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 - 625 533

DEPARTMENT OF CHEMISTRY

B.Sc. Chemistry

Syllabus

Academic Year 2017 – 2018 onwards

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

Programme Specific Outcomes

PSO1: Acquire the knowledge of chemistry in natural products, drugs, biological and computer sciences.

PSO2: Develop critical thinking, formulate problem solving techniques, analytical reasoning to design and perform experiments.

PSO3: Strategize and apply apt techniques in quality control labs, pharmaceutical companies in addition to petrochemical, sugar, leather, dyeing, textile, cosmetics, match, cement and fertilizer industries.

PSO4: Develop communication skills with comprehensive subject knowledge for competitive examinations.

B.Sc., Chemistry

Course Scheme, Scheme of Examinations & Syllabus

Effective from the academic year 2017 – 2018 onwards

Eligibility

A candidate, who has passed in Higher Secondary Examination with any Academic stream under Higher Secondary Board of Examination, Tamil Nadu as per the norms set by the Government of Tamil Nadu or an Examination accepted as equivalent thereto by the Academic Council, is eligible for the **Bachelor of Science – Chemistry Degree**.

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

For Programme Completion

A Candidate shall complete:

- Part I - Language papers – Tamil/Arabic/Malayalam in semesters I, II, III and IV respectively
- Part II - Language papers - English in semesters I, II, III, IV respectively
- Part III - Core papers in semesters I, II, III, IV, V, and VI respectively
- Part III - Elective papers in semesters V and VI respectively
- Part III - Allied papers in semesters I, II, III, IV, V and VI respectively
- Part IV - Non- Major Elective papers in semesters I and II respectively
- Part IV - Skill based Subject papers in semesters I, II, V and VI respectively
- Part IV - Environmental Studies paper in semester V
- Part IV - Value Education paper in semester VI
- Part V - Extension activity in semester VI

Scheme of Examination under Choice Based Credit System

Term End Examination (TEE)	- 75 Marks
Continuous Internal Assessment Examination (CIAE)	- 25 Marks
Total	- 100 Marks

Pattern of Continuous Internal Assessment Examination (CIAE)

Average of Two Internal Tests (each 20 marks)	- 20 Marks
Assignment / Seminar	- 05 Marks
Total	- 25 Marks

Pattern of Term End Examination

(Max. Marks: 75 / Time: 3 Hours)

External Examination Question Paper Pattern for Part I, III and IV
(Non- Major Elective, Elective & Skill based Subject)

Section – A (10 X 1 = 10 Marks)
Answer ALL questions.

- Questions 1 - 10
- Two questions from each unit
- Multiple choice questions and each question carries four choices

Section – B (5 X 7 = 35 Marks)
Answer ALL questions choosing either A or B.

- Questions 11 - 15
- One question from each unit
- Descriptive Type
- 11 A or 11 B
  12 A or 12 B
  13 A or 13 B
  14 A or 14 B
  15 A or 15 B

Section – C (3 X 10 = 30 Marks)
Answer any THREE out of five questions.

- Questions 16 - 20
- One question from each unit
- Descriptive and Analytical Type

The pattern of External Examination Question Paper for Part II will be as follows:

- Section – A: Prose - 16 Marks.
- Section – B: Poetry - 11 Marks.
- Section – C: Short Story - 13 Marks.
- Section – D: Grammar - 19 Marks.
- Section – E: Composition - 16 Marks.

External Examination Question Paper Pattern for Part IV (Environmental Studies and Value Education)

Section – A: (5 X 6 = 30 Marks)
Answer ALL questions choosing either A or B.

- Questions 1 - 5
- One question from each unit
- Descriptive and Analytical Type

Section – B (3 X 15 = 45 Marks)
Answer any THREE out of five questions.

- Questions 6 - 10
- One question from each unit
- Descriptive and Analytical Type

Passing Marks

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

Practical Examination

- Internal - 40 marks (Observation note -10 and model exams-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:6 hrs 1P:2 hrs						1	1x6	**6**
		1T: 6 hrs 1P: 2 hrs					1 1	1x6 1x2	**6 2**
			1T:4hrs 1P:2hrs				1	1x4	**4**
				1T:4hrs 1P:2hrs			1 1	1x4 1x2	**4 2**
					1T: 6hrs 2P: 6hrs 1P: 2hrs		1	1x6	**6**
						1T: 6hrs 2P: 6hrs 1P: 2hrs	1 2 1	1x6 2x5 1x4	**6 10 4**
III Elective					1T: 6hrs		1	1x6	**6**
						1T: 6hrs	1	1x6	**6**
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	1T:2 hrs	1T: 2 hrs			1T: 2 hrs	1T:2 hrs	4	4x2	**8**
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	**6**	**8**	**5**	**8**	**5**	**10**	**42**		
Total Marks							**4200**		
Total Credits	**20**	**23**	**18**	**22**	**20**	**37**			**140**

DETAILS OF COURSE CATEGORY, CODE, CREDITS & TITLE

Part	Course Category	Course Code	Course Title	Hrs/ Week	CIAE	TEE	Max. Marks	Credits
SEMESTER – I								
I	Language – I	17UTAL11/ 17UARL11/ 17UMLL11	Tamil/Arabic/Malayalam	6	25	75	100	3
II	English – I	17UENL11	English for Enrichment – I	6	25	75	100	3
III	Core	17UCHC11	General Chemistry - I	6	25	75	100	6
III	Core	17UCHC2P	Inorganic Semi micro Qualitative Analysis	2	-	-	-	-
III	Allied	17UBYA11/ 17UZYA11	Ancillary Botany/Zoology - I	4	25	75	100	4
III	Allied	17UBYA2P/ 17UZYA2P	Ancillary Practical Botany/Zoology - I	2	-	-	-	-
IV	SBS	17UCHS11	Fundamentals in Chemistry-I	2	25	75	100	2
IV	Non Major Elective – I	17UCHN11	Industrial Chemistry	2	25	75	100	2
			Total	**30**	**150**	**450**	**600**	**20**
SEMESTER – II								
I	Language – II	17UTAL21/ 17UARL21/ 17UMLL21	Tamil/Arabic/Malayalam	6	25	75	100	3
II	English – II	17UENL21	English Paper – II	6	25	75	100	3
III	Core	17UCHC21	General Chemistry –II	6	25	75	100	6
III	Core	17UCHC2P	Inorganic Semi micro Qualitative Analysis	2	40	60	100	2
III	Core	17UBYA21/ 17UZYA21	Ancillary Botany/Zoology-II	4	25	75	100	4
III	Allied	17UBYA2P/ 17UZYA2P	Ancillary Practical Botany/Zoology -1	2	40	60	100	1
IV	SBS	17UCHS21	Fundamentals in Chemistry-II	2	25	75	100	2
IV	NME	17UCHN21	Drugs and Cosmetics	2	25	75	100	2
			Total	**30**	**230**	**570**	**800**	**23**

Part	Course Category	Course Code	Course Title	Hrs/ Week	CIAE	TEE	Max. Marks	Credits
SEMESTER – III								
I	Language-III	17UTAL31/ 17UARL31/ 17UMLL31	Tamil/Arabic/Malayalam	6	25	75	100	3
II	English – III	17UENL31	English for Enrichment –III	6	25	75	100	3
III	Core	17UCHC31	Physical Chemistry-I	4	25	75	100	4
III	Core	17UCHC4P	Volumetric Analysis	2	-	-	-	-
III	Allied	17UPHA11	Ancillary Physics-I	4	25	75	100	4
III	Allied	17UPHA2P	Ancillary Physics Practical-I	2	-	-	-	-
III	Allied	17UBYA31/ 17UZYA31	Ancillary Botany/Zoology – III	4	25	75	100	4
III	Allied	17UBYA4P/ 17UZYA4P	Ancillary Botany/Zoology Practical –II	2	-	-	-	
Total				**30**	**125**	**375**	**500**	**18**
SEMESTER – IV								
I	Language – IV	17UTAL41/ 17UARL41/ 17UMLL41	Tamil/Arabic/Malayalam	6	25	75	100	3
II	English – IV	17UENL41	English for Enrichment - IV	6	25	75	100	3
III	Core	17UCHC41	Inorganic Chemistry	4	25	75	100	4
III	Core	17UCHC4P	Volumetric Analysis	2	40	60	100	2
III	Allied	17UPHA21	Ancillary Physics-II	4	25	75	100	4
III	Allied	17UPHA2P	Ancillary Physics Practical-I	2	40	60	100	1
III	Allied	17UBYA41/ 17UZYA41	Ancillary Botany/Zoology -IV	4	25	75	100	4
III	Allied	17UBYA4P/ 17UZYA4P	Ancillary Botany/Zoology Practical -II	2	40	60	100	1
V	EA	17UEAC61	Extension Activities	0	25	75	100	2
Total				**30**	**270**	**630**	**900**	**24**

