SWAMI DAYANANDA COLLEGE OF ARTS & SCIENCE, MANJAKKUDI.

DEPARTMENT OF CHEMISTRY

B.Sc CHEMISTRY

BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024.

B.Sc. Chemistry Course Structure under CBCS (For the candidates admitted from the academic year 2016-2017 onwards)

Updated on 07.03.2019

Semester	Part	Course	Title	Inst. Hours/ Week	Credit	Exam Hours	Marks		Total
							Int	Ext	
I	I	Language Course–I (LC) – Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course - I (ELC)		6	3	3	25	75	100
	III	Core Course – I (CC)	General Chemistry I	6	6	3	25	75	100
		Core Practical – I (CP)	Volumetric Analysis (P)	3	-	-	-	-	-
		First Allied Course–I (AC)	Mathematics I / Botany I / Computer Science / Zoology I	4	4	3	25	75	100
		First Allied Course – II (AP)	Mathematics II / Botany / Computer Science / Zoology	3	-	-	-	-	-
	IV	Value Education	Value Education	2	2	3	25	75	100
	Total			**30**	**18**				**500**
II	I	Language Course–II (LC)– Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course–II (ELC)		6	3	3	25	75	100
	III	Core Course – II (CC)	General Chemistry – II	6	6	3	25	75	100
		Core Practical – I (CP)	Volumetric Analysis (P)	3	3	3	40	60	100
		First Allied Course – II (AP)	Mathematics II / Botany / Computer Science / Zoology	3	3	3	25 40	75 60	100
		First Allied Course – III (AC)	Mathematics III / Botany II / Computer Science / Zoology II	4	2	3	25	75	100
	IV	Environmental Studies	Environmental Studies	2	2	3	25	75	100
	Total			**30**	**22**				**700**
III	I	Language Course – III (LC)– Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course-III (ELC)		6	3	3	25	75	100
	III	Core Course – III (CC)	General Chemistry - III	6	6	3	25	75	100
		Core Practical – II (CP)	Semimicro Analysis	3	-	-	-	-	-
		Second Allied Course – I (AC)	Physics I	4	4	3	25	75	100
		Second Allied Course-II/ (AP)	Physics (P)	3	-	-	-	-	-
	IV	Non Major Elective I-for those who studied Tamil under Part-I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Chemistry in Every Day Life	2	2	3	25	75	100
	Total			**30**	**18**				**500**

IV	I	Language Course –IV (LC) - Tamil*/Other Languages ** #		6	3	3	25	75	100
	II	English Language Course – IV (ELC)		6	3	3	25	75	100
	III	Core Course – IV (CC)	General Chemistry - IV	5	5	3	25	75	100
		Core Practical – II (CP)	Semi Micro Analysis (P)	3	3	3	40	60	100
		Second Allied Course-II (AP)	Physics (P)	3	3	3	40	60	100
		Second Allied Course - III	Physics II	3	2	3	25	75	100
	IV	Non Major Elective II-for those who studied Tamil under Part I a) Basic Tamil for other language students b) Special Tamil for those who studied Tamil upto +2 but opt for other languages in degree programme	Health Chemistry	2	2	3	25	75	100
		Skill Based Elective - I	Skill Based Elective - I	2	2	3	25	75	100
			Total	**30**	**23**				**800**
V	III	Core Course – V (CC)	Inorganic Chemistry - I	5	5	3	25	75	100
		Core Course – VI (CC)	Organic Chemistry - I	5	5	3	25	75	100
		Core Course – VII (CC)	Physical Chemistry - I	**6**	**5**	3	25	75	100
		Core Practical – III (CP)	Physical Chemistry (P)	3	3	3	40	60	100
		Major Based Elective – I	Analytical Chemistry / Material & Nano Chemistry	**5**	**5**	3	25	75	100
	IV	Skill Based Elective - II	Skill Based Elective - II	2	2	3	25	75	100
		Skill Based Elective – III	Skill Based Elective - III	2	2	3	25	75	100
		Soft Skills Development	Soft Skills Development	2	2	3	25	75	100
			Total	**30**	**29**				**800**
VI	III	Core Course – VIII (CC)	Organic Chemistry - II	6	6	3	25	75	100
		Core Course – IX (CC)	Physical Chemistry - II	6	6	3	25	75	100
		Core Practical – IV (CP)	Gravimetric & Organic Analysis (P)	6	5	6	40	60	100
		Major Based Elective II	Nuclear, Industrial Chemistry & Metallic State	6	6	3	25	75	100
		Major Based Elective III	Polymer Chemistry / Pharmaceutical Chemistry	5	5	3	25	75	100
	V	Extension Activities	Extension Activities	-	1	-	-	-	-
		Gender Studies	Gender Studies	1	1	3	25	75	100
		Total		**30**	**30**				**600**
Grand Total				**180**	**140**				**3900**

Language Part – I	-	4
English Part –II	-	4
Core Paper	-	9
Core Practical	-	4
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
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
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 University 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 University Examinations shall be 40% out of 60 marks [i.e. 24 marks]

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Programme outcome:

PO1: Have sound knowledge about the fundamentals and applications of chemical and scientific theories .

PO2: Easily assess the properties of all elements discovered.

PO3: Apply appropriate techniques for the qualitative and quantitative analysis of chemicals in laboratories and in industries.

PO4: Will become familiar with the different branches of chemistry like analytical, organic, inorganic , physical, environmental, polymer and biochemistry .

PO5: Develops analytical skills and problem solving skills requiring application of chemical principles. Acquires the ability to synthesis, separate and characterize compounds using laboratory and instrumentation techniques.

Programme specific outcome

PSO-1: Gain the knowledge of Chemistry through theory and practical‟s. as well as good laboratory practices and safety.

PSO-2: To explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions and structure-activity relationship.

PSO-3: Identify chemical formulae and solve numerical problems and also Use modern chemical tools, Models, Chem-draw, Charts and Equipments.

PO, PSO ATTAINMENT LEVEL

HIGH LEVEL - 3, MODERATE LEVEL - 2, LOW LEVEL - 1

SEMESTER-I **CORE COURSE I**

GENERAL CHEMISTRY I

Hours/ Week: 6
Credits: 6

UNIT I PERIODIC TABLE AND PERIODIC PROPERTIES

Quantum Numbers, Filling up of atomic orbitals: Pauli's exclusion principle, Aufbau Principle, Hunds rule of maximum multiplicity – electronic configuration. Stability associated with half-filled and completely filled orbitals.

Periodic properties of elements – variation of atomic volume, atomic and ionic radii, onization potential, electron affinity, electronegativity along periods and groups. Pauling scale of electronegativity.

Classification of elements into s, p, d and f block elements.

UNIT II ANALYTICAL METHODS

Qualitative Inorganic Analysis – Dry Test, flame test, cobalt nitrate test–wet confirmatory test for acid radicals, interfering acid radicals – elimination of interfering acid radicals.

Solubility product, common ion effect, complexation, oxidation-reduction reactions involved in identification of anions and cations – separation of cations into groups – Semi micro analysis of simple salts.

Volumetric analysis – preparation of standard solutions – normality, molarity and molality by titrimetric reactions – acid-base, redox, precipitation and complex metric titrations – indicators – effect of change in Ph – selection of suitable indicators.

UNIT III ALKANES, REACTIVE INTERMEDIATES AND METHODS FOR REACTION MECHANISMS

Introduction: Inductive, mesomeric, electromeric effects and hyperconjugation – structure of organic molecules based on sp^3, sp^2 and sp hybridization. Alkanes – sources of alkanes – general preparation – general properties – conformational analysis of ethane and n-butane.

Carbocations, Carbanions, Carbenes and Nitrenes: Generation and stability of reactive intermediates – Correlation of reactivity with structure of reactive intermediates. Free radicals: Generation, stability, identification methods – Free radical halogenation reactions and their mechanism.

Homolytic and Heterolytic cleavages of bonds, Characteristics of nucleophilic, electrophilic and free radical reactions. Thermodynamic and kinetic aspects, Hammond's postulates, isotope effects. Energy profile diagrams – Intermediate versus transition state, Product analysis and its importance, crossover experiments, kinetic methods, Isotopic effects.

