B.Sc. CHEMISTRY

SYLLABUS

2021-2024

Department of Chemistry and Research Centre

POPE'S COLLEGE (AUTONOMOUS)

SAWYERPURAM-628 251

POPE'S COLLEGE (AUTONOMOUS)
Sawyerpuram -628 251
(Re-accredited with "A" Grade with CGPA of 3.28)

Department of Chemistry and Research Centre
B.Sc., Chemistry Syllabus
(Choice Based Credit System)
(W.e.f June 2021-2022 onwards)

Structure of the Curriculum

Parts of the Curriculum	No. of Courses	Hrs/week	Credits
Part – I : Language	04	6x4=24	16
Part – II : English	04	6x4=24	16
Part – III Major			
Core (Theory)	11	52	45
Core (Practical)	05	24	12
Discipline Selective Elective(DSE)	02	02x04=08	08
Skilled Based Core	02	02x02	04
Allied1(Mathematics or Zoology)			
Allied 1Mathematics	02	12	10
Allied1 Zoology	03	12	10
Allied 2 Physics	03	12	10
Group Project/ Discipline selective Elective	01	06	05
Part – IV AECC			
Environmental Studies	01	02	02
Value Education	01	02	02
Generic Elective (Non Major- Elective)	02	04	04
Skill enhancement Course (SEC)	03	03x02=06	06
Part – V **Extension Activities**(NSS/NCC/ YRC/ YWF/ Phy.Edu)	02	---	02
Certification in Professional English (I&II Semester)	01X2	-----	02
Certificate /MOOC course I Year	01	---	01
Mooc /certificate course (IIyear)	01	---	01
Gender Studies Course **V Sem**	01	----	01
Extra credit Course (III/IV/V/VI Semester)	01x1	---	01
		180	140+8

Pope's College (Autonomous), Sawyerpuram
Accredited by NAAC – II Cycle with 'A' Grade
(CGPA:3.28)
Choice Based Credit System-**LOCF**
PROGRAMME Structure for CHEMISTRY
(with effect from the Academic Year
2021onwards)

I Semester						
S. No	**Part**	**Subject Status**	**Subject Code**	**Subject Title**	**Hrs Per Week**	**Credits**
1	I	Language	21ULT11	Tamil	06	04
2	II	Language	21ULE11	English	06	04
3	III	Core Course – I	21UCHM11	Inorganic Chemistry - I	04	04
4		Core Course – 2	21UCHM12	Physical Chemistry - I	04	04
5		Allied**1**	21UCHAZ11	Allied Maths/ Zoology – I	6/4	05/04
6		Allied**1**Practical – 1	21UCHAP1	Allied Zoology Practical - I	02	--
7		Core Course Major Practical – I	21UCHMP1	Volumetric Analysis – I	02	--
8	IV	AECC-I **(Common-1)**	21UEVS11	Environmental Studies	02	02
9	V	Extension Activities - I	21UEA21	NSS/ NCC/ YRC/YWF/Phy.Edu	-	-
10		Certification in Professional English			-	01
11		Certificate course/ MOOCs			-	01
Total					30	23/22+2

II Semester						
1	I	Language	21ULT21	Tamil	06	04
2	II	Language	21ULE21	English	06	04
3	III	Core Course – 3	21UCHM21	Inorganic Chemistry - II	04	04
4		Core Course – 4	21UCHM22	Organic Chemistry – I	04	04
5		Core - Course Major Practical – 1	21UCHMP1	Inorganic Quantitative Analysis-I (Volumetric method)	02	02
6		Allied**1**	21UCHAZ21	Allied Maths/ Zoology – II	06/04	05/04
7		Allied**1** Practical – **1**	21UCHAP1	Allied Zoology Practical - I	02	02
8	IV	AECC-II **(Common-II**)	21UVBE21	Value Based Education	02	02
9	V	Extension Activities - I	21UEA21	NSS/NCC/YRC/YWF/ Phy.Edu	-	01
10		Certification in Professional English			-	01
11		Certificate course/ MOOCs			-	01
Total					30	25/26+2

III Semester						
1	I	Language	21ULT31	Tamil	06	04
2	II	Language	21ULE31	English	06	04
3	III	Core Course – 5	21UCHM31	Organic Chemistry - II	04	04
4		Skilled Based Core – 1	21UCHS3A 21UCHS3B	Agro Chemistry / Chemistry of Consumer Products	02	02
5		Allied**2** – I	21UCHAP11	Allied Physics	04	04
7		Allied**2** Practical – 1	21UCHAP1	Allied Physics Practical - I	02	-
8		Core Course Practical - II	21UCHMP2	Inorganic Qualitative Analysis	02	-
8	IV	Generic Elective-1 (Non Major Elective – 1)	21UCHN3A 21UCHN3B 21UCHN3C	Water Management/ Textile Chemistry/ Dairy Chemistry	02	02
9		Skill enhance ment course-1 **(Common-III)**	21USEC31	Field Visit / Yoga/Soft skill	02	02
10	V	Extension Activities - 2	21UEA41	NSS/ NCC/YRC/YW/Phy.Edu	-	-
11		MOOCs / Certificate course			-	01
12		Extra Credit Courses				
Total					30	22+1