SEMESTER – V								
Part	**Course Category**	**Course Code**	**Course Title**	**Hrs/ Week**	**CIA E**	**TEE**	**Max. Marks**	**Credits**
III	Core	17UCHC51	Organic chemistry	6	25	75	100	6
III	Elective	17UCHE51/ 17UCHE52	Physical chemistry and computers in chemistry/ Polymer Chemistry	6	25	75	100	6
III	Core	17UCHC6P	Gravimetric estimation and organic preparation	3	-	-	-	-
III	Core	17UCHC6Q	Organic estimation and organic analysis	3	-	-	-	-
III	Core	17UCHC6R	Physical chemistry practical	2	-	-	-	-
III	Allied	17UPHA31	Ancillary physics – III	4	25	75	100	4
III	Allied	17UPHA4P	Ancillary physics practical -II	2	-	-	-	-
IV	EVS	17UEVS51	Environmental Studies	2	25	75	100	2
IV	SBS	17UCHS51	Organic and Pharmaceutical chemistry	2	25	75	100	2
Total				**30**	**125**	**375**	**500**	**20**
SEMESTER – VI								
III	Core	17UCHC61	Organic and Analytical chemistry	6	25	75	100	6
III	Elective	17UCHE61/ 17UCHE62	Physical Chemistry – II / Green Chemistry and Nanotechnology	6	25	75	100	6
III	Core	17UCHC6P	Gravimetric Estimation and Organic Preparation	3	40	60	100	5
III	Core	17UCHC6Q	Organic Estimation and Organic Analysis	3	40	60	100	5
III	Core	17UCHC6R	Physical Chemistry Practical	2	40	60	100	4
III	Allied	17UPHA41	Ancillary physics - IV	4	25	75	100	4
III	Allied	17UPHA4P	Ancillary physics practical -II	2	40	60	100	1
IV	VED	17UEVD61	Value Education	2	25	75	100	2
IV	SBS	17UCHS61	Medical Laboratory Technology & Clinical Biochemistry	2	25	75	100	2
Total				**30**	**285**	**615**	**900**	**37**
Grand Total				**180**	**1185**	**3015**	**4200**	**140**

I SEMESTER

Core subject paper – 1 **Part - III**

17UCHC11	General chemistry - I	Hours 6 / Credits 6

Course Outcome: To gain knowledge about types of organic reactions, qualitative analysis, acids, bases, gaseous state, lab hygiene and safety.

Unit – I – Organic reactions and their mechanisms

Empirical and Molecular formula – calculations - Factors influencing the reaction – Inductive effect – Mesomeric effect (Resonance effect), electromeric effect and hyperconjugation- Homolytic and heterolytic fission – reaction intermediates – carbonium ion, carbanion, free radicals and carbenes – formation and stability of these intermediates – tetrahedral valency of carbon – Classification of reagents: Electrophiles and nucleophiles.

Unit – II – Types of organic reactions

Alcohol: 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, mustard gas and Phosphorous ylides.

Unit – III

Laboratory hygiene and safety – carcinogenic chemicals – general precautions for avoiding accidents – first aid techniques - Principles of semi micro methods – solubility product and common ion effect – in groups II, III and IV – preparation of original solution for cation testing on semi micro scale – removal of interfering ions in the analysis of cations – oxalate, borate, fluoride, chromate and phosphate - Acids and bases: Arrhenius concept – Lowry-Bronsted concept – conjugate acid – base pairs, relative strengths of acids and bases – Lewis concept – Levelling effect – hard and soft acids.

Unit – IV – Gaseous state – I

Kinetic theory of gases – Postulates – Kinetic gas equation – Derivation – gas laws and their derivations – Types of molecular velocities – Average, Most probable and root mean square velocities – their relationships - calculation of molecular velocities – Maxwell-Boltzmann distribution of molecular velocities (no derivation) – Graphical representation and its significance – effect of temperature on velocity distribution. Collision diameter – collision number – collision frequency – mean free path – viscosity of gases – thermal conductivity – definition only – principle of equipartition of energy.

Unit – V – Gaseous state – II

Real gases – Deviation of real gases from ideal behavior – Boyle temperature – Explanation for deviations – Vander Waals gas equation of states – derivation – how Vander Waal's equation explain the behavior of real gases – other equations of states – Dieterici, Berthelot, Clausius equation and Radlich - Kwong equation (no derivation). Critical phenomenon of gases - Critical constants – definition – determination of critical constants – PV Isotherms – Andrews experiment – significance of critical constants – compressibility factor for ideal and real gases – Relationship between Vander Waals constants and critical constants – The principle of corresponding states and derivation of reduced equation of state – Joule-Thomson effect – Inversion temperature – Liquefaction of gases – Linde's and Claude's methods.

Reference books

- B. S. Bahl and Arun Bahl - Advanced organic chemistry (2009).
- Puri, Sharma and Pathania - Principles of Physical Chemistry.
- P. L. Soni, O. P. Dharmarha and U. N. Dash - Textbook of Physical Chemistry.
- R. Gopalan, P. S. Subramanian and K. Rengarajan - Elements of Analytical Chemistry.
- Arthur. I. Vogel - A text book of quantitative Inorganic Analysis.

SEMESTER – I

PRACTICAL – I

17UCHC2P	INORGANIC SEMI MICRO QUALITATIVE ANALYSIS	Hours 2/Credits 2

Duration of Examination: 3 hrs

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

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

Maximum marks - 100

Internal – 40 marks	
Performance in the class	30 marks
Observation notebook	10 marks
Total	**40 marks**

External – 60 marks	
Viva voce	10 marks
Record Notebook	10 marks
Four radicals with correct procedures (4 x 10)	40 marks
Total	**60 marks**

SEMESTER - I

Ancillary Chemistry paper – 1 **Part - III**

17UCHA11	**Ancillary Chemistry Paper -I (Organic, Inorganic And Physical Chemistry)**	**Hours 4/Credits 4**

Course Outcome: To study about the properties of hydrogen, oxides, water, electrophiles, nucleophiles, types of reactions, gaseous state, hybridization and MO theory.

Unit – I

Hydrogen: Isotopes of hydrogen – preparation, properties and uses of heavy hydrogen – hydrides – definition – classification – examples - Oxides – Definition – classification – examples. 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.

Unit – II

Detection of nitrogen and halogens in organic compounds – empirical formula – molecular formula – structural formula – simple calculation - 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 carbocation, carbonium ion and free radicals - Nucleophiles – Electrophiles : Definition, types and examples - Type of reactions: Substitution – addition – elimination – rearrangement and polymerization – illustration with examples.

Unit – III

Gaseous state – Postulates of kinetic theory of gases – deducing the basic gas laws – Boyle's law, Charles law, Avogadro's law and Ideal gas equation - Deviation of real gases from ideal behavior – reasons for deviation – Derivation of van der Waals gas equation – explanation of behavior of real gases on the basis of van der Waals gas equation - Critical constants – definition only –Joule-Thomson effect – Inversion temperature - Liquefaction of gases – modern methods.

Unit - IV

Bonding : Orbitals – shapes of s and p orbitals – principle of hybridization – sp, sp^2 and sp^3 hybridisation – methane, ethylene and acetylene – VSEPR theory - $BeC\ell_2$, BF_3, CH_4, $PC\ell_5$, SF_6, IF_7, H_2O and NH_3 - 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 states 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 - Applications of colloids.

Reference books

- Essential of physical chemistry - Arun Bahl, B.S. Bahl and G.D. Tuli (revised edition, S. Chand, 2014).
- Principles of physical chemistry - Puri, Sharma and Pathania (revised edition, Vishal pub., 2014).
- Modern Inorganic chemistry - R.D. Madan (revised edition, S. Chand, 2013).
- A Text book of Organic chemistry – Arun Bahl, B.S. Bahl (revised edition, S. Chand, 2014).

SEMESTER I

PRACTICAL I - VOLUMETRIC ANALYSIS

17UCHA2P	VOLUMETRIC ANALYSIS	Hours 2/Credits 1

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)

C. IODOMETRY (DEMONSTRATION ONLY)

1. Titrations of sodium thiosulphate with potassium permanganate and potassium dichromate.

Distribution of Marks

Maximum marks – 100

Duration of examination: 2 hrs

Internal – 40 marks	
Attendance in the class	20 marks
Model test	10 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	**60 marks**

Error calculation

Error	Marks
2-3%	30
3-4%	25
4-5%	15
> 5%	10

SEMESTER - I

Skill Based subject-1 **Part - IV**

17UCHS11	Fundamentals in Chemistry - I	Hours 2/Credits 2

Course Outcome: To understand organic and inorganic basic concepts, IUPAC nomenclature of organic compounds, mathematical concepts and SI units.

Unit – I – Mathematical Concepts

Inclination of a line and the slope of a line- General equation of a Straight line- Slope & intercept form- slope & point form-Two points form- intercept form- Parallel and perpendicular lines- Curve sketching. Differentiation- Differentiate Sin x, e^x, log x and x^n - Partial differentiation - Simple logarithmic formulas and calculations- Matrices and determinants- Product of two matrices – Inverse matrix (including problems).

Unit – II – Symbols, meanings and SI Units

Useful constants and their values in SI values and cgs units- Common system of measurements- Prefixes used for decimal fractions- Important conversion factors.

Unit – III – Introduction to Inorganic chemistry

Definition - Periodic table-Classification of elements- Electronic configuration of elements- Aufbau principle- Hund's rule of maximum multiplicity- Half and completely filled orbitals.

Unit – IV – Introduction to organic chemistry

Sources and Classification of organic compounds - Definition – vital force theory – various functional groups – homologous series – alcohol, amines, acids, esters, aldehydes and ketones.

Unit – V

IUPAC nomenclature taking examples from aliphatic and aromatic chemistry involving the functional groups (alcohols, amines, acids, esters, aldehydes and ketones).

Reference books

- B. S. Bahl and Arun Bahl – Advanced Organic Chemistry
- Puri, Sharma and Pathania – Principles of Physical chemistry.
- B.S.Bahl, Arun Bahl and G.D.Tuli – Essentials of Physical Chemistry.
- R.D.Madan – Modern Inorganic chemistry.

SEMESTER - I

Non-Major Elective-1 **Part - IV**

17UCHN11	Industrial Chemistry	Hours 2/Credits 2

Course Outcome: To gain knowledge about plant nutrients, fertilizers, insecticides, pesticides, oils, soap, detergents, polymers and nuclear power plants.

Unit – I – Agricultural Industry

Plant Nutrients – Role of NPK in plant growth – Classification of Fertilizers – Urea, Super phosphate and Complex – Fertilizer Industry in India.