UNIT IV CHEMISTRY OF CYCLOALKANES, ALKENES, DIENES AND ALKYNES

Preparation of cycloalkanes – Chemical properties – Relative stability of cyclopropane to cyclooctane – Baeyer's Strain theory – Limitations – Mono and disubstituted cyclohexanes.

Alkenes: Nomenclature – Petroleum source of alkenes and aromatics – General methods of preparation of alkenes – Chemical properties – Markovnikov's rule and peroxide effect-Uses – Elimination reactions and its mechanisms (E1,E2).

Dienes: Structures and properties – conjugated dienes – stability and resonance – electrophilic addition – 1,2 addition and 1,4 addition. Alkynes: Nomenclature – General methods of preparation – Physical properties – Chemical properties – Uses.

UNIT V COLLOIDS AND MACROMOLECULES

Definition and types of Colloids- preparation, Purification (dialysis, electrodialysis and ultrafilteration) and stability of colloids, gold number.

Properties of colloids- kinetic, optical and electrical properties.

Emulsions – Types of emulsions, preparation, properties and applications, Donnan membrane equilibrium.

5.4 Osmosis – reverse osmosis and desalination. Macromolecules- Molecular weight of macromolecules- determination of molecular weight by osmotic pressure and light scattering methods.

REFERENCES

1. R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.
2. P.L. Soni, "Text book of Inorganic Chemistry", 20th revised edition, Sultan Chand & Sons, 2000.
3. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993).
4. J.D. Lee, 'Concise Inorganic Chemistry', 20th revised edition, Sultan Chand & Sons, 2000.
5. R. Gopalan, P.S. Subramanian & K. Rengarajan, "Elements of Analytical Chemistry", 2nd edition, Sultan Chand & Sons, 1000.
6. Morrison, R.T. and Boyd, R.N., Bhattacharjee, S. K. Organic Chemistry (7th edition), Pearson, India, (2011).
7. Bahl, B.S. and Bahl, A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010).
8. Jerry March, "Advanced Organic Chemistry, Reaction, Mechanism and Structure", 7th Edition, Wiley Inter Science (2013).
9. Puri B.R., Sharma L.R. and Pathania M.S. Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin chand and Co. (2013)

10. Glasstone S. and Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co Ltd.

Course Outcome Course Outcome

Semester: I	Course : I	General Chemistry – I	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH1 COURSE TITLE: GENERAL CHEMISTRY- I

CO1: To learn the periodic properties of elements and its classifications.
CO2: To understand the theoretical aspects of qualitative and quantitative analyses.
CO3: To study the basics of alkenes, reactive intermediates and reaction mechanisms.
CO4: To know about the chemistry of cycloalkanes, alkenes and alkynes.
CO5: To find about the types, preparation and properties of sols, colloids and emulsions and the determination of molecular weight of macromolecules.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1		3						
CO2			3			3		
CO3				2			3	
CO4				2				
CO5					2			3

SEMESTER I **CORE PRACTICAL I**

Hours/Week: 3
Credits: 3

VOLUMETRIC ANALYSIS (P)

Titrimetric Quantitative Analysis

1. Estimation of HCl Vs NaOH using a standard oxalic acid solution
2. Estimation of Na_2CO_3 Vs HCl using a standard Na_2CO_3 solution
3. Estimation of oxalic acid Vs $KMnO_4$ using a standard oxalic acid solution
4. Estimation of Iron (II) sulphate by $KMnO_4$ using a standard Mohr's salt solution.
5. Estimation of Ca (II) Vs $KMnO_4$ using a standard oxalic acid solution.
6. Estimation of $KMnO_4$ Vs thio using a standard $K_2Cr_2O_7$ solution.
7. Estimation of Fe (III) by using $K_2Cr_2O_7$ using a standard Mohr's salt solution using internal and external indicators.
8. Estimation of copper (II) sulphate by $K_2Cr_2O_7$ solution
9. Estimation of Mg (II) by EDTA solution
10. Estimation of Ca (II) by EDTA solution
11. Estimation of As_2O_3 using I_2 solution and standard Arsenious oxide solution.
12. Estimation of chloride (in neutral and acid media)

II. Applied Experiments

1. Estimation of Total Hardness of water
2. Estimation of Bleaching Powder
3. Estimation of saponification value of an oil
4. Estimation of copper in brass

Scheme of Valuation		Max. marks
Record	-	5 (marks)
Procedure Writing	-	10 marks

Results

< 1 %	- 45 marks
1-2 %	-35 marks
2-3 %	-25 marks
3-4 %	-15 marks
> 4 %	- 10 marks

Semester: I	Course : I	Volumetric analysis Practical	Credit : 2	Allotted hours per week: 3

CODE: 16SCCCH1P COURSE TITLE: PRACTICAL-I VOLUMETRIC ANALYSIS (P)

CO1: To learn the techniques of titrimetric analyses.
CO2: To understand the neutralization reactions quantitatively.
CO3: To know the estimation of total hardness of water.
CO4: To study about P^H estimation and indicators mechanism.
CO5: To find out the stoichiometry of complexometric titration.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1			3					2
CO2			2			2		
CO3			3					
CO4					3		2	
CO5					3			

SEMESTER II **CORE COURSE II**

Hours/Week: 6
Credits: 6

GENERAL CHEMISTRY – II

UNIT I CHEMICAL BONDING

Ionic bond – formation, variable electrovalency – Lattice energy, Born – Haber Cycle. Covalent bond - formation, variable covalency, maximum covalency, covalent character in ionic bond – Fajans Rule. Polarisation – partial ionic character of a covalent bond.

VB theory, MO theory – Basic principles of bonding and antibonding orbitals, applications of MOT to H_2 He_2, N_2 & O_2 – molecular orbital sequence, comparison of VB & MO Theories.

Hybridisation – Formation of $BeCl_2$ & BCl_3. VSEPR theory of simple inorganic molecules – $BeCl_2$, $SiCl_4$, PCl_5, SF_6, IF_7, XeF_6, BF_3 & H_2O.

Hydrogen bonding – Intermolecular & Intramolecular H_2 – bonding and consequences.

UNIT II CHEMISTRY OF s-BLOCK & ZERO GROUP ELEMENTS AND METALLURGY

General characteristics of s-block elements – comparative study of elements – alkali metals and their hydroxides, oxides and halides, alkaline earth metals and their oxides, carbonates and sulphates.

Diagonal relationship of Li & Mg, Be & Al, chemistry of NaOH, KI & $Mg(NH_4)PO_4$.

Metallurgy : Occurrence of metals – concentration of ores – froth floatation, magnetic separation, calcination, roasting, smelting, flux, aluminothermic process, purification of metals – electrolysis, zone refining, van Arkel de-Boer process.

Zero group elements – position in the periodic table, occurrence, isolation, applications, compounds of Xe – XeF_6 & $XeOF_4$.

UNIT III CHEMISTRY OF BENZENE AND BENZENOID COMPOUNDS

Aromaticity – Huckle's rule - structure of benzene – Benzene-preparation, chemical properties and uses. Aromatic electrophilic substitution reactions and mechanism – Orientation and reactivity in substituted benzenes.

Polynuclear aromatic hydrocarbons – Nomenclature, Naphthalene from coal tar and petroleum – Laboratory preparation, Structure of Naphthalene, Aromatic character, Physical properties, Chemical properties, Uses. Mechanism of Aromatic electrophilic substitution – Theory of orientation and reactivity.

Anthracene, Phenanthrene from coal tar and petroleum, Laboratory preparation, Molecular Orbital structures, Aromatic Characters, Physical Properties, Chemical

properties and uses. Preparation of biphenyls, Physical and Chemical properties and uses.

UNIT IV ALKYL AND ARYL HALOGENS

Nomenclature of haloalkanes – structure - general preparations of haloalkanes - physical and chemical properties and uses.

Nucleophilic aliphatic substitution reaction mechanisms (SN1 and SN2) – Stereochemical aspects.

Halobenzenes: Theory of orientation and reactivity - general preparation – properties - uses. Electrophilic and nucleophilic aromatic substitution reaction mechanisms.

UNIT V ATOMIC STRUCTURE AND BASIC QUANTUM MECHANICS

Rutherford's and Bohr's model an atom- Bohr's theory and origin of hydrogen spectrum. Sommerfield's extension of Bohr's theory.

