

HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)

Re-Accredited with "A" Grade by NAAC (CGPA of 3.26 out of 4.00)

Uthamapalayam - 625533



Department of Chemistry

B.Sc. Chemistry – Syllabus

Effective from the Academic Year 2013 – 2014

(I, II, III, IV, V & VI Semesters)

Choice Based Credit System

B.Sc., Chemistry (Semester)

Course Scheme, Scheme of Examinations & Syllabus

Effective from the academic year 2013 – 2014 onwards

Eligibility: A Pass in H.Sc., or any other Examination accepted by the University as Equivalent

Duration of the Course: B.Sc., Chemistry - 3 years (6 – Semesters)

OBJECTIVES OF THE COURSE:

1. To enable the students to understand the knowledge of chemistry.
2. To acquire skills in the field of life oriented, application oriented and job oriented chemistry.
3. Study of skill based subject can develop various skills in the field of chemistry which will enable the students to get a job.
4. Visit to various chemical industries by the student will create a sound knowledge in the field of Industrial Chemistry

SUBJECTS OF STUDY:

- Part – I - Tamil
- Part –II - English
- Part –III i) Core Subject – Chemistry
ii) Allied Subjects Botany / Zoology and Physics
- Part - IV i) Non-major subjects
ii) Skill based Subjects
iii) Environmental Studies
iv) Value Education
- Part-V Extension Activities

STRUCTURE OF THE QUESTION PAPERS:

Internal – 25 marks

External – 75 marks

Total = 100 marks

I. For Internal Examination: 25 marks

1. Two Tests to be conducted - 15 marks (average of 2 tests to be taken)
2. Group discussion / Seminar / Quiz - 5 marks
3. Two Assignments / Project - 5 marks each (average of 2 to be taken)
4. I Internal Examination - between 30th and 40th working days

5. II Test will be conducted - between 70th and 80th working days

II. External Examination: 75 marks

Question Paper Pattern: Three Parts A, B and C

- Section – A - 10 x 1 = 10 marks (multiple choice, True or False)
- Section – B - 5 x 7 = 35 marks (either A or B)
- Section – C - 3 x 10 = 30 marks (3 out of 5 questions)

III. Passing Marks

- No minimum for Internal exam
- Minimum 27 for External exam
- Eligibility for the degree - passing minimum is 40%

IV. Practical

- Internal - 40 marks (Observation note -10 and Model exam - 30)
- External - 60 marks
- Total - 100 marks
- Passing minimum is 40%

Details of number of Courses and Credits

PART /SEM	I	II	III	IV	V	VI	Courses		Credits
I ; Tamil	1T:6 hrs	1T:6 hrs	1T:6 hrs	1T:6 hrs			4	4x3	12
II ; English	1T 6 hrs	1T 6 hrs	1T 6 hrs	1T 6 hrs			4	4x3	12
III ; Core	1T:4 hrs 1P:2 hrs						1	1x4	4
		1T: 4 hrs 1P: 2 hrs					1 1	1x4 1x2	4 2
			1T:4hrs 1P:2hrs				1	1x4	4
				1T:4hrs 1P:2hrs			1 1	1x4 1x2	4 2
					3T:12hrs 2P: 6hrs 1P: 2hrs		3	3x4	12
						3T:12hrs 2P: 6hrs 1P: 2hrs	3 2 1	3x4 2x5 1x4	12 10 4
III ; Allied-I Zoology / Botany	1T: 4hrs 1P:2 hrs	1T:4hrs 1P:2 hrs	1T:4hrs 1P:2hrs	1T:4hrs 1P:2hrs			4 2	4x4 2x1	16 2
III ; Allied- II Physics			1T:4hrs 1P:2hrs	1T:4hrs 1P:2hrs	1T: 4hrs 1P:2 hrs	1T: 4hrs 1P: 2 hrs	4 2	4x4 2x1	16 2
IV ; NME	1T:2 hrs	1T: 2 hrs					2	2x2	4
IV ; SBS	2T:4 hrs	2T: 4 hrs			1T: 2 hrs	1T:2 hrs	6	6x2	12
IV ; ES					1T: 2 hrs		1	1x2	2
IV ; VE						1T: 2 hrs	1	1x2	2
V ; EA						1T: 0 hrs	1	1x2	2
Total hours	30	30	30	30	30	30			
Total Courses	7	9	5	8	6	11	46		
Total Marks							4600		
Total Credits	20	23	18	22	20	37			140

**SUBJECT CODES AND SYLLABUS FOR CHEMISTRY MAJOR
UNDERGRADUATE PROGRAMME**

(For those admitted in July, 2013)

Part	Course Category	Course Code	Course Title	Hrs/Week	CIAE	TEE	Max. Marks	Credits
SEMESTER – I								
I	Language- I	13UTAL11/ 13UARL11/ 13UMAL11	Tamil/Arabic/Malayalam	6	25	75	100	3
II	English – I	13UENL11	English for Enrichment-I	6	25	75	100	3
III	Core	13UCHC11	Inorganic Chemistry - I	4	25	75	100	4
III	Core	13UCHC2P	Inorganic Semi micro Qualitative Analysis	2	-	-	-	-
III	Allied	13UBYA11/ 13UZYA11	Ancillary Botany/Zoology - I	4	25	75	100	4
III	Allied	13UBYA2P/ 13UZYA2P	Ancillary Practical Botany/Zoology - I	2	-	-	-	-
IV	SBS	13UCHS11	Sugar technology	2	25	75	100	2
IV	SBS	13UCHS12	Perfume Chemistry	2	25	75	100	2
IV	Non Major Elective – I	13UCHN11	Industrial Chemistry	2	25	75	100	2
Total				30	175	525	700	20
SEMESTER – II								
I	Language – II	13UTAL21/ 13UARL21/ 13UMAL21	Tamil/Arabic/Malayalam	6	25	75	100	3
II	English – II	13UENL21	English Paper – II	6	25	75	100	3
III	Core	13UCHC21	Organic Chemistry –I	4	25	75	100	4
III	Core	13UCHC2P	Inorganic Semi micro Qualitative Analysis	2	40	60	100	2
III	Core	13BYA21/ 13UZYA21	Ancillary Botany/Zoology-II	4	25	75	100	4
III	Allied	13UBYA2P/ 13UZYA2P	Ancillary Practical Botany/Zoology -I	2	40	60	100	1
IV	SBS	13UCHS21	Leather technology	2	25	75	100	2
IV	SBS	13UCHS22	Paper and pulp technology	2	25	75	100	2
IV	NME	13UCHN21	Water treatment, Drugs and Cosmetics	2	25	75	100	2
Total				30	255	645	900	23

Part	Course Category	Course Code	Course Title	Hrs/Week	CIAE	TEE	Max. Marks	Credits
SEMESTER – III								
I	Language-III	13UTAL31/ 13UARL31/ 13UMAL31	Tamil/Arabic/Malayalam	6	25	75	100	3
II	English – III	13UENL31	English for Enrichment –III	6	25	75	100	3
III	Core	13UCHC31	Physical Chemistry-I	4	25	75	100	4
III	Core	13UCHC4P	Volumetric Analysis	2	-	-	-	-
III	Allied	13UPHA11	Ancillary Physics-I	4	25	75	100	4
III	Allied	13UPHA2P	Ancillary Physics Practical-I	2	-	-	-	-
III	Allied	13UBYA31/ 13UZYA31	Ancillary Botany/Zoology – III	4	25	75	100	4
III	Allied	13UBYA4P/ 13UZYA4P	Ancillary Botany/Zoology Practical –II	2	-	-	-	-
Total				30	125	375	500	18
SEMESTER – IV								
I	Language – IV	13UTAL41/ 13UARL41/ 13UMAL41	Tamil/Arabic/Malayalam	6	25	75	100	3
II	English – IV	13UENL41	English for Enrichment - IV	6	25	75	100	3
III	Core	13UCHC41	Inorganic Chemistry-II	4	25	75	100	4
III	Core	13UCHC4P	Volumetric Analysis	2	40	60	100	2
III	Allied	13UPHA21	Ancillary Physics-II	4	25	75	100	4
III	Allied	13UPHA2P	Ancillary Physics Practical-I	2	40	60	100	1
III	Allied	13UBYA41/ 13UZYA41	Ancillary Botany/Zoology -IV	4	25	75	100	4
III	Allied	13UBYA4P/ 13UZYA4P	Ancillary Botany/Zoology Practical -II	2	40	60	100	1
V	EA	13UEAC61	Extension Activities	0	25	75	100	2
Total				30	270	630	900	24

