓			
CO4	✓	✓	✓	✓	✓		✓			✓	

CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =38 Relationship: High										

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
57	0	0	39	18	0	0	68	32	National
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER – V

Course Code: 20UCH5CC5

Instruction Hours: 5

Credits:5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

INORGANIC CHEMISTRY – I

Objectives:

- The students will acquire knowledge of transition metal alloys, applications of transition and inner transition elements.
- The students become familiar with the nomenclature and theories of coordination compounds and students to understand the development and uses of bioinorganic compounds.

Learning Outcomes:

- The students will acquire knowledge of transition metal alloys, applications of transition and inner transition elements.
- The students will be able to acquire f – block elements of transition and the elements.
- The students become familiar with the nomenclature and theories of coordination compounds.
- Enable the students to apply the theory to the complexes and applications of coordination complexes in inorganic analysis.
- The students will have a better understanding of hemoglobin, myoglobin, vitamin B₁₂ and role of metal ions in biological systems.

UNIT I: Transition metals (d block elements)

First, second and third transition series - General characteristics -Metallic character, atomic and ionic radii-oxidation states, colour, complex formation, catalytic and magnetic properties-Non stoichiometric compounds- Important compounds of transition metals- Ziegler Natta catalyst- Prussian blue, Sodium nitro prusside, Turnbull's blue, Nickel DMG complex, Wilkinson's Catalyst- KMnO_4 and $\text{K}_2\text{Cr}_2\text{O}_7$.

UNIT II: Inner transition metals (f block elements)

Lanthanides: Properties of lanthanides- Electronic configuration -oxidation states -ionic radii, lanthanide contraction- Colour and magnetic properties- Extraction of mixture of lanthanides from monazite sand and separation of lanthanides- Uses of lanthanides- Actinides: Sources of actinides - preparation of transuranic elements - Electronic configuration -oxidation states -ionic radii -Colour of ions -comparison with lanthanides- Extraction of thorium from monazite sand- Production and uses of plutonium.

UNIT III: Coordination compounds I

Basic concepts Coordination compounds -central metal ion -ligands-types of ligands- mono dentate, Bi dentate, poly dentate -coordination number, oxidation numbers, and coordination sphere -Nomenclature isomerism (structural and stereo) - Werner's theory of complexes- EAN rule -Magnetic properties- VB theory- applications and limitations, Factors affecting stability of complexes- Crystal Field theory- Crystal field splitting in octahedral, tetrahedral and square planar fields -factors influencing the magnitude of crystal field splitting -CFSE calculations- magnetic properties and color.

UNIT IV: Coordination compounds II

Labile and inert complexes- stepwise and overall stability constants- Reaction mechanism - substitution reactions in octahedral complexes -Acid hydrolysis- S_N1 and S_N2 mechanisms - mechanism of electron transfer reactions -inner sphere and outer sphere mechanisms -Two electron transfer reactions -Complementary and non- complementary reactions- Application of coordination compounds - separation of copper and cadmium ions, estimation of nickel using DMG and aluminium using oxine.

UNIT V: Bioinorganic Chemistry

Metal ions in biology and their vital role in the active site, Structure and functions of Metallo proteins and enzymes- Structures and characteristic features of Haemoglobin and myoglobin - Vitamin B₁₂- Biological functions of haemoglobin and myoglobin, cytochromes and ferredoxins, carbonate bicarbonate buffering system and carbonic anhydrase- Biological nitrogen fixation, Photosynthesis: Photosystem I.

TEXT BOOK:

1. R-D-Madan -“Modern Inorganic Chemistry” (1987), S-Chand & Co Pvt Ltd-, New Delhi
2. P-L- Soni -“Text book of Inorganic Chemistry- S- Chand & Co -, New Delhi (1999)-

REFERENCES:

1. Puri B-R-, Sharma L-R-, Kalia K-K-, Principles of Inorganic Chemistry, (23rd edition)New Delhi, Shoban Lal, Nagin Chand & Co-,(1993)-
2. Lee J-D-, Concise Inorganic Chemistry, UK, Black well science (2006)-
3. Warren Gibbs, Concepts and Applied Principles of Bioinorganic Chemistry: Volume III: 3: 2015

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH5CC5	INORGANIC CHEMISTRY – I					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓	✓		✓	✓	✓	✓	✓			
CO4	✓	✓	✓	✓	✓		✓			✓	

CO5			✓	✓			✓	✓	✓	✓
Number of Matches(✓) =37 Relationship: High										

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
60	0	0	0	60	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -V

Course Code: 20UCH5CC6

Instruction Hours: 5

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ORGANIC CHEMISTRY I

Objectives:

- To understand about stereo chemistry, symmetry elements, optical activity and conformational analysis of acyclic and cyclic compounds and To know the Mechanism of Alkyl and Aryl halides-
- To know the Methods of synthesis of aldehydes, ketones and carboxylic acids, Heterocyclic compounds and Rearrangements mechanism-

Learning Outcomes:

- Students can gain the knowledge on stereo chemistry, symmetry elements, optical activity and conformational analysis of acyclic and cyclic compounds-
- Students can get the knowledge on the mechanism of Alkyl and Aryl halides-
- Students can derive an easy and elegance way of giving methods of synthesis of aldehydes/ketones/carboxylic acids-
- It brings an idea of the synthesis, reactions, applications and important features of heterocyclic compounds-
- It reveals the types of rearrangement reactions and its synthetic applications-

Unit I: Isomerism

Structural isomerism - types with examples -tautomerism -ketoenol, nitroacinitro, amido imido- Stereoisomerism –Definition, classification, Optical isomerism, Optical activity, conditions for optical activity- Asymmetric centre -Chirality - Elements of symmetry, Optical activity of lactic and tartaric acids – Racemization, Resolution Various methods of resolving a racemic mixture - Asymmetric synthesis, Walden's inversion- R & S Notations -Cahn Ingold -Prelog rules -Erythro and threo representations- Geometrical Isomerism-Cis trans, Syn Anti and E Z notations.

UNIT II: Alkyl and Aryl halides

Nomenclature IUPAC name common name - General methods of preparation of haloalkanes - Physical properties - Chemical properties - Uses - Nucleophilic substitution mechanisms (SN1, SN2 and SNi) - Evidences - Stereochemical aspects of Nucleophilic substitution mechanisms - General methods of preparation of halobenzenes - Physical properties - Chemical properties - Uses - Mechanisms of electrophilic and nucleophilic substitution reactions - Theory of orientation and reactivity-

Unit III: Carbonyl Compounds and their Derivatives:

Nomenclature - Laboratory preparation of aliphatic carbonyl compounds - Physical properties - Chemical properties - Uses - Molecular Orbital picture of Carbonyl group - Nucleophilic addition mechanism at carbonyl group - Acidity of alpha-hydrogen - General methods of preparation of aromatic carbonyl compounds - Physical and Chemical properties - Uses - Effect of aryl group on the reactivity of carbonyl group - Perkin, Knoevenagel condensations, Cannizzaro reaction-

Nomenclature - General methods of preparation of carboxylic acids (including Arndt-Eistert synthesis) - Physical properties - Structure and acidity - Chemical properties - preparation of dicarboxylic acid - Physical and Chemical properties - Uses - Introduction to Derivatives of Carboxylic acids - nucleophilic substitution mechanism at acyl carbon - Acyl chlorides, Anhydrides - Esters - Amides.

UNIT IV: Heterocyclic compounds

Preparation, properties and uses of furan, pyrrole, thiophene and pyridine - Comparative basic characters of pyrrole, pyridine and piperidine with alkyl amines - Synthesis and reactions of Quinoline, Isoquinoline and Indole with special reference to Skraup, and Fischer indole synthesis - Fischer Napieralski synthesis - Polynuclear hydrocarbons: Naphthalene - anthracene and phenanthrene - preparation - properties and uses.

Unit V: Rearrangements

Rearrangement to electron-deficient carbon - 1,2 shift (Wagner Meerwein rearrangement, pinacol rearrangement, dienone phenol; Wolff rearrangement, benzyl benzylic acid rearrangement) - Aromatic rearrangements from oxygen to ring carbon - Fries, Claisen and benzidine rearrangement-

Rearrangement to electrondeficient nitrogen -Beckmann, Schmidt, Hofmann, Lossen, Curtius rearrangement)- Rearrangement to electron-deficient oxygen- Baeyer Villiger oxidation-hydroperoxide rearrangement, cumenehydroperoxide-phenol rearrangement, Dakin reaction.

TEXT BOOK:

1. B- Y- Paula, Organic Chemistry, 3rd Edition, Pearson Education, Inc-(Singapore), New Delhi, reprint, 2002
2. Bahl and Arun Bahl, Organic Chemistry, S- Chand and Sons, New Delhi, 2005

REFERENCES:

1. R- T- Morrison And R- N- Boyd, Organic Chemistry, 6th Edition, Printice-Hall Of India Limited, New Delhi, 1992
2. T- W- Graham Solomons, Organic Chemistry, 6th edition, John Wiley and Sons, 1996
3. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley And Sons, New York,

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH5CC6	ORGANIC CHEMISTRY I					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓		✓	✓	✓	
CO3	✓	✓		✓	✓	✓		✓			
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5			✓	✓			✓	✓	✓	✓	
Number of Matches(✓) =35 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
78	0	0	0	78	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -V

Course Code: 20UCH5CC7

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

PHYSICAL CHEMISTRY -I

Objectives:

- To learn the fundamentals of Law of Thermodynamics, Thermo Chemistry and Phase Rule-
- To know the basic principles of spectroscopy ii) To learn the principles of rotational spectroscopy and group theory-

Learning Outcomes:

- Students can gain knowledge on thermodynamics and thermo chemistry-
- Students can gain knowledge on various thermodynamics theorem-
- Students can learn the third law of thermodynamics and Phase rule-
- Students can gain knowledge on general basic principles of spectroscopy- students can acquire knowledge on rotational spectroscopy and its applications-
- Students can learn the basics of group theory

Unit I: First Law of Thermodynamics and Thermo Chemistry

Introducing State Variables Energy enthalpy specific heats first law applied to systems Terms used in thermodynamics -Conservation of energy, internal energy, work and heat, state function, path function, exact and inexact differentials, zeroth law of thermodynamics, first law of thermodynamics- definition, heat capacity - C_p and C_v - Joule Thomson effect -definition, Joule Thomson co-efficient and inversion temperature- Calculation of ΔU , ΔH , q and w for ideal gases, calculation of ΔU , ΔH , q and w for real gases - Reversible and irreversible isothermal expansion, reversible and irreversible adiabatic expansion- Thermo chemistry: Change of internal energy and enthalpy in a chemical reaction, Enthalpy of reaction at constant volume and at constant pressure, Enthalpy of combustion, formation, neutralization, dissociation, solution, hydration, dilution, precipitation- Enthalpies of compounds and formation of ions, Kirchhoff equation, Hess's law and its application.

UNIT II: Second Law of Thermodynamics

Need for the law, spontaneous process, Carnot's cycle, efficiency of Carnot's engine, Carnot's theorem, thermodynamic scale of temperature, entropy - Concept of entropy, entropy as a state function, entropy change in isothermal expansion of ideal gas, entropy change in reversible and irreversible processes- Entropy change accompanying change of phase -Solid to liquid, liquid to vapour crystalline changes, isothermal, isochoric and isobaric processes, entropy of mixture of ideal gases, entropy of mixing, Physical significance of entropy- Other state functions -Free energy, work functions, variation of G with T and P, Maxwell's relations $-\Delta A$, ΔG , Criteria for spontaneity and equilibrium- Gibb's Helmholtz equation and its applications.

UNIT III: Third Law of Thermodynamics and Phase Rule

Third law of thermodynamics - Nernst heat theorem, Third law of thermodynamics, Determination of absolute entropies, Absolute entropies of elements and compounds, Application of Third law- Phase Rule - Definition of the terms -Phase, components, degrees of freedom, derivation of Gibbs's phase rule, one component system -H₂O, CO₂, and Sulphur systems, two components system -Simple eutectic system – Pb Ag, freezing mixture, compound formation with congruent melting points - FeCl₃.H₂O system, compound formation with incongruent melting points - Na₂SO₄.H₂O system.

Unit IV: Spectroscopy I

Electromagnetic radiation, quantisation of energies in molecules (Translational, rotational, vibrational and electronic) -Microwave spectroscopy -condition -molecular rotation -theory of microwave spectroscopy -selection rule -effect of isotopic substitution -Calculation of R and bond length of diatomic molecules- Infrared spectroscopy -condition -molecular vibration -modes of vibration of linear and Non-linear molecules -Diatomic CO₂, H₂O -stretching and bending vibrations -selection rules -calculation of force constant -isotope effect -Applications of IR spectra -(Group frequencies, finger printing - Hydrogen bonding only).

Unit V: Group theory

Symmetry elements -symmetry operations -various point groups with examples -point groups - identification and determination -comparison of molecular and crystallographic symmetry-group multiplication table-Matrix representation of symmetry operations.

TEXT BOOK:

1. P-W- Atkins, Physical chemistry, Oxford university press, 1978-
2. K- L- Kapoor, A textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Ltd, 1994-

REFERENCES:

1. S-H- Maron and J-B- Lando, Fundamentals of physical chemistry, Macmillan limited, New York, 1966-
2. B-R- Puri and L-R- Sharma, Principles of physical chemistry, Shoban Lal Nagin Chand and Co- 33rd edition, 1992-
3. Gilbert- W- Castellan, Physical chemistry, Narosa publishing house, third edition 1985-

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH5CC7	PHYSICAL CHEMISTRY – I					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓	✓	✓		✓	✓	✓	
CO3	✓	✓		✓	✓	✓		✓			
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5		✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =38 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
57	0	0	0	57	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-V

Course Code: 20UCH5CP5

Exam Hours: 3

Instruction Hours: 3

Internal Marks: 40

Credits: 3

External Marks: 60

CORE COURSE PRACTICAL 3 -PHYSICAL CHEMISTRY PRACTICAL

Objectives:

- To study phase rule and its applications
- To understand the concept of chemical equilibrium

Learning Outcomes:

- enable the students to learn phase rule and its applications
- Be able to learnunderstand the concept of chemical equilibrium
- Understands fundamentals of conductometric and potentiometric titrations-
- Understands the strong electrolyte and its function-
- Able to Understands strength of a strong acid and base-

Experiments

1. Critical Solution Temperature of Phenol –Water system.
2. Effect of impurity (NaCl) on Critical solution Temperature of Phenol –Water system.
3. Determination of Transition Temperature of a salt hydrate.
4. Determination of molecular weight by Rast's macro method.
5. Phase diagram (Simple eutectic system).
6. Determination of rate constant of acid-catalysed hydrolysis of an ester.
7. Determination of equivalent conductance of a strong electrolyte by conductometry method.
8. Determination of strength of strong acid (HCl) by conductometry using NaOH.
9. Determination of strength of a strong acid by potentiometry.
10. Determination of strength of Ferrous Ammonium Sulphate by potentiometry using KMnO_4 (Redox titration)

REFERENCE BOOK(s):

1. Venkateswaran V- Veerasamy R- Kulandaivelu A-R-,Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons(1997)

- Daniels et al-, Experimental Physical Chemistry, (7th edition), New York, McGraw Hill,(1970).
- Findlay, A-, Practical Physical Chemistry, (7th edition), London, Longman (1959)

Scheme of valuation

Criteria	marks
Record	5
Aim and tabulation	10
calculation	10
Results	
Allowed error 5%	35
5 – 10%	20
10%<	10

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH5CP3	PHYSICAL CHEMISTRY PRACTICAL					3	3			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓	✓	✓	✓	✓	✓		✓			
CO4	✓	✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =42 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
10	6	0	0	4	60	0	0	40	Local
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -V

Course Code: 20UCH5MBE1

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 5

External Marks: 75

ANALYTICAL CHEMISTRY

Objectives:

- To provide the basic idea about the instrumental analysis and analytical techniques and To know about important terminologies involved in Error analysis-
- To understand the concepts of theory behind the titrimetric analysis, concentration units, standard solutions, strong & weak acid, base etc-, and To study about the principles and classification of separation methods, and also to provide, the methods of separation techniques and its applications-

Learning Outcomes:

- Students can enable to handling the instruments with the proper analytical methods and also gives the safety measurements towards the laboratory techniques-
- It brings about terms and methods of finding error analysis, and can able to determine the sources of errors and its effects towards analytical results-
- It can enable the methods for doing titrimetric techniques along with the details of aqueous & non-aqueous solvents, strong and weak acid base concepts-
- Brings about the methods of gravimetric analysis; can able to know the concepts and methods of precipitation techniques and Thermal Gravimetric Analysis-
- Clearly brings about the principles and methods of separation techniques and their applications-

Unit I: Basic concepts of analytical chemistry

Role of Analytical Chemistry- Classification of analytical methods -classical and instrumental-
Types of instrumental analysis- Selecting an analytical method - Neatness and cleanliness -
Laboratory operations and practicals - Analytical balance - Techniques of weighing, errors,
Volumetric glassware-cleaning and calibration of glassware- Sample preparations -dissolution and

decompositions- Gravimetric techniques- Selecting and handling of reagents- Laboratory notebooks- Safety in the analytical laboratory.

Unit II: Errors and their Evaluation

Definition of terms mean and median- Precision-standard deviation, relative standard deviation- Accuracy-absolute error, relative error- Types of errors in experimental data-determinate (systematic), indeterminate (or random) and gross- Sources of errors and the effects upon the analytical results- Methods for reporting analytical data- Statistical evaluation of data-indeterminate errors- The uses of statistics.

Unit III: Titrimetric Analysis

Theoretical considerations of titrimetric analysis -classification of reactions in titrimetric analysis - standard solutions -concentration units -primary and secondary standards -Neutralisation indicators -apparent indicator constant -universal or multiple -Range indicators- Neutralisation curves - Neutralisation of strong acid with strong base, weak acid with strong base, weak base with strong acid, weak acid with weak base and polyprotic acid with strong base- precipitation titrations, redox titrations, self-indicators, external indicators, starch, EMF as an indicator of End Point- Complexometric titration, EDTA titrations, EBT and murexide indicator- Titrations in non-aqueous solvents -solvents for non-aqueous titrations - Indicators for non-aqueous titrations.

Unit IV: Gravimetric Analysis

Principles of gravimetric analysis -characteristics of precipitating agents -choice of precipitants and conditions of precipitation -specific and selective precipitants -DMG, cupferron, salicylaldehyde, ethylene diamine -use of sequestering agents -co precipitation -post precipitation -peptisation - differences reduction of error -precipitation from homogeneous solutions -calculations in gravimetric methods -use of gravimetric factor- Thermal analytical methods -Principle involved in thermogravimetric analysis and differential thermal analysis.

Unit V: Separation Methods

Solvent extraction: Principles and process of solvent extraction -Distribution law and the partition coefficient -Batch extraction -Continuous extraction- Classification of chromatographic methods, Principles of differential migration and adsorption phenomenon -Nature of the adsorbent solvent systems -R_f values -Paper chromatography -various modes of development: ascending, descending and horizontal, Detection of spots -Two dimensional - reversed phase and preparative paper

chromatography, Thin layer chromatography -Coating materials -Preparation of plates -Solvents for development and detection -Preparative TLC - Application of Column chromatography- Adsorption and partition methods: Nature of the column materials, preparation of the column, solvent system and detection methods.

TEXT BOOK:

1. Sharma, B-K-, Instrumental Methods of Chemical Analysis, Coel Publishing House, Merrut, (1997)
2. Gopalan- R-, Subramaniam P-S- and Rengarajan K-, Elements of Analytical Chemistry, Sultan Chand and Sons-

REFERENCES:

1. Douglas A- Skoog and Donald M- West, F-J- Holler, Fundamentals of Analytical Chemistry, 7th edition, Harcourt College Publishers-
2. Mendham J-, Denney R-C-, Barnes J-D-, Thomas M-, Vogel's Text book of Quantitative Chemical analysis 6th edition Pearson education-
3. Usharani S-, Analytical Chemistry, Macmillian-

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH5MBE1	ANALYTICAL CHEMISTRY					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2		✓	✓	✓		✓	✓	✓	✓	✓	
CO3		✓		✓		✓		✓			
CO4	✓	✓	✓	✓	✓		✓			✓	
CO5		✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =36 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
80	0	0	0	80	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -VI

Course Code: 20UCH6CC8

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 40

Credits: 6

External Marks: 60

ORGANIC CHEMISTRY II

Objectives:

- To know the synthetic strategies and Natural Products and Biochemistry Carbohydrates and its reaction-
- To study the applied chemistry in the form of synthesizing Dyes, and rubbers and basic concepts involved in spectroscopic techniques and their instrumentation techniques along with its applications-

Learning Outcomes:

- It brings about the synthetic strategies and terminologies involved in organicsynthesis and the role of important reagents in organic synthesis-
- Students can learn about the classification, structure and properties of Alkaloids, Terpenoids, Steroids, Hormones, Amino acids and proteins-
- Students can able to notify different types of carbohydrates and its structural properties
- Students can able to identify the green route, to apply the synthesis of Dyes and Rubbers in the Industry; and also give an idea towards Microwave and ultrasound methods-
- Can able to know all the spectroscopic techniques in the electromagnetic spectrum- Study of Instrumentation techniques very much useful to identify the simple as well as complex organic molecules-

UNIT I: Synthetic methodology and reagents

Synthetic terminology - Disconnection, synthon, synthetic equivalent (SE), Functional group interconversion (FGI), Target molecule (TM)- retro synthetic analysis - Linear, Convergent and Combinatorial syntheses- List of Nucleophilic reagents and electrophilic reagents- Synthetic applications of malonic ester and ethylacetoacetate in the synthesis of a) monocarboxylic acids

(propionic acid and n butyric acid)- b) dicarboxylic acids (succinic acid and adipic acid)- c) α,β unsaturated carboxylic acids d) heterocyclic compounds- Retrosynthesis of the following molecules
4 methyl acetophenone, methylcyclohex 3 enecarboxylate, phenylethylbromide, 2 methylcyclopentane and 2allyl phenol Role of following reagents in organic synthesis: DIBAL, Gilmann reagent, DCC, trimethylsilylchloride and methyl lithium.

UNIT II: Natural Products and Biochemistry

Alkaloids: Definition - classification with suitable examples for each class - properties - structural determination - Sources, isolation, physiological activities and structure of piperine, conine, cocaine and quinine- Terpenoids- definition, isoprene rule and classification with suitable examples - Isolation, properties, structure and uses of citral, geraniol and limonene- Steroids and Hormones: definition -classification-Occurrence, structure and physiological activities of cholesterol, estrogens and testosterone- Amino acids - introduction **structure, examples of amino acid** - classification, preparation, properties and reaction of amino acids- Zwitter ion, isoelectric point- Peptides - polypeptides - synthesis and end group analysis- Proteins-classification based on physical, chemical properties and physiological functions- Primary, secondary and tertiary structures of protein Nucleic acids - nucleotides, nucleosides, heterocyclic bases and sugars- DNA and RNA, biological functions.

UNIT III: Carbohydrates

Basics of Carbohydrates, Classification- Stereochemistry of carbohydrates- D and L configurations - Erythro and threo diastereomers - Anomers and epimers with suitable examples- structural elucidation of glucose and fructose, Reactions of glucose and fructose - osazone formation - Anomers of glucose- mutarotation and its mechanism - cyclic structure -and determination of ring size - configuration of monosaccharides- Epimerization, ascending and descending of aldoses and ketoses- Inter conversion of aldoses and ketoses- Disaccharides- α and β glucosidic linkages with suitable examples - 1,4' and 1,6' linkages with suitable examples-reactions and structural elucidation of maltose and sucrose polysaccharides starch and cellulose - properties, uses and structure of amylase and glycogen

UNIT IV: Industrial Organic Chemistry

Dyes theory of color and constitution - chromophore, auxochrome, classification according to application and structure - preparation and uses of nitro dyes - naphthol yellow, nitroso fast green O, azo dyes, methyl orange, triphenyl methane dyes - malachite green, indigo dyes- Indigotin, anthraquinone dyes - alizarin, phthalein dyes –fluorescein-Polymers-definition-types of polymers-mechanism of cationic, anionic and free radical polymerisation -thermo setting polymers - preparation of caprolactam, Nylon 66, polyester, epoxide resin- Nylon 6, Dacron, Bakelite, melamine, neoprene, Buna N, Buna S and biodegradable polymers- molecular weight of polymers (elementary treatment)-Green Chemistry - Definition, need and basic principles of green chemistry - green synthesis - Aqueous phase reactions, reactions in ionic liquids, Solid supported synthesis, Solvent free reactions (solid phase reactions), - Green catalysts - Phase transfer catalysts (PTC) and Biocatalysts- Microwave and Ultrasound assisted green synthesis- green chemical synthesis of Paracetamol.

UNIT V: Organic Spectroscopy

UV VIS spectroscopy - types of electronic transitions - solvent effects on λ_{\max} - Woodward -Fieser rules - calculation of λ_{\max} : dienes and α, β unsaturated carbonyls IR spectroscopy - number and types of fundamental vibrations - modes of vibrations and their energies, position of IR absorption frequencies for functional groups like aldehyde, ketone, alcohol, acid and amide- factors affecting the frequency absorption - conjugation, inductive effect and hydrogen bonding- NMR spectroscopy - principle - equivalent and non equivalent protons - shielded and deshielded protons, anisotropy, chemical shift - TMS, tau and delta scales, integral, splitting of signals - spin -spin coupling, NMR spectrum of EtOH, n - propyl bromide and isopropyl bromide- Mass Spectrometry:Basic principles - instrumentation - Representation of mass spectrum- Molecular ion -identification of parent ion - isotopic peaks - Determination of molecular formula - meta stable peak- General fragmentation - McLafferty rearrangement–Retro Diels Alder rearrangement-Mass spectra of ethylbenzene, methoxyethane, acetophenone, n butyl amine, 1 propanal and 1pentanol.

TEXT BOOK:

1. Finar I-L, Organic Chemistry Vol 2, (6th edition) England, Addison Wesley Longman Ltd- (1996)
2. YR Sharma, Elements of Organic Spectroscopy, S Chand Pub- (2010)-

REFERENCES:

1. Morrison R-T, Boyd R-N-, Organic Chemistry, (4th edition) New York, Allyn & Bacon Ltd-, (1976)
2. 2-Bahl B-S, Arun Bahl, Advanced Organic Chemistry, (12th edition) New Delhi, Sultan S Chand and Co-, (1997)-
3. Kalsi- L-, Organic Spectroscopy, New Delhi, New Age International Company- (1998)-

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH6CC8	ORGANIC CHEMISTRY II					3	6			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓	✓			✓	✓		✓			
CO4	✓	✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =40 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
103	0	0	0	103	0	0	0	100	Global

Local-Green; Regional-Pink; National-Blue; Global-Brown

SEMESTER - VI

Course Code: 20UCH6CC9

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 40

Credits: 6

External Marks: 60

PHYSICAL CHEMISTRY - II

Objectives:

- To understand the principles of IR spectroscopy and its applications ii) To study the basics of Raman spectra and its applications iii) To know the theory of Electrochemistry.
- To understand various types of photochemical process ii) To study the Catalysis and Adsorption iii) To learn the Phase Equilibria.