Electromagnetic radiation- definitions for □, υ and velocity.

Dualism of light -Particle nature of radiation- black body radiation and Planck's quantum theory, photoelectric effect and Compton effect of matter.

De Broglie hypothesis and Davisson and Germer experiment. Heisenberg's uncertainty principle. Schrodinger wave equation (Derivation not needed). Physical significance of □ and $□^2$.

REFERENCES

1. R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.
2. P.L. Soni, "Text book of Inorganic Chemistry", 20th revised edition, Sultan Chand & Sons, 2000.
3. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993).
4. J.D. Lee, 'Concise Inorganic Chemistry', 20th revised edition, Sultan Chand & Sons, 2000.
5. R. Gopalan, P.S. Subramanian & K. Rengarajan, "Elements of Analytical Chemistry", 2nd edition, Sultan Chand & Sons, 1991.
6. Morrison R.T. and Boyd R.N., Bhattacharjee S. K. Organic Chemistry (7th edition), Pearson India, (2011).
7. Bahl B.S. and Bahl A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010).
8. Jerry March, "Advanced Organic Chemistry, Reaction, Mechanism and Structure", 7th Edition, Wiley Inter Science (2013).
9. Puri B.R., Sharma L.R. and Pathania M.S. (2013) Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin chand and Co.
10. Bahl B.S., Arun Bahl and Tuli G.D. (2012). Essentials of Physical

Chemistry, New Delhi: Sultan Chand and Sons.

Semester: II	Course : II	General Chemistry – II	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH2 COURSE TITLE: GENEREL CHEMISTRY-II

CO1: To know the principles of bonding and theories of chemical bonding.
CO2: To understand the chemistry of S-block elements and metallurgy of zero group elements.
CO3: To study about the aromatic character of benzene type molecules and to learn the reaction mechanisms involved in haloalkanes and halobenzenes.
CO4: To learn about the properties of atoms and characteristics,
CO5: To find out the effect of radiations and the significance of wave functions.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3					3		
CO2				2				
CO3				2				2
CO4					3		2	
CO5		2						

SEMESTER III **CORE COURSE III**

Hours/Week: 6
Credits: 6

GENERAL CHEMISTRY – III

UNIT I CHEMISTRY OF p-BLOCK ELEMENTS

General characteristics of p-block elements. Comparative study of elements of III A & their compounds. Compounds of boron –boric acid, borax, borazole. Extraction of Al and Pb - alums, alloys of Al. Chemistry of oxides of carbon – CO, CO_2. Allotropic forms of carbon.
Compounds of nitrogen and phosphorous – $NH_2.NH_2$, H_2NOH, hydrazoic acid, N_2– Cycle, fixation of N_2, PH_3 and P_2O_5.

Unit II INTERHALOGEN COMPOUNDS

Peracids of sulphur, Thionic acids, sodium thiosulphate – preparation, properties, structure and uses.
Classification of oxides – acidic, amphoteric, neutral oxides, peroxides and superoxides.
Interhalogen compounds, Pseudohalogens, Oxyacids of halogens, Polyhalides and basic nature of iodine.

UNIT III STEREOCHEMISTRY

Principles of symmetry – symmetry elements (Cn, Ci and Sn) - asymmetry and dissymmetry – isomerism – constitutional isomers - stereoisomers – enantiomers – diastereomers - geometrical isomerism – meso and dl compounds - conventions used in stereochemistry: Newman, Sawhorse and Fischer notations and their interconversions.
Nomenclature, correlation of configuration – Cahn-Ingold-Prelog rules for simple molecules - R,S and D,L notations to express configurations - chirality - optical isomerism - optical activity – polarimeter – specific rotation - stereochemistry of allenes and spiranes
Atropisomerism - erythro and threo conventions – stereoselectivity, stereospecificity in organic reactions with examples. Resolution of racemic mixture
– Walden Inversion – conformational analysis of cyclohexane - asymmetric induction.

UNIT IV GASEOUS STATE

Gases – Boyle's law, Charle's law and Avagadro's law- ideal gas equation.

Real Gases- deviation from ideal behaviour – van der Waals equation of states- derivation – significance of critical constants- law of corresponding states- compressibility factor.

Inversion temperature and liquefaction of gases- Linde and Claude – demagnetization methods.

Maxwell's distribution of molecular velocities (Derivation not needed).Types of molecular velocities- mean, most probable and root mean square velocities-Inter relationships. Collision diameter, mean free path and collision number.

UNIT V SOLID STATES AND LIQUID CRYSTALS

Classification of solids- Isotropic and anisotropic crystals- elements of symmetry- basic seven crystal systems- laws of crystallography- representation of planes- miller indices, space lattice and unit cell.

X-ray diffraction- derivation of Bragg's equation- determination of structures of NaCl by Debye Scherrer (powder method) and rotating crystal methods.

Types of crystals, close packing of identical solid spheres, interstitial sites, limiting radius ratios (derivation not needed), radius ratio rule and shapes of ionic crystals, structures of NaCl, CsCl and ZnS.

Semiconductors- intrinsic and extrinsic semi conductors- n and p-type semiconductors.Liquid crystals- types and applications.

REFERENCES

1. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993).
2. R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.
3. J.D. Lee, 'Concise Inorganic Chemistry', 20th revised edition, Sultan Chand & Sons, 2000.
4. Gurdeep Raj, 'Advanced Inorganic Chemistry', 20th revised edition, Sultan Chand & Sons, 2000.
5. Morrison R.T. and Boyd R.N., Bhattacharjee S. K. Organic Chemistry (7th edition), Pearson India, (2011).
6. Bahl B.S. and Bahl A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010).
7. Glasstone S. and Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co Ltd.
8. Puri B.R., Sharma L.R. and Pathania M.S. (2013) Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin Chand and Co.

Semester: II	Course : III	General Chemistry – III	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH3 COURSE TITLE: GENERAL CHEMISTRY -III
CO1: To learn the chemistry of p-block elements.
CO2: To study about the preparations and properties of inter halogen compounds.
CO3: To understand the arrangement of atoms in space, isomers and their nomenclature.
CO4: To find out about the gas laws, properties of real gases and types of molecular velocities.
CO5: To create the types, structure and properties of solids and liquid crystals.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1		3						
CO2				2				
CO3				3			2	
CO4				3		2		
CO5					3			2

SEMESTER III **CORE PRACTICAL II**

Hours/Week: 3
Credits: 3

SEMIMICRO ANALYSIS (P)

SEMIMICRO INORGANIC QUALITATIVE ANALYSIS

Analysis of a mixture containing two cations and two anions of which one will be an interferring acid radical. Semimicro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations to be Studied: lead, copper, bismuth, cadmium, iron, aluminium, zinc, manganese, cobalt, nickel, barium, calcium, strontium, magnesium and ammonium.

Anions to be studied: Carbonate, Sulphide, Sulphate, nitrate, chloride, bromide, fluoride, borate, oxalate and phosphate.

REFERENCE:

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

Note:

Internal Marks: 40 External marks : 60

Marks Distribution for external	:	Practical	-	55 marks
	:	Record	-	5 marks
	:	Total	-	60 marks

4 radicals correct with suitable tests	:	55 marks
3 radicals correct with suitable tests	;	40 marks
2 radicals correct with suitable tests	:	30 marks
1 radical correct with suitable tests	:	15 marks
Spotting	:	5 marks

Semester: IV	Course : II	Semi Micro Analysis Practical	Credit : 2	Allotted hours per week: 3

CODE: 16SCCCH1P COURSE TITLE: SEMI MICROANALYSIS PRACTICAL(P)

CO1: To learn the techniques of semi micro qualitative analysis of inorganic salt mixtures.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1			3			3	2	-
CO2								
CO3								
CO4								
CO5								

Hours/Week: 5
Credits: 5

SEMESTER IV **CORE COURSE IV**

GENERAL CHEMISTRY – IV

UNIT I d-BLOCK & f-BLOCK ELEMENTS

General characteristics of d-block elements, comparative study of zinc group elements, extraction of Mo & Pt - Alloys of copper, amalgams and galvanization. Evidences for the existence of Hg_2^{2+} ions.