SEMESTER – V

Part	Course Category	Course Code	Course Title	Hrs/ Week	CIAE	TEE	Max. Marks	Credits
III	Core	13UCHC51	Organic chemistry-II	4	25	75	100	4
III	Core	13UCHC52	Physical chemistry -II	4	25	75	100	4
III	Core	13UCHC53	Inorganic, analytical and Applications of Computers in Chemistry	4	25	75	100	4
IV	SBS	13UCHS51	Pharmaceutical and Medicinal chemistry	2	25	75	100	2
III	Core	13UCHC6P	Gravimetric estimation and organic preparation	3	-	-	-	-
III	Core	13UCHC6Q	Organic estimation and organic analysis	3	-	-	-	-
III	Core	13UCHC6R	Physical chemistry practical	2	-	-	-	-
III	Allied	13UPHA31	Ancillary physics - III	4	25	75	100	4
III	Allied	13UPHA4P	Ancillary physics practical - II	2	-	-	-	-
IV	EVS	13UEVS51	Environmental Studies	2	25	75	100	2
Total				30	150	450	600	20
SEMESTER – VI								
III	Core	13UCHC61	Organic chemistry -III	4	25	75	100	4
III	Core	13UCHC62	Physical Chemistry - III	4	25	75	100	4
III	Core	13UCHC63	Applied Chemistry	4	25	75	100	4
III	Core	13UCHC6P	Gravimetric Estimation and Organic Preparation	3	40	60	100	5
III	Core	13UCHC6Q	Organic Estimation and Organic Analysis	3	40	60	100	5
III	Core	13UCHC6R	Physical Chemistry Practical	2	40	60	100	4
III	Allied	13UPHA41	Ancillary physics - IV	4	25	75	100	4
III	Allied	13UPHA4P	Ancillary physics practical –II	2	40	60	100	1
IV	VED	13UEVD61	Value Education	2	25	75	100	2
IV	SBS	13UCHS61	Medical Laboratory Technology & Clinical Biochemistry	2	25	75	100	2
Total				30	310	695	1000	35
Grand Total				180	1185	3015	4600	140

Title of the Paper: Inorganic Chemistry -I

Semester: I

Subject Code: 13UCHC11

Part –III Chemistry Major Core-I

Unit I

a) **Safety measures:**

Laboratory hygiene and safety – storage and handling of chemicals – carcinogenic chemicals-toxic and poisonous chemicals- waste disposal-general precautions for avoiding accidents- First aid techniques-poisoning-methods to avoid poisoning-treatment for specific poison-laboratory safety measures.

b) **Principles and techniques of semi micro methods:**

Aims of semi micro qualitative analysis-types of reactions involved in qualitative analysis-dry reactions –precipitation reactions-applications of solubility product-principle in qualitative analysis- complexation reaction-oxidation and reduction reactions-spot tests-preparation of solution for cation testing on semi micro scale-removal of interfering ions in the analysis of cations-oxalate-tartrate-borate-fluoride-chromate-phosphate and arsenite.

C. Oxidation – reduction :

Concepts of oxidation-reduction in terms of oxidation number – calculation of oxidation number – redox reactions – half reactions – Balancing ionic equations by ion electron method (half reaction) - Reactions involving - $\text{Cr}_2\text{O}_7^{2-}$ and Fe^{2+} - MnO_4^- and Fe^{2+} - $\text{Cr}_2\text{O}_7^{2-}$ in acid medium - CrO_4^{2-} and SO_3^{2-}

Unit II

Periodicity of properties – cause of periodicity – atomic and ionic radii – electron affinity – ionization energy – electro negativity – Pauling and Mullikan scale – Allred and Rochow's scale – factors affecting the magnitude of electro negativity – application of electro negativity.

Unit III

Chemical Bonding I:

Valence bond approach-types of overlapping and orbital diagrams –sigma and pi bonds –hybridization and geometry of molecules – sp - sp^2 - sp^3 - sp^3d and sp^3d^2 -hybridization with examples-VSEPR-theory-shapes of molecules-structure of H_2O and NH_3 –molecular orbital theory-bonding and anti-bonding orbital - relative order of energies of molecular orbital-MO theory applied to homonuclear molecules - H_2 , He, H_2^+ , F_2 , N_2 and O_2 heteronuclear molecules-HF, CO, and NO-comparative study of VB and MO theories.

Unit IV

Chemical Bonding II:

Lattice energy of ionic compounds-definitions-experimental determination of lattice energy-Born-Haber cycle-explanations of some properties of ionic crystals on the basis of lattice energy-Fajan's rule- Vander Waal's forces-ion-ion and ion-dipole interactions

Unit V

Halogens:

Halogens – position of halogens in the periodic table – anomalous behaviour of fluorine – modern method of isolation of fluorine – estimation of available chlorine in bleaching powder – properties and uses – perchloric acid – potassium per chlorate. Oxides and oxy acids of bromine – brominating mixture – periodic acid – preparation – properties – uses – inter halogen compounds – poly halides – pseudo halogens – basic iodine.

References:

- i) Text book of Inorganic Chemistry – Puri, Sharma and Kalia (latest edition 2010)
- ii) Text book of Inorganic Chemistry – P.L. Soni (latest edition 2008)
- iii) Modern Inorganic Chemistry - R.D. Madan (latest edition 2010)

Title of the Paper: Sugar Technology

Semester: I

Subject Code: 13UCHS11

Part – IV-Chemistry Major SBS -I

Unit – I

Sugar Industry in India – Sugarcane and Sugar Beet – Manufacture of Cane sugar

Unit – II

Extraction of Juice – Concentration – Separation of crystals – Recovery of glucose from molasses Defection.

Unit – III

Sulphitation and carbonation – Testing and Estimation of Sugar

Unit – IV

Double Sulphitation Process

Unit – V

Preparation of Bagasse – Use of Bagasse for manufacture of paper and electricity
Preparation of Alcohol from Molasses Preparation of Absolute alcohol Manufacture of Wine, Beer, Methylated Spirit, Power Alcohol and Estimation of No. of Hydroxyl Groups

Visit to a Industry and submission of Report. For industrial visit / Assignment = 5 marks (Internal). Contact District Industrial centre. (DIC for visits)

Text Book:

Industrial Chemistry including Chemical Engineering – B. K. Sharma – Goel Publishing House. 13th Revised and Enlarged Edition

Title of the Paper: Perfume Chemistry

Semester: I

Subject Code: 13UCHS12

Part – IV-Chemistry Major SBS -II

Unit – I

Introduction – Esters, Alcohols, Ketones

Unit – II

Diphenyl Compounds – Production of natural perfumes – flowers perfumes

Unit - III

Jasmine – Lily, Orange Blossom, Rose Fruit Flowers

Unit – IV

Artificial Flavors

Unit – V

Banana Compounds – Grape Compounds, apple compounds and Pine apple compounds (Demonstration of Jasmine perfume)

Visit to an industry and submission of Report. For industrial visit / Assignment = 5 marks (Internal). Contact District Industrial centre. (DIC for visits)

Text Book:

Industrial Chemistry including Chemical Engineering – B. K. Sharma – Goel Publishing House. 13th Revised and Enlarged Edition

Title of the Paper: Industrial Chemistry

Semester: I

Subject Code: 13UCHN11

Part – IV-Chemistry NME -I

Unit – I

Dairy Industry (I) Milk and Milk Products industry: Composition of Milk, Flavour and aroma of milk, Physical properties of milk. Effect of heat on milk, milk products, cream, Butter, ice cream, Milk powder.

Unit – II

Agricultural Industry (2) Nitrogen cycle-Nutrients for plants – Major and minor nutrients – Role of NPK – Urea – super phosphate – Mixed fertilizers – Fertilizer manufacturing units in India Insecticides and pesticides- definition, classification – Inorganic Pesticides – Organic Pesticides (natural, synthetic) – fungicides – Repellants DDT – Gammaxene – Health hazards of Pesticides.

Unit – III

Polymer Industry – Natural and synthetic rubbers – examples for synthetic rubber – applications – Plastic – Bakelite – nylon 66 – PVC –Uses (Structure not necessary)

Unit – IV

Petrochemical industry : crude oil – chemical from crude oil – Natural gas – LPG, Aviation fuel – Fuels used in Locomotives – trucks and ships – Fuels used in light commercial vehicles – air pollution problems due to automobiles, and its control.

Unit –V

Nuclear Power Plants – Nuclear Power Plants in India – Nuclear fuels – Concepts of Nuclear fission and energy production - Nuclear waste disposal and hazards.

Soap and detergents: Manufacture of Soap and detergents, cleaning action of soap. Problems of detergents waste water in water resources.