IV Semester						
1	I	Language	21ULT41	Tamil	06	04
2	II	Language	21ULE41	English	06	04
3	III	Core Course – 6	21UCHM41	Physical Chemistry - II	04	04
4		Core Course Practical – II	21UCHMP4	Inorganic Qualitative Analysis	02	02
5		Skill Based Core –2	21UCHS4A 21UCHS4B	Chemistry in Medicine / Industrial Chemistry	02	02
6		Allied -2– II	21UCHAP21	Allied Physics - II	04	04
7		Allied -2- Practical – I	21UCHAP1	Allied Physics Practical - I	02	02
8	IV	Generic Elective-1(Non Major-Elective-2)	21UCHN4A 21UCHN4B 21UCHN4C	Applied Chemistry / Health Chemistry/Basic Clinical & Pharmaceutical Chemistry	02	02
9		Skill enhance ment course- 2 **(Common-IV)**	21USEC4A 21USEC4B	Computer for Digital Era/ Computer Applications in Chemistry	02	02
10	V	Extension Activities - 2	21UEA41	NSS/ NCC, / YRC/YWF/Phy.Edu	-	01
11		Mooc /Certificate course			-	01
12		Extra Credit Courses				
Total					30	26+2

V Semester						
1	III	Core Course – 7	21UCHM51	Organic Chemistry – III	06	04
2		Core Course – 8	21UCHM52	Physical Chemistry – III	06	04
3		Discipline Specific Elective – 1 **DSE**	21UCHM5A 21UCHM5B 21UCHM5C	Polymer Chemistry / Biochemistry /Bioinorganic Chemistry	04	04
4		Discipline Specific Elective - 2 **DSE**	21UCHM5D 21UCHM5E 21UCHM5F	Analytical Chemistry/ Molecular Dynamics/ Environmental Chemistry	04	04
5		Core Course Practical – III	21UCHMP3	Gravimetric Estimation & Inorganic Preparation	8 Hrs	--
6		Core Course Practical – IV	21UCHMP4	Organic Analysis & Organic Preparation		--
7		Core Course Practical – V	21UCHMP5	Physical Chemistry Experiments		--
8	IV	Skill enhance ment course-3 **(Common –V)**	21UCSB5A 21UCSB5B 21UCSB5C	Personality Development /Effective Communication/ Youth leadership	02	02
9		**Gender Studies** Course			-	01
10		Extra Credit Courses			-	
Total					30	18+1

VI Semester						
1	III	Core Course – 9	20UCHM61	Inorganic Chemistry – III	05	04
2		Core course– 10	20UCHM62	Organic Chemistry – IV	05	04
3		Core Course – 11	20UCHM63	Physical Chemistry - IV	06	05
4		Discipline specific Elective –3 /Project	Core-Project	Chemistry Project	06	05
5		Core Course Practical – III	20UCHMP4	Gravimetric Estimation & Inorganic Preparation	8	02
6		Core Course Practical – IV	20UCHMP5	Organic Analysis & Organic Preparation		03
7		Core Course Practical – V	20UCHM6P	Physical Chemistry Experiments		03
8		Extra Credit Courses			--	
Total					30	26
Grand Total					180	140+8

Extra Credit Courses (III/IV/V/VI -Semester)

No	Title of the Course	Credits
1	Research methodology	1
2	Analytical Clinical Biochemistry	1
3	Chemistry in Everyday life	1
4	Renewable Energies (Solar & Biogas)	1

Certificate Course in Lab Technology (I/II/III/IV -Semester)

No	Title of the Course	Credits
1	Haematology and Clinical Biochemistry	1
2	Microbiology, Clinical Pathology and Parasitology Microbiology	
3	Lab in Clinical Laboratory Technology	

PC/ 2021-2024 / UG /Part - III/CHEMISTRY/ Semester – I				
Core	**Sub Code**	**INORGANIC CHEMISTRY- I**	**Hrs./ Week**	**Credits:**
1	**21UCHM11**		**4**	**4**