General characteristics of f-block elements – Lanthanide contraction and its consequences. Extraction of Th.

Arrhenius, Lowry – Bronsted and Lewis concept of acids and bases.

UNIT II CHEMISTRY OF ORGANOMETALLIC COMPOUNDS

Introduction – preparation of organomagnesium compounds- physical and chemical properties- uses. Organozinc compounds – general preparation, properties and uses.

Organolithium, organocopper compounds – preparation, properties and uses.

Organolead, organophosphorous and organoboron compounds– preparation, properties and uses.

UNIT III CHEMISTRY OF ALCOHOLS, PHENOLS AND ETHERS

Nomenclature – industrial source of alcohols – preparation of alcohols: hydration of alkenes, oxymercuration, hydroboration, Grignard addition, reduction – physical properties – chemical properties - uses – glycols from dihydroxylation, reduction, substitution reactions and glycerols and their uses.

Preparation of phenols including di- and trihydroxy phenols – physical and chemical properties - uses – aromatic electrophilic substitution mechanism – theory of orientation and reactivity.

Preparation of ethers: dehydration of alcohols, Williamson's synthesis – silyl ether. epoxides from peracids - sharpless asymmetric epoxidation – reactions of epoxides – uses – introduction to crown ethers – structures – applications.

UNIT IV THERMODYNAMICS-I

Definitions- system and surrounding- isolated, closed and open system- state of

the system- Intensive and extensive variables. Thermodynamic processes-

reversible and irreversible, isothermal and adiabatic processes- state and path functions.

Work of expansion at constant pressure and at constant volume. First law of thermodynamics- statement- definition of internal energy (E), enthalpy (H) and heat capacity. Relationship between Cp and Cv.

Calculation of w, q, dE and dH for expansion of ideal and real gases under isothermal and adiabatic conditions of reversible and irreversible processes.

Thermochemistry- relationship between enthalpy of reaction at constant volume (q_v) and at constant pressure (q_p)- temperature dependence of heat of reaction- Kirchoff's equation- bond energy and its calculation from thermochemical data- integral and differential heats of solution and dilution.

UNIT V CHEMICAL KINETICS

Rate of reaction- rate equation, order and molecularity of reaction. Rate Laws- rate constants- derivation of first order rate constant and characteristics of zero order, first order and second order reactions- derivation of time for half change ($t_{1/2}$) with examples.

Methods of determination of order of reactions- experimental methods- determination of rate constant of a reaction by volumetry, colorimetry and polarimetry.

Effect of temperature on reaction rate- concept of activation energy, energy barrier, Arrhenius equation. Theories of reaction rates- collision theory- derivation of rate constant of bimolecular reaction- failure of collision theory- Lindemann's theory of unimolecular reaction.

Theory of absolute reaction rates – derivation of rate constant for a bimolecular reaction- significance of entropy and free energy of activation. Comparison of collision theory and absolute reaction rate theory (ARRT).

REFERENCES

1. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edition, New Delhi, Shoban Lal Nagin Chand & Co., (1993).
2. R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.
3. J.D. Lee, 'Concise Inorganic Chemistry', 20th revised edition, Sultan Chand & Sons, 2000.
4. Morrison R.T. and Boyd R.N., Bhattacharjee S. K. Organic Chemistry (7th edition), Pearson India, (2011).
5. Bahl B.S. and Bahl A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010).
6. Puri B.R., Sharma L.R. and Pathania M.S. (2013) Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin Chand and Co.

7. Samuel Glasstone (1974), Thermodynamics for Chemists (3rd printing), East-West Edn.
8. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin Chand and Co.
9. Gurtu J.N. and Amit Gurtu (1979), Chemical Kinetics, 5th Edn, Mittal K.K.

Semester: IV	Course : IV	General Chemistry – IV	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH4 COURSE TITLE: GENERAL CHEMISTRY -IV

CO1: To study the general characteristics of d and f block elements.
CO2: To understand the reactions of organometallic compounds, alcohols, phenols and ethers.
CO3: To learn about the fundamental concepts of first law of thermodynamics, to relate heat, work and energy and to calculate work from pressure – volume relationships.
CO4: To find out about the fundamental concepts of rate of the reaction.
CO5: To know the determination of order of the reaction and theories of reaction rates.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1		3				3		2
CO2				3			3	
CO3				3				
CO4	3							
CO5	3							

SEMESTER V **CORE COURSE V**

Hours/Week: 5
Credits: 5

INORGANIC CHEMISTRY - I

UNIT I COORDINATION COMPOUNDS-I

Introduction - Types of ligands: unidentate, bidentate and polydentate ligands, chelating ligands and chelates- IUPAC nomenclature of coordination compounds.

Isomerism in coordination compounds: Structural isomerism, hydrate isomerism, coordination isomerism, ionisation isomerism, linkage isomerism, coordination position isomerism.

Stereoisomerism: Geometrical isomerism of four and six coordinate complexes, optical isomerism of four and six coordinate complexes, Werner and Sidgwick theories, methods of detecting complex formation.

UNIT II COORDINATION COMPOUNDS-II

Theories of coordination compounds : Valence bond theory, limitations of valence bond theory, crystal field theory – splitting of d orbitals in octahedral, tetrahedral and square planar fields, CFSE, factors affecting CFSE, colour, geometry and magnetic properties of coordination compounds, Jahn – Teller distortion (an elementary idea).

Molecular orbital theory: Molecular orbital diagram for $[Co(NH_3)_6]^{3+}$. Ligand field theory. (An elementary treatment only).

UNIT III COORDINATION COMPOUNDS-III

Labile and inert complexes, stability of coordination compounds – thermodynamic and kinetic stability, relationship between stepwise formation constant and overall formation constant, factors affecting the stability of complexes.

Unimolecular and biomolecular nucleophilic substitution reactions in octahedral and square planar complexes, trans effect – theories of trans effect and applications.

A few biologically important coordination compounds : Chlorophyll, haemoglobin and vitamin B_{12}.

UNIT IV CARBONYLS AND BINARY METALLIC COMPOUNDS

Metal carbonyls : Mono and binuclear carbonyls of Ni, Fe, Cr, Co and Mn – preparation, structure, reactions, bonding and uses.

Structure and bonding in □-metal alkenyl and □-metal alkynyl complexes of $[PtCl_3(C_2H_4)]^-$, $[Co(CO)_6(RC \square CR)]$ and ferrocene.

Binary metallic compounds : borides, carbides, hydrides and nitrides – classification, preparation, properties and uses.

UNIT V NITROSYL COMPOUNDS AND MAGNETIC PROPERTIES

Nitrosyl compounds: Classification-nitrosyl chloride and sodium nitroprusside - preparation, properties and structure.

Magnetic properties-meaning of the terms-magnetic susceptibility-magnetic moment-types of magnetism-Gouy balance-applications of magnetic properties.

Dipole moment-determination, application in the study of simple inorganic molecules.

REFERENCES

1. R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.
2. W.U. Malik, G.D. Tuli and R.D. Madan, S.Chand and Company Ltd., 'Selected topics in Inorganic Chemistry', 7th edition, 2001.
3. Gopalan R, Text Book of Inorganic Chemistry, 2nd Edition, Hyderabad, Universities Press, (India), 2012.
4. P.L. Soni, 'Text Book of Inorganic Chemistry', 20th revised edition, Sultan Chand & Sons, 2000.
5. B.R. Puri, L.R. Sharma, K.C. Kalia, 'Principles of Inorganic Chemistry', 21st edition, Vallabh Publications, 2004-2005.
6. J.E. Huheey, 'Inorganic Chemistry', 4th edition, Pearson Education. Inc. 1993.
7. F.A. Cotton, 'Advanced Inorganic Chemistry', 6th edition, John Wiley & Sons, Pvt. Ltd., 2003 – 2004.
8. R. Gopalan, P.S. Subramanian and K. Rengarajan, 'Elements of Analytical Chemsitry', 2nd edition, Sultan Chand & Sons, 1991.