Unit – II – Insecticides and Pesticides

Definition – Classification – pest control methods- Inorganic Pesticides Lead Arsenate, sodium fluoride, mercurous chloride, organic pesticides – Synthetic - DDT –BHC-Malathion-Fungicides – Bordeaux Mixture-repellants – Adverse effects and preventing methods of using pesticides.

Unit – III – Oils and Fats

Manufacture of soap and detergents – cleaning action of soap-Saponification value, Iodine value, reichest Meissal value, acid value – Definition and their determination.

Unit – IV– Polymer chemistry

Natural rubber – composition of natural rubber - Synthetic rubber- Neoprene and SBR. Polymers- definition – poly ethylene – PVC – Teflon -Polyester – Bakelite, urea formaldehyde, Nylon-66.

Unit – V – Nuclear power plants

Nuclear power plants in India- nuclear fuels – concepts of nuclear fission and energy production – nuclear waste disposal and hazards.

- ❖ Visit to various Industries and submission of report - 5 marks (Internal)

Reference books

- ➢ B.K. Sharma – Industrial Chemistry – (Goel Publishers)
- ➢ Singh and VK Kapoor – Organic Pharmaceutical Chemistry.
- ➢ S. Lakshmi – Pharmaceutical Chemistry.
- ➢ K.Bagavathi Sundari – Applied Chemistry.

SEMESTER - II

Core subject paper –2 **Part - III**

17UCHC21	General chemistry - II	Hours 6 / Credits 6

Course Outcome: To delineate atomic structures, quantum mechanics, bonding, periodic properties of elements and types of organic reactions.

Unit – I – Types of organic reactions

Substitution, addition, elimination, rearrangement and polymerisation reactions – their mechanisms – S_N 1 , S_N2, S_{Ni} , E1, E2 and E1$_C$B, Hofmann's rule, Saytzeff rule, Markownikoff's rule & anti – Markownikoff's rule.

Unit – II – Periodic properties

Variation of effective nuclear charge in the periodic table – in period and group – application of effective nuclear charge – atomic volume – variation of atomic volume in a period and group – atomic and ionic radii – atomic or metallic radius – Vander Waals radius – variation of atomic and ionic radii in a period and group – ionisation energy – factors affecting the magnitude of ionisation potential – variation of ionisation potential of the element in a group and period – electron affinity – factors affecting the magnitude of electron affinity – variation of electron affinity in a group and period – application of ionisation potential and electron affinity – electronegativity – variation of electronegativity in a period and a group – application of electronegativity.

Unit – III – Chemical bonding

Chemical bonding – valence bond approach – types of overlapping and orbital diagrams – sigma and pi bonds. Hybridization and geometry of molecules – sp, sp^2, sp^3d and d^2sp^3 with examples – VSEPR theory – shapes of molecules – Molecular Orbital Theory (MOT) – bonding and antibonding orbitals – relative order of energies of molecular orbitals – MOT applied to homonuclear molecules – H_2, O_2, F_2 and Cl_2 – heteronuclear molecules – HF, CO and NO – comparative study of VB and MOT.

Unit – IV – Atomic structure

Dalton's theory – J. J. Thomson discovery of electron – Discharge tube experiment – Thomson's atom model - Rutherford's atom model – Alpha particles scattering experiment – Moseley's determination of atomic number – Bohr's atom model – Postulates of Bohr's theory – derivation of radius and energy of Bohr's orbit – Bohr's explanation of hydrogen spectrum – Merits and demerits of Bohr's theory – Stark effect and Zeeman effect – Sommerfield's modification of atom model - Dualism of light – wave nature of radiation – classical theory of electromagnetic radiation – Particle nature of radiation.

Unit – V – Quantum mechanics

Black body radiation and Planck's quantum theory, photo electric effect and Compton effect – de Broglie equation – significance – Heisenberg's uncertainty principle- Schrodinger wave equation (no derivation) – argument in favour of Schrodinger wave equation – physical significance of ψ function - Properties of function – well-behaved function- Quantum numbers and their significance - Concept of atomic orbitals – shapes of s, p and d orbitals - Nodal planes and nodal points in atomic orbitals - 'g' and 'u' character of atomic orbitals.

Reference books

- B. S. Bahl and Arun Bahl – Advanced organic chemistry.
- I. L. Finar – Organic Chemistry Vol. I.
- P. L. Soni – Organic Chemistry.
- Puri, Sharma and Pathania – Principles of Physical Chemistry.
- P. L. Soni, O. P. Dharmarha and U. N. Dash – Textbook of Physical Chemistry.
- B. S. Bahl, Arun Bahl and G. D. Tuli – Essentials of Physical Chemistry.
- R. D. Madan – Modern Inorganic Chemistry.

SEMESTER II
PRACTICAL – I

17UCHC2P	INORGANIC SEMI MICRO QUALITATIVE ANALYSIS	Hours 2/Credits 2

Duration of Examination: 3 hrs

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

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

Maximum marks - 100

Internal – 40 marks	
Performance in the class	30 marks
Observation notebook	10 marks
Total	**40 marks**

External – 60 marks	
Viva voce	10 marks
Record Notebook	10 marks
Four radicals with correct procedures (4 x 10)	40 marks
Total	**60 marks**

SEMESTER - II

Ancillary Chemistry paper – 2

`

Part - III

17UCHA21	**Ancillary Chemistry Paper -II (Organic And Physical Chemistry)**	**Hours 4/Credits 4**

Course Outcome: To gain knowledge about nuclear chemistry, carbohydrates, stereoisomerism, chemotherapy, dyes, aminoacids and proteins.

Unit – I - Nuclear Chemistry

Composition of the nucleus – nuclear forces – mass defect – binding energy – nuclear stability - Soddy's group displacement law – illustration - Nuclear fission: Definition – application of fission – principle of atom bomb - Nuclear fusion: Definition – emission of energy – Stellar energy – hydrogen bomb - Applications of radioactivity in medicine, agriculture, industry and analytical fields – carbon dating.

Unit - II

Carbohydrates: Definition – classification – monosaccharides – properties and uses of glucose and fructose –Haworth structure (glucose only) – conversion of glucose to fructose and vice versa, mutarotation - Disaccharides: Sucrose – structure – distinction between sucrose, glucose and fructose - Polysaccharides: Starch and cellulose (Structure only) – cellulose derivatives.

Unit – III

Stereoisomerism – chiral centre – optical activity of compounds containing one or two chiral centers (lactic and tartaric acid) – R-S notation – enantiomers – diastereoisomers – racemization – resolution - Geometrical isomerism of maleic and fumaric acids - E-Z notation of geometrical isomers.

Unit – IV

Chemotheraphy: Sulpha drugs – sulphadiazine – sulphanilamide –preparation and applications - Antimalarials – chloroquine and plasmoquine - Arsenical drugs: Salvarasan – 606 and neosalvarasan - Antibiotics: Definition – classification – penicillin - amoxicillin – ampicillin – tetracyclin – streptomycin – mode of application – uses only.

Hormones: structure – source – importance of testosterone – progesterone – thyroxin.

Unit – V

Amino acids and proteins: Classification – synthesis – properties of amino acids – action of heat, dipolar ion, iso-electric point, and Ruhemnn's purple - 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.

Reference books

- Essential of physical chemistry - Arun Bahl, B.S. Bahl and G.D. Tuli (revised edition, S. Chand, 2014).
- Principles of physical chemistry - Puri, Sharma and Pathania (revised edition, Vishal pub., 2014).
- Modern Inorganic chemistry - R.D. Madan (revised edition, S.Chand, 2013).
- A Text book of Organic chemistry – Arun Bahl and B.S. Bahl (revised edition, S. Chand, 2014).
- J. Ghosh – Fundamental concepts of Applied Chemistry, S. Chand & Co.

SEMESTER II

PRACTICAL I - VOLUMETRIC ANALYSIS

17UCHA2P	VOLUMETRIC ANALYSIS	Hours 2/Credits 1

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

4. Titrations between a strong acid and strong base.
5. Titrations between a strong acid and weak base.
6. Titrations between a weak acid and strong base.

B. PERMANGANIMETRY

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

C. IODOMETRY (DEMONSTRATION ONLY)

2. Titrations of sodium thiosulphate with potassium permanganate and potassium dichromate.

Distribution of Marks

Maximum marks – 100

Duration of examination: 2 hrs

Internal – 40 marks	
Attendance in the class	20 marks
Model test	10 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	**60 marks**

Error calculation

Error	Marks
2-3%	30
3-4%	25
4-5%	15
> 5%	10

SEMESTER II

Skill Based subject-2 **Part - IV**

17UCHS21	Fundamentals in Chemistry-2	Hours 2/Credits 2

Course Outcome: To acquire knowledge about redox reactions, concepts of volumetric analysis, pH, aliphatic hydrocarbons and colloids.

Unit – I – Oxidation and 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 - $Cr_2O_7^{2-}$ and Fe^{2+} - MnO_4^- and Fe^{2+} - $Cr_2O_7^{2-}$ in acid medium - CrO_4^{2-} and SO_3^{2-}.

Unit – II – Colloids

Colloidal States of matter-various types-classification – a) Solids in liquids: Sols-properties, kinetic, optical and electrical properties-stability of colloids and protective action – Hardy-Schultz law- gold number- hofmeister series – b) Liquids in liquids (emulsions): types of emulsion-emulsifier with an example – c) Liquids in solids (Gels): Classification Thixotropy-Syneresis and inhibition- Applications of colloids

Unit – III – Volumetric Analysis

Definitions of Molarity - Normality - Molality and mole fraction - their calculations - definition and examples for primary and secondary standards - Calculation of equivalent weight of acid, base, oxidizing agent, reducing agent and salt – Principle of Volumetric Analysis, Types of titrations- acid-base – permanganimetry, Dichrometry Argentimetry, Iodometric and Iodimetric titrations.