Learning Outcomes:

- Can learn the principles of IR, Raman, NMR spectroscopic and instrumentation techniques and its applications.
- Students can able to identify the Electrochemistry and Transport of ions in solution.
- Gain knowledge about photochemical reactions.
- Brings about the theory of phase rule and its applications to various systems; and to study the Clausius Clapeyron equations.
- It clarifies the topic of catalysis and its applications, and the also the concept of adsorption and its significance.

Unit I: INFRA RED, RAMAN AND NMR SPECTROSCOPY

IR Spectroscopy; Principle, Simple harmonic oscillator, selection rules, pure vibrational spectrum, Hooke's law, Zero point energy, anharmonicity, determination of force constant, fundamental vibrational frequency and overtone, vibrational modes of CO₂ and H₂O, IR- instrumentation and identification of organic molecules from characteristic absorption bands- Raman spectroscopy - condition - Rayleigh and Raman scattering - Stokes and Anti-stokes lines- Difference between Raman and IR spectroscopy - Rotational Raman spectra- Application to covalent compounds - Mutual exclusion principle- NMR Spectroscopy: Principle, Theory, instrumentation - Chemical Shift - number of signals and splitting of signals- NMR spectrum of ethanol, anisole, benzyl chloride.

UNIT II: Electrochemistry

Ionic mobility - Definition, experimental determination, experimental proof for migration of ions, transport number - Definition, Hittorf's rule, experimental determination - Hittorf's method, moving boundary method, effect of concentration on transport number- Transport of ions in solution - Debye-Huckel-Onsager (DHO) theory - assumption and mathematical form - Validity of DHO equation, drawbacks of DHO equation, Extension of Debye-Huckel-Onsager theory to strong electrolytes.

UNIT III: Photochemistry

Laws of photochemistry - Grothus-Draper law - Stark-Einstein law of photochemical equivalence - Quantum efficiency - determination of quantum efficiency - chemical actinometry - consequence of light absorption - Jablonski diagram - radiative and non-radiative transitions - photochemical reactions - kinetics of photochemical combination of H_2-Cl_2 , H_2-Br_2 and decomposition of HI - Energy transfer in photochemical reactions - photosensitization - photosynthesis in plants - Theory of Fluorescence and Phosphorescence- Chemiluminescence and bioluminescence.

UNIT 4: Catalysis and Adsorption

Catalysis - Types-Importance of catalysts, Homogeneous and heterogeneous catalysis -Industrial catalyst, catalyst carrier, catalyst promoter, catalyst inhibitor, catalytic poison, activity of catalyst- concept of acid-base and enzyme catalysis- Michaelis Menton equation- Factors affecting enzyme catalysis- Theory of heterogeneous catalysis on the basis of Langmuir adsorption - Uni-and bimolecular reactions on solid surfaces-Adsorption-definition- - physisorption and chemisorptions - factors influencing adsorption of gases on solids - Langmuir adsorption isotherm - BET theory - Applications of adsorption.

UNIT V: Phase Equilibria

Phase Rule: Concepts of phase, component and degrees of freedom, with examples- Gibb's phase rule - derivation- One component system: Phase diagrams: Water and sulphur systems- Two component system: (i) Simple eutectic: Lead-silver system- Formation of compound with congruent melting point: Ferric chloride - water system- Clausius - Clapeyron equations and their applications to equilibria in phase transitions- solid - liquid, liquid - vapour, solid - vapour.

TEXT BOOK:

1. Kuriacose and Rajaram, Thermodynamics for students of Chemistry, Shoban Lal Nagin Chand & Co- Delhi, 1996-
2. B-R- Puri, L-R- Sharma and M-S- Pathania - Principles of Physical Chemistry, Vishal Publications, Jalandhar, 2000-

REFERENCES:

1. N-Kundu and S-K-Jain, Physical Chemistry, S-Chand & Co- Ltd-1998, New Delhi-
2. Gurtu and Snehi, Advanced Physical Chemistry, Pragati Prakashan, 2002, Meerut-
3. Peter Atkins, "Physical Chemistry", New Z-A-Publishers, 8th Edn, 2009-

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH6CC9	PHYSICAL CHEMISTRY – II					3	6			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3		✓			✓	✓		✓			

CO4		✓	✓	✓	✓	✓	✓			✓
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Number of Matches(✓) =38 Relationship: High										

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
81	0	0	0	81	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-VI

Course Code: 20UCH6CP4

Exam Hours: 6

Instruction Hours: 6

Internal Marks: 40

Credits: 5

External Marks: 60

CORE COURSE PRACTICAL 3 - GRAVIMETRIC & ORGANIC ANALYSIS PRACTICAL

Objectives:

- To learn the techniques of physical constants determination-
- To improve the knowledge about gravimetric estimation-
- To learn qualitative analysis of organic compounds-

Learning Outcomes:

- To enable the students to learn the techniques of physical constants determination-
- To enable the students to learn about gravimetric estimation-
- Be able to learn qualitative analysis of organic compounds-
- Synthesize the students to understand single stage preparations of some organic complex-
- learn single stage preparations of some organic compounds-

Experiments

1. Determination of physical constants

Determination of boiling / melting point of given organic compound

Melting Points: 1- Acetamide 2- m-dinitrobenzene 3- Benzoic acid 4- Benzamide 5- Urea and 6-Cinnamic acid

Boiling Points: 1-Water 2- Benzophenone, 3-Ester and 4-Toluene

2. Gravimetric Estimation:

Sintered Crucible

1- Ni as nickel dimethyl glyoxime

2- Ba as barium chromate-

3- Ca as calcium oxalate monohydrate

Silica Crucible

1- Ca as calcium sulphate-

2- Pb as lead sulphate-

3. Organic analysis:

Analysis of Simple Organic compounds: i) Carboxylic acids, ii) Phenols, iii) Ketones, iv) Carbohydrates, v) Amines and vi) Amides

a. Aliphatic/Aromatic

b. Saturation / Unsaturation

c. Special elements (Only Nitrogen)

d. Functional group

f- Preparation of derivatives-

4- Organic preparations

Preparation of organic compounds involving the following chemical conversions

1- Oxidation (Benzoic acid from benzaldehyde)

2- Hydrolysis (Benzoic acid from ethyl benzoate)

3- Nitration (m-Dinitrobenzene from nitrobenzene)

4- Bromination (p-Bromoacetanilide from acetanilide, Tri-bromoaniline from aniline)

5- Diazotization (Methylorange from aniline)

Reference Book(s):

1. Venkateswaran V- Veerasamy R- Kulandaivelu A-R-, Basic principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & sons (1997)-
2. Vogel's- A-I-, Quantitative Inorganic Analysis, 5th Ed-, Prentice Hall (1996).

Scheme of valuation

Criteria	Marks		
Record	5		
Procedure writing	5		
Physical constant	5		
Organic preparation	10		
Organic analysis	{15}	Gravimetry{20}	
Aliphatic/aromatic	2	error	Marks
Saturated/unsaturated	2		
Element test	4	< 1 %	20
Functional group	4	1 – 2%	15
Derivative	3	2 – 3%	10
		>3%	5

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH6CP4	GRAVIMETRIC & ORGANIC ANALYSIS PRACTICAL					6	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓		✓	✓		✓	✓	✓	✓	✓	
CO3	✓				✓			✓	✓		
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches(✓) =36 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
8	0	0	0	8	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -VI

Course Code: 20UCH6MBE2:1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 6

External Marks:75

NUCLEAR AND INDUSTRIAL CHEMISTRY

Objectives:

- To understand the composition of nucleus and nuclear forces, nuclear stability and Metallic State-
- To understand the Concept of Industrial Inorganic Chemistry and know the Nanotechnology and Organometallic Compounds concepts-

Learning Outcomes:

- Can learn the composition of nucleus and nuclear forces, nuclear stability and its applications-
- Students can able to induced radioactivity - radioactive decay-
- Gain knowledge about Packing of atoms in metals (bcc, ccp and hcp) - theories of metallic bonding-
- Brings about the Fossil fuels and varieties of coal and petroleum-
- It clarifies the basics of nanoscience and nanotechnology and chemistry of nanoparticles-

Unit I: Nuclear Chemistry I

Introduction - composition of nucleus and nuclear forces - nuclear stability - mass defect - binding energy - packing fraction - N/P ratio - magic numbers - nuclear models - liquid drop - Shell and collective model- Isotopes - detection and separation - deviation of atomic weights from whole numbers - isobars, isotones and isomers - Radioactive decay and equilibrium - nuclear isomerism - internal conversion- Nuclear Q value - threshold energy - cross sections, types of reactions - fission and fusion - modes of radioactive decay.

Unit II: Nuclear Chemistry II

Natural and induced radioactivity - radioactive decay – half life period - radioactive displacement law - radioactive series - Radioactive techniques - Geiger Muller and ionization counters- Natural radioactivity - Detection and measurement of radioactivity - radioactive series including neptunium series - group displacement law - Rate of disintegration -half life period - Average life period- Artificial radioactivity - induced radioactivity - uses of radioisotopes - hazards of radiations - nuclear energy - nuclear reactors - nuclear fission and fusion - fission products and fission yields - Spallation - photonuclear and thermo nuclear reactions - energy source of the sun and stars - carbon dating - rock dating- radioactive waste disposal - applications of nuclear science in agriculture-biology and medicine - Atomic power projects in India.

UNIT III: Metallic State

Packing of atoms in metals (bcc, ccp and hcp) theories of metallic bonding - Electron gas, Pauling and Band theories- Structure of alloys - substitutional and interstitial solid solutions - Hume-Rothery ratios - crystal defects in stoichiometric and non-stoichiometric compounds- Semi conductors - extrinsic and intrinsic - n-type and p-type - composition, structure and uses in electronic industry.

UNIT IV: Industrial Inorganic Chemistry

Fossil fuels - varieties of coal and petroleum - petroleum refineries in India- fuel gases - calorific value - composition and preparation of water gas, semi water gas, carburetted water gas, producer gas, natural gas, LPG and biogas- Fertilizers - manufacture of N-P-K and mixed fertilizers - micronutrients and their role in plant life- safety matches, fireworks and explosives - manufacturing details paints and varnishes - manufacture and uses.

Unit V: Nanotechnology and Organometallic Compounds

Basics of nanoscience and nanotechnology - chemistry of nanoparticles - nanotechnology - Methods of synthesis of nano materials - plasma arching, sol gels -applications of nano

chemistry -catenanes -carbon nanotubes types- synthetic methods-fullerene-its properties- Introduction to Organometallic compounds- alkenes, alkynes and cyclopentadiene based Organometallic compounds.

TEXT BOOK:

1. Soni P-L-, Text book of Inorganic Chemistry, S-Chand & Co, New Delhi (2006)
2. Lee J-D-, concise Inorganic Chemistry ELBS edition

REFERENCES:

1. Puri B-R- and Sharma L-R-, Principles of Inorganic Chemistry, soban Lal Nagin Chand & Co-
2. Satyaprakash, Tuli, G-D-, Basu, S-K-, and Madan, R-D, Advanced Inorganic chemistry (vol I & II), S- Chand, New Delhi (2006)
3. Warren Gibbs, *Concepts and Applied Principles of Bioinorganic Chemistry: Volume III:* 3: 2015

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH6MBE2	NUCLEAR AND INDUSTRIAL CHEMISTRY					3	6			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3					✓			✓			
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =36 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
94	0	0	0	94	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-VI
AGRICULTURAL CHEMISTRY

Course Code: 20UCH6MBE2:2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 6

External Marks: 75

Objectives:

- To give the students the importance of Agricultural chemistry and an exposure to find, analyse and find a suitable method to cultivate and promote agricultural methods-
- To know the students the importance of Pesticides and Plant Growth Regulators-

Learning Outcomes:

- Students can gain knowledge on Soil Chemistry-
- It clarifies the basics of knowledge on Fertilizers and application-
- Gain knowledge about the Pesticides and its effects-
- Students can gain knowledge on general basic Plant Growth Regulators-
- Students can learn Plant hormones and importance-

UNIT 1: Soil Chemistry

Soil analysis- soil nature- structure- Composition of soil Organic-Inorganic constituents- Soil acidity, buffering capacity of soils-Soil basicity-Limiting of soil-Absorption of cations and anions - availability of soil nutrients to plants

UNIT 2: Fertilizers

Peat organic manures (composts)-Role of humus-Effluent from gobar gas plants- Use of fertilizers- urea, DAP, Super phosphate-Gypsum-NPK-mixed fertilizers-significance of fertilizer -Optimal addition of Fertilizers to obtain estimated yields

UNIT 3: Pesticides

Insecticides- stomach - contact poisons- Plant derivatives -pyrethrine- Nicotine - rotenone Synthetic organic- carbophos- carbaryl- p-DCB, dimethoate, butachlor, Endrin, Aldrin (Chemical name and uses)- Rodenticides-Fungicides - Inorganic (Bordeaux Mixture) - ganic(dithiocarbamate)- Industrial

fungicides-creosote fractions-Herbicides -weedicides- Selective - non-selective, 2, 4D, 2, 4, 5t (structure function)

UNIT 4: Plant Growth Regulators

3-Indole acetic acid- Naphthalene acetic acid- Ethepon (2 chloroethyl phosphoric acid)- Alar (succinin acid₂, 2dimethyhydrzine) their function.

UNIT 5: Plant hormones

Plant hormones, Gibberlin- Cyclocel- Phosphon- dwarfing compound (CCC₂Chlorethyltrimethyl ammonium chloride)-Defoliant.

TEXT BOOK:

1. G-T- Austin-, shreve's Chemical Process Industries, 5th edition, Mc-Graw-Hill, 1984
2. H- Parameshwar HegdeTextbook of Agro-Chemistry Hardcover - 1 January 2009

REFERENCES:

1. B-A- Yagodin (Ed)- Agricultural Chemistry, 2 Volumes, Mir Publishers (Moscow), 1976-
2. U- D- Chavan, Key Notes on Agriculture Chemistry and Soil Science, 2015-
3. Douglas Watson Gilchrist Shirlaw A Practical Course in Agricultural Chemistry, 1967-

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH6MBE2	AGRICULTURAL CHEMISTRY					3	6			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓	✓			✓			✓	✓	✓	
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
Number of Matches(✓) =40 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
52	0	0	0	52	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-VI

Course Code: 20UCH6MBE3:1

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 5

External Marks: 75

FOOD AND PHARMACEUTICAL CHEMISTRY

Objectives:

- To learn the importance of food and chemical composition and importance of balanced diet
- To know the Analgesics and CNS stimulants-

Learning Outcomes:

- Students can gain knowledge on Food Adulteration & Edible Oils
- Gain knowledge about the first aid for poison consumed victims-
- Students can gain knowledge on esters, aldehydes and heterocyclic compound-
- It clarifies the basics of knowledge on Indian Medicinal plants and uses
- Students can Antipyretic analgesics and salicylic derivative-

UNIT 1: Food Adulteration & Edible Oils

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- - ghee adulterants and their detection- Detection of adulterated food by simple analytic techniques- Fats, Oils - Sources of oils - production of refined vegetable oils - preservation- Saturated and unsaturated fatty acids - iodine value - role of MUFA and PUFA in preventing heart diseases - determination of iodine value and RM value, saponification values and their significance- Estimation of iodine and RM values in edible oils-

UNIT 2: Food Poison & Beverages

Food poisons - natural poisons (alkaloids - nephrotoxing) - pesticides- (DDT, BHC, Malathion)

- Chemical poisons - first aid for poison consumed victims-Beverages - Soft drinks - soda - fruit juices - alcoholic beverages examples- Carbonation - addiction to alcohol - cirrhosis of liver **health issues social problems-**

UNIT 3: Food Additives

Food additives -artificial sweetners - saccharin - cyclamate and aspartate- Food flavours -esters, aldehydes and heterocyclic compound- Food colours, **coloring agent** - nestricted use spurious colours - Emulsifying agents - preservatives learning agents-Baking powder yeast - taste makers - MSG vinegar-

UNIT 4: Basic Pharmaceutical Chemistry

Definition of the following terms: drug, pharmacophore, pharmacology, Pharmacopeia, bacteria, virus and vaccine-Causes, symptoms and drug for anemia, jaundice, cholera, alaria and filarial- Indian Medicinal plants and uses - Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothvelai.

UNIT 5: Analgesics and CNS stimulants

Analgesics- Definition and Actions-narcotic and non narcotic - morphine and its derivatives, pethidine and methodone - disadvantages and uses- Antipyretic analgesics - salicylic derivative, paracetamol, ibuprofen- Drugs affecting CNS - Definition, distinction and examples for tranquilisers, sedatives, hypnotics, psychedelic drugs - LSD, Hashish - their effects.

TEXT BOOK:

1. Thanlamma Jacob, text books of applied chemistry for home science and allied science, Macmillan-
2. Cairns, Essentials of Pharmaceutical Chemistry 4e (PB), Pharmaceutical Press, January 2012

REFERENCES:

1. Swaminathan M-, Food Science and Experimental foods, Ganesh and Company-
2. Jayashree Ghosh, Fundamental concepts of applied chemistry, S- Chand & Co- Publishers-
3. **Bhandari, Textbook of Pharmaceutical Organic Chemistry (PaperBack), CBS publication, January 2013**

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH6MBE3	FOOD AND PHARMACEUTICAL CHEMISTRY					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓	✓			✓			✓	✓	✓	
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓				✓	✓	✓	✓	✓	
Number of Matches(✓) =37 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
63	0	0	36	27	0	0	57	43	National
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-VI

Course Code: 20UCH6MBE3:2

Exam Hours: 3

Instruction Hours: 5

Internal Marks: 25

Credits: 5

External Marks: 75

POLYMER CHEMISTRY

Objectives:

- To understand structure, types and formation of polymers-
- To study the preparation and applications of important industrial polymers-

Learning outcomes:

- Understand structure, types and formation of polymers-
- Students Gain knowledge about Techniques of Polymerization and Polymer Degradation
- Study the preparation and applications of important industrial polymers-
- Learn the application of various type polymer
- Gain knowledge about evaluate the application of various type polymer

UNIT 1: Introduction to Polymer

Basic concepts- polymers synthesis- polymer processing - Oligomers- Polymers - their characteristics - Classification of polymers - Natural synthetic, linear, cross linked and network; plastics-elastomers- fibres- Homopolymers - Copolymers -Bonding in polymers : Primary - secondary bond forces in polymers ; cohesive energy and decomposition of polymers -

Determination of Molecular mass of polymers: Number Average molecular mass (M_n) - Weight average molecular mass (M_w) of polymers - determination by (i) viscosity (ii) Light scattering method (iii) Gel Permeation Chromatography (iv) osmometry - ultracentrifuging-

UNIT 2: Kinetics and Mechanism for Polymerization

Chain growth polymerization :Cationic- anionic- free radical polymerization- Stereo regular polymers : Ziegler Natta polymers - Polycondensation-non catalysed, acid catalysed polymerization- molecular weight distribution Step growth polymers-

UNIT 3: Techniques of Polymerization and Polymer Degradation

Bulk- Solution-Emulsion-Suspension- Melt polycondensation, solution polycondensation interfacial and gas phase polymerization - Types of Polymer Degradation- Thermal degradation- mechanical degradation-Photodegradation- Photo stabilizers- Solid - gas phase polymerization-

UNIT 4: Industrial Polymers

Raw material, preparation- fibre forming polymers, elastomeric material, Thermoplastics :Polyethylene- Polypropylene, polystyrene, Polyacrylonitrile- Poly Vinyl Chloride- Poly tetrafluoro ethylene- nylon and polyester - Thermosetting Plastics : Phenol formaldehyde and epoxide resin - Elastomers : Natural rubber and synthetic rubber -preparation, properties-vulcanization- Buna N, BunaS and neopreneConducting Polymers :Elementary ideas ; examples : poly sulphur nitriles, poly phenylene, poly pyrrole and poly acetylene-

UNIT 5: Introduction to Polymer Processing

Compounding: Polymer Additives: Fillers, Plasticizers antioxidants and thermal stabilizers fire retardants and colourants - Processing Techniques: Calendaring, die casting, compression moulding, injection moulding, blow moulding, extrusion moulding and reinforcing- Film casting, Thermoforming, Foaming-

TEXT BOOK:

1. F- N- Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971-
2. V-R- Gowariker, Polymer Science, Wiley Eastern, 1995-

References:

1. G-S- Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited, 1996-

2. Kumar and S- K- Gupta, Fundamentals and Polymer Science and Engineering, Tata McGraw-Hill, 1978-
3. J M G- Cowie; N Thornes “Polymers: Chemistry and Physics of Modern Materials”

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

B.Sc.– Chemistry

Relationship Matrix for COs– POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
I	20UCH6MBE3	POLYMER CHEMISTRY					3	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓	✓	✓		✓	✓	✓	✓		✓	
CO2	✓	✓	✓	✓		✓	✓	✓	✓	✓	
CO3	✓	✓			✓			✓	✓	✓	
CO4		✓	✓	✓	✓	✓	✓			✓	
CO5	✓	✓	✓	✓		✓	✓	✓	✓	✓	
Number of Matches(✓) =39 Relationship: High											

Mapping	1 – 29%	30 – 59%	60 – 69%	70 – 89%	90 – 100%
Matches	1 – 14	15 – 29	30 – 34	35 – 44	45 – 50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
56	0	0	0	56	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

VALUE ADDED COURSES

**UV-VISIBLE, IR SPECTROSCOPIC
INSTRUMENTATION AND SEPARATION TECHNIQUES**

Course Code: 20VACH01
Credit: 2

Hours: 30
Marks: 100

OBJECTIVES:

- To improve student sense of enthusiasm for spectroscopy and to involve them in an intellectually compounds prediction.
- To expose the students to various developing new areas of spectroscopy and impart them with their established in their future studies and their applications in various spheres of molecular structure.

Course Outcomes:

At the end of the course students will be able to:

- Explain the fundamental components of UV-Visible spectrophotometer
- Familiarize the instrumentation of IR spectroscopy
- Examine the given material by UV-Visible spectroscopy
- The nature of the functional groups present in the sample by IR spectroscopy
- Separate the sample by distillation techniques.

UNI I: Instrumentation of UV-Visible Spectroscopy

6 Hours

UV-Visible Spectroscopy- principle, nomenclature of the components of IR instrument - fundamental components- Schematic diagram of fundamental components, photometer, spectrometer optical, spectrophotometer, colorimeter and spectrograph- UV-Visible Radiation source - essential characteristics, UV- light sources, visible light sources- Dispersing devices, filters and monochromators- prism, gratings- slits, test sample and optical materials, radiation detector and indicator- barrier layer cell, photo emissive cell, photo multiplier cell.

UNIT II: Instrumentation of IR Spectroscopy

6 Hours

IR Spectroscopy- principle, instrumentation-IR spectrometer-types-single beam and double beam spectrometer-Source of IR radiation, IR mono chromator, detector-selective detector-photo conductive cell-non-selective detectors-thermocouple, bolometer, pneumatic detector cell. Preparation of sample-liquid, solid- characteristic group frequencies.

UNIT III:UV-Visible Spectroscopy Practical

6 Hours

Detection of λ_{max} of given organic compounds- aniline ,toluene, benzaldehyde, Acetophenone *o*-cresol, ethyl acetate.- of indicator constant of an indicator-Determination of band gap of ZnO nanoparticle.

UNIT IV: IR Spectroscopy Practical

6 Hours

Identification of functional groups of organic compounds-urea, benzaldehyde, cinnamic acid, glucose and acetophenone- Determination of the purity of the commercial benzoic

acid

UNIT V: Separation Techniques Practical

6 Hours

Purification of aniline by distillation-Separation of organic liquid mixture by fractional distillation-Removal of solvent from a reaction mixture by reduced pressure distillation.

References

1. A. K. Srivastava and P. O. Jain Instrumental Approach to Chemical Analysis 4th Revised Edition. Chand & Company Ltd New Delhi 2008

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
38	5	0	24	9	13	0	63	24	National
Local: GREEN									
Regional: PINK									
National: BLUE									
Global: BROWN									

REAGENTS PREPARATIONS AND THEIR VALIDATION

Course Code: 20VACH02
Credit: 2

Hours: 30
Marks: 100

OBJECTIVES

- To expose the students to various emerging new areas of reagents preparations in laboratory.
- To enhance student sense of preparation of new compounds in laboratory and to involve them in an academically compounds preparation experience.

LEARNING OUTCOMES:

At the end of the course the learners should be able to

- Prepare solutions of desired strength for analysis.
- Prepare important reagents for inorganic, organic and food analysis
- Prepare indicators for chemical analysis
- o inculcate the knowledge on how to prepare different concentration solutions for chemical analysis. T
- o improve the basic ideas of preparing reagents for inorganic, organic and food analysis. T

Unit:I

6 hrs

Preparation of different concentrated solutions: Introduction-Normality, Molarity, ppm. Preparation- aceticacid, hydrochloricacid, nitricacid, Sulphuricacid- ammonium hydroxide, barium hydroxide, calcium hydroxide, potassium hydroxide, sodiumhydroxide.

Unit:II

6hrs

Preparation of salt solutions:Ammonium acetate,ammonium carbonate,ammonium chloride, ammonium oxalate, ammonium sulphate- barium chloride, calcium chloride, calcium sulphate, cobalt nitrate, copper sulphate- ferric chloride, ferrous sulphate, lead acetate, magnesium sulphate -potassium chromate, potassiumferricyanide,potassiumferrocyanide,potassiumthiocyanate, sodium carbonate.

Unit:III

6 hrs

Preparation of Reagents for organic analysis: Sodium nitro prusside- chlorinewater, bromine water- Borche's reagent, phenyl hydrazine, Schiff's reagent -Tollen'sreagent, bromine in carbon tetra chloride- neutral FeCl₃solution, KMnO₄ solution -alcoholic potash.

Unit:IV

6 hrs

Preparation of Reagents for Food analysis: Benedict reagent for sugar- Biuret solution for protein- Sudan III stain for fat- dichlorophenolindophenol for vitamin C,Molische'

reagents- Fehling reagent A and B - Barfoed reagent, Seliwan off reagent, Bial's reagent

Unit:V

6 hrs

Preparation of Indicators:

Phenolphthalein- Methylorange, N- Phenylanthranilic acid- potassium ferricyanide, Starch solution- Potassium chromate, Ferricalum indicator- Fluorescein, Eosin, Erichrome Black T, diphenylamine.