Semester: V	Course : V	Inorganic Chemistry – I	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH5

CO1: To understand the basics and theories of coordination compounds.
CO2: To study a few biologically important coordination compounds.
CO3: To learn the preparation and properties of nitrosyl compounds
CO4: To find out the basic principles and applications
CO5: To know the magnetic properties.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3					3		
CO2		2						
CO3				3			2	
CO4				2	3			3
CO5					3			

SEMESTER V **CORE COURSE VI**

Hours/Week: 5
Credits: 5

ORGANIC CHEMISTRY I

UNIT I CHEMISTRY OF CARBONYL COMPOUNDS

Nomenclature - structure of carbonyl compounds - chemical properties - nucleophilic addition mechanism at carbonyl group (eg: HCN, ROH, RNH2) - acidity of alpha hydrogen – keto-enol Tautomerism (proof for the two forms).
Reduction and oxidation reactions of carbonyl compounds – paraformaldehyde, metaformaldehyde - uses of aliphatic carbonyl compound - Claisen condensation – Aldol condensation – Robinson annulation.
General methods of preparation of aromatic carbonyl compounds - physical and chemical properties – uses - Effect of aryl group on the reactivity of carbonyl group.

UNIT II CHEMISTRY OF CARBOXYLIC ACIDS

Nomenclature - Acidity of carboxylic acids based on substituent effect - comparison of acid strengths of halogen substituted acetic acids - acid strengths of substituted benzoic acids - Acid derivatives - Nucleophilic substitution mechanism at acyl carbon.
Preparation, properties and uses of acid derivatives: acid chloride, anhydrides, esters, amides - chemistry of compounds containing active methylene group – synthesis and synthetic applications of acetoacetic ester and malonic ester.
Preparation of dicarboxylic acid - physical and chemical properties - uses. Introduction to oils and fats - fatty acids - manufacture of soap - mechanism of cleaning action of soap.

UNIT III CHEMISTRY OF NITROGEN COMPOUNDS

Nomenclature - nitro alkanes - alkyl nitrites - differences - aromatic nitro compounds - preparation and reduction of nitro benzene under different conditions, TNT.
Amines – effect of substituents on basicity of aliphatic and aromatic amines - Reactions of amino compounds (primary, secondary, tertiary and

quaternary amine compounds) - Mechanism of carbylamine reaction, diazotization and comparison of aliphatic and aromatic amines.

Diazonium compounds - preparation and synthetic applications of diazomethane, benzene diazonium chloride and diazo acetic ester.

UNIT IV CHEMISTRY OF HETEROCYCLIC COMPOUNDS AND DYES

Introduction – nomenclature of heterocyclic compounds having not more than two heteroatoms such as oxygen, nitrogen and sulphur - structure, synthesis and properties of furan, pyrrole, thiophene. Pyridine – structure, preparation - compare the basicity of pyridine with pyrrole and amines.

Quinoline - structure and Skraup synthesis. Isoquinoline – structure and Napieralski synthesis and Indole – structure and Ficher-indole syntheses.

Dyes - color and constitution – chromophore - auxochrome - classification according to application and structure - preparation and uses of - methyl orange, fluorescein, Alizarin, Indigo and malachite green dyes.

UNIT V OXIDATION AND REDUCTION

Oxidation: Osmium tetroxide – Chromyl chloride – Ozone – DDQ – Dioxiranes.

Lead tetraacetate - selenium dioxide – DMSO either with Ac_2O or oxalyl chloride – Dess-Martin reagent.

Reduction: Catalytic hydrogenation using Wilkinson Catalyst – Reduction with LAH, $NaBH_4$, tritertiarybutoxy aluminum hydride, $NaCNBH_3$, hydrazines.

REFERENCES

1. Finar I.L., Organic Chemistry, Vol 1&2, (6th edition) England, addison Wesley Longman Ltd. (1996).
2. Morrison R.T. and Boyd R.N., Bhattacharjee S. K. Organic Chemistry (7th edition), Pearson India, (2011)
3. Bahl, B.S. and Bahl, A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010)
5. Pine S.H., Organic Chemistry, (5th edition) New Delhi, McGraw – Hill International Book Company (1987)
6. Seyhan N. Ege, Organic Chemistry, (5th edition) New York, Houghton Mifflin Co., (2005)

Semester: V	Course : V	Organic Chemistry – I	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH6

CO1: To learn the reactions of carbonyl compounds, carboxylic acids, amines, heterocycles.
CO2: To know the requirement of the oxidation and reducing agents for synthesis.
CO3 : To study about the nitrogen compounds, amines and diazonium compounds.
CO4 : To find out the mechanism of carbylamines reactions.
CO5 : To understand the oxidation and reduction catalysts.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3					3		
CO2		3					2	
CO3			2					3
CO4				2				
CO5					3			

SEMESTER V **CORE COURSE VII**

Hours/Week: 6
Credits: 5

PHYSICAL CHEMISTRY I

UNIT I PHOTOCHEMISTRY AND GROUP THEORY

Consequences of light absorption- Jablonski diagram- radiative and non-radiative transitions. Lambert's Beer law, quantum efficiency.

Photochemical reactions-Comparison between thermal and photochemical reactions. Photosensitization and quenching. Fluorescence, phosphorescence and chemiluminescence. Laser and uses of lasers.

Group theory – symmetry elements and symmetry operation- group postulates and types of groups- abelian and non abelian – symmetry operation of H_2O molecule.

Illustration of group postulates using symmetry operations of H_2O molecule - construction of multiplication table for the operation of H_2O molecule – point group- definition- elements (symmetry operations) of the following molecules- H_2O, BF_3 and NH_3.

UNIT II THERMODYNAMICS II

Second law of thermodynamics – need for the law- different statements of the law- Carnot's cycle and efficiency of heat engine- Carnot's theorem- thermodynamic scale of temperature.

Concept of entropy- definition and physical significance of entropy- entropy as a function of P, V and T – entropy changes during phase changes- entropy of mixing – entropy criterion for spontaneous and equilibrium processes in isolated system.

Gibb's free energy (G) and Helmholtz free energy(A) – variation of A and G with P, V and T- Gibb's – Helmholtz equation and its applications.

Thermodynamic equation of state, Maxwell's relations- □A and □G as criteria for spontaneity and equilibrium.

UNIT III THERMODYNAMICS III

Equilibrium constant and free energy change- thermodynamic derivation of law of mass action- equilibrium constants in terms of pressure and concentration – NH_3, PCl_5 and $CaCO_3$.

Thermodynamic interpretation of Lechatelier's principle (Concentration, temperature, pressure and addition of inert gases).

Systems variable composition- partial molar quantities- chemical potential – variation of chemical potential with T, P and X (mole fraction) – Gibb's Duhem equation. Van't Hoff's reaction isotherm- van't Hoff's isochore. Clapeyron equation and Clausius – Clapeyron equation- applications.

Third law of thermodynamics- Nernst heat theorem. Statement of III law and concept of residual entropy – evaluation of absolute entropy from heat capacity data.

UNIT IV SOLUTIONS

Raoult's law, Henry's law, Ideal and non-ideal solutions, completely miscible liquid systems-benzene and toluene. Deviation from Raoult's law and Henry' law. Duhem-Margules equation. Theory of fractional distillation. Azeotropes- HCl – water and ethanol- water system.

Partially miscible liquids- phenol- water, triethylamine- water and nicotine- water systems. Lower and upper CSTs – effect of impurities on CST.Completely immiscible liquids- principle and applications of steam distillation. Nernst distribution law – derivation.

Dilute solutions- colligative properties, relative lowering of vapour pressure, osmosis, law of osmotic pressure, derivation of elevation of boiling point and depression in freezing point.

Determination of molecular masses using colligative properties. Abnormal molecular masses, molecular dissociation- degree of dissociation- molecular association.

UNIT V PHASE CHANGES

Definitions of terms in the phase rule- derivation and application to one component system – water and sulphur- super cooling, sublimation.

Two-component systems-solid liquid equilibria, simple eutectic (lead- silver, Bi-Cd), desilverisation of lead.

Compound formation with congruent melting point (Mg-Zn) and incongruent melting point (Na-K).

Solid Solutions-(Ag-Au)-fractional crystallization, freezing mixtures- $FeCl_3$-H_2O systems, $CuSO_4$-H_2O system.