Unit - IV

pH of solutions – buffer solutions – theory of buffer action – Henderson- Hasselbach equation – Types of indicators- acid-base-Indicators- Adsorption indicators - Colour change of Phenolphthalein and Methyl orange.

Unit – V – Aliphatic Hydrocarbons

Alkanes: General methods of preparation, properties and uses. (CH_4, C_2H_6) - Alkenes: General methods of preparation, properties and uses. ($CH_2=CH_2$, $CH_2=CH-CH_3$), Markonikoff rule and peroxide effect - Alkynes: General methods of preparation, properties and uses, (CH≡CH).

Reference books

- B. S. Bahl and Arun Bahl – Advanced Organic Chemistry.
- I.L. Finar – Organic Chemistry. Vol. I
- P.L. Soni – Organic Chemistry.
- Puri, Sharma and Pathania – Principles of Physical chemistry.
- P.L. Soni, O.P. Dharmarha and U.N. Dash – Textbook of physical chemistry.
- B.S. Bahl, Arun Bahl and G.D. Tuli – Essentials of physical chemistry.
- R.D. Madan – Modern Inorganic chemistry.

SEMESTER - II

Non-Major Elective-2 **Part - IV**

17UCHN21	Drugs and Cosmetics	Hours 2/Credits 2

Course Outcome: To **r**ecognize carbohydrates, drugs and its uses, antibiotics, vitamins and cosmetics.

Unit – I

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

Unit – II

Antibiotics: Definition - uses of Antibiotics - Ampicillin, streptomycin, tetracyclin, Rifomycin, Erythromycin, drug actions and side effects.

Unit – III

Vitamins: Classifications Role of vitamins in body's health – Uses of Vitamins – Antipyretic, Analgesic and anti-inflammatory agents, sulphonamide – Drug actions – uses of sulpha drugs.

Unit – IV

Preparation of Washing Powder, Cleaning Powder, White, Black, Yellow, Rose coloured phenoyls.

Unit – V

Preparation of shampoo, liquid blue, preparation of blue, green and red inks, soap, oil, face powder and pain balm.

Visit to various Industries and submission of report - 5marks (Internal)

Preparation of cosmetics to be demonstrated

1. Washing and Cleaning Powder
2. Phenoyls
3. Inks
4. Shampoo

Reference books

- Albert Burger – Medicinal Chemistry.
- G.R.Chatwal – Medicinal Chemistry.
- S. Lakshmi – Pharmaceutical Chemistry.
- ISI Manuals (Contact DIC).

SEMESTER - III

Core Subject Paper –3 Part - III

17UCHC31	Physical Chemistry – I	Hours 4/Credits 4

Course Outcome: To explore the concepts of physical properties, photochemical reactions, catalysis, adsorption, solid state and equilibrium reactions.

Unit – I – 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. Dipole moment – definition – electrical polarization of molecule – Clausius- Mosotti equation – Debye equation – experimental determination – moment of linkage and groups – various applications.

Unit – II – Photochemistry

Definition of photochemical reactions – comparative study of thermal and photochemical reactions – laws of photochemistry – Grotthus-Draper law – Stark-Einstein law – quantum efficiency and its determination – consequence of light absorption by atoms and molecules – photophysical processes – fluorescence, phosphorescence and other deactivating processes – Jablonski diagram. Photochemical processes – kinetics of photochemical reactions. Gaseous reactions: Hydrogen – halogen reactions (Formation of HCI and HBr and decomposition of HI) – Photochemical equilibrium – flash photolysis – photosensitisation, chemiluminescence - bioluminescence.

Unit – III

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 – BET theory (Elementary idea only) – applications of adsorption - Catalysis - Definition – characteristics – theories of catalysis – promoters and

poisons – enzyme catalysis – mechanism – Michaelis – Menten equation – Derivation – acid – base catalysis and autocatalysis – applications of catalysis.

Unit – IV – Chemical equilibrium

Reversible reactions – nature of chemical equilibrium – law of mass action – equilibrium constant -equilibrium constant in terms of partial pressures – relation between K_p and K_c – application of law of mass action to the following equilibria PCl_5, NH_3 and N_2O_4– Lechatelier's principle – conditions for maximum yield in industrial processes – Haber process of manufacture of ammonia – contact process of manufacture of sulphuric acid – Birkeland - Eyde process of manufacture of nitric acid.

Unit – V – Solid state

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 inter planar spacing in crystal systems - X-ray diffraction – Bragg's equation – experimental method of determination of interplanar spacing – X-ray spectrophotometer –Debye–Scherrer's method. Types of crystals – ionic, molecular, covalent, and metallic crystals - Ionic crystals: Analysis of NaCℓ, KCℓ, CsCℓ – determination of Avogadro number - Molecular crystals – Water and ammonia - Covalent crystals – Diamond and graphite - Metallic crystals – Metallic bond in metals - Conductors, insulators and semiconductors – Frenkel and Schottky defects.

Reference books

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

SEMESTER III

PRACTICAL – II

17UCHC4P	VOLUMETRIC ANALYSIS	Hours 2/Credits 2

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

1) Estimation of Na_2CO_3
2) Estimation of NaOH / KOH
3) 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

Maximum marks - 100

Duration of examination: 3hrs

Internal – 40 marks	
Performance in the class	30 marks
Observation notebook	10 marks
Total	**40 marks**
External – 60 marks	
Viva voce	10 marks
Record Notebook	10 marks
Procedure writing	10 marks
Volumetric estimation	30 marks
TOTAL	**60 marks**

Error calculation

Error	Marks
< 2%	30
2-3%	25
3-4%	20
4-5%	15
> 5%	10

SEMESTER - III

Ancillary Chemistry paper – 1 **Part - III**

17UCHA11	**Ancillary Chemistry Paper -I (Organic, Inorganic And Physical Chemistry)**	**Hours 4/Credits 4**

Course Outcome: To study about the properties of hydrogen, oxides, water, electrophiles, nucleophiles, types of reactions, gaseous state, hybridization and MO theory.

Unit – I

Hydrogen: Isotopes of hydrogen – preparation, properties and uses of heavy hydrogen – hydrides – definition – classification – examples - Oxides – Definition – classification – examples. 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.

Unit – II

Detection of nitrogen and halogens in organic compounds – empirical formula – molecular formula – structural formula – simple calculation - 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 carbocation, carbonium ion and free radicals - Nucleophiles – Electrophiles : Definition, types and examples - Type of reactions: Substitution – addition – elimination – rearrangement and polymerization – illustration with examples.

Unit – III

Gaseous state – Postulates of kinetic theory of gases – deducing the basic gas laws – Boyle's law, Charles law, Avogadro's law and Ideal gas equation - Deviation of real gases from ideal behavior – reasons for deviation – Derivation of van der Waals gas equation – explanation of behavior of real gases on the basis of van der Waals gas equation - Critical constants – definition only –Joule-Thomson effect – Inversion temperature - Liquefaction of gases – modern methods.

Unit - IV

Bonding : Orbitals – shapes of s and p orbitals – principle of hybridization – sp, sp^2 and sp^3 hybridisation – methane, ethylene and acetylene – VSEPR theory - $BeC\ell_2$, BF_3, CH_4, $PC\ell_5$, SF_6, IF_7, H_2O and NH_3 - 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 states 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 - Applications of colloids.

Reference books

- Essential of physical chemistry - Arun Bahl, B.S. Bahl and G.D. Tuli (revised edition, S. Chand, 2014).
- Principles of physical chemistry - Puri, Sharma and Pathania (revised edition, Vishal pub., 2014).
- Modern Inorganic chemistry - R.D. Madan (revised edition, S. Chand, 2013).
- A Text book of Organic chemistry – Arun Bahl, B.S. Bahl (revised edition, S. Chand, 2014).

SEMESTER III

PRACTICAL I - VOLUMETRIC ANALYSIS

17UCHA2P	VOLUMETRIC ANALYSIS	Hours 2/Credits 1

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

7. Titrations between a strong acid and strong base.
8. Titrations between a strong acid and weak base.
9. Titrations between a weak acid and strong base.

B. PERMANGANIMETRY

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

C. IODOMETRY (DEMONSTRATION ONLY)

3. Titrations of sodium thiosulphate with potassium permanganate and potassium dichromate.

Distribution of Marks

Maximum marks – 100

Duration of examination: 2 hrs

Internal – 40 marks	
Attendance in the class	20 marks
Model test	10 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	**60 marks**

Error calculation

Error	Marks
2-3%	30
3-4%	25
4-5%	15
> 5%	10

SEMESTER - III

Part-III

17UCHA31	Ancillary Chemistry Paper - III (Organic, Inorganic And Physical Chemistry)	Hours 4/Credits 4

Course Outcome: To comprehend adsorption, catalysis, polymers, photochemistry, coordination compounds and fertilizers.

Unit – I

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

Unit – II

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

Polymers : Definition – classification of polymers – properties of polymers – addition and condensation polymerization reactions with examples – natural rubber – isoprene Unit – vulcanization of rubber – preparation and applications 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 – Jablonski diagram – fluorescence – phosphorescence – photosensitization – chemiluminescence – bioluminescence – applications of photochemistry.

Unit – IV

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

Unit – V

Fertilizers: plant Nutrients -Role of NPK in plant growth-classification of fertilizers-natural and chemical fertilizers-urea-super phosphate –triple super phosphate -potassium nitrate-potassium chloride -ammonium nitrate -calcium ammonium nitrate (CAN) and complex fertilizer -fertilizer industries in India.