Visit to various nearest industries and submission of report – 5 Marks.

Reference Books:

1. Industrial Chemistry – By B.K. Sharma (Goel Publishers)
2. Singh and VK Kapoor – Organic Pharmaceutical Chemistry
3. Mrs. Lakshmi – Pharmaceutical Chemistry
4. Applied Chemistry – K.Bagavathi Sundari

Title of the Paper: Organic Chemistry-I

Semester: II

Subject Code: 13UCHC21

Part – III-Chemistry Major Core-II

Unit –I

Basic Concepts:

a) Classification – Homologous Series – Nomenclature – Purification of Organic Compounds (Distillation, Sublimation, Crystallization, Extraction, Test of Purity) CHN Analyzer – tetra valency of Carbon Atom – Hybridization – Polar and non – Polar Molecules – Resonance – Inductive effect – Hyper conjugation - Mesomeric effect – Types of Reactions – Electrophiles, Nucleophiles, Free radicals – Reaction Intermediates.

Unit –II

Alkanes, Alkenes, Alkynes & Ally halides

Alkanes: Wurtz reaction, Kolbe reaction – Corey – House Synthesis – Conformations

Alkenes: Hydrogenation – Markownikov's rule – Peroxide effect – Mechanism of electrophilic addition – Dienes – Diels – alder reaction

Alkynes: Structure of acetylene – Acidity of acetylene and terminal alkynes – Acetylides

Alkyl Halides: SN^1 and SN^2 Mechanisms – E1 and E2 Mechanisms – Saytzeff rule – vinyl chloride – Allyl iodide.

Unit –III

Acids, Acid Derivatives:-

Effect of substituents on acidity – HVZ reaction – salts of carboxylic acid – Hunsdiecker reaction – acid halides – acid anhydrides – acid amides – estimation of Urea.

Esters of organic and inorganic acids:

Alkyl isocyanides – alkyl nitrites – Diazomethane – Arndt–Eistert reaction mechanism.

Hydroxy and Halo acids: Action of heat on Hydroxy acids – Lactic; Malic, Tartaric and Citric acids – Halo acids – Preparation and properties (Brief study).

Unit- IV

Acetoacetic ester, Malonic esters, amines, amino acids, Ureides and purines:

Acetoacetic ester and Malonic ester; Synthetic use of acetoacetic ester and malonic ester.

Amines: Basicity of amines

Aminoacids: Introduction – Iso- electric Point – Effect of heat on α,β,γ - amino acids.

Ureides and Purines: Barbituric acid, Barbiturates, Uric acid and caffeine.

Unit –V

Poly halogen derivatives:

- a. **Polyhalogen derivatives:** Chlorofluoro carbons- westron and freon- preparation and applications. Preparation and properties of CHCl_3 , CHI_3 and CCl_4 .
- b. **Organometallic compounds:** Grignard reagents- preparation, structure and synthetic applications, limitations. Organozinc, organocadmium and organolithium compounds.

References:

1. Advanced organic chemistry, Arun Bahl and B. S. Bahl,
2. Organic Chemistry, Vol. 1, I. L. Finar.
3. Organic Chemistry, Vol. 2, I. L. Finar.
4. Organic Chemistry, P. L. Soni.

Title of the Paper: Leather Technology

Semester: II

Subject Code: 13UCHS21

Part – IV-SBS -III

Unit – I

History of tanning industry in Tamilnadu -India– conventional tanning process
Animal skin.

Unit – II

Manufacture of leather – Preparation of hides for tanning – use of various inorganic and organic chemicals for tanning process.

Unit – III

Various process of tanning process -soaking-liming-deliming-dehairing-bating.

Unit – IV

Vegetable tanning, type of tanning for soles, belting and heavy leather.

Unit – V

Vegetable tanning – synthetic tanning, chrome tanning, finishing of leather.

Visit to a Tannery Industry and submission of report/assignment-5 marks (Internal)

References:

1. Industrial Chemistry by B.K. Sharma.

Title of the Paper: Paper and Pulp Technology

Semester: II

Subject Code: 13UCHS22

Part – IV-SBS -IV

Unit – I

Introduction, Manufacture of Pulp, Various raw materials used for the preparation of pulp

Unit – II

Preparation of Sulphite Pulp, soda pulp, Rag Pulp.

Unit – III

Various processes: Beating, Refining, Filling sizing and colouring.

Unit – IV

Manufacture of paper, calendaring and uses.

Unit – V

Paper industry in India.

Visit to a paper industries and submission of report/assignment-5 marks (Internal)

References:

1. Industrial Chemistry by B.K. Sharma.

Title of the Paper: Water Treatment, Drugs and Cosmetics Semester: II

Subject Code: 13UCHN21

Part – IV-Chemistry NME –II

Unit – I

Water Quality analysis – Parameters – WHO and Indian standards – Sea water as a source of drinking water – Electrodialysis and reverse osmosis.

Unit – II

Importance of drugs – Important terminologies, their meaning – Bacteria, virus, fungi, Names of drugs – Types of Bacteria.

Unit – III

Antibiotics: Definition Classification, – uses of Antibiotics - Ampicillin, streptomycin, tetracycline, Rifomycin, erythromycin, drug actions and side effects.

Unit – IV

Vitamins: Classifications, Role of vitamins in body's health — Antipyretics, Analgesics and anti - inflammatory agents, sulphonamide drug actions – uses of sulpha drugs.

Unit- V

Preparation of washing Powder, cleaning Powder, White, Black, Yellow, Rose, coloured phenoyls. Preparation of shampoo, liquid blue, preparation of blue, green and red inks, soap oil, face powder and pain balm.

Preparation of cosmetics to be demonstrated

1. Washing and Cleaning Powder
2. Phenoyls
3. Inks
4. Shampoo (Visit to a Industry and submission of Report. For industrial visit /

Assignment = 5 Marks (Internal) Contact district Industrial centre.

Title of the Paper: Physical Chemistry-I

Semester: III

Subject Code: 13UCHC31

Part – III-Chemistry Major Core-III

Unit – I

Gaseous State - I

Postulates of kinetic theory of gases – Derivation of ideal gas laws from the expression on the basis of kinetic theory of gases – Derivations – Vander Waals equation – Reduced equation of state – law of corresponding states – Compressibility factor for gases – Boyle and inversion temperatures of gases.

Unit – II

Gaseous State - II

Maxwell – Boltzmann law of distribution of velocities (Derivation not necessary) graphical representation – effects of temperature on various velocities – experimental verification of Maxwell's law.

Mean free path – viscosity of gases – collision number – Brownian movement and determination of Avogadro number – Loschmidt number – principle of equipartition of energy

Unit -III

Chemical Kinetics - 1

Introduction – rate of reaction – rate law and rate constant – order and molecularity of a reaction - First and pseudo unimolecular reactions, Catalytic decomposition of hydrogen peroxide – decomposition of dinitrogen pentoxide - Inversion of cane sugar and hydrolysis of ester by acid.

Unit -IV

Chemical Kinetics-II

Second order: Rate equation derivation (equal and unequal concentration)

Third order: Derivation of rate equation (equal concentration only)

Zero order reactions – examples – derivation of rate equations – half life period - Influence of temperature on the rate of reaction – Arrhenius rate equation and its significance – measurement of parameters. Theory of reaction rates: Bimolecular collision theory – Unimolecular reactions – Lindemann's hypothesis – Absolute Reaction Rate theory.

Influence of ionic strength on reaction rate – primary and secondary salt effect – kinetics of fast reactions – Flash photolysis -Relaxation method (elementary idea only).

Unit - V

Adsorption: Definition of various terms – adsorption of gases on solids – characteristics of adsorption of gases on solids – physical adsorption and chemisorptions – factors influencing adsorption – adsorption isotherm – Langmuir adsorption isotherm- BET theory (Elementary idea only) – applications of adsorption.

Catalysis: Definition – characteristics – theories of catalysis – promoters and poisons – enzyme catalysis – mechanism – Michaleis-Menten equation - acid – base catalysis and autocatalysis – applications of catalysis.

References:

1. Elements of physical chemistry, B.R. Puri, L.R. Sharma and Madan. S. Pathania, Vishal publishing co, 2008.
2. Textbook of physical chemistry, P. L. Soni, O.P. Dharmarga and U.N. Dash, Sultan Chand and sons, 2009.
3. Essentials of physical chemistry, B.S. Bahl, G.D. Tuli and Arun Bahl, S. Chand and company, 2004.