REFERENCES

1. Gurdeep Chatwal R, Photochemistry, Good publishing House.
2. Raman, K. (1990), Group theory and its application to Chemistry, New Delhi: Tata McGraw-Hill.
3. Samuel Glasstone (1974), Thermodynamics for Chemists (3rd printing), East-West Edn.
4. Rajaram J. and Kuriacose, J.C. (1986) Thermodynamics for students of Chemistry, New Delhi: Lal Nagin Chand.
5. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition),New Delhi: Shoban Lal Nagin Chand and Co.
6. Glasstone S. and Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co Ltd.
7. Atkins P.W. (1994), Physical chemistry, (5th edition), Oxford University press.

8. Sangaranarayanan, M.V., Mahadevan, V., Text Book of Physical Chemistry, 2nd Edition, Hyderabad, Universities Press, (India) 2011.

CO2:

Semester: V	Course : V	Physical Chemistry – I	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH7

CO1: To know the various concepts of photochemistry and group theory.

CO2: To learn the second law of thermodynamics.

CO3: To study about the third law of thermodynamics.

CO4: To understand the theories and laws of solution.

CO5: To find out the phase rule and phase changes of systems.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3					3		
CO2		3					3	
CO3			2					3
CO4				2				
CO5					2			

SEMESTER V **CORE PRACTICAL III**

Hours/Week: 3
Credits: 3

PHYSICAL CHEMISTRY (P)

LIST OF EXPERIMENTS:

1. Critical Solution Temperature
2. Effect of impurity on Critical Solution Temperature
3. Transition Temperature
4. Rast Method
5. Phase Diagram (Simple eutectic system)
6. Kinetics of Ester Hydrolysis
7. Partition Co-efficient of iodine between water and carbon tetrachloride.
8. Conductometric Acid-Base Titration
9. Potentiometic Redox Titration
10. Determination of cell constant

MARK DISTRIBUTION :

Internal : 40 Ext. Evaluation :60
Record :5
Procedure Writting with formula : 10
Practicals :45

Semester: V	Course : V	Physical Chemistry Practical(P) - III	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH3P

CO1: To learn the fundamentals of conductometric and potentiometric titrations.
CO2: To understand the method of determination of molecular weight, CST, TT and rate constant

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3					3		
CO2		2					2	
CO3								
CO4								
CO5								

SEMESTER V **MAJOR BASED ELECTIVE I (A)**

Hours/Week: 5
Credits: 5

ANALYTICAL CHEMISTRY

UNIT I LABORATORY HYGIENE AND SAFETY

Storage and handling of chemicals-corrosion, flammable, explosive, toxic, carcinogenic and poisonous chemicals.
Simple first aid procedures for accidents involving acids, alkalies, bromine, burns and cut by glass.
Precautions to avoid poisoning-treatment for specific poisons, threshold vapour concentrations-safe limits-laboratory safety measures.
Waste disposal-fume disposal-precautions for avoiding accidents.

UNIT II DATA ANALYSIS

The Mean-significant numbers, the median-precision, accuracy- confidence limits, standard deviation.
Errors-method for improving accuracy-rejection of data-presentation of tabulated data-Scatter diagram –method of least squares- S.I. units.
Separation techniques: Precipitation-solvent extraction-chromatography – types, column chromatography-thin layer chromatography.
Paper chromatography – paper electrophoresis –Ion exchange chromatography –Gas liquid chromatography.

UNIT III GRAVIMETRIC ANALYSIS AND THERMO ANALYTICAL METHODS

Gravimetric analysis - principles-methods of gravimetric analysis - requirement of gravimetric analysis-precipitation-theories of precipitation.
Types of precipitation – co–precipitation, post precipitation - and precipitation from homogeneous solution-digestion, filtration and washing, drying and ignition. Inorganic and organic precipitating agents.
Thermo analytical techniques – types-TGA principle-Instrumentation - TGA analysis of CaC_2O_4. H_2O.
Differential thermal analysis-principle-DTA of $CaC_2O_4.H_2O$.-factors affecting TGA & DTA

UNIT IV VISIBLE SPECTROPHOTOMETRY AND COLORIMETRY

Theory of spectrophotometry and colorimetry, Beer-Lambert's law (statement only), Molar absorptivity and absorbance.

Visual comparators-multiple standard methods, duplication and dilution method, balance method, photoelectric colorimeter, spectrophotometer.

Criteria for satisfactory colorimetric estimation-advantages of colorimetric estimation, determination of composition of complexes, colorimetric estimation of iron.

UNIT V ELECTROANALYTICAL TECHNIQUES

Electro gravimetry –theory - electro gravimetric analysis of Fe and Cu.

Electrolytic separation of metals: principle –separation of copper and nickel, Electro deposition- principle –overvoltage.

Coulometry -Principle of coulometric analysis –coulometry at controlled potential- apparatus and technique-separation of nickel and cobalt. Amperometry titrations-principle –Instruments –types-applications.

REFERENCES

1. Gopalan R, Subramanian PS and Rengarajan K (1993) ``Elements of analytical chemistry" second revised edition, Sultan Chand.
2. Gurdeep R Chatwal, Sham K. Anand (2005) ``Instrumental methods of chemical analysis", Himalaya publishing house.
3. Vogel A.I. Text Book of Quantitative Inorganic analysis," The English Language Book Society, Fourth edition.
4. Douglas A. Skoog, Donald M. West and F. J. Holler, Fundamentals of Analytical chemistry, 7thedition, Harcourt College Publishers.
5. Mendham J., Denny R. C., Barnes J.D., Thomas M., Vogel's Test book of Quantitative Chemical analysis 6th edition, Pearson education.
6. Sharma, B. K., Instrumental methods of chemical analysis, Goel Publishing House, Merrut (1997).

Semester: V	Course : V	Analytical Chemistry	Credit : 5	Allotted hours per week: 5

CODE:16SMBECH1

CO1: To know the storage and handling of various chemicals and first aid procedures.

CO2: To learn data analysis, various separation techniques.

CO3: To learn gravimetric analysis and various thermo analytical methods.

CO4: To learn visible spectrophotometry and colorimetry.

CO5: To know the various electro analytical techniques

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3					2		
CO2			3				3	
CO3		3						3
CO4				3				
CO5					3			

SEMESTER VI **CORE COURSE VIII**

Hours/Week:6
Credits:6

ORGANIC CHEMISTRY II

UNIT I CHEMISTRY OF CARBOHYDRATES

Carbohydrate - classification, properties of mono saccharides (glucose and fructose), structure and configuration of mono saccharides, interconversion. Ascending and descending series, muta rotation, epimerization- cyclic structure - determination of size of sugar rings.
Disaccharides - sucrose, maltose - structure elucidation - polysaccharide - starch and cellulose (elementary treatment).

UNIT II CHEMISTRY OF PROTEINS AND VITAMINS

Amino acids – Zwitter ion – isoeletric point - general methods of preparation and reactions of amino acids. Peptides - Peptide linkages – proteins - classification of proteins.
Structure of proteins - primary structure - end group analysis - Edman method - secondary structure - tertiary structure - denaturation - colour reactions of proteins.
Nucleic acids - elementary treatment of DNA and RNA - Vitamins - classification, structure and biological importance of vitamins A, B_1, B_2, B_6, B_{12} and C.

UNIT III CHEMISTRY OF ALKALOIDS AND TERPENOIDS

Chemistry of natural products - alkaloids – classification, isolation - methods for synthesis of coniine, piperine, nicotine and quinine.
Terpenoids - classification - isoprene, special isoprene rule, methods for synthesis of citral, limonene, menthol, camphor.

UNIT IV MOLECULAR REARRANGEMENTS

Molecular rearrangements - types of rearrangement (nucleophilic and electrophilic) – mechanism with evidence for the following re-arrangements: pinacol – pinacolone.
Benzil - benzilic acid, benzidine, Claisen, Fries, Hofmann. Curtius, Lossen, Beckmann and dienone – phenol rearrangements.

UNIT V ORGANIC SPECTROSCOPY

UV - VIS spectroscopy - types of electronic transitions – Instrumentation- solvent effects on λ max - Woodward - Fieser rules for calculation of λ max : dienes only – bathochromic shift and hypsochromic shift.