Reference books

- Essential of physical chemistry - Arun Bahl, B.S. Bahl and G.D. Tuli (revised edition, S. Chand, 2014).
- Principles of physical chemistry - Puri, Sharma and Pathania (revised edition, Vishal pub., 2014).
- Modern Inorganic chemistry - R.D. Madan (revised edition, S. Chand, 2013).
- A Text book of Organic chemistry – Arun Bahl and B.S. Bahl (revised edition, S. Chand, 2014).
- J. Ghosh – Fundamental concepts of Applied Chemistry, S. Chand & Co.

SEMESTER III
PRACTICAL II - ORGANIC ANALYSIS

17UCHA4P	Organic Analysis	Hours 2/Credits 1

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

Maximum marks – 100

Duration of examination: 2 hrs

Internal – 40 marks	
Attendance in the class	20 marks
Observation notebook	10 marks
Model test	10 marks
Total	**40 marks**

External – 60 marks	
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	**60 marks**

SEMESTER - IV

Core Subject Paper – 4 **Part - III**

17UCHC41	Inorganic Chemistry	Hours 4/Credits 4

Course Outcome: To construe the importance and applications of coordination compounds, applications of radioactive isotopes, principles of atom bomb, hydrogen bomb and the isolation of metals from their ores.

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 – 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 – In medicine, agriculture, industry and analytical fields – carbon dating.

Unit – III – Coordination 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 co-ordination complexes- Limitations of VB theory - Crystal field theory – Octahedral, tetrahedral and square planar complexes - Modified CFT – ligand field theory.

Unit – IV – 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 – V – Bioinorganic chemistry

Metalloporphyrins – Chlorophyll – structure and work function (photo system I & II) - Vitamin B_{12} – structural features only - Myoglobin and hemoglobin – Structure - Their role in biological systems - Hill constant, co-operativity effect, Bohr Effect - Explanation for co-operativity effect in haemoglobin - Role of Na^+, K^+, $Ca^{2+}$and Mg^{2+} ions in biological system.

Reference books

- PL. Soni – Textbook of Inorganic chemistry.
- Puri, Sharma and Kalia – Principles of Inorganic Chemistry.
- R. D. Madan – Modern Inorganic Chemistry.
- Arnikar – Nuclear chemistry.
- Chatwal and Bhagi – Bio-inorganic Chemistry.

SEMESTER IV

PRACTICAL – II

17UCHC4P	VOLUMETRIC ANALYSIS	Hours 2/Credits 2

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

4) Estimation of Na_2CO_3
5) Estimation of NaOH / KOH
6) Estimation of oxalic acid.

II. REDOX TITRATIONS

a. Permanganimetry

4) Estimation of ferrous ion
5) Estimation of oxalic acid
6) Estimation of calcium (direct method)

b. Dichrometry

3) Estimation of ferrous ion
4) Estimation of ferric ion using external indicator

III. IODOMETRY AND IODIMETRY

5) Estimation of potassium dichromate
6) Estimation of potassium permanganate
7) Estimation of copper
8) Estimation of arsenious oxide.

IV. ARGENTIMETRY

2) Estimation of potassium chloride.

Distribution of Marks

Maximum marks - 100

Duration of examination: 3hrs

Internal – 40 marks	
Performance in the class	30 marks
Observation notebook	10 marks
Total	**40 marks**
External – 60 marks	
Viva voce	10 marks
Record Notebook	10 marks
Procedure writing	10 marks
Volumetric estimation	30 marks
TOTAL	**60 marks**

Error calculation

Error	Marks
< 2%	30
2-3%	25
3-4%	20
4-5%	15
> 5%	10

SEMESTER - IV

Ancillary Chemistry paper – 2 **Part - III**

17UCHA21	**Ancillary Chemistry Paper -II (Organic And Physical Chemistry)**	**Hours 4/Credits 4**

Course Outcome: To gain knowledge about nuclear chemistry, carbohydrates, stereoisomerism, chemotherapy, dyes, aminoacids and proteins.

Unit – I - Nuclear Chemistry

Composition of the nucleus – nuclear forces – mass defect – binding energy – nuclear stability - Soddy's group displacement law – illustration - Nuclear fission: Definition – application of fission – principle of atom bomb - Nuclear fusion: Definition – emission of energy – Stellar energy – hydrogen bomb - Applications of radioactivity in medicine, agriculture, industry and analytical fields – carbon dating.

Unit - II

Carbohydrates: Definition – classification – monosaccharides – properties and uses of glucose and fructose –Haworth structure (glucose only) – conversion of glucose to fructose and vice versa, mutarotation - Disaccharides: Sucrose – structure – distinction between sucrose, glucose and fructose - Polysaccharides: Starch and cellulose (Structure only) – cellulose derivatives.

Unit – III

Stereoisomerism – chiral centre – optical activity of compounds containing one or two chiral centers (lactic and tartaric acid) – R-S notation – enantiomers – diastereoisomers – racemization – resolution - Geometrical isomerism of maleic and fumaric acids - E-Z notation of geometrical isomers.

Unit – IV

Chemotheraphy: Sulpha drugs – sulphadiazine – sulphanilamide –preparation and applications - Antimalarials – chloroquine and plasmoquine - Arsenical drugs: Salvarasan – 606 and neosalvarasan - Antibiotics: Definition – classification – penicillin - amoxicillin – ampicillin – tetracyclin – streptomycin – mode of application – uses only.

Hormones: structure – source – importance of testosterone – progesterone – thyroxin.

Unit – V

Amino acids and proteins: Classification – synthesis – properties of amino acids – action of heat, dipolar ion, iso-electric point, and Ruhemnn's purple - 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.

Reference books

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- Principles of physical chemistry - Puri, Sharma and Pathania (revised edition, Vishal pub., 2014).
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- A Text book of Organic chemistry – Arun Bahl and B.S. Bahl (revised edition, S. Chand, 2014).
- J. Ghosh – Fundamental concepts of Applied Chemistry, S. Chand & Co.

SEMESTER IV

PRACTICAL I - VOLUMETRIC ANALYSIS

17UCHA2P	VOLUMETRIC ANALYSIS	Hours 2/Credits 1

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

10. Titrations between a strong acid and strong base.
11. Titrations between a strong acid and weak base.
12. Titrations between a weak acid and strong base.

B. PERMANGANIMETRY

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

C. IODOMETRY (DEMONSTRATION ONLY)

4. Titrations of sodium thiosulphate with potassium permanganate and potassium dichromate.

Distribution of Marks

Maximum marks – 100

Duration of examination: 2 hrs

Internal – 40 marks	
Attendance in the class	20 marks
Model test	10 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	**60 marks**

Error calculation

Error	Marks
2-3%	30
3-4%	25
4-5%	15
> 5%	10

SEMESTER - IV

Part-III

17UCHA41	**Ancillary Chemistry Paper- IV (Organic And Physical Chemistry)**	**Hours 4/Credits 4**

Course Outcome: To understand heterocyclic compounds, alkaloids, vitamins, antibiotics, chemical kinetics, chromatography, chemotherapy and electrochemistry.

Unit – I

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

Unit – II

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

Vitamins - Classification and biological functions of vitamins A, B_6, B_{12}, C, D, E and K (Structural elucidation not required)

Unit – III

Chemical kinetics: Rate of reaction-rate law and rate constant – order and molecularity of a reaction – zero order – first order- second order reaction – examples. First order rate equation and half life period – derivation–Pseudo first order reactions- Carbon dating.

Unit – IV

Chromatographic technique: Principle – Classification - Adsorption and partition Chromatography - Thin layer chromatography – Column chromatography (adsorption) - ion exchange chromatography – Paper Chromatography – Gas-solid and Gas-liquid chromatography- Applications of each type.

Unit–V

Electrochemistry:

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 – applications.

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

Reference books

- Essential of physical chemistry - Arun Bahl, B.S. Bahl and G.D. Tuli (revised edition, S.Chand, 2014).
- Principles of physical chemistry - Puri, Sharma and Pathania (revised edition, Vishal pub., 2014).
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- A Text book of Organic chemistry – Arun Bahl, B.S. Bahl (revised edition, S.Chand, 2014).
- J. Ghosh – Fundamental concepts of Applied Chemistry, S. Chand & Co.

PRACTICAL II - ORGANIC ANALYSIS

17UCHA4P	Organic Analysis	Hours 2/Credits 1

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

Maximum marks – 100

Duration of examination: 2 hrs

Internal – 40 marks	
Attendance in the class	20 marks
Observation notebook	10 marks
Model test	10 marks
Total	**40 marks**

External – 60 marks	
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	**60 marks**

SEMESTER - V

Core subject paper –5 **Part - III**

17UCHC51	Organic chemistry	Hours 6 / Credits 6

Course Outcome: To acquire knowledge about aromatic hydrocarbons, halogen, nitro, amino compounds and stereoisomerism.

Unit – I – Aromatic Compounds - I

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

Unit – II – Aromatic Compounds – II

Aromatic hydrocarbons – Preparation, Properties and uses of toluene, Xylene and mesitylene - Aromatic halogen compounds: Preparation, properties and uses of bromobenzene and benzyl bromide – reactivity of aryl halides, distinction between nuclear and side chain halogenated derivatives - Aromatic nitro compounds: preparation and properties of nitrotoluenes and nitrobenzene - 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 phenylenediamines – Preparation and synthetic applications of benzene diazonium chloride.

Unit – III – Aromatic compounds – III

Aromatic aldehydes: Benzaldehyde – Mechanism of Cannizaro, Perkins, Claisen, Knoevenagel reaction and benzoin condensation - Preparation & Properties of cinnamaldehyde & vanillin - Phenols: Acidity of phenols – effect of substituents on the acidity of phenol, mechanism of Kolb's reaction - Isolated systems: Preparation and properties of diphenyl, benzidine, diphenic acid, diphenyl methane, triphenyl methane and stilbene.