Title of the Paper: Inorganic Chemistry -II

Semester: IV

Subject Code: 13UCHC41

Part –III Chemistry Major Core-IV

Unit - I

Metallurgy – occurrence of metals – minerals and ores – mineral wealth of India – refining of metals – zone refining – electrolytic refining – van Arkel – de Boer process – important ores and extraction of the following metals – titanium, thorium and platinum – their important alloys and applications.

Unit -II

General discussion of group IV elements – comparison between carbon and silicon hydrides, silicon and silicates – structure-preparation of carbonyl chloride – lead monoxide – red lead – white lead.

General discussion of group V elements – active nitrogen – preparation and properties of hydrazine, hydrazoic acid and hydroxylamine.

Unit- III

Co-ordination Compounds

Introduction – Nomenclature – Werner's theory – Sidgwick theory - EAN rule applied to Ni and Co carbonyls.

Valence bond theory - low spin and high spin complexes of Fe and Co - Colour and magnetic properties of coordination complexes - Limitations of VB theory - Crystal field theory – Octahedral, tetrahedral and square planar complexes - Modified CFT – Ligand field theory.

Unit - IV

Nuclear chemistry -Composition of the nucleus – nuclear forces – mass defect – binding energy – nuclear stability.

Soddy's group displacement law – illustration – law of radioactive disintegration.

Nuclear fission: Definition – the principle of atom bomb.

Nuclear fusion: Definition – emission of energy – Stellar energy – hydrogen bomb.

Applications of radioactivity – medicine, agriculture, industry and analytical fields – carbon dating.

Unit- V

The Inner Transition Elements

- The lanthanide series – Occurrence – Properties - electronic configuration, oxidation states, ionic radii-lanthanide contraction- consequences- causes, color, magnetic

properties, oxidation potential, basic character, solubility of compounds, double salts, complexes - Extraction of lanthanides from monazite sand.

- b. The actinide series – Sources - Transuranic elements – Preparation - Electronic configuration – Properties - Oxidation states - Ionic radii – Color of ions - Comparison of actinides with lanthanides.

References:

1. PL. Soni - Text book of Inorganic chemistry.
2. Puri, Sharma and Kalia - Principles of Inorganic Chemistry.
3. R.D. Madan - Modern Inorganic Chemistry.
4. Nuclear chemistry - Arnikar

Title of the Paper: Organic Chemistry – II

Semester: V

Subject Code: 13UCHC51

Part –III Chemistry Major Core-V

Unit – I

Alcohols: Preparation by hydroboration, reduction of carbonyl compounds, acids and esters by using Grignard reagents - Reaction with metals - Mechanism and reactivity towards HX, dehydration, rearrangement - Ascending and descending the alcohol series- estimation of number of hydroxyl groups.

Ethers: mechanism of Williamson's synthesis, mechanism of cleavage by HX – estimation of methoxy group by Zeisel method - Applications of crown ethers.

Thioalcohols and thioethers: Preparation and properties of sulphonal and mustard gas - Phosphorus ylides – Definition with examples, mechanism of Wittig reaction.

Unit – II

Aldehydes and Ketones

Electronic structure of carbonyl group – preparation of aldehydes and ketones from fatty acids by oxidation, cleavage of vicinal diols and Grignard reagents - Relative reactivities of aldehydes and ketones. Mechanism of nucleophilic addition to carbonyl compounds; reaction with HCN and ammonia derivatives, hemiacetal and acetal formation, hydride transfer – LiAlH_4 , NaBH_4 , reduction and Cannizzaro reaction. Grignard reagent addition (C-C bond formation), α – halogenations – iodoform reaction.

Name reactions - MPV reactions, Oppenauer reaction, Wolf-Kishner reduction, Clemmensen reduction, aldol condensation.

Chemistry of acrolein – crotonaldehyde, glyceraldehydes, glyoxal and acetyl acetone.

Unit – III

Carbohydrates:

Disaccharides: preparation, properties, constitution and configuration of sucrose and maltose.

Polysaccharides: A general study of Starch and cellulose – uses of cellulose in industries.

Unit – IV

Stereoisomerism Geometrical isomerism: definition - Geometrical isomerism of maleic and fumaric acids – aldoximes and ketoximes – determination of configuration of geometrical isomers - E-Z notations – stereochemistry of addition of bromine to double bond.

Optical isomerism

Optical activity – specific rotation and its polarimetric determination – definition of optical isomerism – elements of symmetry.

Optical isomerism of compounds containing asymmetric carbon atom – Racemisation and Resolution of Racemic mixtures – Walden inversion – asymmetric synthesis. Chirality – specifications of absolute configuration by R and S configuration.

Optical activity of compounds without asymmetric carbon atoms: allenes, spiranes, and biphenyl compounds.

Optical activity of elements other than carbon atoms – Quaternary ammonium compounds and tertiary amine oxides.

Unit – V

Dyes

Definition – theory of colour and constitution – classification of dyes according to structure and applications – azo dyes- preparation of methyl orange, congo red and Bismark brown.

Triphenyl methane dyes – preparation of malachite green – rosaniline and crystal violet.

Phthalein dyes – Phenolphthalein, Fluorescein and eosin – preparation and properties.

Vat dyes – Preparation of indigo.

References:

1. P. L. Soni and Chawla – Text book of Organic Chemistry (Sulthan Chand – 2012)
2. B. S. Bahl & Arun Bahl – Advanced Organic Chemistry (S. Chand & company Ltd. – 2009).
3. I.L. Finar – Organic Chemistry (Volume – II) – Pearson Education – VI Edition.
4. Y. R. Sharma – Elementary Organic Spectroscopy (S. Chand & Company Ltd. – 2009).

Title of the Paper: Physical Chemistry II

Semester: V

Subject Code: 13UCHC52

Part –III Chemistry Major Core-VI

Unit – I

Liquid State

Nature of cohesive forces in liquids – Trouton's rule and its significance.

Physical properties and chemical constitution

Molar volume and its application - Surface tension – influence of temperature on surface tension – Parachor – atomic and structural Parachors – applications - Viscosity – influence of temperature on viscosity – relation to chemical constitution – molecular viscosity – atomic and structural viscosity – Rheochor - Refraction – refractive index – specific refractive index – molar, atomic and structural refraction – applications – liquid crystal – their applications.

Unit – II

Quantum Theory

Particle and Wave nature of electron, de-Broglie's theory – equation – Davison-Germer experiment - photoelectric effect and Compton effect— Heisenberg's uncertainty principle - Schrodinger wave equation (no derivation) – postulates of quantum theory – eigen values and eigen function – significance of Ψ and Ψ^2 – quantum number – Zeemann effect.

Unit – III

Phase Rule

Definitions of terms – Gibbs phase rule – one component system – water, carbon di oxide and sulphur – polymorphism – two component system – reduced phase rule – simple eutectic system – Pb-Ag system – KI-water system

Partially miscible liquid system – CST – completely immiscible liquid system.

Nernst Distribution law: Mathematical formulation – experimental verification – condition under which the law is obeyed

Unit- IV

Solid State -I

- a. Laws of crystallography – law of constancy of interfacial angle, law of symmetry, law of rational indices – Miller indices – symmetry elements in a crystal – calculations involving interplanar spacing in crystal systems.

- b. X-ray diffraction – Bragg's equation – experimental method of determination of interplanar spacing – X-ray spectrophotometer – the Debye – Scherrer's method.

Unit-V

Solid State -II

Types of crystals – ionic, molecular, covalent, and metallic crystals.

- a. Ionic crystals - Analysis of NaCl, KCl, CsCl – determination of Avogadro number.
- b. Molecular crystals – Water and ammonia.
- c. Covalent crystals – Diamond and graphite.
- d. Metallic crystals – Metallic bond in metals.
- e. Conductors, insulators and semiconductors – Frenkel and Schottky defects.

References:

1. Principles of Physical chemistry, Puri, Sharma and Pathania, Vishal Publishing Co. 2012 edition.
2. Textbook of physical chemistry, P.L. Soni, O.P. Dharmarha and U.N. Dash. , Sultan Chand and sons, 2012 edition.
3. Essentials of physical chemistry, B.S. Bahl, Arun Bahl and G.D.Tuli, S. Chand and Company Pvt. Ltd.

Title of the Paper: Inorganic, Analytical and Applications of Computers in Chemistry

Semester: V

Subject Code: 13UCHC53

Part –III Chemistry Major Core-VII

Unit - I

Acids and bases

- a. Acids and bases - Arrhenius concept - Lowry Bronsted concept - conjugate acid–base pairs, relative strength of acids and bases - Lewis concept - Levelling effect - hard and soft acids.
- b. Non aqueous solvents: Classification of solvents - Chemical reaction in liquid ammonia - Precipitation reaction - Acid –base reactions in liquid ammonia – Protolysis – Ammonolysis.