References

1. A. K.Srivastava and P.O. Jain Instrumental Approach to Chemical Analysis 4th Revised Edition. Chand & Company Ltd New Delhi 2008

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
26	9	0	11	6	35	0	42	23	National
Local: GREEN Regional: PINK National: BLUE Global: BROWN									

2020

B.Sc Allied Chemistry

Course Structure and Syllabus

(For the candidates admitted from the academic year 2020-2021 onwards)

CHOICE BASED CREDIT SYSTEM (CBCS)



THANTHAI HANS ROEVER COLLEGE(AUTONOMOUS)

(Approved by NAAC, Affiliated to Bharathidasan University)

ELAMBALUR, PERAMBALUR – 621 220



Thanthai Hans Roever College (Autonomous), Elambalur, Perambalur - 621 220
 Master of Computer Science - PG Course Structure under CBCS
 (For the candidates admitted from the academic year 2020-2021 onwards)

Semester	Part	CourseCode	Title of the Course	Ins. Hours/ Weeks	Credits	Exam Hours	CIA (Max)	ESE (Max)	Total (Max)
I	Allied Course-I	20UCH3AC3	Allied Chemistry-I (Physics & Bot-Zoo)	4	4	3	25	75	100
II	Allied Course-II	20UCH4AC4	Allied Chemistry-II (Physics & Bot-Zoo)	4	4	3	25	75	100
	Allied Practical- I (Physics)	20UCH4AP1	Volumetric And Organic Analysis	3	3	3	40	60	100
	Allied Practical- II (Bot & Zoo)	20UCH4AP2	Volumetric And Organic Analysis	3	3	3	40	60	100

SEMESTER-III

Course Code: 20UCH3AC3

Exam Hours: 3

Instruction Hours: 4

Internal Marks: 25

Credits: 4

External Marks: 75

ALLIED CHEMISTRY-I

INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY - I

Objectives:

- To know about the properties of elements and fertilizer
- To learn the understand the reactions of alkan

Learning Outcomes:

- Get knowledge about basic concepts of Periodic properties
- Students gain knowledge on Volumetric analysis.
- Preparation, properties Aliphatic Compounds
- Students can get knowledge of Thermosetting and thermoplastics
- Students can learn about the Synthetic Products.
- Gain knowledge about Basic Physical Chemistry

Unit I

Periodic properties atomic radii, ionic radii- ionization potential- electron affinity and electro negativity - variation in the periodic table -Molecular Orbital Theory: Some important basic concepts of molecular orbital theory - LCAO Bonding, antibonding orbitals and bond order - applications of MO theory to H₂, He₂, O₂ and F₂ molecules- Industrial Chemistry: Fuel gases - Water gas, Producer gas, L.P.G., Gobar gas - Natural gas. Fertilizers - N.P.K and mixed fertilizers. Soap and detergents - shampoo- An elementary idea of soap - detergent.Cleansing action of soap-detergents.

Unit II

Volumetric analysis- Standard solution- titration- equivalence point- end point- indicators- primary and secondary standards- expressing concentrations of standard solutions - Normality, Molarity, Molality and mole fraction-Volumetric titrations - Acid base titrations - theory - strong acid Vs strong base- strong acid Vs weak base- Redox titrations - theory - Mohr salt Vs KMnO₄- complexometric titrations –theoryChelating agents - EDTA titrations.

Unit III

Nomenclature of alkanes- General methods of preparation of alkanes- properties mechanism of free radical halogenation of alkanes, conformation analysis of ethane, n- butane and cyclohexane. Methods of preparation of alkenes-stereochemistry of dehydrohalogenation (E1, E2, E1cB mechanism)-Properties of alkenes- electrophilic - nucleophilic addition mechanisms.

UNIT IV

Synthetic polymers - Teflon- nylon -Alkyl - Epoxy resins- Polyesters - definitions - uses Types of polymerization – Thermosetting, thermoplastics-Heterocyclic compounds:Furan- thiophene- pyrrole and pyridine - Preparation and properties.Stereoisomerism:Optical isomerism - lactic and tartaric acid - Racemic mixture and resolution - Geometrical isomerism -maleic and fumaric acid-optical isomerism

Unit V

Rate of reaction ,rate constant, order, molecularity, first order rate law and simple problems, half life period of first order equation, pseudo first order reaction, zero and second order reactions. Arrhenius and collision theories- important -assumption, derivation, demerits- experimental determination of order of reactions.

TEXT BOOKS

1. I.Bahl and Arun Bahl– “Advanced Organic Chemistry” – 19th Edition., (2005) –Sulthan and Chand company, New Delhi.
2. M.K. Jain – “Organic Chemistry” – 12th Ed., (2003) Sulthan and Chand Company, New Delhi.

REFERENCES:

1. R.D. Madan, J.S. Tiwari and G.L. Mudhara– A Textbook of First Year B.Sc. Chemistry: S.Chand and Co, 2002.
2. B.R. Puri And L.R. Sharma – Principles Of Inorganic Chemistry: Shoban Lal Nagin Chand And Co., New Delhi (2000).
3. B.R. Puri, L.R. Sharma And S. Pathania– Principles Of Physical Chemistry: Shoban Lal Nagin Chand And Co., New Delhi, 2001.
4. 6.R. Gopalan, P.S. Subramanian, K. Rangarajan– “Elements of Analytical Chemistry”, Sultan Chand & Sons, 1995.

Question Pattern		
Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
63	0	0	0	63	0	0	0	100	63
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-IV

Course Code: 20UCH3AC4

Instruction Hours: 4

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ALLIED CHEMISTRY-II

Objectives:

- To know about the basic concepts of C-ordination compounds.
- To learn the aromaticity Chromatography and electrochemistry.

Learning Outcomes:

- Get knowledge about basic concepts of C-ordination compounds.
- Gain knowledge about Carbohydrates
- Students gain knowledge on Aromaticity, preparation, properties and reactions of Aromaticity compounds.
- Students can get knowledge of Electrochemistry.
- Students can learn about the behavior of Solvent and can Chromatography Techniques.

Unit I: Coordination Chemistry (12 hrs)

Nomenclature and isomerism of coordination compounds. EAN rule, VB and Crystal field theories of octahedral, tetrahedral and square planar complexes. Chelation, its industrial applications. Magnetic studies paramagnetic, diamagnetic properties- magnetism susceptibility- ferromagnetism - anti ferromagnetism- ferrimagnetism.

UNIT II Carbohydrates

Classification, Glucose and fructose, Preparation and properties, Sucrose, Manufacture and properties, Starch and cellulose, Properties and uses. Classification, Amino Acids and Proteins: Amino acids, Classification- preparation - properties. Peptides (Elementary treatment) Proteins Classification based on physical properties and biological functions-Nucleic acid: DNA, RNA, functions (Structure not necessary)

UNIT III Aromaticity

Aromaticity- Conditions - Huckel's rule-significance of Huckel's rule aromaticity of benzene-properties of aromaticity Substitution reactions- Nitration, halogenation, sulfonation - alkylation of

benzene-Halogen containing compounds: Preparation - uses of Dichloromethane- Chloroform- Carbon tetrachloride- DDT -BHC-Name reactions: Benzoin-Perkin-Cannizzaro-Claisen-Haloform- Carbylamine reactions- Biuret reaction.

Unit IV Electrochemistry:

Basic principles of electrochemistry- Specific and equivalent conductance their determination - Effect of dilution on conductivities - An elementary idea about ionic theory - Ostwald's Dilution Law, Kohlrausch Law, Conductometric titrations- pH and Buffer: Importance of pH and buffers in the living systems-pH determination by colorimetric and electrometric methods. Corrosion: Types of corrosion- Prevention- importance of corrosion

Unit V Chromatography

Principles of column- paper - thin layer chromatography- Photochemistry- Photochemical reaction - Lambert's law - Beer's law – Absorption- Extinction Coefficient – R_f value- R_f value important- The law of Photochemical equivalence- Quantum efficiency- Some Photochemical reactions and their quantum yield- Phase Rule- Phase Component- Degree of freedom- Phase Rule - Definition- One component system - Water system.

TEXT BOOK

1. P. L. Soni, "Text book of Organic Chemistry", S. Chand and Company Ltd., New Delhi.
2. Morrison R.T. and Boyd R.N., Organic Chemistry (6th edition), New York, Allyn & Bacon Ltd., (1976).

REFERENCE

1. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, (23rd edition), New Delhi, Shoban Lal Nagin Chand & Co., (1993)
2. Bahl and Arun Bahl- "Advanced Organic Chemistry" – 19th Edition., (2005) – Sulthan and Chand company, New Delhi.
3. B.R. Puri, L.R. Sharma and S. Pathania- Principles of Physical Chemistry: Shoban Lal Nagin Chand and Co., New Delhi, 2001.

Question Pattern

Section :A (1 Marks)	MCQ type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Ans three out of five	3x10=30
Total Marks		75

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
58	0	0	0	58	0	0	0	100	58
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER III

ALLIED CHEMISTRY PRACTICAL

Course Code: 20UCH3AP1

Instruction Hours: 3

Credits: 3

Exam Hours: 3

Internal Marks: 40

External Marks: 60

Objectives:

- To learn the techniques of semi micro qualitative analysis of inorganic salt mixtures.
- To learn the techniques of titrimetric analyses.

Learning Outcomes:

- Students can learn about the Qualitative Analysis.
- Students can learn about the Aromatic and Aliphatic Compounds.
- Students can get knowledge of Compound identification techniques.
- Learn the different reaction techniques.
- Students gain knowledge about sample report.

I. VOLUMETRIC ANALYSIS

a) Acidimetry and Alkalimetry

- i) Estimation of hydrochloric acid
- ii) Estimation of sodium hydroxide

b) Permanganometry

- iii) Estimation of oxalic acid using KMnO_4
- iv) Estimation of ferrous sulphate using KMnO_4

II. ORGANIC ANALYSIS

A study of reactions of the following organic compounds along with

- (i) tests for Aromatic/ Aliphatic, saturated/ unsaturated, solubility in common solvents, and presence of Nitrogen :
- (ii) Carbohydrate
- (iii) Diamide

(iv) Aldehyde

(v) Ketone

(vi) Acid

(vii) Amine

(viii) The students may be trained to perform the specific reactions like- aliphatic or aromatic, saturated or unsaturated, solubility test, nitrogen test involving (Zn / Na₂CO₃) fusion, and functional group present and record their observation.

TEXT BOOK:

Dr.N.Mururanantham, Allied Chemistry Practical,THRC/Perambalur-2019

REFERENCE BOOK:

1. V.Venkateswaran, R.Veerassamy, A.R. Kulandaivelu, "Basic Principles of Practical Chemistry" Sultan Chand &ons , New Delhi, 1997.

Scheme of valuation

Criteria	Marks		
Record	5		
Procedur writing	10		
	Organic analysis {15}	volumetry{30}	
Aliphatic/aromatic	2	Error	Marks
Saturated/unsaturated	2		
Element test	4	< 1 %	30
Functional group	4	1-2 %	25
derivative	3	2-3 %	15
		>3 %	10

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
7	0	0	0	7	0	0	0	100	7
Local-Green; Regional-Pink; National-Blue; Global-Brown									



M.Sc. CHEMISTRY
Course Structure and Syllabus

(For the candidates admitted from the academic year 2020-2021 onwards)

CHOICE BASED CREDIT SYSTEM (CBCS)



THANTHAI HANS ROEVER COLLEGE (AUTONOMOUS)

(Approved by NAAC-Affiliated to Bharathidasan University)

ELAMBALUR-PERAMBALUR -621 220

Thanthai Hans Roever College (Autonomous)–Elambalur-Perambalur - 621 220

M.Sc.-CHEMISTRY- Course Structure Under CBCS

(For the candidates admitted from the academic year 2020-2021 onwards)

Semester	Course Code	Title of the Course	Hours/Weeks	Credits	Exam Hours	CTA (Max) ESE	(Max)	Total (Max)
1	20PCH1CC1	Aromaticity-Stereochemistry and Reaction Mechanism	6	5	3	25	75	100
1	20PCH1CC2	Chemistry of Lanthanides-Boranes-Coordination and Radioactivity	6	5	3	25	75	100
1	20PCH1CC3	Group theory-Quantum mechanics-Thermodynamic and Photochemistry	6	5	3	25	75	100
1	20PCH1CP1	Organic Preparations and Mixture Analysis	6	4	6	40	60	100
1	20PCH1CP2	Inorganic Qualitative Analysis and Colorimetric Estimations	6	4	6	40	60	100
Total			30	23	-	-	-	500
2	20PCH2CC4	Bio-Inorganic and Organometallics	6	5	3	25	75	100
2	20PCH2CC5	Spectroscopy of Organic Molecules	6	5	3	25	75	100
2	20PCH2EC1:1 20PCH2EC1:2 20PCH2EC1:3	(A) Concept and Modern in Chemistry/ (B) Metallo proteins-Enzymes and Natural products (*)/ (C) Supramolecular Chemistry	6	4	3	25	75	100
2	20PCH2CP3	Organic Estimation and Double stage preparations -Practical	6	4	6	40	60	100
2	20PCH2CP4	Inorganic Estimation and Complex Preparations -Practical	6	4	6	40	60	100
Total			30	22	-	-	-	500
3	20PCH3CC6	Photochemistry-Pericyclic reactions-Heterocycles and Reagents	6	5	3	25	75	100
3	20PCH3CC7	Spectroscopy of coordination complexes	6	5	3	25	75	100
3	20PCH3EC2:1 20PCH3EC2:2	(A) Crystal structure-Organic solid state and Optical properties (*)	6	4	3	25	75	100

	20PCH3EC2:3	(B) Selected topics in Chemistry (C) Agricultural Chemistry						
3	20PCH3EC3:1 20PCH3EC3:2 20PCH3EC3:3	(A) Electro Organic Chemistry (B) Analytical Chemistry (*) (C) Medicinal Chemistry	6	4	3	25	75	100
3	20PCH3CP5	Physical Chemistry Non-Electrical Practical	6	4	6	40	60	100
Total			30	22	-	-	-	500
4	20PCH4CC8	Electrochemistry-Surface Phenomena and Statistical Thermodynamics	6	5	3	25	75	100
4	20PCH4EC4:1 20PCH4EC4:2 20PCH4EC4:3	(A) Instrumentation Techniques (B) Nano and Green Chemistry (*) (C) Inorganic and Organic Photochemistry	6	4	3	25	75	100
4	20PCH4EC5:1 20PCH4EC5:2 20PCH4EC5:3	(A) Industrial Chemistry (*) (B) Polymer Chemistry (C) Chemistry of Natural Products	6	4	3	25	75	100
4	20PCH4CP6	Physical Chemistry Electrical Practical	6	4	6	40	60	100
4	20PCH4PW	Project	6	6	-	-	-	100
Total			30	23	-	-	-	500
Grand Total			120	90	-	-	-	2000

CIA: Continuous Internal Assessment; ESE: End Semester Examination; CC: Core Course; EC: Elective Course.

List of Elective Courses

Elective	Course Code	Title of the Course
Elective -1	20PCH2EC1:1 20PCH2EC1:2 20PCH2EC1:3	(A) Concept and Modern in Chemistry (B) Metallo proteins-enzymes and Natural products (*) (C) Supramolecular Chemistry
Elective -2	20PCH3EC2:1 20PCH3EC2:2 20PCH3EC2:3	(A) Crystal structure-Organic solid state and Optical properties (*) (B) Selected topics in Chemistry (C) Agricultural Chemistry
Elective - 3	20PCH3EC3:1 20PCH3EC3:2 20PCH3EC3:3	(A) Electro Organic Chemistry (B) Analytical Chemistry (*) (C) Medicinal Chemistry
Elective -4	20PCH4EC4:1 20PCH4EC4:2 20PCH4EC4:3	(A) Instrumentation Techniques (B) Nano and Green Chemistry (*) (C) Inorganic and Organic Photochemistry
Elective -5	20PCH4EC5:1 20PCH4EC5:2 20PCH4EC5:3	(A) Industrial Chemistry (*) (B) Polymer Chemistry (C) Chemistry of Natural products

Note:

Project : 100 Marks
Dissertation : 80 Marks
Viva Voce : 20 Marks

Core Papers - 8
Core Practical - 6
Elective Papers - 5
Project - 1

1. Theory Internal 25 marks External 75 marks

2. Practical " 40 marks " 60 marks
3. Separate passing minimum is prescribed for Internal and External
 - a) The passing minimum for CIA shall be 40% out of 25 marks (i.e. 10 marks)
 - b) The passing minimum for Semester Examinations shall be 40% out of 75 marks (i.e. 30 marks)
 - c) The passing minimum not less than 50% in the aggregate.

SEMESTER - I

Course Code: 20PCH1CC1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE 1-AROMATICITY-STEREOCHEMISTRY AND REACTION MECHANISM

Course Outcomes:

- To enable the students to understand the concept of aromaticity
- To enable the students to understand basic stereochemistry concept in proper perspective.
- To enable the students to understand the concept of asymmetric synthesis.
- To enable the students to understand various types of reaction mechanisms involved in synthetic organic transformation.
- To enable the students to understand various types of nucleophilic substitution reaction.

Unit I

Aromaticity: Aromaticity definition -Huckel's and Craig's rules -effects of aromaticity on bond lengths ring currents -aromatic character in 3,4,5,6,7,8 member rings and non-benzenoid rings with 2, 4, 8, 10, 14 and 18 π electron systems- Annulation effect. Concept of Homoaromaticity- Antiaromaticity –alternant and non-alternant hydrocarbons. Aromaticity of annulenes 10, 12, 14, 16 and 18 annulenes heteroannulenes-syndones and fullerenes.

Unit II

Stereochemistry: Stereochemistry: Geometrical isomerism Cis trans- Optical activity- Plane polarized light- chirality-Classification of chiral molecules as asymmetric and dissymmetric-Molecules with helical structures absolute configuration R S notation of biphenyls and allenes. Stereochemistry of mono and di-substituted cyclopropane, cyclobutane, cyclopentane and cyclohexane- ZigZag representation of glucose, Fischer projection. Inter conversion of Sawhorse-Newmann and Fischer projections. Molecules

with more than one asymmetric center (restricted to five carbons).e.g. Erythro and threo compounds.

Unit III

Conformational Analysis: Types of conformation-Conformational analysis of disubstituted cyclohexane and their stereo chemical features (geometric and optical isomerism (if shown) by these derivatives). Conformation and reactivity of substituted cyclohexanol (oxidation)-cyclohexanone (reduction) and cyclohexane carboxylic acid derivatives (esterification and hydrolysis) Conformation and stereochemistry of cis and trans decalin and 9- methyldecalin. Baeyer 's strain theory -alpha haloketone effect-3-alkyl ketone effect-2-alkyl ketone effect. Conformation of n butane Vander Waals repulsion-Factors affecting stability of conformation, Conformation of cycloalkanes-Equatorial and axial bond in cyclohexane-Stereoisomerism of cyclic compounds: Cis and trans isomers Stereoisomerism of cyclic compounds. Conformational analysis.

Unit IV

Aliphatic Nucleophilic Substitution Reaction: SN^1 - SN^2 and SN^i mechanisms - Neighboring group participation - reactivity-structural and solvent effects - substitution in norbornyl and bridgehead systems substitution at allylic and vinylic carbons - substitution by ambident nucleophiles - substitution at carbon doubly bonded to oxygen and nitrogen - alkylation and acylation of amines-halogen exchange-Von-Braun reaction-alkylation and acylation of active methylene carbon compounds-hydrolysis of esters-Claisen and Dieckmann condensation. Role of LDA-crown ethers and phase transfer catalysts (PTC) in nucleophilic substitution reactions. Migration of double bond-keto-enol interconversion-HVZ reaction-Stark-Enamine reaction-halogenation of aldehydes and ketones and decarboxylation of aliphatic acids.

Unit V

Aromatic Electrophilic and Nucleophilic Substitution Reactions: The arenium ion mechanism. Orientation and reactivity (ortho, meta and para directing groups). Typical reactions nitration, halogenations, alkylation, acylation and diazonium coupling-Formylation-Reimer - Tieman reaction-Vilsmeier - Hack-Gattermann-Gattermann - Koch-Kolbe reaction.

Aromatic nucleophilic substitution in aryl halides by Meisenheimer complex mechanism and benzyne mechanism. Reactions of aryl diazonium salts-Zeigler alkylation-Vicarious Nucleophilic Substitution (VNS)-Chichibabin and Schiemann reactions

Text Book(s):

1. Mukherji S.M. and S.P.Singh-Organic Reaction Mechanism-MacMillan India Ltd.-2010.(Unit-1)
2. Nasipuri. D.-Stereochemistry of organic compounds-Principles and applications 2012. (Unit-2 & Unit-3)
3. Bansal R.K.-Organic Reaction Mechanism-Mchill publication-2015. (Unit-3)
4. Aluwalya-Reaction Mechanism 5th Edition-Mchill publication-2015. (Unit-4 & Unit-5)
5. M.K. Jain-S. C. Sharma-Modern Organic Chemistry-Vishal Publishing Company-2014. (Unit-5)

Reference Book(s):

1. Organic Synthesis by R.O.C. Norman-Chapman and Hall-NY-1980
2. Physical Organic Chemistry by Niel Isaacs-ELBS Publications 1987
3. Advanced Organic Chemistry-Part A and B-by Francis A. Carey and Richard J. Sundberg-3rd Edition (1990)-Plenum Press.
4. Advanced organic reaction mechanism and structure by J. March-Tata McGraw Hill.
5. Organic Chemistry-Graham Solomons-Stereochemistry-Conformation analysis and Mechanism by P.S. Kalsi-2nd Edition (1993)-Wiley Eastern Limited-Chennai.
6. Stereochemistry of carbon compounds by Ernest Eliel-1993
7. Stereochemistry and Mechanism through solved problems by P.S. Kalsi. Wiley Eastern Ltd.-(1994).

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
I	20PCH1CC1	Aromaticity- Stereochemistry and Reaction Mechanism	6	5						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
65	0	0	0	65	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - I

Course Code: 20PCH1CC2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE 2-CHEMISTRY OF LANTHANIDES-BORONES- COORDINATION AND RADIOACTIVITY

Course Outcomes:

- Learn the properties of lanthanides
- To appreciate the structure of boranes-carboranes-metal clusters and inorganic polymers.
- Distortion in co-ordination complexes concept of sigma and pi bonding in complexes.
- Application of substitution reactions in the synthesis of Platinum and Cobalt complexes.
- Learn the fusion and fission reactions of inorganic elements.

Unit I

Chemistry of Lanthanides: Studies and Application of Lanthanides and Actinides: Spectral and Magnetic properties Methods of separation of Lanthanides and Actinides using complex formation-Solvent extraction-ion exchange-fractional crystallization.

Organometallic Compounds of lanthanides-Application of lanthanides and actinides compounds in Industries-Use of lanthanides compounds as Shift reagents-Extraction of lanthanides from monazite mineral.

Unit II

Boron Compounds and Clusters : Chemistry of boron (metal borides, halides and complex halides of B,Al, Ga, In and Tl, oxides, oxo acids, oxoanions and hydroxides)borane higher boranes- carboranes borazines - boron nitrides-Classification Nomenclature preparation- Structure and Bonding-STYX numbers -Wade's rule. Carboranes- Types such as nido-closo-arachno- preparation properties and Structure-

Metallocarboranes a general study-Metal clusters: Chemistry of low molecularity metal clusters only-Structure of Re_2Cl_8 - multiple metalmetal bonds.

Unit III

Coordination Chemistry: Theories of Metal Ligand Bond: Postulates of Werner's coordination theory, Explanation of the structure of Co(III) ammines and Pt(IV) complexes on the basis of Werner's coordination theory -VB theory and its limitations - Crystal field theory splitting of d-orbitals under various geometries -Factors affecting splitting CFSE and evidences for CFSE (Structural and thermodynamic effects) Spectrochemical series, Jahn-Teller distortion -Spectral and magnetic properties of complexes -Site preferences - Limitations of CFT Ligand field theory -MO theory sigma and pi-bonding in octahedral-square planar and tetrahedral complexes-Nephelauxetic effect - The angular overlap model.

Unit IV

Coordination Chemistry: Reaction Mechanism: Kinetics and mechanism of reactions in solution - **Stability of complexes** labile and inert complexes -Ligand displacement reactions in octahedral and square planar complexes -acid hydrolysis, base hydrolysis and anation reactions, trans effect -theory and applications. Electron transfer reactions - electron exchange reactions -complementary and non complementary types -inner sphere and outer sphere processes -Cross reactions and marcus Hush theory - isomerisation and racemisation reactions of complexes -Molecular rearrangement -. Reactions of four and six-coordinate complexes -Inter conversion between stereoisomers- Application of trans effect -synthesis of isomers of pt(II) complexes theories of trans effect and cis-trans isomerisation reaction- Application of substitution reactions in the synthesis of Platinum and Cobaltcomplexes.

Unit V

Nuclear and Radiation Chemistry: half-life ($t_{1/2}$) Properties of nucleus -different types of nuclear forces -Nuclear structure and nuclear stability, Nuclear models, liquid drop model- shell model of nucleus- Radioactivity and nuclear reactions- **Major forms of Radioactivity**-nuclear reactions induced by charged particles Q value -nuclear reaction cross section-significance and determination theory of nuclear fission-nuclear fusion-stellar energy. **Hot atom chemistry**-Nuclear fission and fusion reactors. The interaction of nuclear radiations with matter, Radiation hazards and therapeutics. Detectors and their

principles. Tracer Application of radioisotopes in agriculture-industry and medicine. Isotope dilution and radio-activation methods of analysis.

Text Book(s):

1. J. D. Lee -"A New Concise Inorganic Chemistry"-5th Edition-Oxford University Press-2011. (Unit-1).
2. Wahid Malik-G. D. Tuli and R. D. Madan-"Selected Topic in Inorganic Chemistry"-S.Chand & Co.-Ltd (2011). (Unit-2).
3. R.Gopalan-V.Ramalingam "Concise Coordination Chemistry"-Vikas Publishing House Pvt. Ltd.-Newdelhi-2001. (Unit-3 & Unit-4)
4. H.J. Arnikar "Essential of Nuclear Chemistry"-4th Edition-New Age International-Publishers-2011. (Unit-5).

Reference Book(s):

1. M.C. Day-J. Selbin-Theoretical Inorganic Chemistry-2nd Ed.-East West Press-1985.
2. F.A. Cotton-G. Wilkinson-Advanced Inorganic Chemistry-4th Ed.-John Wiley & Sons-198.
3. J. E. Huheey-E. A. Keiter and R. L. Keiter-Inorganic chemistry-Principles on structure and reactivity-4th Ed-Pearson- education-(2002).
4. S.F.A. Kettle-Physical Inorganic Chemistry -A Coordination Chemistry Approach-Oxford University Press-1996.
5. D.E. Douglas-D.H. McDaniel-J.J. Alexander-Concepts and Models in Inorganic Chemistry-3rd Ed. 1994.
6. J.D. Lee-Concise Inorganic Chemistry-5th Ed-Wiley-1999.
7. D.F. Shriver-P.W. Atkins-Inorganic Chemistry-3rd Ed-1999.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
I	20PCH1CC2	Chemistry of Landhanides-Borones-Coordination and Radioactivity	6	5						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
68	0	0	0	68	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - I

Course Code: 20PCH1CC3

Instruction Hours: 6

Credits: 5

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE 3-GROUP THEORY-QUANTUM MECHANICS-DYNAMIC AND PHOTOCHEMISTRY

Course Outcomes:

- Understand the rules and concepts of group theory
- Learn the principles and postulates of quantum mechanics of simple systems.
- To understand and explore the reaction kinetics of fast reactions
- Know the limitations of classical thermodynamics in the evaluation of macroscopic properties and principles of activity and fugacity.
- Understand concepts photochemical reactions and radiation absorption and emissions involved reactions.

Unit I

Elements of Group Theory: Introduction, Symmetry elements, Symmetry operations n-fold Proper axis of symmetry-Centre of Symmetry-Plane of Symmetry-n-fold Improper axis of Symmetry-Group Rules for forming a Group Finite, Group Infinite Group-Abelian Group-Cyclic Group Sub, Groups, Group Multiplication Table- Class and Similarity transformation. Point Group -Method of Assigning Point Group-Matrix Representation - Theory Matrix Representation of Symmetry operation Reducible-Irreducible Representation-The Great Orthogonality Theorem Properties of Irreducible Representation Construction of Character Table for C_{3V} , C_{2V} Point Groups Explanation of Character Table Correlation Table- Use of point group symmetry: optical activity-dipole moment representation of group by matrices.