Unit – IV – Aromatic compounds - IV

Effect of substituents on acidic character - Substituted acids: Preparation, Properties of salicylic acid and anthranilic acid - Aromatic sulphonic acids: preparation, Properties and uses of benzene sulphonic acid, saccharin, chloramine–T and dichloramine–T - Condensed systems: Preparation, properties, uses and structure of Naphthalene, Naphthylamines, Naphthols, Naphthaquinones, anthracene, anthraquinone, alizarin and phenanthrene.

Unit – V – Stereoisomerism

Geometrical isomerism of maleic and fumaric acids and aldoximes and ketoximes – determination of configuration of geometrical isomers – E - Z notations - Optical isomerism: optical activity – specific rotation and polarimetric determination-definition of optical isomerism- elements of symmetry – optical activity of compounds containing asymmetric carbon atom – lactic and tartaric acids – enantiomers and diastereomers – racemic and meso forms – racemization and resolution of racemic mixtures – Walden inversion – asymmetric synthesis - Chirality – specifications of absolute configuration by R-S notations - Optical activity of compounds without asymmetric carbon atoms: allenes, spiranes, and biphenyl compounds - Optical activity of elements other than carbon atoms – quatenary ammonium compounds and tertiary amine oxides.

Reference books

- P. L. Soni & Chawla – Text book of Organic Chemistry (S. Chand - 2012).
- B. S. Bahl & Arun Bahl – Advanced Organic Chemistry (S. Chand - 2009).
- I. L. Finar – Organic Chemistry (Vol. I) – Pearson Education – VI Edition.

SEMESTER - V

Elective Paper - I **Part - III**

17UCHE51	Physical Chemistry and Computers in chemistry	Hours 6 / Credits 6

Course Outcome: To understand phase rule, order of reactions, thermodynamics and applications of computer in chemistry.

Unit – I – 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 – 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.

Unit – II – Thermodynamics-II

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. 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 relationship – 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.

Applications 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 - 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 of 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.

Unit – III – 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 and 5) Beer-Lamberts law.

Unit – IV – Chemical Kinetics

First, Second, third and zero order reactions – examples – rate equations – Derivation of rate equations - half- life period- determination of order of reactions - 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 – relaxation method.

Unit – V – Phase Rule

Definition of terms – Gibbs phase rule –derivation- one component system – water and sulphur – polymorphism – two component system – reduced phase rule – simple eutectic system – Pb-Ag system - Completely miscible liquid systems: ideal and non-ideal systems – Raoult's law and Konowaloff's rule- distillation of homogenous binary liquid mixture- theory of fractional distillation and azeotropic distillation.

Partially miscible liquid system –phenol-water system- CST – completely immiscible liquid system- influence of impurities on CST and applications - Immiscible liquid system: theory of steam distillation and its applications -Salt hydrates: Efflorescence, Deliquescence and hygroscopic –dehydration of copper sulphate crystals.

Reference books

- Puri, Sharma and Pathania – Principles of Physical chemistry, Vishal Publishing Co. 2012 edition.
- P.L. Soni, O.P. Dharmarha and U.N. Dash – Textbook of physical chemistry, Sultan Chand and sons, 2012 edition.
- B.S. Bahl, Arun Bahl and G.D. Tuli – Essentials of physical chemistry, S. Chand and Company Pvt. Ltd.
- K.V Raman – Computers in Chemistry.
- E. Balagurusamy – Programming in ANSI C.

SEMESTER - V

Elective Paper -II **Part - III**

17UCHE52	Polymer Chemistry	Hours 6 / Credits 6

Course Outcome: To gain knowledge about polymers, types, properties, uses and molecular weight determination.

Unit-I

Basic concepts: Monomer, polymerization, degree of polymerization, repeat units. Classification of Polymers-addition and condensation polymers, natural and synthetic, based on structure, inorganic and organic, thermoplastic and thermosetting resin.

Structure of polymers- linear, branched and cross linked. Homo & hetro copolymers. Block copolymers &graft copolymers. Stereochemistry of polymers-Isotactic, Syndiotactic and Atactic.

Unit-II

General methods of preparation of polymers - Polymerization through functional groups, multiple bonds and ring opening and Coordination polymerization.

Properties of polymers: The crystalline melting point. The glassy state and glass transition temperature

Unit-III

Molecular weight of polymers - Number average molecular weight and weight average molecular weight - Determination of molecular weight by Viscosity and Osmometry methods.

Polymer processing- calendaring, Die casting, blow moulding, and Wet spinning.

Unit-IV

Preparation, properties and uses of -polythene, PVC, polypropylene, polystyrene, Dacron, nylon, polymethyl methacrylate and Teflon.

Unit-V

Plastics and Resins Definitions - Thermoplastic and thermo setting resins - Constituents of plastic-fillers, dyes, pigments, plasticizers, Lubricants and catalysts - Uses of thermoplastic resins and thermo setting resins.

Reference books

- V. R. Gowrikar, N.V.Viswanathan : Polymer Science- Wiley Eastern Limited ,New
- Delhi. 1986.
- R.B. Seymour, Introduction to Polymer Chemistry, MC Craw Hill, New York 1971.
- S.S. Dara, A Text Book in Engineering Chemistry, S.Chand & Company Ltd, New Delhi. Third Edition, 1992.

SEMESTER V

PRACTICAL – III

17UCHC6P	GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATION	Hours 3/Credits 5

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

Maximum 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	
Viva voce	10 marks
Record Notebook	10 marks
Organic preparation Procedure Crude sample Recrystallised sample	**10 marks** 2 marks 6 marks 2 marks
Gravimetric Estimation Procedure Estimation	**30 marks** 10 marks 20 marks
TOTAL	**60 marks**

Error calculation

Error	Marks
< 2%	20
2-3%	18
3-4%	16
4-5%	14
> 5%	8

SEMESTER V

PRACTICAL – IV

17UCHC6Q	ORGANIC ANALYSIS AND ESTIMATION	Hours 3/Credits 5

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

Maximum 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	
Viva voce	10 marks
Record Notebook	10 marks
Organic Estimation Procedure Estimation	**20 marks** 5 marks 15 marks
Organic analysis Preliminary reaction Elements present Aliphatic or aromatic Saturated / Unsaturated Functional group Derivative	**20 marks** 2 marks 4 marks 3 marks 3 marks 6 marks 2 marks
TOTAL	**60 marks**

Error calculation

Error	Marks
< 3%	15
3-4%	13
4-5%	10
> 5%	8

SEMESTER V

PRACTICAL – V

17UCHC6R	PHYSICAL CHEMISTRY PRACTICAL	Hours 2/Credits 4

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

$$KI + I_2 \rightleftharpoons KI_3,$$

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

Maximum 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	
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	**60 marks**

SEMESTER V

Part-III

17UCHA31	Ancillary Chemistry Paper - III (Organic, Inorganic And Physical Chemistry)	Hours 4/Credits 4

Course Outcome: To comprehend adsorption, catalysis, polymers, photochemistry, coordination compounds and fertilizers.

Unit – I

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

Unit – II

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

Polymers : Definition – classification of polymers – properties of polymers – addition and condensation polymerization reactions with examples – natural rubber – isoprene Unit – vulcanization of rubber – preparation and applications 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 – Jablonski diagram – fluorescence – phosphorescence – photosensitization – chemiluminescence – bioluminescence – applications of photochemistry.

Unit – IV

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

Unit – V

Fertilizers: plant Nutrients -Role of NPK in plant growth-classification of fertilizers-natural and chemical fertilizers-urea-super phosphate –triple super phosphate -potassium nitrate-potassium chloride -ammonium nitrate -calcium ammonium nitrate (CAN) and complex fertilizer -fertilizer industries in India.

Reference books

- Essential of physical chemistry - Arun Bahl, B.S. Bahl and G.D. Tuli (revised edition, S. Chand, 2014).
- Principles of physical chemistry - Puri, Sharma and Pathania (revised edition, Vishal pub., 2014).
- Modern Inorganic chemistry - R.D. Madan (revised edition, S. Chand, 2013).
- A Text book of Organic chemistry – Arun Bahl and B.S. Bahl (revised edition, S. Chand, 2014).
- J. Ghosh – Fundamental concepts of Applied Chemistry, S. Chand & Co.

SEMESTER - V

PRACTICAL II - ORGANIC ANALYSIS

17UCHA4P	Organic Analysis	Hours 2/Credits 1

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

Maximum marks – 100

Duration of examination: 2 hrs

Internal – 40 marks	
Attendance in the class	20 marks
Observation notebook	10 marks
Model test	10 marks
Total	**40 marks**

External – 60 marks	
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	**60 marks**

SEMESTER - V

Part-IV

17UCHS51	ENVIRONMENTAL STUDIES	Hours 2/Credits 2

COURSE OUTCOMES:

CO1: Demonstrate basic knowledge about Ecology, Living Organisms and its allied problems.

CO2: Acquire skills to help individuals in identifying and solving problems related to pollution.

CO3: Motivate public to understand the values of Conservation of Biodiversity.