Unit - II

Bio-Inorganic Chemistry

- a. Metallo porphyrins – Chlorophyll – structure and work function (photo system I & II) - Vitamin B₁₂ – structural features only.
- b. Myoglobin and hemoglobin – Structure - Their role in biological systems -Hill constant, cooperativity effect, Bohr effect - Explanation for cooperativity effect in hemoglobin.
- c. Role of Na⁺, K⁺, Ca²⁺ and Mg²⁺ ions in biological system.

Unit – III

Analytical Chemistry

- a. Methods of obtaining the Precipitate – Condition – Choice of Precipitant – merits and demerits of Organic Precipitants – Types – Specific and selective precipitants Sequestering agents – theory of precipitation – Dendrites – Paneth – Fajans – Hahn law – Coprecipitation – post precipitation – precipitation from homogeneous solution.
- b. Precision – Accuracy – Absolute and relative error – Classification of errors – Confidence Limit – Students Q–test – Rejection of experimental data – Sources and elimination of errors – Significant figures and computation.

Unit – IV

Analysis of experimental results

Graphical method – Curve fitting – Method of least squares – Problems involving straight line graphs.

Instrumental methods of Analysis

Beer-Lamberts Law – Principles of Colorimetric Analysis – Visual Colorimeter – Standard Series method – Balancing method – Estimation of Ni²⁺, Fe²⁺.

Basic principles of common types of Chromatography – Column Chromatography – Thin layer Chromatography – Paper Chromatography – Ion exchange Chromatography
Applications of each technique.

Unit – V

Computers in Chemistry

Application of 'C' language in Chemistry – Introduction of 'C' language – Character set – 'C' tokens – Keywords and Identifiers – Constants, variables, Data types and operators – Computation of some simple problems in Chemistry such as 1) Half life period, 2) Normality, Molality and Molarity of a solution, 3) Root mean square velocity, 4) Ionic strength of an electrolyte, 5) Beer-Lamberts law.

References:

1. R.Gopalan. P.S.Subramanian, K.Rengarajan. Elements of Analytical Chemistry.
2. K.V Raman. Computers in Chemistry.
3. E. Balagurusamy. Programming in ANSIC.

Title of the Paper: Pharmaceutical and Medicinal Chemistry

Semester: V

Subject Code: 13UCHS51

Part –IV SBS-V

Unit- I

a. Introduction to the different systems of medicine

Ayurveda, siddha, Homeopathy and Allopathy - History of medicinal chemistry - Discovery of drugs- an introduction.

b. Analgesics and Antipyretics

Narcotic analgesics- Morphine and derivatives- Totally synthetic analgesics- pethidine and methadones. Antipyretic analgesics- Salicylic acid derivatives. Indole derivatives and p-amino phenol derivatives (Medicinal uses & Structure only).

c. Diagnostic tests and estimation of sugar, Urea and cholesterol in serum, Urine, etc., Detection of pesticides and poisons- Antidotes for poisoning- First aid for poison by pesticides.

Unit- II

Chemotherapy and application of a few drugs (Elementary study)

a. Sulpha drugs - Sulphadiazine, prontosil and prontosil-S

b. Antimalarials - Quinine and its derivatives

c. Arsenical drugs-Salvarasan-606- Neosalvarasan

d. Antibiotics: Definition, penicillin-Tetracyclin (Auromycin and Tetramycin) - Streptomycin and Chloromyceitin - drug action and uses.

Hormones and Vitamins

Definition and classification - Testosterone, Progesterone, Thyroxine, Vitamin C, Structure only (Structural elucidation not necessary)

Unit- III

Gaseous anaesthetics - Vinyl ether - Cyclopropane - Halohydrocarbons - Chloroform- Haloethane- Trichloro ethylene - Intravenous anaesthetics – Thiopentone - Local anaesthetics - Cocaine and its derivatives. (Therapeutic use only)

Unit- IV

Synthetic drugs and its therapeutic function of paracetamol- Aspirin- naproxen- amoxicillin – ciprofloxacin – Ibuprofen, Ethambutal HCl.

Unit – V

Pharmaceutical analysis and Instrumental techniques – Assay of aspirin – paracetamol- naproxen – Ibuprofen –proparmanol instrumental methods- (Introduction and applications only – colorimetry –HPLC-TLC- Column chromatography – GC.

Visit to an industry and submission of report. For industrial visit/Assignment=5 marks (Internal).

Contact District industrial centre (DIC for Visit).

References:

1. Clinical Bio-Chemistry - Varley, Sulthan Chan, 2005.
2. Text Book of Medical Laboratory Technology, Volumes, I, II &III by Mukherji.

Title of the Paper: Organic Chemistry -III

Semester: VI

Subject Code: 13UCHC61

Part –III Chemistry Major Core-VIII

Unit – I

Aromatic Compounds - I

- a. Introduction - general characteristics of aromatic compounds. Aromaticity and Huckel's rule. Structure of benzene – M.O. Model.
- b. Mechanism of aromatic electrophilic substitution (Halogenations, nitration, Sulphonation and Friedel – Crafts reactions).
- c. Directive influence of substituents based on electronic effects (detailed study).
- d. Trisubstituted benzenes – steric hindrance and rules for trisubstitution in benzene.
- e. Mechanism of aromatic nucleophilic substitution: Unimolecular, bimolecular and benzyne mechanisms.

Unit – II

Aromatic Compounds – II

Aromatic hydrocarbons, halogen, nitro and amino compounds

- a. Preparation, Properties and uses of toluene, Xylene and mesitylene
- b. Aromatic halogen compounds: Preparation, properties and uses of bromobenzene and benzyl bromide- Reactivity of aryl halides, distinction between nuclear and side chain halogenated derivatives.
- c. Aromatic nitro compounds: preparation and properties of nitro toluenes and nitrobenzene.
- d. Aromatic amino compounds: Preparation by reduction of nitro compounds and from chlorobenzene. Effect of substituents on the basic character of aromatic amines: Comparison between aliphatic and aromatic amines. Estimation of aniline. Preparation of sulphanilic acid, nitroanilines and phenylene diamines.
- e. Preparation and synthetic applications of benzene diazonium chloride.

Unit – III

Aromatic compounds – II

- a. Aromatic aldehydes: Benzaldehyde – Mechanism of Cannizzaro, Perkins, Claisen, Knoevenagel reaction and benzoin condensation.
- b. Preparation & Properties of cinnamaldehyde & vanillin.
- c. Phenolic ketones: Chloroacetophenone – Preparation – Houben-Hosch synthesis.
- d. Phenols: Acidity of phenols – effect of substituents on the acidity of phenol, mechanism

of Kolbe's reaction.

Unit – IV

Aromatic acids

- a. Effect of substituents on acidic Character.
- b. Substituted acids: Preparation, Properties of salicylic acid and anthranilic acid.
- c. Dicarboxylic acids: Preparation, properties of phthalic acid, phenylacetic acid, mandelic acid, cinnamic acid & coumarin.
- d. Aromatic sulphonic acids: preparation, Properties and uses of benzene sulphonic acid, saccharin, chloramine – T and dichloramine – T.

Unit – V

Poly nuclear hydrocarbons and their derivatives:

- i. Isolated systems: Preparation and properties of diphenyl, benzidine diphenic acid, diphenylmethane, triphenylmethane and stilbene
- ii. Condensed systems: Preparation, properties, uses and structure of Naphthalene, Naphthylamines, Naphthols, Naphthaquinones, anthracene, anthraquinone, alizarin and phenanthrene.

References:

1. P. L. Soni And Chawla – Text book of Organic Chemistry (Sulthan Chand – 2012).
2. B. S. Bahl & Arun Bahl – Advanced Organic Chemistry (S. Chand & Company Ltd. 2009).
3. I.L. Finar – Organic Chemistry (Volume – I) – Pearson Education – VI Edition.

Title of the Paper: Physical Chemistry -III

Semester: VI

Subject Code: 13UCHC62

Part –III Chemistry Major Core-IX

Unit - I

Group Theory

Molecular symmetry elements and symmetry operations – operations – products of symmetry operations – properties of a group – classes and sub groups – groups multiplication table – C_{2v} and C_{3v} – abelian and non-abelian groups - Point groups – classification of molecules into point groups – C_{2v} , C_{3v} , C_{2h} , D_{2h} , D_{3h} , D_{4h} , D_{6h} , T_d and O_h – Matrices - Representation of symmetry operations by matrices – C_{2v} - inverse matrix and transformation matrices.