Unit II

Basic concept of classical and quantum mechanical: Classical mechanics -General principles basic assumptions-postulates of classical mechanics conservation laws Lagrange and Hamilton equations of motion (no derivation) -Postulates of quantum mechanics quantum mechanical operators-Schrödinger equation Operator algebra: operator-linear and

hermitian-eigen functions and eigen values-angular momentum operator-commutation relations. Application of wave mechanics to simple systems - particle in a box one- and three dimensional distortion of the box and Jahn-Teller effect quantum numbers. Orthogonalisation and normalization -Potential barrier of definite thickness: Quantum mechanical tunneling.

Unit III

Chemical Kinetics: Theories of reaction rate - Absolute reaction rate theory (ARRT) - significance of reaction coordinate - Potential energy surfaces - Kinetic isotopic effect molecular dynamics Marcus theory of electron transfer processes Principle of microscopic reversibility – Steady state approximation. Effect of temperature on reaction rate-Effect of **Catalyst**. Chain reactions - thermal and photochemical reactions between hydrogen and bromine - explosions and hydrogen -oxygen reactions. Factors influencing reaction rates in solution - application of ARRT to solution kinetics effect of solvent and ionic strength-influence of pressure on rates in solution - significance of volume of activation. Lindemann theory of unimolecular reaction-Kinetics of Complex reaction-Opposing or reversible reaction-Consecutive reactions-Chain reaction and Branch Chain reaction-Activated Complex Theory (ACT) of bimolecular reaction

Unit IV

Classical Thermodynamics: Thermodynamics of systems, variable composition partial molar property -partial molar quantities of E, V, H, A, G and S, chemical potential **classification** -physical significance of chemical potential-variation of chemical potential with respect to T and P chemical potential in terms of U and H partial molar quantities from experimental data direct method apparent molar properties intercepts method and general methods-Calculation of thermodynamic properties of real gases - fugacity concept-variation of fugacity with T and P calculation of fugacity of real gases-determination of fugacity -graphical method equation of state method-determination of fugacity in gas mixtures Lewis Randall rule. Trouton's Rule

Unit V

Photochemistry and Radiation Chemistry: Photochemistry and Radiation chemistry: Characteristics of electromagnetic radiation-Lambert Beer's law and its limitations- Laws of photochemistry quantum yield, actinometry-examples of low and high quantum yields. Photo physical process in electronically excited molecules - Jablonski diagram Primary

and Secondary Processes-quantum yield and its determination -Excimers and exciplexes
Kinetics of collisional quenching Stern-Volmer equation Chemical Actinometers
Photosensitization-Chemiluminescence.Photosynthesis-solar energy conversions.
Semiconductor photo catalysis-Lasers and their applications.
Radiation chemistry: Sources of high energy radiation radiolysis of water-solvated
electrons Scavenging techniques Uses -Applications of radiation chemistry.

Text Book(s):

1. K.V.Raman Group theory and its Application to Chemistry. Tata McGraw –Hill Publishing Company Limited New Delhi-2000. (Unit-1)
2. R.K.Prasad-Quantum Chemistry-New Delhi-Wiley-Eastern Ltd-1992. (Unit-2)
3. K. J. Laidler-Chemical Kinetics-2nd ed-Tata McGraw Hill (1975). (Unit-3).
4. J.Rajaram and J. C. Kuriacose-Thermodynamics for Students of Chemistry-Lal Nagin Chand-New Delhi-(1986). (Unit-4).
5. K. K. Rohatgi and Mukerjee-Fundamentals of Photo Chemistry-Wiley Eastern Ltd (1986) (Unit-5)
6. G. Hughes-Radiation Chemistry-Oxford University Press (1973). (Unit-5)

Reference Book(s):

1. F.A.Cotton-Chemical Application of Group Theory. 2nd Edn. Wiley -Eastern Press-1995.
2. K. Veera Reddy-“Symmetry and Spectroscopy of Molecules”-New Age International Publishers-2010.
3. A.K.Chandra-“Introductory Quantum Chemistry” 4th edition; Tata -McGraw Hill-2010.
4. F.L.Pillar-Elementary Quantum Chemistry-McGraw Hill-1970
5. Frost and R. G. Pearson-Kinetics and Mechanisms-John Wiley & Sons (1953).
6. J. C. Kuriacose and J. Rajaram-Kinetics and Mechanisms Transformations-Macmillan & Co.-(1993).
7. Paula-Peter Atkins and Julio de-Elements of Physical chemistry-5th Ed-Oxford U.P-(2012).
8. Kloz and P. M. Rosenberg-Chemical Thermodynamics: Basics Theory and Methods-3rd Ed.-W. A. Benjamin-NY (1974).

9. R. P. Rastogi and R. R. Misra-An Introduction to Chemical Thermodynamics-Vikas Publishing House Pvt Ltd.-(1992)
10. S. Glasstone-Thermodynamics for Chemists-East-west Affiliated Pvt Ltd-New Delhi (1969).
11. N. J. Turro-Modern molecular photochemistry-Benjamin/Cummings-Menlo Park-California-1978.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
I	20PCH1CC3	Group Theory-Quantum Mechanics-Dynamic and Photochemistry	6	5						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
69	0	0	0	69	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - I

Course Code: 20PCH2CP1

Exam Hours: 6

Instruction Hours: 6

Internal Marks: 40

Credits: 4

External Marks: 60

CORE COURSE PRACTICAL 1 -ORGANIC PREPARATIONS AND MIXTURE ANALYSIS - PRACTICAL

Course Outcomes:

- To enable the students to learn about separation technique of organic compounds.
- Be able to learn qualitative analysis of organic compounds.
- Synthesize the students to understand simple double stage preparations of some organic complex.
- To enable the students to learn about find out melting point of organic compounds.
- To enable the students to learn about preparations of derivatives.

1. Separation of Organic Mixtures

I. Pilot separation

Bulk separation

Determination of melting point/boiling point

II. Analysis of Soluble/Insoluble component:

- a) Aliphatic/Aromatic
- b) Saturation / Unsaturation
- c) Special elements
- d) Functional group

e) Derivatives

2. Preparations -(Two stages)

- I. Acetanilide to *p*-bromoacetanilide to *p*-bromoaniline.
- II. Acetanilide to *p*-nitroacetanilide to *p*-nitroaniline.
- III. Preparation of Cu_2Cl_2 ; 2-chlorobenzoic acid from anthranilic acid.
- IV. Benzoin to benzil to benzilic acid.

Reference Book(s):

1. A.I. Vogel-A.R. Tatchell-B.S. Furniss-A.J. Hannaford-P.W.G. Smith-Vogel's Textbook of Practical Organic Chemistry-5th Ed.-Prentice Hall-1996.
2. J. Mohan-Organic Analytical Chemistry-Theory and Practice-Narosa-2003.
3. V.K. Ahluwalia-P. Bhagat-R. Aggarwal-Laboratory Techniques in Organic Chemistry-I.K. International-2005.
4. N.S. Gnanaprakasam-G. Ramamurthy-Organic Chemistry Lab Manual-S.V. Printers-1987.

Scheme of valuation

Criteria	Marks	
Record	5	
Procedure writing	10	
Organic preparation	15	
Analysis		
	I	II
Aliphatic/aromatic	2	2
Saturated/unsaturated	2	2
Element test	4	4
Functional group	5	5
Derivative	2	2

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
I	20PCH2CP1	Organic preparations and mixture analysis - practical	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
6	0	0	0	6	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - I

Course Code: 20PCH2CP2

Exam Hours: 6

Instruction Hours: 6

Internal Marks: 40

Credits: 4

External Marks: 60

CORE COURSE PRACTICAL 2 -INORGANIC QUALITATIVE ANALYSIS AND COLORIMETRIC ESTIMATIONS - PRACTICAL

Course Outcomes:

- To enable the students to learn about inorganic qualitative analysis.
- Be able to learn quantitative separation of metal ions in binary mixtures.
- To enable the students to learn knowledge about analysis of rare earth elements.
- Use colorimeter to estimate inorganic compounds.
- Synthesize the students to understand simple single stage preparations of some inorganic complex.

1. Semi-micro Qualitative Analysis

Analysis of two common and two rare earth elements in a given inorganic mixture

Common : Pb-Cu-Bi-Cd-Zn-Co-Ni-Ca-Ba-

Rare : Se-Te-Mo-Ce-Zr-Th-V-Li.

2. Colorimetric Estimation:

Cu-Fe-Mn-Ni-Cr

Reference Book(s):

- 1.V.V. Ramanujam-Inorganic Semi Micro Qualitative analysis-National Pubs-1988.
2. A.I. Vogel-Text Book of Quantitative Inorganic Analysis-3rd Ed.-Longman-1966.

Scheme of Valuation

Criteria	Marks
Record	5
Aim and tabulation	5
Mixture analysis [30]	Colorimetry [20]

4- radicals with correct procedure	30	Error	Marks
3- radicals with correct procedure	25	< 1 %	20
2- radicals with correct procedure	20	1-2%	15
1- radical with correct procedure	10	2-3%	
Spotting	10	3%	10
			5

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
I	20PCH2CP2	Inorganic qualitative analysis and colorimetric estimations - practical	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
6	0	0	0	6	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - II

Course Code: 20PCH1CC4

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE 4-BIO-INORGANIC AND ORGANOMETALLICS

Course Outcomes:

- To enable the students to understand the importance of transport and storage metals in biological systems.
- To enable the students to understand the importance of Fe-Mg and Cu-containing proteins.
- To enable the students to understand the structure and importance of biomolecules of proteins and metal in proteins
- To enable the students to understand the importance of trace elements in biological system and also the toxicity of metal ions and understand the role of metals in medicine.
- To enable the students to learn the various types of reactions of coordinated ligands in organometallics.

Unit I

General Principles of Bioinorganic Chemistry: Chemistry of amino acids- proteins their derivatives- methods of isolation and identification, Occurrence and availability of Inorganic elements in Organisms -Biological function of inorganic elements -Biological ligands for metal ion coordination of proteins and enzymatic catalysis -Porphyrins and other Macrocycles, Nucleobases, nucleotides and Nucleic acids as ligands-bleomycin and siderophores, Communication roles for metals in biology-Biological Nitrogen Fixation and Nitrogenase

Transport and storage of metals: Mechanism Fe, Cu, Zn and V storage and transport metallothioeins, Molecular mechanism of iron transport across the membrane -sodium and potassium ion pumps. Metals at the Center of Photosynthesis: Primary Processes in Photosynthesis -Photosystems I and II.

Unit II

Oxygen Transport and energy transfer of metals proteins-Reactions of the alkyl cobalamins, One electron Reduction and Oxidation –coenzyme B12 -Alkylation reactions of methylcobalamin-Heme and Non-heme Proteins: Hemoglobin and Myoglobin - Hemerythrin -Oxygen transport and storage-Electron transfer Ferredoxins and Rubredoxins -Cytochromes -Cytochrome C Oxidase -Oxygen activation -Mononuclear non-heme iron enzymes model systems.

Copper containing proteins–blue copper proteins -structure of blue copper electron transferases -copper protein as oxidases-Superoxide dismutase (Cu-Zn).

Unit III

Medicinal Bioinorganic Chemistry: Bioinorganic Chemistry of quintessentially toxic metals. Lead-Cadmium-Mercury-Aluminum-Chromium-Iron, Copper, Plutonium-Detoxification by metal chelation Drugs that act by binding at the metal sites of Metalloenzymes.

Chemotherapy: Chemotherapy with compounds of certain non-essential elements. Platinum complexes in Cancer therapy -Cis platin and its mode of action -Cytotoxic compounds of other metals -Gold containing drugs as anti-rheumatic agents and their mode of action -Lithium in Pschyco–pharmacological drugs-Radiopharmaceuticals - Technetium.

Unit IV

Organometallics: Basic Concepts: Types of organometallic compounds on the basis of the nature of M C bond, EAN rule: 18e and 16e rules determination of oxidation state-Preparation-properties-structure and bonding in Metal carbonyls-nitrosyls-Metal olefins-acetylenes-Metallocene and arene complexes.-fluxional organometallic compounds - application of organometallics- (C C bond coupling reactions (Heck Sonogoshira-Suzuki etc). C N bond coupling reactions. Reduction reactions using transition metal hydrides; asymmetric hydrogenation).

Unit V

Organometallic Chemistry: Reactions and Catalysis by Organometallics: Organometallic reactions -Ligand association and dissociation-carbonylation and decarbonylation; oxidative addition and reductive elimination-insertion reaction-

Stability, preparation and reactivity. Metalcarbonyls, Metal, phosphines, metal nitrosyls, metal isocyanide: structures reactivity and bonding. Metal carbenes-metal carbynes

Reactions of coordinated ligands in organometallics –Hydrogenation-hydroformylation-epoxidation-polymerization of olefins-olefin oxidation (Wacker process) and carbonylation of methanol.

Text Book(s):

1. W. Kaim and B. Schwederski-Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life-(An Introduction and Guide)-John Wiley and Sons-1994. (Unit-1)
2. S. J. Lippard and J. M. Berg-Principles of Bioinorganic Chemistry-Panama Publishing Corporation-1997. (Unit-2)
3. W. Kaim and B. Schwederski-Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life-(An Introduction and Guide)-John Wiley and Sons-1994. (Unit-3)
4. G.L. Eichorn-Inorganic Biochemistry-Volumes 1 & 2-2nd Ed.-Elsevier-1973. (Unit-4)
5. J.P. Collman-L.S. Hegedus-J.R. Norton-R.G. Finke-Principles and Applications of Organotransition Metal Chemistry-University Science Books-1980. (Unit-5)

Reference Book(s):

1. J. E. Huheey-Inorganic Chemistry-3rd Ed.-Harper & Row Publishers-1983.
2. K.F. Purcell-J.C. Kotz-Inorganic Chemistry-Saunders Golden Sunburst Series-1977.
3. F.A Cotton-G.Wilkinson-Advanced Inorganic Chemistry-5th Ed.-John Wiley& Sons-1992.
4. L. Finar-Organic Chemistry Vol 2-Stereochemistry and the Chemistry of Natural Product-Dorling Kindersley India (P) Ltd-2009.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
II	20PCH1CC4	Bio-inorganic and organometallics	6	5						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
64	0	0	0	64	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - II

Course Code: 20PCH2CC5

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE 5-SPECTROSCOPY OF ORGANIC MOLECULES

Course Outcomes:

- To enable the students to understand-Rotational and Vibrational Spectroscopy.
- To enable the students to correlate the IR stretching frequencies of organic compounds with their functional groups.
- To enable the students to interpret the ^1H as well as ^{13}C NMR spectra of organic compounds with individual nuclei (protons/carbons).
- To enable the students to interpret different types of carbons (CH-CH₂-CH₃ and quaternary C) using ^{13}C NMR spectral editing and ^{13}C NMR DEPT techniques. To enable the students to interpret 2D-NMR techniques such as HSQC-HMBC and NOESY.
- To enable the structural elucidation of organic compounds using Mass Spectral data.

Unit I

Rotational and Vibrational Spectroscopy: Microwave spectroscopy -rotational spectra of diatomic molecules- rigid and non-rigid rotors -Intensity of spectral lines-Effects of isotopic substitution -Microwave spectra of polyatomic molecules-Linear and symmetric top molecules-techniques and instrumentation.

Vibrational Spectroscopy: Introduction - Instrumentation Sampling techniques - Woodward-Fieser and Scott rules for conjugated dienes and polymers- ketones, aldehydes, α β -unsaturated acids, esters, nitriles, and amides- Differentiation of geometrical isomers and positional isomers -Disubstituted benzene.

Unit II

Advanced Spectroscopy: Infrared Spectroscopy: Introduction- Instrumentation- Sampling techniques-factors influencing group frequencies -Both internal and external quantitative

studies. Infrared spectra diatomic molecules- simple harmonic and anharmonic oscillators- diatomic vibrating rotator-rotation-vibration spectrum of carbon monoxide- Interaction of rotation and vibration (breakdown of Born- Oppenheimer approximation) -Influence of the rotation on the spectrum of polyatomic molecules-linear and symmetric top molecules- parallel and perpendicular vibrations-influence of nuclear spin- Characterization of functional group frequency (-NH₂ -OH -CH -CO -COOH -CONH₂ -COOR and -CHO).

Unit III

Nuclear Magnetic Resonance and Their Applications: ¹H NMR Spectroscopy - Instrumentation of NMR spectroscopy - Multiplicity -Coupling constant -First order and second order proton. Shielding and Deshielding- Factors affecting chemical shift and factors affecting coupling constant- Spin spin splitting -Dependence of J on dihedral angle -Vicinal and geminal coupling constants -anisotropic effect-double bond-triple bond-aromatic compounds-carbonyl compounds and annulenes. Karplus equation -long range coupling constants-NMR spectrum of cyclopropane, cyclobutane, acetylacetone, benzamide, dibromoethane, glycol,cyclohexane, aniline, phenol and anisole. ¹H NMR Spectral parameters -intensity chemical shift-multiplicity-coupling constant-factors affecting.

Unit IV

¹³C NMR & ³¹P NMR and 2-D NMR Techniques: ¹³C NMR-difficulties in recording ¹³C NMR: Homo nuclear and heteronuclear coupling. Off Resonance decoupled spectrum identification of various types of carbon (functional groups) using ¹³C NMR. ³¹P NMR- Chemical shift and heteronuclear coupling, Identification of organo phosphorous compounds such as (Me)₃P-(EtO)₃P=O. Basic aspects of 2-D NMR techniques: Correlation spectroscopy (COSY). HOMO COSY (HOMCORR: ¹H-¹H connectivity- ¹³C-¹³C connectivity): HSQC and HETERO COSY (HETCORR): HMBC. 2D NOE Correlation Spectroscopy (NOESY). off-resonance decoupled; proton noise decoupled ¹³C NMR spectra-Assignment of chemical shifts additively effect characteristic chemical shifts of common organic compounds and functional groups-APT-DEPT - INEPT spectra.

Unit V

Mass Spectrometry: Origin basics and bloc diagram of Mass spectrum-Variou types of Ionization techniques- Stability of Molecular ions-Meta stable ions, Base peaks and Isotope peaks. Fragmentation patterns of organic molecules such as benzenes-phenyl halides-phenols-benzyl alcohols-benzyl halides-aliphatic alcohols-aliphatic as well as aromatic carbonyl compounds. Fragmentation patterns of aliphatic/aromatic nitro and amine compounds. Fragmentation patterns of heterocyclic compounds (furan, pyrrole and pyridine only). McLafferty rearrangements of organic molecules-Basic principle, instrumentation- production of ions, EI, CI, FAB, molecular ion peak, Base peak, meta stable peak, nitrogen rule, even electron rule.

Text Book(s):

1. C. N. Banwell and E. M. Mccash-“Fundamentals of Molecular Spectroscopy”-Tata McGraw-Hill Publishing Company Limited-New Delhi-2009. (Unit-1)
2. Y.R. Sharma-Elementary Organic Spectroscopy: Principles and Chemical Applications-S.Chand Publications-New Delhi-2012. (Unit-1 & Unit-2)
3. K. Veera Reddy-“Symmetry and Spectroscopy of Molecules”-New Age International Publishers-2010. (Unit-3)
4. P.S.Kalsi-Spectroscopy of Organic Compounds. (Unit-3)
5. W. Kemp-Organic Spectroscopy-3rd Ed.-MacMillon-1994. (Unit-4)
6. Gurdeep R Chatwal and Sham K Anand-Spectroscopy-Himalaya Publishing House (2009). (Unit-5).

Reference Book(s):

1. R. S. Drago-“Physical Methods in Chemistry”-New Delhi-East West Press Ltd.-1971.
2. B.P. Straughan and S.Walker Spectroscopy Vol.3-Chapman Hall London-1976.
3. P.K.Ghosh-Introduction to Photoelectron Spectroscopy-John Wiley New York-1989.
4. P.M. Silverstein-F. X. Wester-Spectroscopic Identification of Organic Compounds-6thEd.-Wiley 1998.
5. G. M. Barrow-“Introduction to Molecular Spectroscopy”-Tata-McGraw- Hill Edition-1993.
6. Clegg.W.-Crystal structure determination-Oxford University press -New York-1998.
7. Stout-G.H.-Jensen -L.H. X-ray structure determination : A practical guide -John wiley & sons Publication: New York-1989
8. **Webpages :**

- a) Cambridge Structural Database (CSD) - <http://www.ccdc.cam.ac.uk/products/csd/>
b) Protein Data Bank (PDB) - <http://www.rcsb.org/pdb/home/home.do>

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
II	20PCH2CC5	Spectroscopy of organic molecules	6	5						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
81	0	0	0	81	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - II

Course Code: 20PCH2EC1:1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 1:1-CONCEPTS AND MODELS IN CHEMISTRY

Course Outcomes:

- To learn about polymeric bio-organic molecules such as carbohydrates-proteins and nucleic acids.
- To enable the students to understand the importance of trace elements in biological system
- To enable the students to understand the structure and importance of biomolecules such as proteins-nucleic acids and carbohydrate.
- To identify the bonding types.
- Learn the chemical bonding and chemical thermodynamics. Learn chemical kinetics.

Unit I

Bio-Organic Chemistry: Amino acids and proteins: Structure-classification-nomenclature and function of amino acids-functional groups-isoelectric point -Peptide structure-structural levels of proteins -primary-secondary-tertiary and quaternary-alpha-beta helix -collagen-fibrous and globular proteins.

Nucleic acids: Structures of RNA and DNA.

Enzymes: Coenzymes -Classification -Characteristics-properties-nomenclature-functions-factors affecting enzyme activity: pH, temperature-substrate concentration-Examples for coenzymes and its functions.

Unit II

Metal Ions in Biology & Chemotherapy: Metal Ions in Biology -Occurrence and availability of Inorganic elements in Organism-Biological function of inorganic elements - Biological ligands for metal ions -Coordination of Proteins and enzymatic catalysis,

Porphyrins and other Macrocycles -Nucleobases-nucleotides and other Nucleic acids as ligands. Metal ion transport and storage -Cobalamines -Metals at the Center of Photosynthesis. Dioxygen transport: Oxygen Transport and Storage through Hemoglobin and Myoglobin-Alternative oxygen Transport in some Lower Animals: Hemereythin - Hemocyanin.

Chemotherapy-Platinum complexes in Cancer therapy -Cisplatin and its mode of action - Cytotoxic compounds of other metals -Gold containing drugs as anti-rheumatic agents and their mode of action-Lithium ion Pschycopharmacological drugs.

Unit III

Chemical Bonding: Atomic structure - Types of chemical bonds-Core and valence electrons -concept of hybridization-periodicity, valence shells and chemical reactivity - valence and chemical formulas, covalent-ionic covalent character of ionic bond co-ordinate bonds -hydrogen bonds -non-covalent interactions -electronic and molecular structure - σ - π and δ bonds -bond parameters, conformation, configuration various representations -macromolecules and three dimensional structures.

Unit IV

Chemical Thermodynamics: Energy and the First Law of Thermodynamics-Conservation of energy-principle work and heat-enthalpy, exothermic and endothermic reactions-Cp & Cv- Internal energy Hess's law of heat summation-use of standard enthalpies of formation -Entropy and the second law of Thermodynamics-Kelvin and Clausius statements of Second Law-variation of chemical potential with temperature and pressure -definition of entropy-spontaneity and reversibility-entropy change of the system-molecular basis of entropy-free energy and chemical equilibrium-Factors affecting equilibrium.

Unit V

Chemical Kinetics: Rate of Reaction Molecularity -order of reaction - derivation of rate equation for first order reaction-Determination of rate equation by isolation method -Effect of temperature on reaction rate -Arrhenius equation limitations -Enzyme Kinetics - Michaelis -Menten equation -Salt effect on reaction rate (derivation not needed).

Text Book(s):

1. S. J. Lippard and J. M. Berg-Principles of Bioinorganic Chemistry-Purnima Publishing Company-1997. (Unit-1)
2. Geoffrey L. Zubay-William W. Parson and Dennis E. Vance-Principles of

- Biochemistry- McGraw-Hill Education-1995. (Unit-2)
3. D. E. Douglas-D.H. McDaniel and J. J. Alexander-Concepts and Models in Inorganic Chemistry-3rd Ed-1994. (Unit-3)
 4. S. Glasstone-Thermodynamics for Chemists-Affiliated East West Press-New Delhi-1960. (Unit-4)
 5. Gordon M. Barrow-Physical Chemistry-Tata McGraw Hill-1994. (Unit-5)

Reference Book(s):

1. B.H. Mahan-University chemistry-Narosa Publishers.
2. Bruce H. Mahan-University chemistry-Narosa Publishers.
3. David L. Nelson and Michael M. Cox-Leninger Principles of Biochemistry-WH Freeman-2017.
4. R.T. Morrison and R.N. Boyd-Organic Chemistry-6th Ed.-Pearson-1992.
5. I.L. Finar-Organic Chemistry-Vol.II-5th ed.-ELBS 1975.
6. J.E. Huheey-Inorganic Chemistry-3rd Ed.-Harper & Row publisher-1983.
7. W. Kaim and B. Schwederski-Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life-John Wiley
8. C.H. Snyder-The extra-ordinary chemistry of ordinary things-John Wiley-1992.
9. P.W. Atkins-Physical Chemistry-ELBS and Oxford University Press-1998.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
II	20PCH2EC1:1	Concepts and models in chemistry	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5

C01	✓		✓	✓	✓		✓	✓	✓	✓
C02	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C03	✓		✓		✓	✓	✓	✓	✓	✓
C04	✓		✓		✓	✓	✓	✓		✓
C05	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
78	0	0	0	78	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - II

Course Code: 20PCH2EC1:2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 1:2-METALLO PROTEINS-ENZYMES AND NATURAL PRODUCTS

Course Outcomes:

- To enable the students to understand the structure and importance of biomolecules such as of amino acids and proteins.
- To enable the students to understand the structure and functions of various types of metallo enzymes.
- To enable the students to understand the structure and importance of biomolecules such as-nucleic acids and proteins synthesis.
- To enable the students to understand the structure and importance of antibiotics and vitamins.
- To enable the students to understand the structural elucidation and biosynthesis of alkaloids and terpenes.

Unit I

Amino Acids and Proteins: Structure-classification-synthesis and properties of amino acids-isoelectric point-biosynthesis of amino acids. Peptides-oligo-and polypeptides-geometry of peptide linkage-N-terminal and C-terminal residue analysis-synthesis of peptides-amino and carboxyl protecting groups-solid phase peptide synthesis-Proteins: classification and properties (denaturation-isoelectric point –electrophoresis)-primary-secondary-tertiary -quaternary structures of proteins methods of isolation and identification -collagen and triple helix.

Unit II

Enzymes and Cofactors-Mechanism of enzyme catalysis-Factors influencing enzyme action-Examples of typical enzyme mechanisms: chymotrypsin-ribonuclease and lysozyme-Enzyme-catalyzed addition-elimination-condensation-carboxylation-decarboxylation-isomerisation-group transfer and rearrangement reactions-structure and biological functions of coenzyme A, thiamine pyrophosphate-pyridoxal phosphate-NAD⁺-

NADP⁺-FMN-FAD-lipoic acid and Vitamin B12-Mechanisms of reactions catalysed by the above cofactors.