UNIT – I: Earth and its Environment

a) Earth- formation and Evolution of Earth over time - structure of Earth and its components – Atmosphere, Lithosphere, Hydrosphere and Biosphere.

b) Resources – renewable and non renewable resources

UNIT – II: Ecology and ecosystem concepts

a) Ecology – definition - Ecosystem : Definition – structure and function – energy flow – food chain and Food web – one example for an ecosystem

b) Biogeochemical cycles – Nitrogen, carbon, Phosphorous and Water

UNIT – III: Biodiversity of India

a) Introduction – definition – Values of Biodiversity _ Threat to Biodiversity –Conservation of Biodiversity

b) Biodiversity of India – as a megadiversity nation – bio-geographical distribution – Hot spots of biodiversity – National Biodiversity conservation Board and its function

UNIT – IV: Pollution and Global issues

a) Definition, causes, effects and control measures of Air, Water, Soil, Marine, Noise, Thermal and Nuclear pollution

b) Global issues: Global Warming and Ozone layer Depletion

UNIT – V: Development and Disaster Management

a) Sustainable Development – Sustainable Agriculture – Organic farming, Irrigation – Water harvesting and Waste recycling – Cyber waste and management

b) Disaster Management – Flood and Drought – Earthquake and Tsunami – Landslides and Avalanches – Cyclones and Hurricanes –Precautions, Warnings, Rescue and Rehabilitation.

TEXT BOOK:

1.Environmental studies – Published by Madurai Kamaraj University.

REFERENCES:

1. Environmental Studies by Dr.N.Arumugam&Prof.V.Kumarasan, Saras Publication-2009.

2. Environmental Studies by Bharathiar University, Coimbatore – 2004.

SEMESTER - V

Skill based subject – 3 **Part-IV**

17UCHS51	Organic and Pharmaceutical Chemistry	Hours 2/Credits 2

Course Outcome: To ascertain fundamental concepts in carbohydrates, hormones, vitamins, chemotherapy, antibiotics and anaesthetics.

Unit – I

Carbohydrate: definition- classification- monosaccharides- preparation and properties of glucose and fructose- Haworth structure (glucose only) - mutarotation- epimerization- difference between glucose and fructose – conversion of glucose into fructose and vice versa.

Unit – II

Disaccharides: structure and properties of sucrose- inversion of sucrose- difference between monosaccharides and disaccharides – Polysaccharides: structure of starch and cellulose- uses of cellulose.

Unit – III

Anti-inflammatory, 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) - Synthetic drugs and its therapeutic function of paracetamol- Aspirin- naproxen- Ibuprofen - Antibiotics: penicillin- ampicillin- amoxicillin- tetracycline - chloramphenicol -ciprofloxacin- 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 – IV

Chemotherapy and applications of a few drugs (Elementary study)

Sulphadrugs -Sulphadiazine, prontosil and prontosil-S – Antimalarials - Quinine and its derivatives - Arsenical drugs -Salvarasan-606 - Neosalvarasan - Antibiotics: Definition, penicillin- tetracycline (Auromycin and Tetramycin) - Streptomycin and Chloromyceitin - drug action and uses.

Hormones and Vitamins

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

Unit – V

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

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

Reference books

- Varley – Clinical Bio-Chemistry, Sulthan Chand, 2005.
- Mukherjee – Text Book of Medical Laboratory Technology, Volumes, I, II &III.
- B. S. Bahl and Arun Bahl – Advanced Organic Chemistry (S. Chand & Company Ltd. – 2009) .
- J. Ghosh – Fundamental concepts of Applied Chemistry, S. Chand & Co.

SEMESTER - VI

Core subject paper – 7 **Part - III**

17UCHC61	Organic and Analytical chemistry	Hours 6/Credits 6

Course Outcome: To deliberate the applications of spectroscopy, analytical chemistry and basic ideas of natural products.

Unit – I - Principles and applications of spectroscopy

UV: Introduction: Type of electronic transitions – absorption law – Lamberts-Beer's law – bathochromic shift and hypsochromic shift – hyperchromic and hypochromic effect – applications of UV to organic compounds – Woodward-Fisher rule – calculation of λ_{max} for dienes - IR: Introduction: Instrumentation – Mode of vibration – Overtone and combination bands – applications of IR to organic compounds – finger print region – effect of hydrogen bond. NMR: Introduction – chemical shift – shielding and deshielding effects – factors influencing chemical shift – solvent used – splitting of signals – coupling constants –NMR spectra of ethanol and anisole - Simple Problems involving the application of UV, IR and $_1H^1$ NMR spectroscopy.

Unit – II

Terpenes - Introduction, Classification, Occurrence and isolation – general properties – isoprene rule – general methods of determining structure – synthesis, properties and structural elucidation of citral, geraniol, terpeniol, menthol and camphor.

Proteins and Nucleic acids - Definition – classification of proteins – color reactions of proteins – primary, Secondary, tertiary and quaternary structure of proteins (An elementary idea only) - Nucleic acids – nucleosides – nucleotides – RNA and DNA (General structure).

Unit – III

Alicyclic compounds: General methods of preparation and properties of cycloparaffins – Baeyer's strain theory and its modification - Conformational analysis: Difference between configuration and conformation - Fischer, Sawhorse and Newmann projection formulae – Conformational analysis of ethane, n-butane, 1, 2-dichloroethane, cyclohexane and monosubstitued cyclohexane - Civetone and Muscone: Structure only (no Structural elucidation).

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

Unit – IV

Heterocyclic compounds: Synthesis and properties of pyrrole, pyridine, quinoline and isoquinine - Alkaloids: Definition- Occurrence and extraction of alkaloids – general methods for determining the structure of alkaloids – classification of alkaloids – structure and synthesis of following alkaloids – coniine, piperine, nicotine and papavarine.

Molecular rearrangements: Detailed mechanism of the following: Pinacol-pinacolone, Hofmann, curtius, benzyl – benzilic acid, claisen, benzidine, Beckmann, Fries and Wagner – Meerwein rearrangements.

Unit – V – Analytical Chemistry

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.

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.

Reference books

- P. L. Soni and Chawla – Text book of Organic Chemistry (S. Chand – 2012).
- B. S. Bahl and Arun Bahl – Advanced Organic Chemistry (S. Chand – 2009).
- I.L. Finar – Organic Chemistry (Volume – II) Pearson Education – VI Edition.
- Y. R. Sharma – Elementary Organic Spectroscopy (S. Chand & Company Ltd. – 2009).
- R. Gopalan, P. S. Subramanian and K. Rengarajan – Elements of Analytical Chemistry.

VI SEMESTER

Elective Paper - III **Part - III**

17UCHE61	Physical Chemistry II	Hours 6 / Credits 6

Course Outcome: To interpret about electrochemistry, ionic equilibrium, group theory and molecular spectroscopy.

Unit – I – Electrochemistry -I

Introduction – definition and determination of specific, equivalent and molecular conductance – variation of equivalent conductance with dilution - Strong and weak electrolytes – anomaly of strong electrolytes – Debye-Huckel- Onsager equation (no derivation) - Kohlrausch's law of ionic mobilities and its applications – absolute velocity of ions and its determination – transport number of ions and their determinations.

Ionic equilibrium

Hydrolysis of salts – types of salts – degree of hydrolysis – hydrolysis constant – relation between hydrolysis constant and dissociation constant for different types of salts undergoing hydrolysis – experimental determination of degree of hydrolysis – electrical conductance method and indirect method.

Unit – II - Electrochemistry-II

Concepts of electrochemical cell – cell diagram and terminology – conventions regarding signs of cell e.m.f. – calculation of cell emf from single electrode potential – standard emf of the cell – Nernst equation derivation - Reversible and irreversible cells – thermodynamics and electromotive force – calculation of ΔG, ΔH, ΔS and K for cell reactions - Single electrode potential and cell emf measurement of single electrode potential – types of electrodes – reference electrodes – standard electrode potential – electrochemical series – experimental determination of cell emf – Weston cadmium cell.

Types of electrochemical cells - chemicals cells with and without transference – examples – liquid junction potential – salt bridge – Concentration cells – definition – types of concentration cells – examples, emf of electrolyte concentration cells with and without transference.

Unit – III - Electrochemistry-III

Commercial cells - primary and secondary cells – dry cell – lead storage cell – Ni-Cd cell – fuel cell – H_2O_2 cell - Applications of emf measurements - Determination of solubility and solubility products of sparingly soluble salt - Determination of pH using hydrogen electrode, glass electrode and quinhydrone electrode - Determination of transport number- Hittorff's method - Potentiometric titrations – acid – base, redox and precipitation titrations.

Unit – IV - 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 – V – Molecular Spectroscopy

Introduction – electromagnetic radiation – different regions – absorption spectroscopy molecular spectra – types of molecular spectra - Rotational spectra of diatomic molecules – rigid rotator – derivation for energy and frequency of transition - selection rule – determination of moment of inertia and bond length – intensities of spectral lines.

Vibrational spectra – IR spectra of diatomic molecules – Hooke's law – simple harmonic oscillator - force constant – selection rule – derivation for energy and frequency of transition – vibrational energy level diagram – anharmonic oscillator – applications - force constant determination - Modes of vibration in polyatomic molecules – vibrational spectra of H_2O and CO_2 -Rotational vibrational spectra of diatomic molecules. Raman spectra – Raman effect – stokes and anti stokes lines – comparison between IR and Raman spectra – applications of Raman spectra - Electronic spectra – Franck-Condon principle, Born Oppenheimer approximation - types of transitions with examples.

Reference books

- Puri, Sharma and Pathania – Principles of Physical chemistry, Vishal Publishing Co. 2012 edition.
- P.L. Soni, O.P. Dharmarha and U.N. Dash – Textbook of physical chemistry, Sultan Chand and sons, 2012 edition.
- B.S. Bahl, Arun Bahl and G.D. Tuli – Essentials of physical chemistry, S. Chand and Company Pvt. Ltd.
- V. Ramakrishanan and M.S. Gopinathan – Group Theory in Chemistry, Vishal Publishing Co, 2012 edition.