Unit II

Thermodynamics I

First Law; statement – mathematical formulation – internal energy – enthalpy or heat content – heat changes at constant volume and at constant pressure conditions – relationship between C_p and C_v – work done, heat change and enthalpy change for reversible isothermal expansion and compression of an ideal gas – calculation of q , w , ΔE , ΔH for reversible adiabatic expansion of an ideal gas – relation between T , V and P of an ideal gas undergoing adiabatic reversible expansion - comparison of work done in isothermal and adiabatic reversible expansion of an ideal gas.

Unit III

Thermodynamics II

Application of I law to non ideal gas undergoing reversible isothermal and adiabatic expansion – Joule effect – Joule-Thomson effect – Joule Thomson coefficient in the case of ideal and real gases – inversion temperature – Hess' law of heat summation – Kirchoff's equation – Bond enthalpies.

Limitations of I law of thermodynamics – spontaneous process – statement of II law – conversion of heat into work - thermodynamic efficiency – Carnot cycle – refrigeration cycle – Carnot theorem – Kelvin scale of temperature.

Entropy – definition and significance – derivation of the concept of entropy – entropy changes in reversible and irreversible (spontaneous) processes. Entropy as a thermodynamic function – dependence of entropy on the variables of the system for ideal gases – entropy of

mixing of gases – ΔS for physical transformation in chemical reactions – entropy and probability.

Unit IV

Thermodynamics III

Free energy function – Helmholtz free energy (A) – definition and its temperature dependence – Gibbs free energy (G) – definition, variation of Gibbs free energy with temperature and pressure. Gibbs – Helmholtz equation and its applications – Maxwell's relationships – criteria for reversible and irreversible processes in terms of entropy and free energy changes.

Partial molar quantities – Definition and significance of chemical potential – Gibbs – Duhem equation – variation of chemical potential with temperature and pressure – chemical potential in the case of system of ideal gases. Clausius – Clapeyron equation – derivation and applications – thermodynamic properties of real gases – fugacity and activity concepts.

Unit -V

Application of Thermodynamics

1. Application of thermodynamics to various type of equilibria – equilibrium constant and free energy changes – van't Hoff reaction isotherm and Van't Hoff isochore – thermodynamic interpretation of law of mass action and Lechatelier principle.
2. Thermodynamics of ideal solution – free energy change of mixing, enthalpy changes of mixing and entropy changes of mixing – relation between osmotic pressure and vapour pressure lowering - thermodynamic derivation – relation between the depression of freezing point and concentration – elevation of boiling point and concentration – thermodynamic derivations. Thermodynamics III – Nernst heat theorem and its applications third law of Thermodynamics.

References:

1. Principles of Physical chemistry, Puri, Sharma and Pathania, Vishal Publishing Co. 2012 edition.
2. Textbook of physical chemistry, P.L. Soni, O.P. Dharmarha and U.N. Dash, Sultan Chand and sons, 2012 edition.
3. Essentials of physical chemistry, B.S. Bahl, Arun Bahl and G.D. Tuli, S. Chand and Company Pvt.Ltd.

Title of the Paper: Applied Chemistry

Semester: VI

Subject Code: 13UCHC63

Part –III Chemistry Major Core-X

Unit - I

Water quality analysis-Chemical and Physical Analysis of water – Water Quality parameters - Standards prescribed for water quality by WHO and other Indian standards - Sea water as a source of drinking water- Electro dialysis method and Reverse osmosis method for purifications of water.

Sewage Treatment: Municipal waste-Sewage Treatment-Aerobic and Anaerobic process-Miscellaneous method of sewage treatment.

Unit-II

Rubber - Natural and synthetic rubbers-composition of natural rubber, Neoprene, Styrene-Butadiene rubber (SBR).

Polymer Chemistry - Types of polymerisation-Addition and condensation polymerization - Mechanism- Copolymer - Homopolymer -Definition of natural and synthetic fibres - natural and synthetic resins - Bakelite, Urea formaldehyde resins, Teflon, Nylon-66 and Dacron.

Oils and Fats - Saponification value, Iodine value, Reichert – Meissal value, Acid value, Definition and their determination – Applications – manufacture of soap – detergents – cleansing action of soap and detergents.

Insecticides and Pesticides - Definition-Classification-Inorganic pesticides: lead arsenate, Paris green, lime, sulphur, hydrocyanic acid –Organic pesticides, natural, synthetic (DDT, Gammaxene) –Fungicides -Repellants.

Preparation of domestically useful chemical products- washing powder-Cleaning powder-Phenols (white, black and coloured) Shampoo, Liquid blue, blue, Red and Green inks, soap oil, Face powder, pain balm.

Unit - III

a. Match industry - Pyrotechniques and explosives- Raw materials needed for the match industry –Manufacturing processes –Pyrotechniques - Coloured smokes.

b. Cement, Glass and ceramics –Raw materials and manufacture of cement –Glass and ceramics.

Unit-IV

a. Petrochemicals - Elementary study -Definition –Origin- Composition -Chemicals from natural gas, Petroleum, Light Naphtha and Kerosene -Synthetic gasoline.

b. Paints and lacquers – Pigments –Paints -Ingredients in paints -Manufacture –Lacquers-Varnishes.

Unit-V

Fertilizers: Definition-nutrients for plants - role of various elements in plants growth – natural and chemical fertilizers-classification of chemical fertilizers-urea super phosphate and potassium nitrate- mixed fertilizer -fertilizer industries in India.

References

1. J.Ghosh – Fundamental Concepts of Applied Chemistry.
2. B.K. Sharma – Industrial Chemistry.

Title of the Paper: Medical Laboratory Technology and Clinical Biochemistry

Semester: VI

Subject Code: 13UCHS61

Part –IV SBS - VI

Unit-I

Types of microorganisms, general characteristics of Bacteria, Fungi and Viruses, sterilization and disinfection - Types of stains and staining procedures.

Collection and preparation of samples, Typhoid test and Tuberculin test, VDRL, Pregnancy and HIV test - Blood collection, use of anti coagulants - Transportations of blood after collection, Rh and blood grouping.

Unit-II

Determination of Hemoglobin content, Total RBC, WBC and platelet count, ESR calculation of red blood cell - examination of Malaria parasites, Routine examination of urine.

Unit-III

Carbohydrates: Properties and General classification. Test for Glucose and other reducing sugar from urine and blood - Interpretation of results, Glucose tolerance test.

Unit-IV

Lipids: General properties, Functions and classification of lipids - Determination of total lipids, Triglycerides and cholesterol in blood.

Unit-V

Analytical Biochemistry: Principles of colorimetry, Flame photometry, Chromatography, Electrophoresis and Basic Immunochemical Techniques. Use of Microscope - Fundamentals of Automation in clinical laboratories.

(Visit to a Hospital Clinical Lab and submission of Report. For Report/Assignment=5 marks (Internal). Contact Govt Hospital for Visit)

References:

1. Clinical Biochemistry by Varely, Sultan Chand, 2005.
2. Text Book of Medical Laboratory Technology Vol. I, Vol. II and Vol. III by Muherji (2006) Sultan Chand.

SYLLABUS FOR B.SC., CHEMISTRY MAJOR PRACTICALS

PRACTICAL – I

INORGANIC SEMI MICRO QUALITATIVE ANALYSIS-13UCHC2P

Duration of Examination: 3 hrs

Analysis of a mixture containing two anions of which one is an interfering ion-semi-micro method and two cations.

- Anions** : Carbonate, sulphate, nitrate, fluoride, chloride, bromide, iodide, oxalate, borate, phosphate, arsenite, arsenate and chromate.
- Cations** : Lead, bismuth, copper, cadmium, antimony, iron (II & III), aluminium, chromium, zinc, manganese, cobalt, nickel, barium, strontium, calcium, magnesium and ammonium.

Distribution of Marks

(Max. marks – 100)

Performance in the class: 30 marks

Int:40

Observation notebook : 10 marks

Total : 40 marks

Ext :60

Viva voce - 10 marks

Record Notebook - 10 marks

Four radicals with correct procedures (4 x 10) - 40 marks

TOTAL - 60 marks

PRACTICAL – II

VOLUMETRIC ANALYSIS (13UCHC4P)

A double titration involving the making up of the solution to be estimated and the preparation of a primary standard.

LIST OF EXPERIMENTS

I. ACIDIMETRY AND ALKALIMETRY

Estimation of Na_2CO_3

Estimation of NaOH / KOH

Estimation of oxalic acid.