Unit III

Nucleic Acids and Protein Synthesis : Nucleotides and nucleosides-DNA: primary and secondary structure-replication of DNA. RNA and protein synthesis: Messenger RNA synthesis-transcription-Ribosomes-r RNA-Transfer RNA-genetic codetranslation. Determination of base sequence of DNA-Polymerase Chain Reaction (PCR), Antisense technology in chemotherapy and other nucleic acid-targeted drugs-intercalaters-sequence specific drugs, A brief account of ribosome and iRNA. Hydrolysis of ATP

Unit IV

Antibiotics and Vitamins: Biomolecules: Antibiotics and vitamins: A detailed study of structure-stereochemistry and synthesis of penicillin-cephalosporin-Chemistry and physiological action of ascorbic acid-thiamin-riboflavin and pyridoxine -Elementary aspect of vitamin A-E-K - B12.

Unit V

Natural Products: Alkaloids: Synthesis and reactions of the following-Tropine-Cinchonine-Morphine-Papaverene and structural elucidation of Reserpine (synthesis not expected).

Terpenes: Structural elucidation-medicinal values and synthesis of alpha -pinene-camphor

Terpenes: Structural elucidation-medicinal values and synthesis of alpha -pinene-camphor

Text Book(s):

1. Bioorganic Chemistry: A Chemical approach to Enzyme action-Hermann Dugas and C.Penny-Springer-Verlag. (Unit-1)
2. David L. Nelson and Michael M. Cox-Leninger Principles of Biochemistry-WH Freeman-2017. (Unit-2 & Unit-3)
3. Geoffrey L. Zubay-William W. Parson and Dennis E. Vance-Principles of Biochemistry- McGraw-Hill Education-1995. (Unit-4)
4. I. L. Finar-Organic Chemistry Vol. I & II-6th edition-Pearson Education-Dorling Kindersley India (P) Ltd-2009. (Unit - 5).

Reference Book(s):

1. Fundamentals of Enzymology–N.C. Price and L.Stevens-Oxford University Press.
2. Designing Organic Synthesis: The Disconnection Approach by Stuart Warren-Wiley-2nd edition-1984.
3. Asymmetric Synthesis by H. B. Kagan-Thieme Medical Publishers-2003.
4. Advanced Organic Chemistry: Part-A and Part-B by Francis A. Carey and Richard B. Sundberg-Springer-5th edition-2007.
5. Koji Nakanishi-Toshio Goto and Shô-Itô-Natural Product Chemistry-Vol. I-Academies Press-1974.
6. A. Newman-Chemistry of Terpenes and Terpenoids-Academic Press-1972.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
II	20PCH2EC1:2	Metallo proteins-enzymes and natural products	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓

CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
67	0	0	0	67	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - II

Course Code: 20PCH2EC1:3

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 1:3 -SUPRAMOLECULAR CHEMISTRY

Course Outcomes:

- To enable the students to understand fundamentals of supramolecules.
- Understand concepts Metallo Organic Frameworks
- To enable the students to understand co-receptor molecules and multiple recognition
- To enable the students to understand the concept of supramolecular reactivity and catalysis.
- To learn the designs various types of supramolecular devices

Unit I

Concepts of Supramolecular Chemistry: Concepts and languages of supramolecular chemistry -various types of noncovalent interactions, building blocks, hydrogen bonds C-H...X interactions-halogen bonds π - π interactions non-bonded interactions, various types of molecular recognition- Control of supramolecular chemistry-Applications of supramolecular.

Crystal engineering of organic solids -hydrogen bonded supramolecular patterns involving water / carboxyl / halide motifs -concepts of different types of synthons based on non-covalent interactions -principles of crystal engineering and non-covalent synthesis - polymorphism and pseudopolymorphism-supramolecular isomorphis polymorphism - crystal engineering of pharmaceutical phases.

Unit II

Metallo Organic Frameworks: M.O.F (Metallo Organic Frameworks) -organometallic systems, combinations of different interactions to design molecular rods, triangles,ladders-networks etc. design of nanoporous solids -interligand hydrogen bonds in metal complexes,MOF membranes for CO₂ capture- implications for drug design, crystal engineering of NLO materials-OLED.

Unit III

Co-receptor Molecules and Multiple Recognition: Dinuclear and polynuclear metal ion cryptates -linear recognition of molecular length by ditopic co-receptors -heterotopic co-receptors -cyclophane receptors amphiphilic receptors and large molecular cages, multiple recognition in metalloreceptors -supramolecular dynamics.

Unit IV

Supramolecular Reactivity and Catalysis: Catalysis by reactive macrocyclic cation receptor molecules -catalysis by enactive anion receptor molecules -catalysis with cyclophane type receptors -supramolecular metallocatalysis -cocatalysis -catalysis of synthetic reactions -biomolecular and abiotic catalysis. Supramolecular chemistry in solution -cyclodextrin micelles dendrimers classification and typical reactions applications.

Unit V

Supramolecular Devices: Supramolecular devices and sensors -various types of supramolecular devices -an overview -supramolecular photochemistry -molecular and supramolecular photonic devices light conversion and energy transfer devices -molecular and supramolecular electrochemistry-electronic devices -electronic conducting devices -molecular wires-modified and switchable molecular wires -molecular recognition, information and signals semiochemistry-molecular and supramolecular ionic devices -tubular mesophases-molecular protonics -switching devices -electro-photo switch -ion and molecule sensors -role of supramolecular chemistry in the development of nanoscience and technology.

Text Book(s):

1. Jonathan W. Steed-David R. Turner and Karl J. Wallace-Core Concepts in Supramolecular Chemistry and Nanochemistry-John Wiley & Sons-Ltd-(2007). (Unit-1)
2. J. M. Lehn-Supramolecular Chemistry; VCH-Weinheim-Germany-1995. (Unit-2)
3. G. R. Desiraju-Crystal Engineering: The Design of Organic Solids; Elsevier-United States-1989. (Unit-3).
4. G. A Jeffrey-Introduction to Hydrogen Bonding; Oxford University Press: UK-1997. (Unit-3).

5. J. W. Steed and J. L. Atwood-Supramolecular Chemistry-2nd edition John Wiley & Sons (2009). (Unit-4)
6. J. M. Lehn-Transition Metals in Supramolecular Chemistry; John Wiley and Sons: New York-1999. (Unit-5)

Reference Book(s):

1. J. M. Lehn-Supramolecular Chemistry; VCH-Weinheim-Germany-1995.
2. G. R. Desiraju-Crystal Engineering: The Design of Organic Solids; Elsevier-United States-1989.
3. G. R. Desiraju-and T. Steiner-The Weak Hydrogen Bond in Structural Chemistry and Biology; Oxford University Press-Oxford-1999.
4. J. M. Lehn-Transition Metals in Supramolecular Chemistry; John Wiley and Sons: New York-1999.
5. G. R. Desiraju-Current Science; 2001-81-1038.
6. Web source:
 - (i) Crystal Growth and Design–
<http://www.pubs.acs.org/journals/cgdefu/index.html>
 - (ii) Crystal Engineering
Communication<http://www.rsc.org/Publishing/Journals/ce/index.asp>

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
II	20PCH2EC1:3	Supramolecular chemistry	6	4

Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
	C01	✓		✓	✓	✓		✓	✓	✓
C02	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C03	✓		✓		✓	✓	✓	✓	✓	✓
C04	✓		✓		✓	✓	✓	✓		✓
C05	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
56	0	0	0	56	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - II

Course Code: 20PCH2CP3

Exam Hours: 6

Instruction Hours: 6

Internal Marks: 40

Credits: 4

External Marks: 60

CORE COURSE PRACTICAL 3 -ORGANIC ESTIMATION AND DOUBLE STAGE PREPARATIONS -PRACTICAL

Course Outcomes:

- To enable the students to learn about estimation of organic compounds. Be able to learn quantitative analysis of organic compounds.
- Synthesize the students to understand simple double stage preparations preparation of organic compounds.
- Synthesize the students to understand isolation of organic compounds.
- To enable the students to learn about find out melting point of organic compounds.
- To enable the students to learn about purification of organic compounds.

1. Estimations

1. Estimation of Aniline
2. Estimation of Phenol
3. Estimation of Methyl ketones
4. Estimation of Glucose
5. Estimation of Hydroxyl group
6. Estimation of Nitro group
7. Saponification Reaction Value

2. Preparation and Isolation

1. Aniline to tribromoaniline to tribromobenzene
2. Methyl benzoate to methyl-*m*-nitrobenzoate to methyl-*m*-nitrobenzoic acid
3. Methyl salicylate to salicylic acid to acetyl salicylic acid
4. Chlorobenzene to dinitrochlorobenzene to 2-4-dinitrophenylhydrazine
5. Hydroquinone to *p*-benzoquinone to 5-hydroxy-1-3-benzoxathiaole to 5-acetoxy-1-3-benzoxathiaole-2-one
6. Extraction of Eugenol from clove

Reference Book(s):

1. J. Mohan-Organic Analytical Chemistry-Theory and Practice-Narosa-2003.
2. V.K. Ahluwalia-P. Bhagat-R. Aggarwal-Laboratory Techniques in Organic Chemistry-I.K. International-2005.
3. N.S. Gnanaprakasam-G. Ramamurthy-Organic Chemistry Lab Manual-S.V. Printers-1987.
4. A.I. Vogel-A.R. Tatchell-B.S. Furnis-A.J. Hannaford-P.W.G. Smith-Vogel's Textbook of Practical Organic Chemistry-5th Ed.-Prentice Hall-19

Scheme of Valuation

Criteria		Marks	
Record		5	
Aim and tabulation		10	
Organic double stage preparation [25]		Organic estimation 20]	
Stage I	10	Error	Marks
Stage II		< 1 %	20
	1-2%	15	
	2-3%	10	
	3%		
		5	

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course					Hours	Credits				
II	20PCH2CP3	Organic estimation and double stage preparations -practical					6	4				
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)						
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5		

C01	✓		✓	✓	✓		✓	✓	✓	✓
C02	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
C03	✓		✓		✓	✓	✓	✓	✓	✓
C04	✓		✓		✓	✓	✓	✓		✓
C05	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
6	0	0	0	6	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - II

Course Code: 20PCH2CP4

Exam Hours: 6

Instruction Hours: 6

Internal Marks: 40

Credits: 4

External Marks: 60

CORE COURSE PRACTICAL 4 -INORGANIC ESTIMATION AND COMPLEX PREPARATIONS -PRACTICAL

Course Outcomes:

- To enable the students to learn about gravimetric estimation.
- Synthesize the students to understand preparations of coordination complex.
- Synthesize the students to understand characterization of coordination complex.
- To enable the students to learn about quantitative analysis of cations.
- To enable the students to learn about purification of coordination compounds.

1. Volumetric and gravimetric analysis of a solution containing two cations

1. Copper and Nickel
2. Copper and Zinc
3. Ferrous and Ferric ions
4. Barium and Calcium

2. Preparations and Characterization of Co-ordination Complexes

1. Tris(thiourea)copper(I) sulphate
2. Tetramminecopper(II) sulphate
3. Pentathioureadicuprous nitrate
4. Potassium trioxalato ferrate
5. Potassium trioxalatoaluminate
6. Potassium trioxalatochromate
7. Cis-Potassium dioxalato diaquochromate
8. Hexathiourea plumbum nitrate
9. Hexamminecobalt(III) chloride Ferroc

Reference Book(s):

1. A.I. Vogel's-Quantitative Inorganic Analysis-5th Ed.-Prentice Hall-1996.

Scheme of valuation

Criteria		Marks	
Record		5	
Aim and tabulation		10	
Inorganic preparation [15]		Gravimetry 30	
Bulk precipitate	15	Error	Marks
		< 1 %	30
		1-2%	25
		2-3%	15
		3%	10

Relationship Matrix for COs-POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
II	20PCH2CP4	Inorganic estimation and complex preparations - practical					6	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓		✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓		✓	✓	✓	✓	✓	✓	
CO4	✓		✓		✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Number of Matches(✓) = 42 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
6	0	0	0	6	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -III

Course Code: 20PCH3CC6

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE 6 - PHOTOCHEMISTRY, PERICYCLIC REACTIONS, HETEROCYCLES AND REAGENTS

Course Outcomes:

- Learn the knowledge in organic photochemistry
- Learn the reagents and reaction of organic compounds
- Learn the theoretical aspect of organic synthesis
- The students will be able to introduce about basic chemistry of the heterocyclic.
- The students will get familiar with particular properties and reactions for the most important heterocyclic as well as different systems of nomenclature.

UNIT -I: Organic Photochemistry

(18 – Hours)

Fundamental concepts -Jablonski diagram energy transfer characteristics of photo sensitization-characteristics of photo reactions of ketones-Norrish type I and II-reactions photochemistry of alkenes, dienes and aromatic compounds -reactions of unactivated centres, photo additions, Patterno Buchi reaction. Photo substitution - Barton reaction - Hoffmann Loffler - Freytag reaction. Photo rearrangement - Photo Fries and di - π methane rearrangements-Photochemistry of azo compounds, diazo compounds, azides and diazonium salts.

UNIT II: Orbital Symmetry & Pericyclic Reactions (18 – Hours)

Pericyclic reactions -Concerted reactions -Symmetry properties of molecular orbital-molecular orbital in ethylene- 1,3-butadiene, 1,3,5-hexatriene. - Electrocyclic reactions-correlation diagram and Frontier molecular orbital (FMO) approach -Woodward Hoffmann rules. Cycloaddition reactions-Diels Alder reaction- stereochemical modes: suprafacial and antarafacial processes-orbital symmetry in cycloaddition reaction: correlation diagrams and FMO method. Endo-exo selectivity in Diels-Alder reaction and it's explanation by FMO theory Sigmatropic rearrangements -analysis -Cope and Claisen rearrangements. Applications of FMO methods to pericyclic reactions.

UNIT-III: Heterocycles and their Reactivity (18 – Hours)

Structure, synthesis and their reaction of the following systems; a) One heteroatom - Pyrrole, Furan, Thiophene, Pyridine; b) Benzo fused Heterocycles Indole, Quinoline; Two heteroatom - Pyrazole, Imidazole, Pyrimidine, Pyrazine.

UNIT-IV: Named Reactions and Strategic Applications (18–Hours)

Bamford-Stevens Reaction -Baylis-Hillman Reaction -Biginelli Reaction, Henry Reaction -Hosomi-Sakurai Reaction -Hunsdiecker Reaction –Mukaiyama Aldol Addition -Nazarov Cyclization -Peterson Olefination -Prevost Reaction -Prins Reaction –Ugi reaction - Wittig reaction and its modifications. Palladium based reactions: Fukuyama Coupling -Heck Reaction -Hiyama Coupling -Stille Coupling -Suzuki Coupling -Tsuji-Trost Reaction. Arndt-Eistert, Hunds-Diecker reaction, Baeyer-Villiger, Dakin, Gabriel synthesis, Michael, Darzen, Prins, Henry, ReimerTiemann, Hoffmann Löffler–Freytag, Dieckmann cyclization, Chichibabin- Vilsmeier, Ene, Ullmann reaction, Mannich, Strecker amino acid synthesis.

UNIT V: Reagents in Organic Synthesis (18 – Hours)

Catalytic hydrogenation and dehydrogenation -Reduction with LAH, NaBH₄, tritertiary butoxy aluminum hydride, NaCNBH₃, tributyltin hydride, Me₃SiCN, alkali metals for reduction, reductions with hydrazines-Osmium tetroxide -Sharpless asymmetric epoxidation -Chromyl chloride -Ozone -DDQ -Dioxiranes -Lead tetraacetate -Selenium dioxide -Gilman reagents - Dithione -DMSO either with Ac₂O or oxalyl chloride -Dess-Martin reagent -LDA -Phase transfer catalysis (PTC) -Merrifield resin -Baker's yeast-DCC, EDC , 1,3 Dithiane, LDA, DMDO, RuO₄, SmI₂, Dess-Martin Periodinane, Diazomethane, Lawesson's reagent.

Text Books:

1. R.K. Bansal, Heterocyclic chemistry- Syntheses, Reactions and Mechanisms, Wiley Eastern Ltd, 1990.
2. S.M.Mukherji and S.P.Singh, Reaction Mechanism in Organic Chemistry, 3rd edition, Macmillan, 2010.
3. Ahluwalia, V K, Textbook of Organic Chemistry, New Delhi: Narosa Publishing, 2000.

References:

1. H.O. House, Modern Synthetic Reactions, 2nd Ed., W. A. Benjamin, 1972.
2. F.A. Carey, R.J. Sundberg, Advanced Organic Chemistry, Parts A & B, 5th Ed., Springer, 2007.
3. T. L. Gilchrist, Heterocyclic Chemistry, 3rd Ed., Prentice Hall, 1997.
4. K. Mackie, M. Smith, Guide Book to Organic Synthesis, ELBS, England 1982.
5. L. Kurti, B. Czako, Strategic Applications of Named Reactions in Organic Synthesis, Elsevier, 2005.
6. Hassner, C. Stumer, Organic Synthesis Based on Name and Unnamed Reactions, Elsevier Science Ltd., UK, 1994.
7. R.O.C. Norman -"Principles of Organic Synthesis" -2nd Ed., (1986), Chapman and Hall Publications, New York.
8. Also refer: <http://www.organic-chemistry.org/>; <http://www.organicworldwide.net>.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
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III	20PCH3CC6	Photochemistry, pericyclic reactions, heterocycles and reagents				6	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
78	0	0	0	78	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -III

Course Code: 20PCH3CC7

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

CORE COURSE 7 - SPECTROSCOPY OF COORDINATION COMPLEXES

Course Outcomes:

- Identify molecular geometries associated with various d-orbital splitting patterns
Learn electronic spectroscopy of metal complexes.
- Predict electron configurations of split d orbitals for selected transition metal atoms or ions
- Learn detail IR, Raman and NMR of inorganic compounds
- Learn the EPR, Mossbauer and magnetic properties of metal complexes.
- Determine the nature of proton and determine number of equivalent proton in a molecule from proton NMR spectra.

UNIT- I: Electronic Spectroscopy

(18 – Hours)

Electronic configuration-quantum numbers spin-spin coupling, orbit-orbit coupling and spin-orbit coupling, microstates, terms, Mulliken symbols for microstates and energy level splitting for d^1 - d^9 ions in cubic and square fields -selection rule for electronic spectra – Orgel diagram and Tanabe-Sugano diagram, evaluation of $10Dq$ and β for octahedral complexes of cobalt, nickel and $[\text{Ru}(\text{bipy})_3]^{2+}$ -intensity of bands - effect of distortion and spin-orbit coupling on spectra -applications to simple coordination compounds -charge transfer spectra L-M and M-L charge transfer transition. ORD, CD and MCD -principle - applications to metal complexes.

UNIT II: Infrared and Raman Spectroscopy

(18 – Hours)

Conditions for IR active, vibrations in simple molecules (H_2O , CO_2) and their symmetry notation for molecular vibrations -group vibrations and the limitations -combined uses of IR and Raman spectroscopy in the structural elucidation of simple molecules like N_2O ,

ClF₃, NO₃ -effect of coordination on ligand vibrations -uses of groups vibrations in the structural elucidation of metal complexes of urea **Effect of hydrogen bonding- solvent effect on vibrational frequencies** - thiourea- cyanide- thiocyanate and dimethyl sulfoxide. Effect of isotopic substitution on the vibrational spectra of molecules -vibrational spectra of metal carbonyls with reference to the nature of bonding -geometry and number of C-O stretching vibrations (group theoretical treatment) -applications of Raman spectroscopy.

UNIT III: NMR Spectroscopy

(18 – Hours)

NMR spectroscopy -theory of NMR spectra, number of NMR signals -chemical shifts, factors affecting the chemical shift values and coupling constants involving different nuclei (¹H, ³¹P, ¹³C)-Effect of quadrupolar nuclei (²H, ¹⁰B, ¹¹B) on the ¹H NMR spectra. ¹³C NMR -proton decoupled and off -resonance ¹³C NMR spectra -factors affecting the ¹³C NMR chemical shifts - Systems with chemical exchange -study of fluxional behaviour of molecules -NMR of paramagnetic molecules. Spin-spin couplings, Different types of couplings, factors affecting on coupling constants- Karplus equation, Spin systems (AB, AX, ABX, AMX), Rate processes, spin decoupling- shift reagents- Nuclear Overhauser effect (NOE), INEPT and INADEQUATE

UNIT IV: EPR Spectroscopy and Magnetic properties

(18 – Hours)

Theory of EPR spectroscopy -spin densities and McConnell relationship -factors affecting the magnitude of g and A tensors in metal species -zero-field splitting and Kramers degeneracy -spectra of V(II), Mn(II), and Cu(II) complexes -applications of EPR to a few biological molecules containing Cu(II) - Fe(III) ions.

Magnetic properties -types of magnetism -dia- para- ferro- and antiferromagnetism - magnetic properties of free ions -first-order Zeeman effect -second order Zeeman effect -states kT -states $\ll kT$ -determination of magnetic moments and their applications to the elucidation of structures of inorganic compounds. Principle of ESR spectroscopy- presentation of spectrum-hyperfine splitting in various structures, hyperfine splitting diagram of representative examples-Anisotropy in the hyperfine coupling constant, electron delocalization-instrumentation and applications.

UNIT V: Mossbauer and NQR Spectroscopy

(18 – Hours)

Mossbauer Spectroscopy - Introduction, principle, instrumentation, recoil energy- Doppler effect, number of MB signals- isomer shift-quadrupole splitting- magnetic hyperfine splitting- applications to ^{57}Fe , and ^{119}Sn compounds- factors affecting the line position and shape, isomer effect and Quadrupole splitting iron salt like compounds, complexes- NQR spectroscopy -characteristics of quadrupolar nucleus -effects of field gradient and magnetic field upon quadrupolar energy levels -NQR transitions - applications of NQR spectroscopy.

Text Books:

1. C. N. Banwell and E. M. Mccash, "Fundamentals of Molecular Spectroscopy", Tata McGraw-Hill Publishing Company Limited, New Delhi, 2009.
2. Y. R. Sharma, Elementary Organic Spectroscopy -Principles and Chemical Applications; S. Chand and Co., New Delhi, 1992.
3. P. S. Kalsi, Spectroscopy of Organic Compounds; 6th Ed., New Age International Publishers, New Delhi, 2004.

References:

1. R. S. Drago, Physical Methods in Inorganic Chemistry; Affiliated East-West Press Pvt. Ltd., New Delhi, 2012.
2. F. A. Cotton and G. Wilkinson, Advanced Inorganic Chemistry, 6th Ed., Wiley-Eastern Company, New Delhi, 1999.
3. P. J. Wheatley, The Determination of Molecular Structure; 2nd Ed., Dover Publications, Mineola, 1981.
4. G. J. Leigh, N. Winterton, Modern Coordination Chemistry; Royal Society of Chemistry, UK, 2002.
5. E. A. V. Ebsworth, Structural Methods in Inorganic Chemistry; 3rd Ed., ELBS, Great Britain, 1987.
6. W. Kemp, Organic Spectroscopy; 3rd Ed., Palgrave, New York, 2011.
7. J. R. Dyer, Applications of Absorption Spectroscopy of Organic Compounds, PHI Learning, New Delhi, 2009.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25

Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course		Hours	Credits					
III	20PCH3CC7	Spectroscopy	of	6	5					
		coordination complexes								
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
81	0	0	0	81	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -III

Course Code: 20PCH3EC2:1

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ELECTIVE COURSE 2:1 - CRYSTAL STRUCTURE, ORGANIC SOLID STATE AND OPTICAL PROPERTIES

Course Outcomes:

- An overview of the synthesis and applications of inorganic materials
- Learn to crystal structures of few inorganic solids.
- Learn the applications of magnetic materials.
- Structure and compound identification in the solid state
- Learn the chemistry of organic solids.

UNIT - I: Crystal Structure and Crystal Engineering of Organic Solids (18 – Hours)

Types of close packing hcp and ccp packing efficiency -SC, BCC, and FCC, **calculation of density of unit cell- packing in solids, voids- number of atoms per unit cell in a cubic unit cell, point defects** radius ratio rule -calculate the packing fraction- applications -polyhedral description of solids structure types: Na_2O , Cs_2O , rutile, perovskite (ABO_3), ReO_3 , K_2NiF_4 , spinels and antispinel. Supramolecular chemistry- motifs -concepts of different types of synthons based on non-covalent interactions -principles of crystal engineering and non-covalent synthesis polymorphism and pseudopolymorphism - supramolecular isomorphism, polymorphism and crystal engineering of pharmaceutical phases.

UNIT II: Preparative Methods in Solid State Chemistry (18 – Hours)

Experimental procedure, coprecipitation as a precursor to solid state reaction, other precursor methods, kinetics of solid state reactions -crystallizations of solutions, melts, glasses and gels, solutions and gels: zeolite synthesis -precipitation from solution or melt: flux method, epitaxial growth of thin layers, verneuil flame fusion method. Graphite intercalation compounds, transition metal dichalcogenide and other intercalation compounds, ion exchange reaction, synthesis of new metastable phases by 'Chimie

Douce'. Electrochemical reduction methods -preparation of thin films, chemical and electrochemical methods, physical methods growth of single crystals, Czochralski method, Bridgman-Stockbarger methods zone melting.

UNIT III: Chemistry Of Solid State: Diffraction Methods (18 – Hours)

X-Ray diffraction by single crystal method -space groups -systematic absences in X-ray data and identification of lattice types, glide planes and screw axes -X-ray intensities - structure factor and its relation to intensity and electron density -Basis of crystallography-production of X- rays-phase problem -structure solution by heavy atom method and direct method -determination of absolute configuration of molecules -a brief account of Cambridge Structural Database (CSD) and Protein Data Bank (PDB)-Application and uses of X- rays.

UNIT IV: Magnetic Materials and Optical Properties (18 – Hours)

Selected examples of magnetic materials and their properties -metals and alloys, transition metal oxides, spinels, garnets, ilmenite and perovskites. Magnetoplumbites -applications - structure/property relations -transformer, information storage, magnetic bubble memory devices, permanent magnets. Luminescence, Lasers and phosphors -definitions and general comments- configurational coordinate model, some phosphor materials, anti-Stokes phosphors lasers -the ruby laser- Neodymium lasers

UNITV: Organic Solid State Chemistry (18 – Hours)

Topochemical control of solid state organic reactions -intramolecular reactionsconformational effects intermolecular reactions, molecular packing effects photodimerization of 2-ethoxycinnamic acid (α form, β form, γ form)-photopolymerization of 2,5-distyrylpyrazine photopolymerizations of diacetylenes. Asymmetric syntheses - dimerization of anthracene -control of molecular packing arrangements. Geometrical isomerization-hydrogenatio,addition of halogens-Organic reactions within inorganic host structures electrically conductive organic solids -organic metals, conjugated systems, doped polyacetylene, polyparaphenylene, polypyrrole -organic charge transfer complexes - new superconductors

Text Books:

1. James E. Huheey, Ellen A. Keiter and Richard L. Keiter -“Inorganic Chemistry Principles of Structure and Reactivity”, 4 th Edn., Pearson Education, 11th Impression, 2011.