IR spectroscopy - number and types of fundamental vibrations – selection rules- modes of vibrations and their energies. Instrumentation - position of IR absorption frequencies for functional groups like aldehyde, ketone, alcohol, acid, amine and amide.

NMR spectroscopy - principle - chemical shift- factors affecting the chemical shift - inductive effect and hydrogen bonding - TMS, delta scales, splitting of signals - spin-spin coupling, NMR spectrum of EtOH, n -propyl bromide and isopropyl bromide.

REFERENCES

1. Finar I.L., Organic Chemistry, Vol 1&2, (6th edition) England, addison Wesley Longman Ltd. (1996).
2. Morrison R.T. and Boyd R.N., Bhattacharjee S. K. Organic Chemistry (7th edition), Pearson (India)., (2011)
3. Bahl B.S. and Bahl A., Advanced Organic Chemistry, (12th edition), New Delhi, Sultan Chand & Co., (2010)
4. Pine S.H., Organic Chemistry, (5th edition) New Delhi, McGraw – Hill International Book Company (1987)
5. Seyhan N. Ege, Organic Chemistry, (5th edition) New York, Houghton Mifflin Co., (2005)
6. William Kemp, Organic Spectroscopy, 3rd edition, ELBS.
7. Introduction to Spectroscopy by Pavia, D. L. Lampman, G. M, Kriz, G. S, Vyvyan, J. A. 5th edition, Cengage Learning, (2015)
8. Spectroscopy identification of Organic compounds, Silverstein, R. M, Webster, F. M 7th edition, CRC Press, (2015)

Semester: VI	**Course : VI**	**Organic Chemistry – II**	**Credit : 5**	**Allotted hours per week: 5**

CODE:16SCCCH8

CO1: To learn the chemistry of carbohydrates, proteins, vitamins, alkaloids and terpenoids.
CO2: To understand the rearrangements and spectroscopy techniques for the elucidation of structures.
CO3: To study about the chemistry of natural products alkaloids and terpenoids.

CO4: To find out the mechanism of molecular rearrangement reactions.

CO5: To know the instrumentation and principles of UV-VIS, IR and NMR spectroscopy.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	2					3		
CO2		3					3	
CO3			2					3
CO4				2				
CO5					3			

SEMESTER VI **CORE COURSE IX**

Hours/Week: 6
Credits: 6

PHYSICAL CHEMISTRY II

UNIT I ELECTRICAL CONDUCTANCE

1.1. Conductance in metal and in electrolytic solution- specific conductance and equivalent conductance. Arrhenius theory of electrolytic dissociation and its limitation. Weak and strong electrolyte according to Arrhenius theory. Ostwald's dilution law- Derivation, applications and limitation.

1.2 Effect of dilution on equivalent conductance and specific conductance. Kohlrausch's law and its applications. The elementary treatment of the Debye-Huckel- Onsager equation for strong electrolytes-evidence for ionic atmosphere. Transport number and Hittorf's rule. Determination of transport number by Hittrof's method and moving boundary method.

Application of conductance measurements- determination of degree of dissociation of weak electrolytes -determination of solubility product of a sparingly soluble salt. common ion effect, conductometric titrations.

UNIT II ELECTROCHEMICAL CELLS

Galvanic cells - reversible and irreversible cells. Conventional representation of electrochemical cells. Electromotive force of a cell and its measurement – computation of E.M. F. – calculation of thermodynamic quantities of cell reactions (□G, □H, □S and K).

Types of reversible electrodes- gas/metal ion- metal/metal ion, metal/ insoluble salt/anion and redox electrodes, electrode reactions.

Nernst equation – derivation of cell E. M. F and single electrode potential – standard hydrogen electrode- reference electrodes- standard electrode potentials- sign convention- electrochemical series and its significance.

Potentiometric titrations -Acid-Base titrations- Oxidation-reduction (Redox) titrations- Precipitation titrations.Corrosion- general and electrochemical theory – passivity-prevention of corrosion.

UNIT III CATALYSIS AND SURFACE PHENOMENA

Catalyst-Definition and Characteristics - Types of catalysis-Homogeneous and heterogeneous, induced, auto, positive and negative catalysis, catalytic poisons and catalytic promoters.

Enzyme catalysis – Michaelis-menten equation and Michaelis-menten law.

Adsorption-types-chemical and physical, characteristics of adsorption. Theories of catalysis- intermediate compound formation theory and adsorption theory.

Different types of isotherms- Freundlich and Langmuir adsorption isotherms.

UNIT IV SPECTROSCOPY I

Electromagnetic spectrum- the region of various types of spectra. Microwave spectroscopy- rotational spectra of diatomic molecules treated as rigid rotator, condition for a molecule to be active in microwave region.

Rotational constants (B) and selection rules for rotational transition. Frequency of spectral lines, calculation of inter-nuclear distance in diatomic molecules.

Infrared spectroscopy- vibrations of diatomic molecules- harmonic oscillators, zero point energy, dissociation energy and force constant, condition for molecule to be active in the IR region, selection rules for vibrational transition, fundamental bands, overtones and hot bands.

UV- Visible spectroscopy-conditions- Franck-Condon principle- pre dissociation-applications.

UNIT 5 SPECTROSCOPY II

Raman spectroscopy – Rayleigh scattering and Raman scattering. Stokes and anti-stokes lines in Raman spectra, Raman frequency, quantum theory of Raman effect, conditions for a molecule to be Raman active.

Comparison of Raman and IR spectra – structural determination from Raman and IR spectroscopy, rule of mutual exclusion.

NMR spectroscopy- nuclear spin and conditions for a molecule to give rise to NMR spectrum – theory of NMR spectra, number of NMR signals, equivalent and non- equivalent protons.

REFERENCES

1. Puri B.R., Sharma L.R. and Pathania M.S. (2013), Principles of Physical Chemistry, (35th edition), New Delhi: Shoban Lal Nagin chand and Co.
2. Bahl B.S., Arun Bahl and Tuli G.D. (2012). Essentials of Physical Chemistry, New Delhi: Sultan Chand and Sons.
3. Moore W. J. (1972), Physical chemistry, 5th Edition, Orient Longman Ltd.
4. Glasstone S. and Lewis D., Elements of Physical Chemistry, London, Mac Millan & Co Ltd.
5. Colin Bannwell N and Elaine Mc Cash M, Fundamentals of molecular spectroscopy, 4th edition, Mc Graw hill publishing company limited.
6. Russell S. Drago, (1978), Physical methods in Inorganic chemistry, East-west student edition.

Semester: VI	Course : VI	Physical Chemistry – II	Credit : 5	Allotted hours per week: 5

CODE:16SCCCH9

CO1: To learn the various concepts of electrochemistry.

CO2: To know the types and theories of catalysis.

CO3: To learn the adsorption isotherms.

CO4: To know the spectroscopic techniques such as IR, UV-visible, Raman and NMR.

CO5: To study of instrumental IR, UV-visible, Raman and NMR.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3					3		
CO2	3						2	
CO3			3					3
CO4				3				
CO5					3			

SEMESTER VI **CORE PRACTICAL IV**

Hours/Week: 6
Credits: 5

GRAVIMETRIC & ORGANIC ANALYSIS (P)

GRAVIMETRIC ANALYSIS:

1. Estimation of Lead as lead chromate.
2. Estimation of Barium as barium chromate.
3. Estimation of Nickel as Nickel - DMG complex.
4. Estimation Calcium as calcium oxalate monohydrate
5. Estimation of Barium as barium sulphate.

ONLY FOR DEMONSTRATION:

1. Estimation of Copper as copper (I) thiocyanate
2. Estimation of Magnesium as magnesium oxinate
3. Estimation of Iron as Iron (III) oxide.

ORGANIC QUALITATIVE ANALYSIS AND ORGANIC PREPARATION:

Organic Analysis
Analysis of Simple Organic compounds (a) characterization of functional groups
(b) confirmation by preparation of solid derivatives / characteristic colour reactions.
Note: Mono –functional compounds are given for analysis. In case of bi- functional compounds, students are required to report any one of the functional groups.

ORGANIC PREPARATION: (ANY FOUR)

Preparation of Organic Compounds involving the following chemical conversions.
1.Oxidation 2. Reduction 3. Hydrolysis 4. Nitration 5. Bromination 6. Diazotization 7. Osazone formation

DETERMINATION OF PHYSICAL CONSTANTS

Determination of boiling /melting points by semimicro method.