II. REDOX TITRATIONS

a. Permanganimetry

- 1) Estimation of ferrous ion
- 2) Estimation of oxalic acid
- 3) Estimation of calcium (direct method)

b. Dichrometry

- 1) Estimation of ferrous ion
- 2) Estimation of ferric ion using external indicator

III. IODOMETRY AND IODIMETRY

- 1) Estimation of potassium dichromate
- 2) Estimation of potassium permanganate
- 3) Estimation of copper
- 4) Estimation of arsenious oxide.

IV. ARGENTIMETRY

- 1) Estimation of potassium chloride.

Distribution of Marks (Max. marks – 100)

Duration of examination: 3hrs

Int : 40

Performance in the class: 30 marks

Observation notebook : 10 marks

Total : 40 marks

Ext :60

Viva voce	-	10 marks
Record Notebook	-	10 marks
Procedure writing	-	10 marks
Volumetric estimation	-	30 marks
TOTAL	-	60 marks

[Error < 2%	-	30 marks
2-3%	-	25 marks
3-4%	-	20 marks
3-5%	-	15 marks
> 5%	-	10 marks]

PRACTICAL – III

GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATION (13UCHC6P)

I. GRAVIMETRIC ANALYSIS

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of calcium as calcium oxalate monohydrate
4. Estimation of copper as cuprous thiocyanate
5. Estimation of nickel as NiDMG.

II. ORGANIC PREPARATION / SEPARATION

1. Nitration
 - a. m-dinitrobenzene from nitrobenzene
 - b. Picric acid from phenol
2. Bromination: p-bromoacetanilide from acetanilide
3. Hydrolysis: Aromatic acid from (a) an ester (b) an amide
4. Oxidation: Benzoic acid from benzaldehyde.
5. Benzoylation: (a) Amine (b) phenols
6. Acetylation: (a) Amine (b) phenols

Separation of mixtures

A mixture containing an acid or a base and a neutral compound (Acid or alkali separation).

Distribution of Marks

(Max. marks – 100)

Duration of examination: 6 hrs

Internal : 40 Marks

Performance in the class: 30 marks

Observation notebook : 10 marks

Total : 40 marks

External: 60 Marks

Record Notebook – 10 marks

Viva voce – 10 marks

Organic preparation (10 marks)

Gravimetric Estimation (30 marks)

Procedure – 2 marks

Procedure – 10 marks

Crude sample – 6 marks

Recrystallised sample – 2 marks

Estimation - 20 marks

[Error < 2% – 20 marks

2-3% – 18 marks

3-4% – 16 marks

4-5% – 14 marks

> 5% – 8 marks]

PRACTICAL – IV**ORGANIC ANALYSIS AND ESTIMATION (13UCHC6Q)****I. ORGANIC ANALYSIS**

Analysis of an organic compound containing one or two functional groups and confirmation by the preparation of a solid derivative - acids, phenols, aldehydes, ketones, esters, nitro compounds, amines (primary, secondary and tertiary), amides, anilides, aliphatic diamide, side chain and nuclear halogen compounds, aliphatic diamide containing sulphur and monosaccharides.

II. ORGANIC ESTIMATION

- 1) Estimation of phenol
- 2) Estimation of aniline
- 3) Estimation of glucose.

Distribution of Marks (Max. marks – 100)

Duration of examination: 6 hrs

Int : 40

Performance in the class:	30 marks
Observation notebook :	10 marks

Total :	40 marks

Ext :60

Record Notebook – 10 marks Viva voce – 10 marks

Organic estimation

(20 marks)

Procedure	– 5 marks
Estimation	– 15 marks
[Error < 3%	– 15 marks
3-4%	– 13 marks
4-5%	– 10 marks
> 5%	– 8 marks]

Organic analysis

(20 marks)

Preliminary reaction	– 2 marks
Elements present	– 4 marks
Aliphatic or aromatic	– 3 marks
Saturated / Unsaturated	– 3 marks
Functional group	– 6 marks
Derivative	– 2 marks.

PRACTICAL – V

PHYSICAL CHEMISTRY EXPERIMENTS (13UCHC6R)

1. Determination of molecular weight by

- a. Transition temperature method – sodium thiosulphate pentahydrate, strontium chloride hexahydrate and sodium acetate trihydrate.
- b. Cryoscopic method – Rast method – camphor and naphthalene.

2. Phase diagram involving

- a. Simple eutectic and
- b. Compound formation

3. Critical solution temperature

Determination of CST of phenol – water system and effect of impurity on CST - strength of sodium chloride.

4. Thermo chemistry

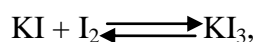
Heat of solution – potassium dichromate, ammonium oxalate and oxalic acid.

5. Viscosity

Determination of the composition of an unknown mixture.

6. Partition co-efficient experiments:

- a. (i) Study of the equilibrium constant for the reaction



by determining the partition co-efficient of iodine between water and carbon tetrachloride.

- (ii) Determination of strength of given KI
- b. Determination of association factor of benzoic acid in benzene.

7. Kinetics

Determination of relative strength of acids by

- a) Acid catalysed hydrolysis of ester.
- b) Inversion of cane sugar.

8. Electrochemistry

- a) Conductivity
 - i) Determination of cell constant of the cell and equivalent conductance of solution.
 - ii) Conductivity titration between an acid and a base (HCl vs NaOH)
- b) Potentiometric titrations
 1. KMnO_4 vs FeSO_4

2. $K_2Cr_2O_7$ vs $FeSO_4$

3. HCl vs $NaOH$.

Distribution of Marks (Max. marks – 100)

Duration of examination: 6 hrs

Int : 40

Performance in the class: 30 marks

Observation notebook : 10 marks

Total : 40 marks

Ext :60

Viva voce	-	10 marks
Record Notebook	-	10 marks
For completion of the experiment	-	20 marks
Graph	-	2 marks
Calculation	-	5 marks
Tabulation	-	3 marks
Result	-	10 marks

TOTAL	-	<u>60 marks</u>
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Title of the Paper: Organic, Inorganic and Physical Chemistry

(For Zoology & Physics Major)

Semester: I

Subject Code: 13UCHA11

Part – III Allied Chemistry -I

Unit – I

1. **Hydrogen** : Isotopes of hydrogen – preparation, properties and uses of heavy hydrogen – ortho and para hydrogen – hydrides – definition – classification – examples.
2. **Oxides** – Definition – classification – examples.
3. **Water**: Hardness of water – types of hardness – removal of hardness – industrial implications of hardness in water – estimation by EDTA method (outline only) units of hardness of water.
4. **Hydrogen peroxide** – Manufacture, properties, structure and uses – estimation by permanganimetry method – strength of hydrogen peroxide.

Unit -II

1. Detection and estimation of nitrogen and halogens in organic compounds – empirical formula – molecular formula – structural formula – calculation of EF and MF from percentage composition.
2. Nature of valency of carbon in organic compounds – tetrahedral arrangement of valency of carbon - bond-breaking and bond forming in organic reactions – homolytic cleavage – heterolytic cleavage – reaction intermediates – formation, stability and reactions of carbo cation ion and free radicals.
3. **Nucleophiles** – Electrophiles : Definition, types and examples – specific reactions involving these.
4. **Type of reactions**: substitution – addition – elimination – rearrangement and polymerization – illustration with examples.

Unit -III

Gaseous state – Postulates of kinetic theory of gases – derivation of expression for pressure of an ideal gas on the basis of kinetic theory – deducing the basic gas laws. Deviation of real gases from ideal behaviour – reasons for deviation – Derivation of Vander

waals gas equation – explanation of behaviour of real gases on the basis of Vander waals gas equation.

Average, rms and most probable velocities – (equations only – no derivation) relationship between these different velocities.

Liquefaction of gases – critical phenomenon – modern methods – Joule – Thomson effect – inversion temperature.

Unit - IV

Bonding: V.B. Theory – postulates of V.B. theory – application to the formation of simple molecules like H_2 and O_2 – overlap of atomic orbitals – s-s, s-p and p-p overlap – principle of hybridization – sp , sp^2 and sp^3 hybridisation – VSEPR theory.

M.O. theory: Formation of M.O's – bonding and antibonding and non – bonding. M.O.'s – M.O. diagram for H_2 , He and F_2 .

Unit - V

COLLOIDS

Colloidal state of matter – various types – classification. Sols – dialysis – electro osmosis – electrophoresis – stability of colloids – protective action – Hardy Schulze law – gold number.

Emulsion: Types of emulsions – emulsifier with examples.

Gels: Classification, preparation

Application of colloids.