2. R. West, Solid State Chemistry and Its Applications; 2nd Ed., John Wiley and sons, New York, 2014 (Unit III -V).

References:

1. J. M. Lehn, Supramolecular Chemistry; VCH, Weinheim, 1995.
2. G. R. Desiraju, Crystal Engineering: The Design of Organic Solids; Elsevier, Amsterdam, 1989.
3. G. R. Desiraju, and T. Steiner, The Weak Hydrogen Bond in Structural Chemistry and Biology; Oxford University Press: Oxford, 2002.
4. G. A. Jeffrey, Introduction to Hydrogen Bonding; Oxford University Press, New York, 1997.
5. J. M. Lehn, Transition Metals in Supramolecular Chemistry; Vol 5, John Wiley and Sons, New York, 1999.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
III	20PCH3EC2:1	Crystal structure, organic solid state and optical properties	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓

CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
56	0	0	0	56	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - III

Course Code: 20PCH3EC2:2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 2:2 - SELECTED TOPICS IN CHEMISTRY - I

Course Outcomes:

- Able to interpret ¹H-NMR, IR, MASS and UV spectral properties for a given compound.
- Learn the general information about spectroscopy, aminoacids , proteins and ionic concept
- Expertize in writing conformational structures of carbohydrates and in determination of amino acid sequence in proteins.
- Students are able to recognize and balance oxidation-reduction reactions
- Learn the oxidation-reduction reactions , metals in biology

UNIT- I: Introduction to Spectroscopy

(18 – Hours)

Electromagnetic radiations and spectroscopy -UV-Visible spectroscopy: Theory -Beer-Lambert's law (derivation not required) -Important terminologies: molar absorptivity, chromophore- auxochrome- bathochromic shift- hypsochromic shift -Instrumentation (block diagram only) - Spectra of acetone and benzene -IR spectroscopy: Theory - Molecular vibrations -Characteristic group frequencies -Instrumentation (block diagram only) -Spectra of acetone and ethanol -NMR spectroscopy: Theory -Chemical shift **Factors affecting chemical shift** -Spin-spin splitting -Instrumentation (block diagram only) -Spectra of ethanol and ethyl benzene -Mass spectroscopy: Introduction -Application for determination mass for simple organic molecules- ion production (EI, CI, FD and FAB)

UNIT II: Amino acids and Proteins

(18 – Hours)

Amino acids: Structure -Classification -Nomenclature -Functional groups -Isoelectric point -Peptide structure -Structural levels of proteins -Primary, secondary, tertiary and quaternary, alpha, beta helix -Collagen, fibrous and globular proteins -Nucleic acids: Structure of RNA and DNA.

Enzymes: Classification of enzymes -Basic aspects of enzymes -Factors affecting enzyme activity: pH- temperature- substrate concentration -Examples of Coenzymes and its function.- **Biological nitrogen fixation Enzyme activity - kinetics mechanism (Michaelis Menten and Lineweaver–Burk plots)**

UNITIII: Ionic equilibria in aqueous solution (18 – Hours)

Acids and bases, Arrhenius theory- Lowry - Bronsted Concept- Lewis concept -Self ionization of water -Weak acids and bases- dissociation constants -hydrolysis -buffer solutions, action of buffers -acid base indicators -Acid-base titrations -basics , Complex ion equilibria.

UNIT IV: Oxidation -Reduction reactions and redox potentials (18 – Hours)

Concept of Oxidation state (Oxidation number), rules to assign oxidation states in polyatomic molecule –Half reaction concept -balancing oxidation -reductions by half -reaction method -Galvanic cells, various types of electrode -Standard electrode (cell) potential -various conventions regarding half cell potentials -Nernst equation -Chemical and concentration cells -cell potentials and equilibrium constants- **EMF series.**

UNIT V: Metals in biology (18 – Hours)

Occurrence and availability of inorganic elements in organism -Biological function of inorganic elements -Biological ligands for metal ions -Coordination of proteins and enzymatic catalysis -Porphyrins and other macrocycles –Nucleobases- nucleotides and other nucleic acids as ligands -Metal ion transport and storage -Dioxygen transport -Oxygen transport and storage through hemoglobin and myoglobin -Alternative oxygen transport in some lower animals -Hemereythin and hemocyanin.

Text Books:

1. W. Kemp, Organic Spectroscopy, 3rd Ed., MacMillon, 1994.
2. D.L. Pavia, G.M. Lampman, G.S. Kriz, Introduction to Spectroscopy, 3rd Ed., Brooks Cole, 2000.
3. R.T. Morrison and R.N. Boyd, Organic Chemistry, 6th Ed., Pearson, 1992.
4. S. J. Lippard and J. M. Berg, Principles of Bioinorganic Chemistry, Purnima Publishing Company, New Delhi, 1997.

References:

1. P.M. Silverstein, F.X. Wester, Spectroscopic Identification of Organic Compounds, 6th Ed., Wiley 1998.
2. J. Mohan, Organic Spectroscopy Principles and Applications, 2nd Ed., CRC, 2004.
3. I.L. Finar, Organic Chemistry, Vol.II, 5th ed., ELBS 1975.
4. J. E. Huheey, Inorganic Chemistry, 3rd ed., Harper & Row Publishers, Singapore.
5. W. Kaim and B. Schwederski, Bioinorganic Chemistry: Inorganic Elements in the Chemistry of Life, John Wiley & Sons, New York, USA.
6. G. L. Eichorn, Inorganic Biochemistry, Volumes 1 & 2, 2nd ed., Elsevier Scientific Publishing company, New York, 1973.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	20PCH3EC2:2	Selected topics in chemistry -I					6	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓		✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓		✓	✓	✓	✓	✓	✓	
CO4	✓		✓		✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Number of Matches(✓) = 42 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
78	0	0	0	78	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - III

Course Code: 20PCH3EC2:3

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 2:3 -AGRICULTURAL CHEMISTRY

Course Outcomes

- Students will gain knowledge on concepts and principles of Soil Science
- Understand the role of soil forming factors and processes in soil formation
- Understand various soil physical, chemical and biological properties and their impact on plant growth.
- Imparts knowledge on essential nutrients, soil fertility, nutrient transformations in soil.
- Manures, fertilizers and soil fertility management through various approaches.

UNIT I Soil Fertility and Soil Productivity (18 – Hours)

Nutrient sources -fertilizers and manures; essential plant nutrients - functions and deficiency symptoms. Soil and fertilizer nitrogen -sources, forms, immobilization and mineralization- nitrification- denitrification- biological nitrogen fixation -types mechanism- microorganisms and factors affecting; nitrogenous fertilizers and their fate in soils; management of fertilizer nitrogen in lowland and upland conditions for high fertilizer use efficiency-Biofertilizers -definition, classification, specifications, method of production and role in crop production-BIS standards for biofertilizer for quality control.

UNIT II Fixation Nutrient

(18 – Hours)

Soil and fertilizer phosphorus - forms, immobilization, mineralization, reactions in acid and alkali soils- factors affecting phosphorus availability in soils- phosphatic fertilizers - behavior in soils and management under field conditions, potassium - forms, equilibrium in soils and its agricultural significance- mechanism of potassium fixation; management of potassium fertilizers under field conditions- sulphur - source, forms, fertilizers and their behavior in soils; calcium and magnesium-factors affecting their availability in soils; management of sulphur.

UNIT III Secondary Macronutrients

(18 – Hours)

Calcium and magnesium fertilizers, macronutrients -critical limits in soils and plants; factors affecting their availability and correction of their deficiencies in plants-Role of chelates in nutrient availability- common soil test methods for fertilizer recommendations; quantity-intensity relationships; soil test crop response correlations and response functions.

UNIT IV Soil quality

(18 – Hours)

Fertilizer use efficiency; blanket fertilizer recommendations -usefulness and limitations; site- specific nutrient management; plant need based nutrient management; integrated nutrient management, soil fertility evaluation - biological methods, soil, plant and tissue tests; soil quality in relation to sustainable agriculture.

UNIT V Essential Macronutrients

(18 – Hours)

Chemical analysis of soil for total N,P&K and available nutrients (N, P, K, S, Cu, Fe, Mn,Zn, Mo. B)- analysis of plants for essential elements (N, P, K, S, Cu, Fe, Mn, Zn, Mo, B).

Text Books:

1. Environmental Chemistry, S. E. Manahan, Lewis Publishers.
2. Environmental Chemistry, Sharma & Kaur, Krishna Pabilshers.
3. Environmental Chemistry, A. K. De, Wiley Easlem
4. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West and F.J. Holler, W. B. Saunders.

References:

1. Brady NC & Weil RR. 2002. The Nature and Properties of Soils. 13th Ed. Pearson Edu.
2. Kannaiyan S, Kumar K & Govindarajan K. 2004. BiofertilizersTechnology. Scientific Publ. Leigh JG. 2002. Nitrogen Fixation at the Millennium. Elsevier.
3. Mengel K & Kirkby EA. 1982. Principles of Plant Nutrition. International PotashInstitute, Switzerland.
4. Mortvedt JJ, Shuman LM, Cox FR & Welch RM. 1991. Micronutrients in Agriculture.2nd Ed. SSSA, Madison. Pierzinsky GM, Sims TJ & Vance JF. 2002. Soils andEnvironmental Quality. 2nd Ed. CRC Press.

5. Troeh FR & Thompson LM. 2005. Soils and Soil Fertility. Blackwell.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
III	20PCH3EC2:3	Agricultural chemistry	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
33	0	0	0	33	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTR -III

Course Code: 20PCH3EC3:1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 3:1 - ELECTRO ORGANIC CHEMISTRY

Course Outcomes:

- Learn the knowledge about electro organic synthesis and electrochemical reactions
- Learn to the information about cathodic reduction and anodic oxidation reactions
- Learn about the electro organic synthesis.
- Students recognize the different types of electrochemical cells.
- Students are able to recognize and balance oxidation-reduction reactions
- Describe various Chromatographic techniques

UNIT -I: Basic concepts of electro organic synthesis

(18 – Hours)

Introduction, fundamental aspects of electro transfer reaction - oxidation- reduction reactions vs electron transfer reactions in organic chemistry and electrochemistry - Standard potentials - Mechanism and theory of outer sphere electron transfer reactions - Fundamental aspects of electrode phenomena- monitoring a half-reactions, general view of an electrode reaction- adsorption phenomena Chemisorption, Physisorption -Mass transfer in electro chemistry, fundamental aspects- steady state electrochemical methods- Transient electrochemical methods.

UNIT II: Methods for studies of electrochemical reactions (18 – Hours)

Introduction, linear sweep voltammetry and cyclic voltammetry-Excitation signal and current response in CV-Experimental setup, simple electrotransfer reaction, electron transfer reaction followed by chemical reaction and solutions- limiting experimental factors -potential step and current step method- Different voltametric techniques- chronoamperometry- chronocoulometry- chronopotentiometry -polarography -methods for determination of number of electrons-Applications of polarography.

UNIT III: Cathodic reductions (18 – Hours)

Introduction-formation of radical anions- dianions and polyanions-experimental aspects-thermodynamics kinetics- addition of electrophilic reagents and related reaction-dimerization. Electrochemical reduction of halogenated compounds: monohalogenated alkanes, halogenated aromatic compounds- acyl halides- aliphatic alpha -halo carbonyl compounds- cathodic reduction of nitro and related compounds- Aliphatic nitro compounds- aromatic nitro compounds(preparation of para amino phenol nitrobenzenes, nitramines and azides)-Electrochemical reduction of carbonyl compounds, general aspects.

UNIT IV: Anodic oxidation of organic compounds (18 – Hours)

Introduction, general mechanistic consideration- direct anodic oxidation- indirect anodic oxidation. Anodic oxidation of hydrocarbons- nitrogen containing compounds. Electrosynthesis of Bioactive materials: Introduction- simple Kolbe oxidation: application to synthesis of (+) - α onxerin and (+) -penta cyclosqualene- Kolbe cyclisation and Tandem cyclization.

UNIT V: Special topic in electro organic synthesis (18 – Hours)

Paired electro organic synthesis, simple examples -electrogenerated reagents Homogeneous redox catalysts -General aspects of indirect electron exchanges, pure redox catalysis (general case) -use of indirect electrochemical reactions in synthesis, mechanism of redox reaction oxidations, reductions -Electrogenerated superoxides. Electrochemical partial fluorination: Introduction- Anodic fluorination of aromatic compounds- olefins- carbonyl compounds, heterocyclic compounds. Electro enzymatic synthesis: Introduction, principles of redox catalytic enzyme activation and co-factor regeneration - electroenzymatic reductions and oxidation (simple examples only).

References:

1. Organic electro chemistry by Henning Lund & Ole Hammerich, 4th edition, Publisher: Marcel Dekker, Inc, New York.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
III	20PCH3EC3:1	Electro organic chemistry	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
56	0	0	0	56	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -III

Course Code: 20PCH3EC3:2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

1 COURSE 3:2 - ANALYTICAL CHEMISTRY

Course Outcomes:

- Learn to instrumental methods
- Learn the nature of errors and their types.
- Learn the various techniques in chromatography.
- The course make the student to learn how to prepare solutions quantitatively and analysis the analyze with high accuracy.
- Describe various Chromatographic techniques

UNIT I: Analytical Techniques

(18 – Hours)

Analytical chemistry - chemical analysis -Advantages and limitations of chemical methods- types of chemical analysis- Instrumental methods- Advantages and Limitations of Instrumental methods- Analytical methods on the basis of Sample size -Sampling- sampling methods- sampling in different physical states- Sampling statistics- source of error in sampling- dangers during sampling.

Techniques of Analysis -Introduction- Classification of analytical techniques- classification of instrumental methods of analysis - factors affecting the choice of analytical methods interferences- typical separation procedures- sensitivity and detection limits.

UNIT –II Data Analysis

(18 – Hours)

Mean, Average- Standard Deviation- Variance and its testing-Correlation and Regression -Least square method for curve fitting, Errors its types.

UNIT III: Chromatography

(18 – Hours)

Solvent extraction -principles of ion exchange-paper- thin layer and column chromatography techniques –columns- adsorbents- methods Rf values-McReynold's constants and their uses –HPTLC- HPLC techniques –adsorbents- columns- detection methods, estimations- preparative column –GC MS techniques -methods, principles and

uses- applications- Method validation process - Precision, Accuracy, Specificity, Linearity, Range, Limit of Detection, Ruggedness, Robustness, Stability.

UNIT IV: Thermoanalytical Methods and Fluorescence Spectroscopy (18 – Hours)

Thermoanalytical Methods - Principles -instrumentations and applications of thermogravimetry analysis (TGA) for quantitative analysis- factors affecting thermogram, Differential Thermal Analysis (DTA) and Differential Scanning Calorimetry (DSC) - thermometric titrations -types -advantages. Fluorescence Spectroscopy - Basic aspects of synchronous fluorescence spectroscopy -spectral hole burning -flow cytometry - fluorometers (quantization) -instrumentation -applications.

UNIT V: Electroanalytical Techniques (18 – Hours)

Electrochemical sensors-ion-sensitive electrodes- glass -membrane electrodes, solid-liquid membrane electrodes -ion-selective field effect transistors (ISFETs) -sensors for the analysis of gases in solution- Phase problem -heavy atom method and introduction to the principal of direct methods of phase determination

Principles and applications of extended X-ray absorption fine structure (EXAFS) -surface extended X ray absorption (SEXAFS) -atomic absorption spectroscopy (AAS) -flame emission spectroscopy (FES) -turbidimetry -theory and applications.

Text Books:

1. H. Kaur - “Instrumental methods of Chemical Analysis”, 6th edition, (2010), Pragati prakasan Publications, Meerut.
2. H. H. Willard, L. L. Merritt, J. A. Dean and F. A. Settle, Instrumental Methods of Analysis; 6th Ed., CBS Publishers and Distributors, Chennai, 1986.
3. N. Banwell and E. M. McCash, Fundamentals of Molecular Spectroscopy; 4th Ed., Tata McGraw-Hill, New Delhi, 1994.
4. I. Vogel, Text Book of Quantitative Inorganic Analysis; 6th Ed., Longman, New Delhi, 2000.
5. S. C. Gupta, Fundamentals of Statistics; 6th Ed., Himalaya Publications, Delhi, 2006

References:

1. D. B. Hibbert and J. J. Gooding, Data Analysis for Chemistry; Oxford University Press, UK, 2006.
2. J. Topping, Errors of Observation and Their Treatment; 4th Ed., Chapman Hall, London, 1984.

3. Braithwaite and J. F. Smith, Chromatographic Methods; 5th Ed., Springer, Germany; 1995.
4. K. Srivastava and K. K. Srivastava, Introduction to Chromatography; 2nd Ed., Holden Day, New York, 1985.
5. D. A. Skoog, D. M. West and D. J. Holler, Fundamentals of Analytical Chemistry, 7th Ed., Harcourt College Publishers, Singapore, 2004.
6. Sharma, S. G. Schulman, Introduction to Fluorescence Spectroscopy; Wiley-Interscience, New York, 1999.
7. D. C. Harris, Quantitative Chemical Analysis; 4th Ed., W. H. Freeman Publications, New York, 1995.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
III	20PCH3EC3:2	Analytical chemistry					6	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓		✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓		✓	✓	✓	✓	✓	✓	
CO4	✓		✓		✓	✓	✓	✓		✓	
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓	
Number of Matches(✓) = 42 Relationship: High											

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
69	0	0	0	69	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -III

Course Code: 20PCH3EC3:3

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 3:3 - MEDICINAL CHEMISTRY

Course Outcomes:

After completing the course, students shall be able to:

- Describe the various stages involved in the development of a drug,
- Describe the "interaction between ligand and receptor" concept
- Describe methods for medicinal chemistry, including combinatorial chemistry,
- Actively participate in discussions during seminars and group exercises
- Application the gained knowledge about the therapeutic classes of drugs.

UNIT - I - Molecular Basis Of Drug Action

(18 – Hours)

Receptor: Drug Receptor Interaction. Basic ligand concept, agonist, antagonist, partial agonist, inverse agonist. Receptor Theories - Occupancy, Rate & Activation Theories. Receptor Binding Assays, Determination of B-max and Kd by transforming data with Hill plot and Scatcherd plot-Above concepts with special reference to Opioid, Histaminergic, Adrenergic and GABA nergic receptors. Enzyme Inhibitors as drugs - ACE, leukotrienes, Lipoxigenase, Cyclooxygenase. DNA Polymerase Inhibitors, HIV - Protease / Reverse Transcriptase, Integrase and Cytochrome P-450 Inhibitors. Drug binding to nucleic acid - Antimalarial, anti-cancer, antiviral

UNIT II Drug Design

(18 – Hours)

Introduction to drug discovery- Folklore drugs, stages involved in drug discovery- disease, drug targets, bioassay-Design And Application Of Prodrugs –Prodrug concept. Prodrugs of various functional groups like carbonyl, hydroxy. amide, amines. Application of Prodrug approach to-Improvement of bioavailability -Prevent first pass metabolism. Reduction of side effects-Prolong duration of action-Site specific delivery.

UNIT III Antibiotics

(18 – Hours)

Historical background, Nomenclature, Stereochemistry, Structure activity relationship, Chemical degradation classification and important products. β -Lactam antibiotics: Penicillin, Cephalosporins, β -Lactamase inhibitors, Monobactams Aminoglycosides: Streptomycin- Neomycin- Kanamycin Tetracyclines: Tetracycline, Oxytetracycline- Chlortetracycline-Minocycline-Doxycyclin.

UNIT IV Introduction to Drug Design

(18 – Hours)

Various approaches used in drug design- Physicochemical parameters used in quantitative structure activity relationship (QSAR) such as partition coefficient- Hammett's electronic parameter-Taft's steric parameter and Hansch analysis. Pharmacophore modeling and docking techniques.-physicochemical properties pKa, electronic effects, lipophilicity constant (π), steric effects- linear and nonlinear relationship between biological activity and Hammett/ Lipophilicity Substituent constants.

Combinatorial Chemistry: Concept and applications chemistry: solid phase and solution phase synthesis of combinatorial

UNIT V Principle of drug design

(18 – Hours)

Analogue synthesis versus rational design; discovery of lead compounds-Pharmacophoric identification, Prodrugs and soft drug-Ring Analogues of Phenothiazines: Chlorprothixene- Thiothixene- Loxapine succinate- Clozapine. Fluro buterophenones: Haloperidol, Droperidol, Risperidone. Beta amino ketones: Molindone hydrochloride. Benzamides: Sulpieride.

Recommended Books

1. Burger: Medicinal Chemistry (John Wiley & Sons N.Y.)
2. Foe: Principles of Medicinal Chemistry (Varghese & Co.)
3. Text Book of Bio-chemistry
4. Molecular biology - Watson & Crick

Reference Books:

1. Lednicer: Organic Drug synthesis Vol. 1, 2, 3, 4 (John Wiley & Sons N.Y.)
2. Bunerworther Progress in Medicinal Chemistry Series
3. Wilson & Gisvold - Text book of Medicinal Chemistry (J.B. Lippincott cam)
4. Stuart Warren: Organic Synthesis- The Disconnection, approach (John Wiley

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
III	20PCH3EC3:3	Medicinal Chemistry	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
37	0	0	0	37	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -III

Course Code: 20PCH3CP5

Exam Hours: 6

Instruction Hours: 6

Internal Marks: 40

Credits: 4

External Marks: 60

CORE COURSE PRACTICAL - 5 - PHYSICAL CHEMISTRY NON-ELECTRICAL PRACTICAL

Course Outcomes:

- Learn the chemical kinetics.
- Learn the adsorption techniques using Freundlich isotherm
- Learn the Phase diagram
- Learn the polymerization.
- Learn the calculate molecular weight.

Any ten experiments from the following experiments (to be decided by the course teacher):

1. Kinetics -Acid Hydrolysis of Ester -Comparison of strength of acids.
2. Kinetics -Acid Hydrolysis of Ester -Determination of Energy of Activation (E_a).
3. Kinetics -Saponification of Ester -Determination of E_a by conductometry.
4. Kinetics-Persulphate-Iodide Reaction-Determination of order, effect of Ionic strength on rate constant.
5. Polymerization -Rate of polymerization of acrylamide.
6. Distribution Law -Study of iodine -Iodide equilibrium.
7. Distribution Law -Study of Association of Benzoic Acid in Benzene.
8. Adsorption -oxalic Acid\Acetic Acid on charcoal using Freundlich isotherm.
9. Determination of critical solution temperature of phenol-water system and effect of impurity of added electrolyte on CST.
10. Determination of molecular weight by Rast Macro method
11. Determination of molecular weight by Transition Temperature.
12. Determination of eutectic temperature and eutectic composition of binary mixture.
13. Determination of primary salt effect.

References:

1. Daniels.I, Experimental Physical Chemistry, (7th edition), NewYork, McGraw Hill, (1970).
2. B.P. Levitt, Ed., Findlay`s practical Physical Chemistry, 9th Ed., Longman, 1985.
3. J.N. Gurtu, R. Kapoor, Advanced Experimental Chemistry, Vol.I, S.Chand & Co., 1987.

Scheme of valuation

Criteria	Marks
Record	5
Aim and tabulation	10
Calculation	10
Results	35
Allowed error 5%	20
5-10%	10
10%<	

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
III	20PCH3CP5	Physical chemistry non-electrical practical	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
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Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
13	0	0	0	13	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -IV

Course Code: 20PCH4CC8

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

CORE COURSE -8 - ELECTROCHEMISTRY, SURFACE PHENOMENA AND STATISTICAL THERMODYNAMICS

Course Outcomes:

- Learn improve the quantum chemistry and electrochemistry.
- Learn the detailed information about thermodynamics.
- Learn the surface phenomena.
- To learn the group theory.
- Learn the symmetry of elements.

UNIT- I: Applications of Group Theory

(18 – Hours)

Applications of Group Theory, The Direct Product and its Applications, Applications of Group theory to Spectroscopy, Vanishing of Integrals, Symmetry selection rules for Vibrational, Raman and electronic spectroscopy. Infra red Spectroscopy -Reduction Formula -Determination of Normal Modes of Vibration and IR activity for H₂O and NH₃ Molecule, Vibrational Raman Spectroscopy for H₂O and NH₃ Molecule, Electronic Spectra of Formaldehyde. Hybridization Schemes of Orbitals (sp³, sp², dsp², sp³d²), Projection Operator -Symmetry Adapted Linear Combination (SALC) Procedure. Symmetry factoring of secular determinant and its applications to butadiene.

UNITII: ElectrochemistryI

(18 – Hours)

Ionics: Debye-Huckel theory of ion-ion interaction- radius of ionic atmosphere and its calculation -Debye- Huckel-Onsager equation-ion association, ion pairs and triple ions and its modifications - asymmetry and electrophoretic effects -Debye Falkenhagen and Wien's effects - Activity of ions in solutions - Debye Huckel limiting Law. Electrode - electrolyte equilibrium: **Kohlrausch's Law** Nernst equation derivation and its limitations- Application- equilibrium electrode potentials - Calomel electrode, concentration cells - liquid junction potentials - Thermodynamic quantities from EMF data.

UNIT III: Electrochemistry II

(18 – Hours)

Electro kinetic Phenomena: Theories of electrical double layer - Theory of multiple layers at electrode electrolyte interface - electro kinetic phenomena. Processes at electrodes - the rate of charge transfer, current density, Butler Volmer equation - Taft equation. Principles and applications of Polarography - Instrumentation, Types of cells, advantages of dropping mercury electrode, interpretation of current voltage curves, determination of 'n' value, polarographic maxima. Cyclic voltammetry, advantages over polarography techniques - test of reversibility of electron transfer reactions. Corrosion and passivation of metals - local cell theory of corrosion, mechanism of corrosion of ultrapure metals- cathodic reaction in corrosion, thermodynamics and the stability of metals- corrosion in the absence of films- Pourbaix diagram - Evans diagram - Batteries and Fuel cells- Ion selective electrodes.

UNIT IV : Surface Phenomena

(18 – Hours)

B.E.T. isotherms - Surface area determination Adsorption, adsorbent, adsorbate, physisorption, chemisorptions and vander-waals forces. Heat of adsorption and its determination- Adsorption from solution- Freundlich adsorption- Gibbs adsorption isotherm - solid - liquid interfaces - wetting and contact angle - solid gas interfaces - soluble and insoluble film. Surface tension - methods of measuring surface tension - electrical phenomenon at Interfaces, including electro kinetic, micelles and reverse micelles, Solubilisation, Micro - emulsions. Role of surface in catalysis - semiconductor catalysis, n and p type surfaces - kinetics of surface reactions involving adsorbed species - Langmuir - Hinshelwood mechanism. **Tyndall effect, Brownian movement- electrophoresis, coagulation.**

UNIT V : Statistical Thermodynamics

(18 – Hours)

Partition functions: Translational, rotational- vibrational, electronic - calculation of enthalpy - internal energy- entropy and other thermodynamic functions - application of partition functions to mono and diatomic molecules. Heat capacity of solids: Einstein and Debye's treatments - concept of negative Kelvin temperature. Non-equilibrium thermodynamics: Thermodynamics of irreversible process - enthalpy production and entropy flow in open system - Onsager theory - phenomenological relations - Onsager reciprocal relations - steady state conditions.

Text Books:

1. K.V.Raman Group theory and its Application to Chemistry. Tata McGraw –Hill Pu Samuel Glasstone -Textbook of Physical Chemistry 5th Ed.2010, MacMillan India.
2. F. A. Cotton, “Chemical Application of Group Theory”, 2nd edition, Wiley -Eastern Press, 1995.