VI SEMESTER

Elective Paper - III **Part - III**

17UCHE62	Green Chemistry and Nanotechnology	Hours 6 / Credits 6

Course Outcome: To understand green chemistry, principles, nanomaterials, its properties, preparations and applications.

Unit - I Green Chemistry

Green Chemistry- Principles & Greener Reactions- Definition, need of green chemistry, Twelve basic principles of green chemistry- Planning a green synthesis in a chemical laboratory- Solvent-less reactions, Selection of appropriate solvent.

Unit - II

Use of microwaves- Fundamentals of closed-vessel heating and sonication - Water as green solvent- reactions in ionic-liquid, Solid support organic synthesis, Phase transfer catalyst (PTC) (Simple treatment only).

Unit - III

Fundamentals of nanoscience and nanotechnology

Historical perspectives (ancient, medieval and modern periods) in nanoscience and nanotechnology; terms and definitions; scale of materials: macro, micro and nanoscale; size dependent properties of materials: surface and volume, surface energy, band gap in metals and semiconductors (bulk vs nano), confinement and delocalization dimensions of excitons and quantum nanostructures; classification of nanomaterials; importance of nanoscience.

Unit - IV

Preparation of Nano structured materials- Bottom up and Top down Approaches- Methods of preparation of nanomaterial - Plasma arching, Chemical vapour deposition, Electro deposition, Sol-gel synthesis, Ball-milling, Chemical reduction.

Unit - V

Fullerenes, Carbon nanotubes, Nano rods, nano wires, quantum dots and nanocomposites - properties of nano materials – Plasmon resonance.

Applications of nanomaterials - Use of natural nanoparticles (elementary treatment only)- Catalysis, Environmental and Biomedical (Drug delivery) applications.

References

- V.K. Ahluwalia and Kidwali, New trends in Green Chemistry, 2nd edition, Anamaya publishers.
- R. Sanghi and M.M. Srivastava, Green Chemistry, Narosa publishing House.
- P. Poole, Introduction to nanotechnology. John Wiley and sons (asia) pvt. Ltd., 2010. New Delhi.
- T. Pradeep, Nano: the essentials, understanding nanoscience and nanotechnology, Tata Mcgraw-hill publishing company ltd., 2007. New Delhi.

SEMESTER VI

PRACTICAL – III

17UCHC6P	GRAVIMETRIC ANALYSIS AND ORGANIC PREPARATION	Hours 3/Credits 5

I. GRAVIMETRIC ANALYSIS

6. Estimation of lead as lead chromate
7. Estimation of barium as barium chromate
8. Estimation of calcium as calcium oxalate monohydrate
9. Estimation of copper as cuprous thiocyanate
10. Estimation of nickel as NiDMG.

II. ORGANIC PREPARATION / SEPARATION

7. Nitration
   a. m-dinitrobenzene from nitrobenzene
   b. Picric acid from phenol
8. Bromination: p-bromoacetanilide from acetanilide
9. Hydrolysis: Aromatic acid from (a) an ester (b) an amide
10. Oxidation: Benzoic acid from benzaldehyde.
11. Benzoylation : (a) Amine (b) phenols
12. 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

Maximum 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	
Viva voce	10 marks
Record Notebook	10 marks
Organic preparation Procedure Crude sample Recrystallised sample	**10 marks** 2 marks 6 marks 2 marks
Gravimetric Estimation Procedure Estimation	**30 marks** 10 marks 20 marks
TOTAL	**60 marks**

Error calculation

Error	Marks
< 2%	20
2-3%	18
3-4%	16
4-5%	14
> 5%	8

SEMESTER VI
PRACTICAL – IV

17UCHC6Q	ORGANIC ESTIMATION AND ORGANIC ANALYSIS	Hours 3/Credits 5

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

4) Estimation of phenol
5) Estimation of aniline
6) Estimation of glucose.

Distribution of Marks

Maximum 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	
Viva voce	10 marks
Record Notebook	10 marks
Organic Estimation Procedure Estimation	**20 marks** 5 marks 15 marks
Organic analysis Preliminary reaction Elements present Aliphatic or aromatic Saturated / Unsaturated Functional group Derivative	**20 marks** 2 marks 4 marks 3 marks 3 marks 6 marks 2 marks
TOTAL	**60 marks**

Error calculation

Error	Marks
< 3%	15
3-4%	13
4-5%	10
> 5%	8

SEMESTER VI
PRACTICAL – V

17UCHC6R	PHYSICAL CHEMISTRY PRACTICAL	Hours 2/Credits 4

1. Determination of molecular weight by

c. Transition temperature method – sodium thiosulphate pentahydrate, strontium chloride hexahydrate and sodium acetate trihydrate.

d. Cryoscopic method – Rast method – camphor and naphthalene.

2. Phase diagram involving

c. Simple eutectic and

d. 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

$$KI + I_2 \rightleftharpoons KI_3,$$

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

iii) Determination of cell constant of the cell and equivalent conductance of solution.

iv)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

Maximum 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	
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	**60 marks**

VI SEMESTER

Part-III

17UCHA41	**Ancillary Chemistry Paper- IV (Organic And Physical Chemistry)**	**Hours 4/Credits 4**

Course Outcome: To understand heterocyclic compounds, alkaloids, vitamins, antibiotics, chemical kinetics, chromatography, chemotherapy and electrochemistry.

Unit – I

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

Unit – II

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

Vitamins - Classification and biological functions of vitamins A, B_6, B_{12}, C, D, E and K (Structural elucidation not required).

Unit – III

Chemical kinetics: Rate of reaction-rate law and rate constant – order and molecularity of a reaction – zero order – first order- second order reaction – examples. First order rate equation and half life period – derivation–Pseudo first order reactions- Carbon dating.

Unit – IV

Chromatographic technique: Principle – classification - adsorption and partition Chromatography - Thin layer chromatography – Column chromatography (adsorption) - Ion exchange chromatography – Paper Chromatography – Gas-solid and Gas-liquid chromatography- Applications of each type.

Unit–V

Electrochemistry:

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

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

Reference books

- Essential of physical chemistry - Arun Bahl, B.S. Bahl and G.D. Tuli (revised edition, S.Chand, 2014).
- Principles of physical chemistry - Puri, Sharma and Pathania (revised edition, Vishal pub., 2014).
- Modern Inorganic chemistry - R.D. Madan (revised edition, S.Chand, 2013).
- A Text book of Organic chemistry – Arun Bahl, B.S. Bahl (revised edition, S.Chand, 2014).
- J. Ghosh – Fundamental concepts of Applied Chemistry, S. Chand & Co.

SEMESTER VI

PRACTICAL II - ORGANIC ANALYSIS

17UCHA4P	Organic Analysis	Hours 2/Credits 1

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

Maximum marks – 100

Duration of examination: 2 hrs

Internal – 40 marks	
Attendance in the class	20 marks
Observation notebook	10 marks
Model test	10 marks
Total	**40 marks**

External – 60 marks	
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	**60 marks**

VI SEMESTER

Part-IV

17UVED61	VALUE EDUCATION	Hours 2/Credits 2

COURSE OUTCOMES:

CO1: Develop the overall personality including physical, mental, emotional and spiritual aspects
CO2: Demonstrate good manners and cooperative citizenship
CO3: Develop respect for the dignity of individual and society

UNIT – I: Values and the Individual

Values meaning – The Significance of Values – Classification of Values – Need of Value Education –Values and the individual: Self Discipline, Self Confidence, Self Initiative, Empathy, Compassion, Forgiveness, Honesty and Courage.

UNIT – II: Values and Religion

Karmayoga in Hinduism – Love and Justice in Christianity – Brotherhood in Islam – Compassion in Buddhism – Ahimsa in Jainism – and Courage in Sikhism – Need for Religious Harmony.

UNIT – III: Values and Society

Definition of Society – Democracy – Secularism – Socialism – Gender Justice – Human Rights – Socio-Political Awareness – Social Integration – Social Justice.

UNIT – IV: Professional Values

Definition – Accountability – Willingness to learn – Team Spirit – Competence Development –Honesty – Transparency – Respecting Others – Democratic Functioning – Integrity and Commitment.

UNIT- V: Role of Social Institutions in Value Formation

Role of Family – Peer Group – Society – Educational Institutions – Role Models, and Mass Media in value formation.

Text Book:

Value Education, Madurai Kamaraj University Publications

REFERENCE BOOKS:

- **Subramanyam, .K , values in Education. Madurai; Ramana Publications, 1995.**
- **Doss. A. G. Indian Social Institutions, Delhi: Forward Publishing Company, 2000.**
- **Joseph.K.P, e.d., Peace and Value Education : A Creative Response to Consumerism and**
- **Communalism, Hyderabad: National Institute of Peace and Value Education. 2003.**
- **BediKiran, What Went Wrong….and Continues, Delhi: UBS Publishers and Distributors Pvt.Ltd., 2005.**
- **Sekar, Vincent, Quest for Harmony: An Anthology of Religions in Dialogue, Bangalore: Claretian Publications, 2001.**

METHODOLOGY: The each above mentioned values may be taught through parables, new analysis, role play, group discussions, debates, case studies and field work.

VI SEMESTER

Skill Based Subject – 4 **Part-IV**

17UCHS61	Medicinal Laboratory Technology and Clinical Bio-Chemistry	Hours 2/Credits 2

Course Outcome: To explore the microorganisms, determination of Hb, RBC, WBC, Platelet, ESR, lipids, tests regarding typhoid, tuberculosis, HIV, Rh factor, GTT, cholesterol and instrumental analysis.

Unit – I

Types of micro organism - 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

Reference books

- Varely - Clinical Biochemistry, Sultan Chand, 2005.
- Mukherji - Text Book of Medical Laboratory Technology, Vol. I, Vol. II and Vol. III, (2006) Sultan Chand.