Title of the Paper: Organic, Inorganic and Physical Chemistry-II (For Zoology & Physics Major)

Semester: II:

Subject Code: 13UCHA21

Part – III Allied Chemistry –II

Unit -I

Carbohydrates:

Definition – classification – monosaccharides – properties and uses of glucose and fructose – configuration of glucose – Haworth structure – conversion of glucose to fructose and vice versa.

Disaccharides: Sucrose – manufacture – properties and uses – structure – distinction between sucrose, glucose and fructose.

Polysaccharides: Starch and cellulose (Structure only) α – amylase, β - amylase – difference between these two.

Unit -II

Aminoacids and proteins: Classification – synthesis – properties of aminoacids – polypeptides – proteins – classification and biological functions.

Dyes : Definition – theory of colour and constitution – classification based on structure and applications – preparation of methyl orange – bismark brown, malachite green – vat dye – indigo.

Unit -III

Adsorption: Definition – difference between adsorption and absorption – adsorbate, adsorbent – physical adsorption – chemical adsorption – differences between these two types – factors influencing adsorption – adsorption isotherm – Langmuir isotherm (no derivation, statement only) adsorption of gases on solid surface.

Chromatographic technique: Principle and application – partition and gas chromatography – thin layer chromatography – column chromatography – paper chromatography – gas-solid and gas-liquid chromatography

Unit IV

Nuclear chemistry

1. Composition of the nucleus – nuclear forces – mass defect – binding energy – nuclear stability.
2. Soddy's group displacement law – illustration – law of radioactive disintegration.
3. Nuclear fission: Definition – theory of fission – application of fission – the principle of atom bomb.
4. Nuclear fusion: Definition – emission of energy – Stellar energy – hydrogen bomb.
5. Application of radioactivity - In medicine, agriculture, industry and analytical fields – carbon dating.

Unit V

1. **Air pollution** : Definition, composition of air – chemical reactions occurring in air due to sunlight – sources of air pollution – classification and effects of air pollutants – effect of fluorocarbons – ozone layer – composition – formation – depletion – green house effect.
2. **Acid rain** – formation theory and control of acid rain methods to control air pollution.
3. **Water pollution**: Types – sources – water sewages – industrial effluents – inorganic pollutants – organic pollutants – water pollution control – water treatment.
4. **Radioactive pollution**: Sources – nuclear traces – wastes – effect of radiation – preventive methods.

Title of the Paper: Organic and Physical Chemistry - III

(For Zoology & Physics Major)

Semester: III

Subject Code: 13UCHA31

Part – III Allied Chemistry -III

Unit – I

Adsorption : Definition – difference between adsorption and absorption – adsorbate, adsorbent – physical adsorption – chemical adsorption – differences between these two types – factors influencing adsorption – adsorption isotherm – Freundlich isotherm – Langmuir isotherm - adsorption of gases on solid surface.

Unit – II

Catalysis : Definition – different types of catalysis – acid-base catalysis – surface catalytic reactions – definition and examples – autocatalyst – catalytic poisoning – promoters – enzyme catalysis – characteristics.

Polymers : Definition – classification of polymers – properties of polymers – addition and condensation polymerization reactions with examples – natural rubber – isoprene unit – vulcanization of rubber – preparation and application of polystyrene, urea – formaldehyde resin, Teflon and buna-S-rubber.

Unit – III

Photochemistry: Comparison of thermal and photochemical reactions – definition of photochemical reactions – laws of photochemistry – Grotthus – Draper law – Einstein law – quantum efficiency – reasons for low and high quantum yield with examples – consequence of light absorption by atoms and molecules – Jablonsky diagram – fluorescence – phosphorescence – photosensitization – chemiluminescence – bioluminescence – applications of photochemistry.

Unit – IV

Coordination compounds: Definition – nomenclature – definition of various terms involved in coordination chemistry – Werner's theory EAN rule – VB theory – Nickel carbonyl – chelates.

Unit V

Petrochemicals: crude oil- chemicals from crude oil- LPG-aviation fuel-fuels used in Locomotives, trucks, ships and light commercial vehicle-knocking- TEL-Octane number- Synthetic petrol.

References:

1. Essential of physical chemistry: Arun Bhal, B.S. Bhal, G.D. Tuli (revised edition, S.Chand, 2014).
2. Principles of physical chemistry: Puri, Sharma, Pathania (revised edition, Vishal pub., 2014)
3. Modern Inorganic chemistry: R.D. Madan (revised edition, S. Chand, 2013).
4. A Text book of Organic chemistry: Arun Bhal, B.S. Bhal (revised edition, S. Chand, 2014).

Title of the Paper: Organic and Physical Chemistry - IV

(For Zoology & Physics Major)

Semester: IV

Subject Code: 13UCHA41

Part – III Allied Chemistry -IV

Unit – I

Heterocyclic compounds – preparation and reactions of pyrrole, furan, pyridine, quinoline, isoquinoline, (Structural elucidation & synthesis not necessary).

Unit II

Alkaloids – pharmacological properties and importance of the following alkaloids – nicotine, quinine, piperine and cocaine (Structural elucidation not necessary).

Vitamins and antibiotics

Classification and biological functions of vitamins A, B₆, B₁₂, C, D, E and K (Structural elucidation not required)

Classification and biological functions of antibiotics – penicillin, chloroamphenicol, streptomycin and tetracyclins.

Unit –III

Chemical kinetics: Reaction rate – order and molecularity of a reaction – zero order – first order. First order rate equation and half life period – derivation. Examples of first order reactions – second order reactions – examples. Carbon dating – enzyme catalysis – Michaelis and Menten mechanism – Line-weaver Burk plot – significance of K_m .

Unit – IV

Chromatographic technique: Principle and application – partition and gas Chromatography – thin layer chromatography – column chromatography – paper Chromatography – gas-solid and gas-liquid chromatography

Unit – V

Electro chemistry:

P^H - Definition-simple calculation of P^H from Molarity of acids and bases-common ion effect- and its application in analytical chemistry-buffer solution-definition-theory of buffer action- application

Acid – base indicators-working range - commercial cells and batteries - primary and secondary cells-Weston – cadmium cell- lead storage cell-electroplating - principle and methods.

References:

1. Essential of physical chemistry: Arun Bhal, B.S. Bhal, G.D. Tuli (revised edition, S.Chand, 2014).
2. Principles of physical chemistry: Puri, Sharma, Pathania (revised edition, Vishal pub., 2014)
3. Modern Inorganic chemistry: R.D. Madan (revised edition, S. Chand, 2013).
4. A Text book of Organic chemistry: Arun Bhal, B.S. Bhal (revised edition, S. Chand, 2014).

**Syllabus for Allied Chemistry Practical
(Zoology & Physics Major)
Practical I - Volumetric Analysis- 13UCHA2P**

A double titration involving making up of the solution to be estimated or single titration involving making up of the solution to be estimated and the preparation of a primary standard.

A. ACIDIMETRY AND ALKALIMETRY

1. Titrations between a strong acid and strong base.
2. Titrations between a strong acid and weak base.
3. Titrations between a weak acid and strong base.

B. PERMANGANIMETRY

1. Titrations between potassium permanganate and oxalic acid, ferrous sulphate and ferrous ammonium sulphate (Mohr's salt)

Distribution of Marks

(Max. marks – 100) Duration of examination: 2 hrs

Performance in the class: 30 marks **(Internal: 40 Marks)**

Observation notebook : 10 marks

Total : 40 marks

External : 60 Marks

Viva voce	-	10 marks
Record Notebook	-	10 marks
Procedure	-	10 marks
Estimation	-	30 marks
Total	-	<u>60 marks</u>
[Errors 2-3%	-	30 marks
3-4%	-	25 marks
4-5%	-	15 marks
> 5%	-	10 marks

Practical II - Organic Analysis - 13UCHA4P
(Zoology & Physics Major)

ORGANIC ANALYSIS

Analysis of an organic compound containing one or two functional groups and confirmation by the preparation of a solid derivative / colour reactions - acids, phenols, aldehydes, esters, amines (primary, secondary and tertiary), amides, anilides, aliphatic diamide and monosaccharide.

Distribution of Marks

(Max. marks – 100) Duration of examination: 2 hrs

Int: 40

Attendance in the class:	20 marks
Model test	: 10 marks
Observation notebook	: 10 marks
Total	: 40 marks

Ext: 60

Viva voce	-	10 marks
Record Notebook	-	10 marks
Preliminary reactions	-	5 marks
Detection of element	-	5 marks
Aliphatic / Aromatic	-	5 marks
Saturated / Unsaturated	-	5 marks
Detection of functional group with correct procedure	-	15 marks
Derivative / Colour reaction	-	5 marks
TOTAL	-	<u>60 marks</u>