References:

1. H.Goldstein, Classical Mechanics, Adison -Wesley Publishing company, 1956.
2. S. Glasstone, Introduction to Electrochemistry, Affiliated East-West Press, 1968.
3. D. R. Crow, Electrtrochemistry, Academic Press, New York
4. D. R. Crow, Polarography of metal complexes, Academic Press, New York
5. Daniel C.Harris, Quantitative Chemical Analysis, 4th edn, W.H.Freeman and Company, New York,1995
6. P.W.Atkins -Physical Chemistry E.L.B.S. 6th Ed.1998.
7. K.L.Kapour -A text book of physical chemistry, Machmillaln India press, Chennai - 2009.
8. P. W. Atkins, Physical Chemistry, ELBS and Oxford University Press, Oxford,1983
9. J. Rajaram and J. C. Kuriacose, Thermodynamics for students of Chemistry - Classical, Statistical and Irreversible, Shobhan Lal Nagin, New Delhi, 1981

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
IV	20PCH4CC8	Electrochemistry, surface	6	4

		phenomena and statistical thermodynamics								
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
67	0	0	0	67	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -IV

Course Code: 20PCH4EC4:1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 4:1 - INSTRUMENTATION TECHNIQUES

Course Outcomes:

- Learn improve the technical knowledge about various spectroscopy.
- Learn the detailed information about conductometry.
- Learn the separation of compounds by using chromatography.
- Learn the ion fragmentation.
- Learn the prediction of NMR.

UNIT I : UV- Visible spectroscopy

(18 – Hours)

Instrumentation- sources, filters and monochromators, slits, grating, cuvette, radiation detectors and indicators, photoelectric spectrophotometer - types, sources of errors during recording, calibration- presentation of spectral data Infrared Spectroscopy: Dispersive infrared spectrometer- source (Nernst, Globar) monochromator, detector, double-beam spectrophotometer -rotational spectra of polyatomic molecule-linear and symmetric top molecule- presentation of spectra- sample preparation techniques for IR, FT-IR- simple diagram of a Fourier transform infrared spectrometer working mode, advantages. Raman spectroscopy, **Raman effect, Stoke and anti stroke line**: Instrumentation- source of light, filters, sample holders, spectrograph, detectors, Sample preparation.

UNIT II: Nuclear Magnetic Resonance (NMR)

(18 – Hours)

Instrumentation Nuclear spin and nuclear parameters- mechanism of absorption- calculation of ν resonance frequency-magnet, magnetic field sweep, radio frequency source, signal detector and recording system, sample holder, sample probe. Electron Spin Resonance (ESR): Theoretical principles" g ' factor, hyperfine splitting-Illustration and example-Instrumentation - electromagnet, source of micro wave radiation, sample cavity, choice of solvent, crystal detectors and recorder-double resonance spectrometers. Mass Spectrometry: Instrumentation - sample preparation, generation of ions, analyzer, ion

collector and measuring system, resolution- representation of mass spectrum -double focusing mass spectrometer.

UNIT III: Conductometry

(18 – Hours)

Introduction, laws and definitions of conductance, effects of dilution, conductance measurements, conductometric titrations - apparatus, types and advantages. Potentiometry: electrochemical series, reference electrodes -hydrogen electrode, calomel and silver-silver chloride electrode, measurement of pH -glass indicating electrode, potentiometric titrations, variations in potentiometric titrations, its advantages. Atomic Absorption Spectroscopy: Introduction, principle of AAS, classification of atomic spectroscopic methods, measurement of atomic absorption, instrumentation –application Atomic Emission spectroscopy -Introduction, origin of spectra, principle of emission spectroscopy, Instrumentation, measurement of light intensity and applications.

UNIT IV: Ion Chromatography

(18 – Hours)

Electrophoresis : Separation by Adsorption- Affinity techniques, Affinity elution from Ion exchangers and other Adsorbents, Pseudo affinity adsorbents polycrylamide gel electrophoresis, Isoelectric focussing Isotachopheresis, Two dimensional gel electrophoresis, Capillary electrophoresis in rotation- stabilized media-Electrophoresis in stabilized salts-Applications in Nuclei acids- Clinical and capillary zone electrophoresis of carbohydrates.

UNIT V: Mass Spectroscopy

(18 – Hours)

Mass spectrometry principle,condition Instrumentation, Ionization methods -EL, CI, FAB, arc & spark, photoionization, thermal ionization, FI*& FD, laser induced- Photoelectric ionization, SIMS- stereochemical activity of lone pair,magnetic interaction-Mass analyzers -Magnetic, Double focussing, Time of flight, Quadrupolar, Ion cyclotron resonance analyzer. Coupled techniques, GC FTIR, GCMS (Use of stable isotopes) HPLC-MS- Applications of mass spectroscopy.

Text Books:

1. H. Kaur - “Instrumental methods of Chemical Analysis”, 6th edition, (2010), Pragati prakasan Publications, Meerut.
2. B.K. Sharma -“Instrumental methods of Analysis”, (2000), Goel Publications.

3. R.A. Day and A.L. Underwood -“Quantitative Analysis”, (1999), Prentice-Hall of India Pvt., Ltd., New Delhi.

References:

1. Willard, Meeritt, Dean and Settle -“Instrumental Methods of Analysis”, 7th Ed.,(2006), CBS Publishers.
2. S.M. Khopkar, “Basic Concepts of Analytical Chemistry”, Revised edition (2006) Wiley Eastern Ltd.
3. B.S. Furniss, A.J. Hannaford, P.W.G. Smith and A.R. Tatchell -“Vogel’s Text book of Practical Organic Chemistry”, fifth edition ,2009, Pearson Education Publisher.
4. L. Pavia -“Spectroscopy” cengage CourseIndia Pvt. Ltd -2010.
5. Harald Guther, “NMR Spectroscopy”, Wiley india (p) Ltd, 2nd Edn,2010.
6. G.Aruldas -“Molecular structure & Spectroscopy ”,PHI CoursePvt.Ltd.2nd Edition ,2008.
7. Colin N.Banwell -“Fundamentals of Molecular structure Spectroscopy ” Mc.Grow – Hill publishing company Ltd. 4th edition ,,1995.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits
IV	20PCH4EC4:1	Instrumentation techniques	6	4
Course	Programme Outcomes(POs)		Programme Specific	

Outcomes (COs)	Outcomes(PSOs)									
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
43	0	0	0	43	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - IV

Course Code: 20PCH4EC4:2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 4:2 - NANO AND GREEN CHEMISTRY

Course Outcomes:

- Learn a basic idea on nano and green chemistry
- Learn the knowledge about solvent free reactions
- Learn about the sono chemistry.
- Learn the various spectroscopies.
- Learn the essentials of green chemistry.

UNIT - I: Synthesis And Applications Of Nanomaterials

(18 Hours)

Definition Nanotechnology Nanomedicine, properties of nanomaterials-optical, electrical, mechanical and redox properties-Preparation of nanomaterials -plasma arcing, CVD, electrodeposition, sol-gel synthesis, ball milling, uses of natural nano particles. Synthesis and applications of carbon nanotubes. Self assembled mono layers -mono layers on gold -preparation -structure -growth process -patterning mono layers -mixed mono layers.

semiconducting and oxide nanoparticles – homo and hetero-nucleation growth methods

Semiconductor quantum dots synthesis -electronic structure & spectral properties

Monolayer-protected metal nano particles -characterization -functionalization

Application – Core Shell nano particles -introduction -types of systems -characterization -properties -Applications of Nanosensors -electrochemical sensors, sensors based on physical properties -nanobiosensors.

UNIT II: Characterization Of Nanomaterials

(18 Hours)

Electron microscopes -scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Scanning Transmission Electron Microscopy (STEM), Scanning Probe Microscopy (SPM) -scanning tunneling microscopy (STM) Atomic manipulations, photoelectron microscopy-XPS and auger spectroscopy-Focused Ion beam (FIB)

technique adsorption sothems and porosity determination:bet technique for surface area determinaton- Atomic force microscopy (AFM) -scanning probe Lithography (SPL), Dip pen nanolithography (DPN) - Optical microscopies for nanoscience and Technology - Confocal microscopy -scanning near field optical microscopy -particle size analysis.

UNIT III: Carbon nanotubes

(18 Hours)

CNT definition- Classification –Single wall CNT Multiwall, CNT Preparation - arc method –laser ablation method, Chemical vapour deposition method -Electro-deposition method- Ball milling method. SWCNT and MWCNT –Properties,fullerenes, properties - uses. Nan composites, Classification,Properties - uses.

UNIT IV: Essentials Of Green Chemistry

(18 Hours)

Introduction to green chemistry-definition, origin, history, needs, goals, twelve principles of green chemistry. Usage of Conventional and Green solvents-Advantages, Limitations and drawbacks. Green Synthesis -Designing, Choice of starting materials, choice of reagents, choice of catalysts: bio catalysts, polymer supported catalysts, choice of solvents. Synthesis involving basic principles of green chemistry. Examples: synthesis of adipic acid, methyl methacrylate, paracetamol. Microwave, Ultrasonication and Ultrasound assisted reactions -esterification, reduction AND coupling reactions.

UNIT V: Green Synthesis

(18 Hours)

Adipic acid -catechol- methyl methacrylate, acetaldehyde, Ibuprofen, Paracetamol- Microwave assisted reaction in water- Definition -Hofmann eliminations -Hydrolysis- Oxidation- Microwave assisted reaction in organic solvents- Esterification -Fries rearrangement -Decarboxylation- Diels Alder reaction. Ultrasound assisted reaction:

Definition- Cannizaro reaction,-Strecker synthesis, Reformatsky reaction.

Text Books:

1. Sulabha K. Kulkarni Nanotechnology: Principles and practices (capital Pvt. Co.)-2002.

2. R.Sanghi and M.M srivastva, Green chemistry, Narosa P ublications, 2003.

References:

1. Nanoscale materials in chemistry, Wiley interscience, Kenneth, J.Klaburde, 2002.
2. M. M. Srivastva and R.Sanghi, Chemistry for green environment, Narosa, 2005.
3. S, Delvin Green chemistry, IVY publication house, 2006.
4. F.J. Ownes Introduction to Nano technology John Wiley and New Jersey, 2003.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	20PCH4EC4:2	Nano and green chemistry					6	4			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓		✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓		✓	✓	✓	✓	✓	✓	

CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
61	0	0	0	61	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -IV

Course Code: 20PCH4EC4:3

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 4:3 - INORGANIC AND ORGANIC PHOTOCHEMISTRY

Course Outcomes:

- Understand the concepts related to light induced organic synthesis, mechanisms and the functions of various reagents.
- Apply their understanding about the photochemical reactions of industrial significance.
- Analyze the product distribution and the stereochemistry of various organic products derived from photochemistry.
- Evaluate the photochemical reactions based on the influence of the substituents on substrate molecules.
- Design new photochemical reactions in order to achieve the required product(s).

UNIT-I Metal Complexes Spectra

(18 Hours)

Excited States of Metal Complexes-Excited states of metal complexes: comparison with organic compounds- electronically excited states of metal complexes- charge-transfer spectra-charge transfer excitations- methods for obtaining charge-transfer spectra.

UNIT II Photochemistry Reaction

(18 Hours)

Ligand Field Photochemistry-Photosubstitution- photooxidation and photoreduction- lability and selectivity- zero vibrational levels of ground state and excited state- energy content of excited state- zero zero spectroscopic energy- development of the equations for redox potentials of the excited states-Photodissociation-addition and isomerization reactions with examples

UNIT III Inorganic Photochemistry

(18 Hours)

Inorganic Photochemistry : Basic principles- Basic photochemical processes- Kasha's rule- Thexi state- Photochemical behaviour of transition metal complexes- charge transfer spectra of crystalline and gaseous alkali halides- photochemical reactions of coordination compounds- oxidation-reduction reactions, Photo substitution reactions- Adamson's rules and photosubstitution reactions of cobalt(III) complexes i.e. $[\text{Co}(\text{NH}_3)_5\text{X}]^{2+}$, $[\text{Co}(\text{en})_3]^{3+}$, and chromium(III) complexes i.e. $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{Cr}(\text{NH}_3)_6]^{3+}$ and ruthenium (II) polypyridyl complexes.

UNIT IV Organic Photochemistry

(18 Hours)

Organic Photochemistry: Photochemical energy plank Condon Principle- Jablonski diagram singlet and triplet states- dissipation of photochemical energy-photosensitization, quenching- quantum efficiency and quantum yield- experimental methods of photochemistry. transitions Norrish type I and Norrish* $\pi=\pi$, $\pi-\pi$ -Photochemistry of carbonyl compoundsn-n type II cleavages, patterno-Buchi reaction- Photochemistry of aromatic compounds-excited states of benzene and its 1-2,1-3,1-4-additions.

UNIT V Rearrangement

(18 Hours)

Photoreduction photochemistry of enone - Hydrogen abstraction-rearrangement of ; β - α ,unsaturated ketones and cyclohexadienes- Photochemistry of p- Benzoquinones, photochemistry of unsaturated systems - Olefins, cis trans Isomerisation and dimerization hydrogen abstractions and, addition acetylenes dimerisation, dienes - Photochemistry of 1,3 butadienes (2+2) additions leading to cage structures photochemistry .of cyclohexadienes.

Text books:

- 1.Introduction to Inorganic Photochemistry, Arjun Singh Negi, Cyber Tech Publication, New Delhi.
2. Inorganic Photochemistry, Fmiza Hammer, Sarup Book Publishers Pvt. Ltd., New Delhi.
3. Concepts of Inorganic photochemistry, A. W. Adamson and P D Fleischaves Wiley.
4. Advanced Organic Chemistry: Reactions Mechanisms and Structure by Jerry March, Me.Graw Hill and Kogakush.

5. Molecular reactions and Photochemistry by Charles Dupey and O. Chapman, Prentice Hall.

Reference:

1. Mechanisms and Theory in Organic Chemistry by T.H. Lowery and K.S. Richardson.
2. The modern structural theory in Organic Chemistry by L.N. Ferguson, Prentice Hall
3. Physical Organic Chemistry by Jack Hine, Mc. Graw Hill.
4. Advanced Inorganic Chemistry- Cotton and Wilkinson
5. Inorganic Chemistry- T. Moeller

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
IV	20PCH4EC4:3	Inorganic and organic photochemistry	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
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Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
47	0	0	0	47	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -IV

Course Code: 20PCH4EC5:1

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 5

External Marks: 75

ELECTIVE COURSE 5:1 - INDUSTRIAL CHEMISTRY

Course Outcomes:

- Learn develop the knowledge about chemical industries
- Learn the fuels and dyes
- Learn about synthesis of dyes and polymer chemistry
- Learn the application of chemistry in quality control measurements.

- Learn about the polymers.

UNIT-I: Green Methods and Industrial Process

(18 – Hours)

Basic ideas about unit operation -Flow charts -Chemical conversion -Batch versus continuous processing -Chemical process selection -Design -Chemical process control- Research & Development and its role in chemical industries. Industrial safety measures - Fire extinguisher- Fire retardant materials -Fire retarding wood -Procedures for handling toxic chemicals

UNIT II: Renewable Energy Resources

(18 – Hours)

Renewable energy sources: types of renewable energy sources-Solar cells: basic principles- types and their applications. Fuel cells: basic principles-types and their applications. Working principle and applications of Biofuel cells- brief introduction about hydroelectric- biomass-wind power and geothermal power and their applications and limitations-energy from some other natural source.

UNIT III: Polymers

(18 – Hours)

Polymers definition - types of polymers - liquid crystalline polymers. Molecular mass - number and mass average molecular mass - determination of molecular mass (osmometry, viscosity, diffusion, light scattering, and sedimentation methods). viscoelasticity, Rubber elasticity. Kinetics of linear stepwise polymerization addition polymerization - free

radical, cationic and anionic polymerization. Unactivated carbon–hydrogen bond-definition-mechanism and synthetic application-Kinetics of copolymerization. Polymerization in homogeneous and heterogeneous systems - stereochemistry and mechanism of polymerization. Coordination Polymerization: Kinetics; mono and bimetallic mechanism.

UNIT IV: Commercial Polymers

(18 – Hours)

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers-Functional polymers-Fire retarding polymers and electrically conducting polymers. Biomedical polymers.

UNIT V: Industrial Water Pollution and its Control & Analysis

(18 – Hours)

Sources of water pollution -domestic -industrial -agricultural -soil and radioactive wastes as sources of pollution. Water pollutants and their effects. Eutrophication-salt water interaction- salinity –blue baby syndrome-Objectives of analysis -parameter for analysis-colour -turbidity -total solids -conductivity -acidity -alkalinity -hardness –chloride -sulphate -fluoride -silica -phosphates, different forms of nitrogen, DO, BOD, COD Heavy metal pollution-public health significance of Cadmium -Chromium -Copper -Lead -Zinc – Manganese-Prevention and control its measures. Industrial hygiene- **Effluent- Ecofriendly effluents disposal**

Text Books:

1. B. K. Sharma, Industrial Chemistry; 8th Ed., Goel Publishing House, New Delhi, 1997.
2. V.R.Gowariker, N.V. Viswanathan and Jayadev Sreedhar, Polymer Science, New Age Publishers, New Delhi, 1986.
3. B.K. Sharma and H. Kaur, “Environmental chemistry” ,Goel Publishing House, Meerut, 2008

References:

1. Chemical Process Industries -Norrish Shreve, R. and Joseph A. Brink Jr. McGraw Hill, Industrial Book Company, London.
2. Production and Properties of Industrial Chemicals -Brain A.C.S. Reinhold -New York.
3. Petroleum Products Hand Book. Guthrie V., McGraw Hill, Tokyo.

4. Outlines of Chemical Technology -For the 21st Century -M. Gopala Rao & Matshall Sittig (3rd Edition)
5. Charles E. Carraher, Polymer chemistry, 6th edn, Marcel Dekker, Pvt .Ltd, 2003.
6. F.W.Billmeyer, Jr., A Text Book of Polymer Science, Wiley & Sons, New York, 1971.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
IV	20PCH4EC5:1	Industrial chemistry	6	5						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
61	0	0	0	61	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -IV

Course Code: 20PCH4EC5:2

Exam Hours: 3

Instruction Hours: 6

Internal Marks: 25

Credits: 4

External Marks: 75

ELECTIVE COURSE 5:2 - POLYMER CHEMISTRY

Course Outcomes:

- Learn the knowledge in Polymer Chemistry
- Use essential descriptions about polymer chemistry.
- Defines related concepts.
- Different kind of polymers and their properties
- An understanding of basic principles of design and color, concepts, media and formats and the ability to apply them to a specific aesthetic intent.

Unit I

(18 – Hours)

Industrial Polymers - Basic Concepts of Polymers-History-Trends and General Polymer Background-Concept of functionality and reactivity-Degree of polymerization. Techniques of Polymerization - Bulk-Solution - Emulsion - Suspension and Interfacial polymerization.

Classification of Polymers: Homopolymers-co-polymers-linear polymers-branched polymers-cross linked or three dimensional polymers-block co-polymers-organic-inorganic polymers-natural and synthetic polymers-chain and step growth polymers-thermoplastic and thermoset-based on applications- fibers-foams-adhesives - elastomers-based on performance-commodity and engineering polymers.

Unit II**(18 – Hours)**

Identification of Polymers: Preliminary tests-Elemental analysis-solubility chart-Specific end group analysis (Acid value-Hydroxyl Value-Iodine value-Epoxy value-SAP Value-Amine value) Spectroscopic analysis (IR & NMR). Solubility chart for identification of polymers-Specific chemical tests for various polymers and group analysis.

Unit III**(18 – Hours)**

Paint Technology Paints-Introduction and Definitions of paints-pigments-varnishes-lacquers, Anatomy of paints-functions & requirements of constituents of paints-classification of paints on the basis of order of application-methods of curing-nature of solvent-uses etc. Paint Properties -color-tinting strength-reducing power-pigments classification of pigments-pigments properties-oil absorption-refractive index-particle size shape-bleeding-resistance to light and heat.

Unit IV**(18 – Hours)**

Manufacture of Paints

Ball mill-triple roll mill-bead mill-titrator-high speed and heavy-duty disperser.

Important Resins or Modifications of Resins for Paints and Coatings

Epoxy Resins (BPA based resin-curing agents & flame retardant epoxy resins) Alkyds - Introduction of alkyds-different components of it- Modification with rosin-maleic anhydride-acrylics-vinyls-imides etc. Polyester resins-Unsaturated polyester resins-Modification of phenolics such as novolac-epoxy oil soluble and oil reactive Modification of aminor resins (UF & MF) with alcohols and phenols.

Unit V**(18 – Hours)**

Synthetic Polymers Chemistry, Technology of Production-Properties and Applications of Thermoplastic Polymers Polyester:-PET-PBT-Polycarbonate-Poly(amides)-Fluorocarbons (PTFE)-Thermosetting Polymers Silicone-oil-rubber and resin Unsaturated polyesters Polyurethanes

Text Books:

1. P. Munk & T.M. Aminabhavi, Introduction to Macromolecular Science, 2nd ed. John Wiley & Sons (2002).
2. M.P. Stevens, Polymer Chemistry: An Introduction 3rd ed. Oxford University Press (2005).
3. L. H. Sperling, Introduction to Physical Polymer Science, 4th ed. John Wiley & Sons (2005)

Reference:

1. Polymer Chemistry - M. P. Stevens, 2nd Ed., Oxford University Press, 1990.
2. Poly. Synthesis - Stanley R. Sandler, Wolf Karo, Vol. 1, Academic Press, Inc., California, 1994.
3. Introduction to Polymer Chemistry - R.B. Seymour, Marcel Dekker, 3rd Ed., (1992)
4. Experiments in Poly. Sci., Collins Bares, F. W. Billmeyer, Wiley Interscience, 1973.
5. Physical Chemistry of Macromolecules. D.D. Deshpande, Vishal Publications, Jalandhar, 1989.
6. Physical Chemistry of Polymers -Hiemenz
7. Organic Polymer Chemistry, V. Jain, IVY Publishing House, New Delhi,
8. Outlines of Paint Technology, W. M Morgan 3rd edn CBS Publishers.
9. Paints, Coatings and solvents, Dieter Stoye, Werner Freitag, Wiley VCH Pub.
10. Encyclopedia of PVC, 2nd Ed., Edited by I Nass, Marcel Dekker Inc., New York.
11. Encyclopedia of Chemical Technology - Kirk and Othemer, Vol.- John Wiley
12. Rubber Chemistry and Technology -Britson

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
IV	20PCH4EC5:2	Polymer chemistry	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
86	0	0	0	86	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -IV

Course Code: 20PCH4EC5:3

Instruction Hours: 6

Credits: 4

Exam Hours: 3

Internal Marks: 25

External Marks: 75

ELECTIVE COURSE 5:3 - CHEMISTRY OF NATURAL PRODUCTS

Course Outcomes:

- Occurrence, classification and isolation
- Classification, Occurrence And isolation of terpenes
- General nature of anthocyanins, introduction and biological importance of flavones.
- Occurrence and isolation of purines. Classification and spectral properties of steroids.
- Classification- isolation-purification and properties.

UNIT-1:

(18 – Hours)

Alkaloids: Introduction and functions of alkaloids-General methods of structural elucidation-Structural elucidation-synthesis and biological properties of coniine - piperine-nicotine - papaverine.

UNIT 2:

(18 – Hours)

Terpenoids and Carotenoids: Terpenoids: Introduction-Isoprene rule-General methods of determining structure-Structure and synthesis of citral-menthol-Geraniol and camphor-Carotenoids: Introduction-geometrical isomerism-Structure determination and synthesis of β -carotene -vitamin-A.

UNIT 3:

(18 – Hours)

Anthocyanines and flavones: Anthocyanines: Introduction to anthocyanines-Structure and general methods of synthesis of anthocyanines-Cyanidine chloride: structure and determination- Flavones: Structure and determination of flavone - flavonoids- Quercetin: Structure determination and importance.

UNIT 4:**(18 – Hours)**

Purines and Steroids: Purines: Introduction-biological importance-Synthesis and structural elucidation of Uric acid- Xanthine, Caffeine and Theophylline- Steroids: Introduction, stereochemistry and nomenclature- Structural determination and synthesis of cholesterol- Synthesis of (\pm)-oestrone.

UNIT 5:**(18 – Hours)**

Natural Dyes: Occurrence-colour and constitution-Structural determination and synthesis of indigoitin and alizarin.

Text books:

1. O. P. Agarwal, Chemistry of Natural Products, Vol-1, Goel Publishing House, 1997.
2. Gurdeep Chatwal and Anand, Chemistry of Natural Products, Himalayan Publishing Co, 2001

Reference book:

1. I. L. Finar, Organic Chemistry, Vol-2, 5th edition, Pearson education, London, 1975.

Question Pattern

Section :A (1 Marks)	MCQ Type	20x1=20
Section :B (5 Marks)	Either OR choice	5x5=25
Section :C (10 Marks)	Answer three out of five	3x10=30
Total Marks		75

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course	Hours	Credits						
IV	20PCH4EC5:3	Chemistry of natural products	6	4						
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)				
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	✓		✓	✓	✓		✓	✓	✓	✓
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
CO3	✓		✓		✓	✓	✓	✓	✓	✓
CO4	✓		✓		✓	✓	✓	✓		✓
CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
36	0	0	0	36	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -IV

Course Code: 20PCH4CP6

Exam Hours: 6

Instruction Hours: 6

Internal Marks: 40

Credits: 5

External Marks: 60

CORE COURSE PRACTICAL 6 - PHYSICAL CHEMISTRY ELECTRICAL PRACTICAL

Course Outcomes:

- Practiced the Conductometry titrations.
- Practiced the potentiometric titrations.
- Learn to compare the theoretical values with experimental values.
- Learn the pH measurements.
- Learn the strength of mixture of acids.

Any ten experiments (to be decided by the course teacher) out of the following experiments.

1. Conductometry- Acid- alkali titrations.
2. Conductometry- Precipitation titrations.
3. Conductometry- Displacement titrations.
4. Conductometry- Determination of dissociation constant of weak acids.
5. Conductometry- solubility product of sparingly soluble silver salts.
6. Verification of Onsager equation- conductivity method.
7. Determination of degree of hydrolysis and hydrolysis constant of a substance.
8. Potentiometric titrations- Acid alkali titrations.
9. Potentiometric titrations- Precipitation titrations.
10. Potentiometric titrations- Redox titrations.
11. Potentiometry- Determination of dissociation constant of weak acids.
12. Potentiometry- Determination of solubility of silver salts.
13. Potentiometry- Determination of activity and activity coefficient of ions.
14. pH titration of ortho-phosphoric acid.
15. To determine the relative strength of two acids by conductance measurements.
16. To determine the pH of a buffer solution using a quinhydrone electrode.

References:

1. J.B.Yadav, "Advanced Practical Physical chemistry", 20th Edn. GOEL publishing House, Krishna Pakashan Media Ltd., (2001).
2. B.P. Levitt, Findlay's "Practical Physical Chemistry" Revised and 9th ed., Longman, London, 1985.
3. J.N. Gurtur and R.Kapoor, "Advanced Experimental chemistry", Vol.I. Chand & Co., Ltd, New Delhi.

Scheme of valuation

Criteria	Marks
Record	5
Aim and tabulation	10
Calculation	10
Results	
Allowed error 5%	35
5-10%	20
10%<	10

Relationship Matrix for COs, POs and PSOs

Semester	Code	Title of the Course					Hours	Credits			
IV	20PCH4CP6	Physical chemistry electrical practical					6	5			
Course Outcomes (COs)	Programme Outcomes(POs)					Programme Specific Outcomes(PSOs)					
	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4	PSO5	
CO1	✓		✓	✓	✓		✓	✓	✓	✓	
CO2	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
CO3	✓		✓		✓	✓	✓	✓	✓	✓	
CO4	✓		✓		✓	✓	✓	✓		✓	

CO5	✓	✓	✓	✓	✓	✓		✓	✓	✓
Number of Matches(✓) = 42 Relationship: High										

Mapping	1-29%	30-59%	60-69%	70-89%	90-100%
Matches	1-14	15-29	30-34	35-44	45-50
Relationship	Very Poor	Poor	Moderate	High	Very High

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
13	0	0	0	13	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER -IV

Course Code: 20PCH4PW

Instruction Hours: 6

Credits: 4

Exam Hours: -

Internal Marks: 20

External Marks: 80

PROJECT WORK

Objectives:

The student can get the knowledge to prepare the document, to implement tools for the specific problem and learn the industrial need programs for their placement.