MARK DISTRIBUTION:

Internal : 40 Ext. Evaluation : 60
Record : 5+5 = 10
Gravimetry : 25
org. preparation & org Analysis : 25 Org.
preparation : 6
Phy Contant 4
Org. analysis 15
Armatic/ Alphatic –2
Sat/Unsat – 2
Spl. Element –3
functinonal group –5
Derivatives - 3

REFERENCE

1. Venkateswaran V, Veeraswamy R., Kulandaively A.R., Basic principles of practical chemistry, 2nd edition, New Delhi, sultan chand & sons, (1997)

Semester: VI	Course : VI	Gravimetric & Organic Analysis (P)	Credit : 5	Allotted hours per week: 5

CODE: 16SCCCH4P
CO1: To learn the techniques of gravimetric analysis.
CO2: To learn the methods of different organic compounds preparation and analysis.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	2					2		
CO2		2					3	
CO3								
CO4								
CO5								

SEMESTER VI **MAJOR BASED ELECTIVE II**

Hours/Week: 6
Credits: 6

NUCLEAR, INDUSTRIAL CHEMISTRY & METALLIC STATE

UNIT I NUCLEAR CHEMISTRY I

Introduction, nuclear structure – composition of the nucleus, subatomic particles, nuclear forces, nuclear stability – mass defect and binding energy, whole number rule and packing fraction, n-p ratio, odd even rules, nuclear models – liquid drop and shell models, isobars, isotones and isomers.

Isotopes – detection, physical and chemical methods of separation, isotopic constitution of elements.

Radioactivity – introduction – radioactive emanations – characteristics of □, □ and □-rays, disintegration theory, modes of decay-group displacement law, rate of integration and half-life period, disintegration series, Geiger- Nuttal rule.

UNIT II NUCLEAR CHEMISTRY II

Detection and measurement of radioactivity – Wilson cloud chamber, Geiger – Muller counter.

Particle accelerators – linear accelerator and cyclotron.

Artificial radioactivity – nuclear transformation – classification of nuclear reactions, fission – atom bomb, fusion – hydrogen bomb, Stellar energy – nuclear reactor – atomic power projects in India.

Applications of radioisotopes as tracers in reaction mechanism, medicine, agriculture, industry and carbon dating. Hazards of radiations.

UNIT III METALLIC STATE

Metallic bond : Packing of atoms in metals (BCC, CCP, HCP) electron gas, Pauling and band theories, structure of alloys, substitutional and interstitial solid solutions, Hume-Rothery ratios, crystal defects – stoichiometric and non-stoichiometric defects.

Semi conductors - intrinsic and extrinsic – n-type and p-type. Composition, properties, structure and uses in electronic industry.

UNIT IV INORGANIC POLYMERS AND THERMO ANALYTICAL METHODS

Inorganic polymers – coordination polymers, metal alkyls, phosphonitrilic polymers.
Silicates – classification into discrete anions – one, two and three dimensional structures with typical examples.
Composition, properties and uses of beryl, asbestos, talc, mica, feldspar and zeolite.

UNIT V INDUSTRIAL CHEMISTRY

Gaseous fuels : Natural gas, gobar gas, water gas, semi water gas, carburetted water gas, producer gas and liquified petroleum gas (LPG) – composition, manufacture and applications.
Fertilizers : Manufacture of nitrogen, phosphorus, potassium and mixed fertilizers, micro nutrients and their role in plant life.
Safety matches : Introduction, raw materials and manufacturing method.
Paints and varnishes : Definition, types and composition.
Glass : Composition, manufacture, types and uses.
Cement : Manufacture – wet and dry processes, composition and setting of cement.

BOOKS FOR REFERENCE:

1. R.D. Madan, "Modern Inorganic Chemistry", 2nd edition, S. Chand & Company Ltd., 2000.
2. Gilreath, 'Fundamental concepts of Inorganic Chemistry', 18th Printing, McGraw Hill International Book Company, 1985.
3. S. Glasstone, 'Source book on Atomic Energy', East-West Press, 1967.
4. R.Gopalan, P.S. Subramanian and K. Rengarajan, 'Elements of Analytical Chemsitry', Sultan Chand & Sons, 2nd edition, 1991.
5. P.L.Soni, 'Text Book of Inorganic Chemistry', 20th revised edition, Sultan Chand & Sons, 2000.

Semester: VI	Course : VI	Nuclear, Industrial Chemistry & Metallic State	Credit : 5	Allotted hours per week: 5

CODE:16SMBECH2

CO1: To know the fundamentals of nuclear chemistry.

CO2: To found the applications of nuclear chemistry.

CO3: To study the metallic bond, theories and applications.

CO4: To understand the applications of inorganic polymers.

CO5: To learn the preparation methods and uses of gaseous fuel, safety matches and fertilizers.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	3					3		
CO2	3						2	
CO3	2							3
CO4	2							
CO5					2			

SEMESTER VI **MAJOR BASED ELECTIVE III (A)**

Hours/Week: 5
Credits: 5

POLYMER CHEMISTRY

UNIT 1 INTRODUCTION TO POLYMERS AND RUBBERS

Basics of polymers – monomers and polymers - definition .classification of polymers on the basis applications - thermosetting and thermoplastics - distinction among plastics. Functionality -. Copolymers. Degree of polymerization. Types of polymerization reactions – chain polymerization -free radical and ionic polymerization – coordination and step polymerization reactions- polyaddition and polycondensation – miscellaneous reactions: ring- opening and group transfer polymerization. Basics of rubbers: types - vulcanization of rubber- ebonite- uses of rubbers.

UNIT II PROPERTIES AND REACTIONS OF POLYMERS

Properties: Glass transition temperature (Tg) -definition – factors affecting Tg. Relationship between Tg and molecular weight. Importance of Tg. Molecular weight of polymers: number average (Mn), weight average (Mw), sedimentation and viscosity average molecular weights. Reactions: Hydrolysis – hydrogenation – addition – substitutions – cross linking and cyclisations reaction. Polymer degradation- thermal, photo and oxidation degradation of polymers (basics only)

UNIT III POLYMERIZATION TECHNIQUES AND MOULDING TECHNIQUE

Polymerization techniques: bulk, solution, emulsion, melt condensation and interfacial polycondensation polymerization. Moulding technique: Injection, compression, extrusion, rotational and calendaring.

UNIT IV CHEMISTRY OF COMMERCIAL POLYMERS

Preparation, properties and uses of the polymers: Polyethylene, polypropylene, polystyrene, PVC, teflon and polymethylmethacrylate, polycarbonate, polyurethanes, polyamides (Kevlar), phenol-formaldehyde, urea-formaldehyde resin, epoxy resins, rubber-styrene and neoprene rubbers.

UNIT V ADVANCES IN POLYMERS

Biopolymers – biomaterials. Polymers in medical field - High temperature and fire – resistant polymers. Silicones - conducting polymers- carbon fibers.(basic idea only) and polymer composites.

TEXT BOOK :

Billmeyer F.W., Text book of polymer science, Jr. John Wiley and Sons, 1984.

BOOKS FOR REFERENCE

1. Gowariker V.R., Viswanathan N.V. and Jayader Sreedhar, Polymer Science, Wiley Eastern Ltd., New Delhi, 1978.
2. Sharma, B.K., Polymer Chemistry, Goel Publishing House, Meerut, 1989.
3. Arora M.G., Singh M. and Yadav M.S., Polymer Chemistry, 2nd Revised edition, anmol Publications Private Ltd., New Delhi, 1989.

Semester: VI	Course : VI	Polymer Chemistry	Credit : 5	Allotted hours per week: 5

CODE:16SMBECH3:1

CO1: To know the chemistry of polymers.

CO2: To study the importance of polymers.

CO3: To understand the concepts of polymerization and techniques.

CO4: To found the preparation methods , properties and uses of commercial polymers.

CO5: To learn the advances of biopolymers and silicones.

PO-CO MAPPING MATRIX:

	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3
CO1	2					3		
CO2		2					3	
CO3			3					3
CO4		3						
CO5					3			