S.No.	Work Description	Maximum Marks
1	Dissertation	80
2	Viva voce	20
Total		100

Note:

PASSING MINIMUM -50 MARKS

I Review –December last week

- Confirmation letter from the company
- Project type & title
- Company profile
- Synopsis
- Contact number &mail-id of the external guide
- S/w selection

II Review -January3rd week

- Data or System flow diagram
- Documentation of first three chapters
- Database design
- Input design -Forms

- Output design -Reports

III Review -February 3rd week

- Complete coding
- Test plan with demo
- Rough documentation of the entire project

IV Review -March 1st week

- Corrected rough draft
 - Explanation of the entire project
 - Execution of Implementation Work
-
- Attending all the review is compulsory
 - PPT and necessary Documentation should be brought for each Review
 - Font size in documentation has to be 12, Times New Roman, Space 1.5
 - Document should be neatly aligned and justified
 - No change can be made in the review marks later
 - Internal mark will be submitted at the same day of review to controller section.

VALUE ADDED COURSES

**UV-VISIBLE, IR SPECTROSCOPIC
INSTRUMENTATION AND SEPARATION TECHNIQUES**

Course Code: 20VACH01
30
Credit: 2
100

Hours:
Marks:

OBJECTIVES:

- To improve student sense of enthusiasm for spectroscopy and to involve them in an intellectually compounds prediction.
- To expose the students to various developing new areas of spectroscopy and impart them with their established in their future studies and their applications in various spheres of molecular structure.

Course Outcomes:

At the end of the course students will be able to:

- Explain the fundamental components of UV-Visible spectrophotometer
- Familiarize the instrumentation of IR spectroscopy
- Examine the given material by UV-Visible spectroscopy
- The nature of the functional groups present in the sample by IR spectroscopy
- Separate the sample by distillation techniques.

UNI I: Instrumentation of UV-Visible Spectroscopy

6

Hours

UV-Visible Spectroscopy- principle, nomenclature of the components of IR instrument -fundamental components- Schematic diagram of fundamental components, photometer, spectrometer optical, spectrophotometer, colorimeter and spectrograph-

UV-Visible Radiation source - essential characteristics, UV- light sources, visible light sources- Dispersing devices, filters and monochromators- prism, gratings-slits, test sample and optical materials, radiation detector and indicator- barrier layer cell, photo emissive cell, photo multiplier cell.

UNIT II: Instrumentation of IR Spectroscopy

6

Hours

IR Spectroscopy- principle, instrumentation-IR spectrometer-types-single beam and double beam spectrometer-Source of IR radiation, IR mono chromator, detector- selective detector-photo conductive cell-non-selective detectors-thermocouple, bolometer, pneumatic detector cell. Preparation of sample-liquid, solid- characteristic group frequencies.

UNIT III:UV-Visible Spectroscopy Practical

6

Hours

Detection of λ_{\max} of given organic compounds- aniline ,toluene, benzaldehyde, Acetophenone *o*-cresol, ethyl acetate.- of indicator constant of an indicator- Determination of band gap of ZnO nanoparticle.

UNIT IV: IR Spectroscopy Practical

6

Hours

Identification of functional groups of organic compounds-urea, benzaldehyde, cinnamic acid, glucose and acetophenone- Determination of the purity of the

commercial benzoic acid

UNIT V: Separation Techniques Practical Hours

6

Purification of aniline by distillation-Separation of organic liquid mixture by fractional distillation-Removal of solvent from a reaction mixture by reduced pressure distillation.

References

1. A. K. Srivastava and P. O. Jain Instrumental Approach to Chemical Analysis, 4th Revised Edition. Chand & Company Ltd New Delhi 2008

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
38	5	0	24	9	13	0	63	24	National
Local: GREEN Regional: PINK National: BLUE Global: BROWN									

REAGENTS PREPARATIONS AND THEIR VALIDATION

Course Code: 20VACH02
30
Credit: 2

Hours:
Marks:

OBJECTIVES

- To expose the students to various emerging new areas of reagents preparations in laboratory.
- To enhance student sense of preparation of new compounds in laboratory and to involve them in an academically compounds preparation experience.

LEARNING OUTCOMES:

At the end of the course the learners should be able to

- Prepare solutions of desired strength for analysis.
- Prepare important reagents for inorganic, organic and food analysis
- Prepare indicators for chemical analysis
- - o inculcate the knowledge on how to prepare different concentration solutions for chemical analysis.
- - o improve the basic ideas of preparing reagents for inorganic, organic and food analysis.

Unit:I**6 hrs**

Preparation of different concentrated solutions: Introduction-Normality, Molarity, ppm. Preparation- aceticacid, hydrochloricacid, nitricacid, Sulphuricacid- ammonium hydroxide, barium hydroxide, calcium hydroxide, potassium hydroxide, sodiumhydroxide.

Unit:II**6hrs**

Preparation of salt solutions:Ammonium acetate,ammonium carbonate,ammonium chloride, ammonium oxalate, ammonium sulphate- barium chloride, calcium chloride, calcium sulphate, cobalt nitrate, copper sulphate- ferric chloride, ferrous sulphate, lead acetate, magnesium sulphate -potassium chromate, potassiumferricyanide,potassiumferrocyanide,potassiumthiocyanate, sodium carbonate.

Unit:III**6 hrs**

Preparation of Reagents for organic analysis: Sodium nitro prusside- chlorinewater, bromine water- Borche's reagent, phenyl hydrazine, Schiff's reagent -Tollen'sreagent, bromine in carbon tetra chloride- neutral FeCl₃solution, KMnO₄ solution -alcoholic potash.

Unit:IV**6 hrs**

Preparation of Reagents for Food analysis: Benedict reagent for sugar- Biuret solution for protein- Sudan III stain for fat- dichlorophenolindophenol for vitamin C,Molische' reagents- Fehling reagent A and B - Barfoed reagent, Seliwan off reagent, Bial's reagent

Unit:V

6 hrs

Preparation of Indicators:

Phenolphthalein- Methylorange, N- Phenylanthranilic acid- potassium ferricyanide, Starch solution- Potassium chromate, Ferricalum indicator- Fluorescein, Eosin, Erichrome Black T, diphenylamine.

References

1. A. K.SrivastavaandP.O. Jain InstrumentalApproachto ChemicalAnalysis₄th Revised Edition. Chand &CompanyLtd NewDelhi 2008

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
26	9	0	11	6	35	0	42	23	National
Local: GREEN Regional: PINK National: BLUE Global: BROWN									

THANTHAI HANS ROEVER COLLEGE

(Autonomous)

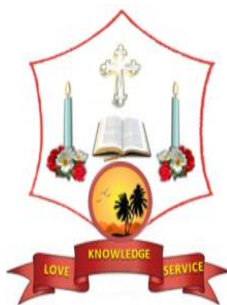
Accredited by NAAC

UGC Recognized 2(f) and 12(B) Institution

Affiliated to Bharathidasan University, Tiruchirapalli

Perambalur - 621 220,

Tamil Nadu, India



M.Phil CHEMISTRY

CHOICE BASED CREDIT SYSTEM SYLLABUS

SEMESTER PATTERN

**PG & RESEARCH DEPARTMENT OF
CHEMISTRY**

(2020-2021 ONWARDS)



THANTHAI HANS ROEVER COLLEGE PERAMBALUR-621212
(AUTONOMOUS)
M.Phil Chemistry -Course Structure Under CBCS
(For the candidates to be admitted from the academic year 2018-2019 onwards)



Semester	Course Code No	Title of the Course Paper	Hours /week	Credits	Exam hours	CIA	ESE	Total
First Semester	20MPCH1CC1	Research Methodology in chemistry	4	4	3	75	25	100
	20MPCH1CC2	Recent Trends in Chemistry	4	4	3	75	25	100
	20MPCH1CC3	Teaching and Learning Skills	4	4	3	75	25	100
	20MPCH1CC4	Paper on Topic of Research (Guide will prepare the syllabus and it will be sent to the COE)	4	4	3	75	25	100
Total			16	16	-	-	-	400
Second Semester	20MPCH2DW	Dissertation and Viva-Voce	-	8	-	-	-	200
Total				24	-	-	-	600

CIA- Continuous Internal Assessment

ESE- End Semester Examination

SEMESTER-I

Research Methodology in chemistry

Core course: I
Credits:4
Max.Marks :100

Hours : 3
Course code: 20MPCH1CC1
Internal : 25
External :75

OBJECTIVES

- To know the Idea about the problem choosing the research
- To under stand the method of research
- To know about prepare the thesis

UNIT I Basic Principles of Research

Meaning of Research - Need for research, Objectives-Motivation- Types of research - Significance - Formulation of Research Problem -Developing Hypothesis - Preparing Research Design Selection of Research Problem -Determining Sample Design Characteristics of a Good Sample Design- Collection of Data Methods of Data Collection - Execution of Work- Analysis of Data- Hypothesis-Testing - Generalization and Interpretation-Preparation of Report - Submission of Report in the form of Thesis.

UNIT II : Literature Searching and Writing Reports:

Literature Searching

Online searching- Database-Scifinder- Scopus CA on CD Locating research article-Citation Index, Impact Factor

Writing scientific report :

Planning- preparation, draft revision and refining- writing project proposal to funding agency- Paper writing for International Journals submitting to editors- Conference presentation- preparation of effective slides and presentation.

UNIT III: Statistical Tools of research

Significant figures- Precision- accuracy Error analysis- types of errors **Random error-systematic error-gross error**-Mean-median- measures of spread -range- standard deviation and variance- F test, t test, Types of correlation, correlation coefficient, Regression analysis -binomial distribution, normal distribution -hypothesis generation and testing of hypothesis

UNIT IV: Introduction to Computing and Networking

Introduction to computers and computing -hardware, Basic organization of a computer, CPU, Main memory, Secondary storage, I/O device, Software, System and application software, High and low level languages, Compilers, Algorithms and Flow charts-

Introduction to networking Computer networks, Network components, Hubs, switches, repeaters, routers, bridges and gateways -LAN, WAN, internet and internet worldwide web, internet for chemists -online search of chemistry databases- e-journals-search engines for chemistry-chemweb-chemsketch

UNITV Chemical safety and Disaster Management:

(a) Emergency response: chemical spills-radiation spills- biohazard spills-leaking compressed gas cylinders-fires- medical emergency accident reporting-emergency responses mitigation-preparedness-response-recovery

b) General safety : General safety and operational rules-safety equipments, personal protective equipments, compressed gas safety-safety practices for disposal of broken glass wares- centrifuge safety- treated biomedical wastes and scientific ethics.

REFERENCES:

1. Thesis and Assignment writing, J. Anderson, B.H.Durston and M.Poole, John Wiley Publications, Sydney. 1970.
2. How to write a research paper, R.Berry, Pergoman, 1969.
3. Fundamentals of analytical Chemistry by D. A. Skoog, D. M. West and F. J. Hooler.
4. Quality in the Analytical Chemistry Laboratory by R. D. Treble and D. G. Holcombe.
5. Eckschlager K., 1969, —Errors, Measurement and results in chemical analysis, London, Van Nostrand Reinhold company
6. K.V. Raman, “Computer in Chemistry”, Tata McGraw Hill, New Delhi, 1993.
7. Practical Skills in Chemistry, J. R. Dean, A. M. Jones, D. Holmes, R. Reed, J. Weyers and A Jones, Pearson Education Ltd. [Prentice Hall] (2002)

Question Pattern

Section-A	Two Question For Each Unit	10x 2 = 20
Section-B	Internal Choice and On Set Of Questions From Each Unit	5x 5 = 25
Section-C	Answer Any Three Out Of 5 Questions and One Questions From Each Unit	3x 10= 30

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
65	0	0	0	65	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-I
RESENT TRENDS IN CHEMISTRY

Hours :3

Course code: 20MPCH1CC2

Credits :4

Max.Marks :100

Internal : 25

External :75

OBJECTIVES

- **To know the methods of analytical techniques**
- **To understand the handling of chemical in the times of analysis**
- **To carry out the interpretation of spectral data's**

UNIT I : NMR, IR and Mass Spectroscopy:

- a) IR spectroscopy- Applications of IR in analysis - NMR spectroscopy: Chemical shifts and coupling constant- Introduction of NOE- DEPT and 2D NMR, ¹³CNMR and its applications-
- c) Mass spectroscopy: Mass spectral fragmentation of complex molecules and its applications-
- d) Combined spectroscopic problems based on IR- NMR-and mass spectral data.

UNIT II Electroanalytical Techniques

Polarography Theory DME and importance-disadvantage Current Voltage curves, Diffusion current and its theory- factors affection it Polarographic wave and half wave potentials-polarogram applications. Oscillographic Polarography-Square wave polarography- Tensimetry- Chronopotentiometry- Cyclic Voltammetry- Amperometry- galvanic cell-theoretical principles-applications in chemical investigations-Electrogravimetry- Principles and applications.

UNIT III

Nanotechnology:

Introduction- Nanotechnology and Nanomachines molecular nanotechnology -methods of synthesis of nano materials - plasma arching, sol-gel method - electro deposition, ball milling - analytical tools to study nano materials (SEM, TEM & SPM) -applications of nano chemistry - CNT and its applications, molecular switches, rotaxanes - catenanes - lithography -nano biometrics-metal nano clusters-nano crystals- quantum wells- dots- wires etc biological materials - future applications

Sonochemistry

Fundamentals of sound and ultrasound - cavitation and its principle - instrumentation - homogeneous and heterogeneous processes - sonoluminescence - uses in chemistry, material science- medicine and life - synthetic applications -esterification, saponification, hydrolysis, substitution, Cannizzaro reaction, Stecker's synthesis

UNIT IV :Xray Diffraction, XPS, EDX and TEM :

Principle instrumentation and application of Xray diffraction (XRD)- Xray photoelectron spectroscopy (XPS) - electron spectroscopy for chemical analysis (ESCA)- transmission electron microscopy (TEM)- Scanning electron microscopy (SEM).

UNITV: Computational Chemistry

Molecular Modeling: Introduction -Coordinate Systems -Potential Energy surfaces- Molecular graphics -Surfaces -Mathematical concepts-molecular mechanics. Introduction to nonbonded interactions -electrostatic interactions-van der Waals interactions- Many body effects in empirical potentials -effective pair potentials, hydrogen bonding in molecular mechanics -force field models for the simulation of liquid water. Computer simulation methods: Introduction calculation of simple thermodynamic properties- phase space- practical aspects of computer simulation.

REFERENCES:

1. Silverstein and Bassalar: Spectroscopic identification of organic compounds.
2. V. M.Parikh: Absorption spectroscopy of organic compounds. (J. Wiley)
3. D.W. Williams and Fleming: Spectroscopic methods of organic compound.
4. R.C. Kapor and B.S. Agarwal, Principles of polarography, Wiley Eastern Ltd., 1991.
5. <http://www.sjctni.edu/department/CH/ooc/biometrics.ppt>
[http://www.sjctni.edu/department/CH/ooc/nano preparation.ppt](http://www.sjctni.edu/department/CH/ooc/nano%20preparation.ppt)
<http://www.sjctni.edu/department/CH/ooc/sonochemistry.ppt>
6. Instrumental Methods of Analysis: Chatwal & Anand
- 7) Principles of Instrumentals Analysis: D.Skoog & West.
8. Andrew R. Leach, Molecular Modelling second edition Pearson Prentice Hall, England 2001.

Question Pattern

Section-A	Two Question For Each Unit	10x 2 = 20
Section-B	Internal Choice and On Set Of Questions From Each Unit	5x 5 = 25
Section-C	Answer Any Three Out Of 5 Questions and One Questions From Each Unit	3x 10= 30

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
68	0	0	0	68	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER - I

CORE COURSE III - TEACHING AND LEARNING SKILLS

Course Code: 20MPMB1CC3

Total Marks: 100

Hours: 6

External Marks: 75

Credit: 4

Internal Marks: 25

Objectives

- Acquaint different parts of computer system and their functions
- Understand the operations and use of computers and common accessories
- Develop skills of ICT and apply them in teaching learning context and research
- Appreciate the role of ICT in teaching, learning and research
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles
- Understand the terms communication Technology and Computer mediated teaching and develop multimedia / e-content in their respective subject
- Understand the communication process through the web
- Acquire the knowledge of Instructional Technology and its Applications
- Develop different teaching skills for putting the content across to targeted audience

Unit I - Computer Application Skills

Computer System: Characteristics, Parts and their functions - Different generations of computer – Operation of Computer: switching on/off/restart. Mouse control, Use of key board and some functions of key – Information and Communication Technology (ICT): Definition, Meaning, Features, Trends – Integration of ICT in teaching and learning – ICT applications: Using word processors, Spread sheets, Power point slides in the classroom – ICT for Research: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations.

Unit II - Communication Skills

Communication Definitions – Elements of Communication: Sender, Message, Channel, Receiver, Feedback and Noise – Types of Communication: Spoken and Written: Non-verbal Communication – Intrapersonal, Interpersonal, Group and Mass communication – Barrier to communication: Mechanical, Physical, Linguistic & Cultural – Skills of Communication: Listening, Speaking, Reading and writing – Methods of developing fluency in oral

and written communication – Style, Diction and Vocabulary – Classroom communication and dynamics.

Unit III - Communication Technology

Communication Technology: Bases, Trends and Developments – Skills of using Communication Technology – Computer Mediated Teaching Multimedia, E – content – Satellite – based communication: EDUSAT and ETV Channels. Communication through web: Audio and Video applications on the internet, interpersonal communication through the web.

Unit IV - Pedagogy

Instructional Technology: Definition, Objectives and Types – Difference between Teaching and Instruction – Lecture Technique: Steps, Planning of a Lecture, Delivery of a Lecture – Narration in tune with the nature of different disciplines – Lecture with power point presentation – Versatility of Lecture technique – Demonstration: Characteristics, Principles, Planning Implementation and Evaluation – Teaching – learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion – Modes of teaching: CAI, CMI and WBI

Unit V - Teaching Skills

Teaching Skill: Definition, Meaning and Nature: Types of Teaching skills: Skill of Set induction, Skill of Stimulus Variation, Skill of Explaining, Skill of Probing Questions, Skill of Black Board Writing and Skill of Closure – Integration of Teaching Skills – Evaluation of Teaching Skills.

Text Book:

1. Mangal, S.K. (2002) Essential of Teaching - Learning and Information Technology, Tandon Publications, Ludhiana

Reference Books:

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
3. Information and Communication Technology in Education: A Curriculum for Schools and programme of Teacher development, Jonathan Anderson and Tom Van Weert, UNESCO, 2002
4. Kumar K.I (2008) Educational Technology, New Age International Publishers, New Delhi

Question Pattern

Section-A	Two Question For Each Unit	10x 2 = 20
Section-B	Internal Choice and On Set Of Questions From Each Unit	5x 5 = 25
Section-C	Answer Any Three Out Of 5 Questions and One Questions From Each Unit	3x 10= 30

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
95	0	0	0	95	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

SEMESTER-I
GUIDE PAPER

Hours : 4
Course code: 20MPCH1CC4

Credits:4
Max-Marks :100
Internal : 25
External :75

SYLABUS PREPARED BY GUIDE THEIR OWN RESEARCH AREAS

Question Pattern

Section-A	Two Question For Each Unit	10x 2 = 20
Section-B	Internal Choice And On Set Of Questions From Each Unit	5x 5 = 25
Section-C	Answer Any Three Out Of 5 Questions and One Questions From Each Unit	3x 10= 30

PAPER-IV

BACKGROUND PAPER -SYNTHETIC ORGANIC CHEMISTRY

OBJECTIVE

- To understand synthesis through environment friendly by studying green Chemistry
- The course “Synthetic organic Chemistry” provides students with a detailed knowledge of fundamental aspects of the subject,
- To analyze the influence of an on the reactivity of a various reagents-
- To know various analytical technique to summarize the research outcomes

UNIT I: Green chemistry:

Introduction Principles of Green chemistry - Environmental friendly green techniques - Solvent less organic synthesis - supercritical carbondioxide and water as solvents ionic liquids reactions of solid supported catalysts- Biocatalysts.

UNIT II: Named Reactions and Strategic Applications in Organic Synthesis

Bamford Stevens Reaction- Barton McCombie Reaction (Barton Deoxygenation)- Baylis Hillman Reaction -Enamines and selective alkylation (mono and di) via enamine reactions - Henry Reaction -Hunsdiecker Reaction- Peterson Olefination Prevost Reaction, Prins Reaction ,Ugi Reaction, Weinreb Ketone Synthesis- Wittig reaction and its modifications- Palladium based reactions:Fukuyama Coupling Heck Reaction- Hiyama Coupling- Sonogashira Coupling- Stille Coupling-Suzuki Coupling.

UNIT III: Oxidation and Reduction reactions

Synthetic uses of the following oxidants: OsO₄-DDQ- PCC- MnO₂- SeO₂- Jones reagent-ozone- HNO₃-Chromyl chloride- Lead Tetra Acetate- periodate- peracids-Fetizones reagent
Synthetic uses of the following reductions: NaNH₂, Wilkinson's catalyst- LAH- NaBH₄- (tBuO)₃AlH- NaBH₃CN-R₃SnH-Me₃SiCl-hydrazine- Alkali metals- MPV reduction.

UNIT IV: Chromatography:

Principles of chromatography, adsorption chromatography, partition chromatography- Thin layer chromatography - R_f value - column chromatography - separation techniques-principles of Gas - liquid chromatography - Instrumentation Applications, Principle and applications of HPLC and HPTLC.

UNIT V: Advanced NMR Spectroscopy

IR spectroscopy: Applications of IR in analysis- NMR Spectroscopy:¹H NMR Spectroscopy Multiplicity -Coupling constant -Spin -spin splitting -Vicinal and geminal coupling constants- ¹³C NMR Spectroscopy -Off resonance decoupling and chemical shifts of common functional groups, DEPT spectra- Basic principles of two dimensional correlated NMR spectroscopy- ¹H¹³C COSY, ¹H¹H COSY, Two dimensional relayed NMR spectroscopy, H relayed (H, C) COSY H relayed (H H) COSY experiments- Two dimensional exchange NMR,NOESY- Total correlation spectroscopy, two dimensional inadequate experiments.

Mass spectroscopy: Mass spectral fragmentation of complex molecules and its applications.

References:

1. Rashmi Sanghi, Green Chemistry - Environment friendly alternatives- Srivastava, Narosa Publishers, New Delhi-
2. House H-O- Modern Synthetic Reactons, W-A- Benjamin- Norman R-O-C- Modern Methods in organic synthesis- Macmillan- 1967-
3. Corey, E-J- Reaction and reagent in organic synthesis, V-C-H- 1988-
4. Willard and D- Merrit, Instrumental methods of analysis- W-B- Saunder, 1987-
5. Silverstein, R-M- and F-X- Webster, Spectrometric identification of Organic Compounds, John Wiley, 1998-
6. Stothers, J-B-, Carbon-13 NMR Spectroscopy- Academic, 1972-

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
62	0	0	0	62	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

PAPER-IV
THEORIES OF COORDINATION CHEMISTRY

OBJECTIVE

- To understand the key features of coordination compounds, including the variety of structures.
- Use knowledge of the periodic table to locate the position of the d block and the transition metals.
- To understand the structures of complexes containing monodentate and polydentate ligands

Unit I: d block elements: General characteristics of d block elements - Group IB, IIB, IIIB, IVB, VB, VIB, VIIB and VIII elements - metallic character, atomic and ionic radii - oxidation states, colour, complex formation, catalytic and magnetic properties-comparison of IB and IIB group elements with special reference to coordination compounds.

Unit II: Basic concept of coordination chemistry: Basic concept of coordination complexes - central metal ion -ligands types of ligands -coordination number, oxidation numbers and coordination sphere -Werner's theory of complexes. IUPAC Nomenclature - mononuclear and polynuclear complexes. Stability of complexes-relation between stepwise and overall stability constants- factors affecting the stability-EAN rule -Magnetic properties.

Unit III: Coordination Chemistry: Theories of Metal-Ligand Bond: Valence Bond theory and its limitations -Crystal field theory - splitting of d orbitals under various geometries -Factors affecting the magnitude of CFSE and evidences for CFSE (Structural and thermodynamic effects) -Spectrochemical series - Jahn Teller distortion -Spectral and magnetic properties of complexes -Site preferences - Limitations of CFT Ligand field theory -MO theory -sigma -and pi-bonding in octahedral, square planar and tetrahedral complexes-Nephelauxetic effect -The angular overlap model.

Unit IV: Coordination Chemistry: Reaction Mechanism: Kinetics and mechanism of reactions in solution -labile and inert complexes -Ligand displacement reactions in octahedral and square planar complexes -acid hydrolysis, base hydrolysis and anation reactions -trans effect -theory and applications- Electron transfer reactions -electron exchange reactions - complementary and noncomplementary types -inner sphere and outer sphere processes -Cross reactions and Marcus Hush theory - isomerisation and racemisation reactions of complexes -

Molecular rearrangement -Reactions of four and sixcoordinate complexes -Inter conversion between stereoisomers. Application of trans effect -synthesis of isomers of pt(II) complexes - theories of trans effect and cis-trans isomerisation reaction. Application of substitution reactions in the synthesis of platinum and cobaltcomplexes.

Unit V: Bioinorganic Chemistry: Essential and non-essential metals in biological systems- metal ioninteraction with DNA and RNA Biochemistry of cobalt, copper, zinc, molybdenum and platinum and iron-antibacterial and antifungal activities of complexes.

References:

1. James E. Huheey, Ellen A. Keiter, and Richard L. Keiter, "Inorganic Chemistry; Principles of Structure and Reactivity", 4th edn., Harper Collins College Publishers, New York, (1993).
2. F. A. Cotton and G. Wilkinson, "Advanced Inorganic Chemistry" 3rd edn., Wiley Eastern, New Delhi, (1972).
3. J. D. Lee, "Concise Inorganic Chemistry" 4th edn., ELBS, (1991).
4. F. A. Cotton, G. Wilkinson and P.L..Gaus, "Basic Inorganic Chemistry" John Wiley and Sons, Inc. 3rd edn., (1994).
5. R.L.Carlin "Transition Metal Chemistry" Marccel Dekke, New York, Vol. 1-5 (1965-69).
6. G.L. Eichron, "Inorganic Biochemistry" Elsevier Publications, New York, (1975).
7. S.F.A. Kettle, Physical Inorganic Chemistry -A Coordination Chemistry Approach, Oxford University Press (1996).
8. D.E. Douglas, D.H. McDaniel, J.J. Alexander, Concepts and Models in Inorganic Chemistry, 3rd Ed. 1994.

Total No of Topics	Number of Topics relevance on				% of Topics relevance on				Category Based on %
	Local	Regional	National	Global	Local	Regional	National	Global	
53	0	0	0	53	0	0	0	100	Global
Local-Green; Regional-Pink; National-Blue; Global-Brown									