COURSE OBJECTIVES	• To know the arrangement of elements in the periodic table and the periodic properties. • To understand the different kinds of chemical forces in molecules. • To know the nature of compounds formed by s- and p-block elements • To know about oxidation, reduction and acid base concepts and basic principles behind the volumetric analysis.
COURSE OUTCOME	• Gain knowledge about periodic table and its periodic properties. • Describe the different kinds of chemical forces in molecules. • Understand the role of electrons in bonding and various theories • Know about the properties of s-block elements and their compounds of bonding. • Explain the chemistry of s- and p-block elements.
Unit I	**PERIODIC PROPERTIES** Long form of periodic table- classification as s,p,d and f block elements - periodicity in properties variation of atomic and ionic radii, electron affinity, ionisation energy and electro negativity along periods and groups – various scales of electronegativity – Pauling, Mullikan and Allred Rochow's scale of electronegativity – factors affecting the magnitude of electronegativity – applications of electronegativity.
Unit II	**CHEMICAL BONDING -I** Types of bonds- Ionic, covalent, coordinate – Condition for formation of ionic bond- Properties of ionic compounds – Factors influencing the formation of ionic bond- Lattice energy- definition- Born-Lande equation (derivation not required), lattice energy- factors affecting lattice energy, Born-Haber cycle - Covalent character in ionic compounds- Polarization and Fajan's rule - Metallic bond - Electron sea model- Physical properties of metals .
Unit III	**CHEMICAL BONDING -II** Valence bond theory – Types of overlapping and nature of chemical bond- σ bond and pi bond hybridization of atomic orbitals and geometry of molecules – sp, sp^2, sp^3, sp^3d, sp^3d^2 and sp^3d^3 hybridisation with examples. VSEPR theory- shapes of simple inorganic molecules – $BeCl_2$,BF_3 ,CH_4, NH_3, H_2O- Molecular Orbital theory – Linear combination of atomic orbitals- Energy level diagram for bonding and anti-bonding MO's – Conditions for combination of atomic orbitals-Differences between bonding and anti-bonding MO's – Bond order - applications of MOT to H_2 ,O_2, and CO - Paramagnetism of O_2 , Comparison of VBT and MOT.
Unit IV	**s- BLOCK ELEMENTS** Occurrence, General characters of s block elements , Position of Hydrogen in the periodic table, Chemistry of Li and Be- their anomalous behaviour and diagonal relationship, Hydrides (classification, general methods of preparation and salient features), hydration energies, solvation and complexation tendencies of alkali and alkaline-earth metals.

Unit V	**p-BLOCK ELEMENTS** Occurrence, General characteristics of p block elements, Group study of 13-18 group elements anomalous behaviour and diagonal relationship. Compounds such as hydrides-, halides, oxides and oxyacids-. Preparation, properties, bonding and structure of diborane, borazine and alkali metal borohydrides. Preparation, properties and technical applications of carbides and fluorocarbons. Silicones and silicates (structures only)- Inter halogen compounds
Text Books	1. B.R.Puri, L.R.Sharma, K.C.Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi,. 2. P.L.Soni, Text Book of Inorganic Chemistry, 3. R.D.Madan, Modern Inorganic Chemistry, S.Chand and company, 13th edition. 4. J.D.Lee, Concise Inorganic chemistryBlackwell science, London. 5. F.A.Cotton, G.Wilkinson, C.Murillo and M.Bochman, Advanced Inorganic Chemistry, Wiley India, 6th edition.
References	1. Jolly, William L. Modern Inorganic Chemistry, New York: McGraw-Hill. 2. Petrucci, Ralph H. General Chemistry. 9th edition. New Jersey: Pearson Prentice Hall. 3. Gray, Harry B. Electrons and Chemical Bonding. W. A. Benjamin, Inc. New York.

PC/ 2021-24/ UG /Part - III/ B.Sc. Chemistry / Semester – I				
Core	**Sub Code**	**PHYSICAL CHEMISTRY-I**	**Hrs./ Week**	**Credits:**
2	**21UCHM12**		**4**	**4**

COURSE OBJECTIVES	• To learn different states of matter • To understand the basic concepts of photo chemistry and nuclear chemistry • To understand the atomic structure
COURSE OUTCOME	• Explain the behaviour of gases • Differentiate liquid state and colloidal state • Understand different types of solids system of crystals • Describe the atomic model. • Explain the behaviour of atomic nuclear properties of atom
Unit I	**GASEOUS STATE**: Concept of ideal and real gases- postulates of kinetic theory of gases -Types of molecular velocities and their inter relations - mean, rms, most probable velocities - Calculation of most probable velocity, average velocity and root mean square velocity for CO,CO_2, H_2O and NH_3 Maxwell's distribution of molecular velocities– graphic representation - effect of temperature on velocity distribution- Degrees of freedom of gaseous molecules – CO, CO_2, H_2O NH_3 (translational, vibrational, rotational) Deviation of real gas from ideal gas behaviour.
Unit II	**LIQUID STATE:** Introduction- Intermolecular forces in liquid- dipole-dipole interaction- London dispersion forces- Hydrogen bonding- types- effects on their properties. Physical properties of liquids- Vapour pressure, surface tension, viscosity, Refraction- Definition, Experimental determination (one method each), effect of temperature on properties- Surface active agents- Optical activity. **COLLOIDAL STATE:** Definition of colloids; classification-Solids in liquids (sols)-definition with example-properties optical- Tyndall effect & Tyndall cone-electrical-electrical double layer; stability of colloids protective action, Hardy-Schulze law, gold number; Liquids in liquids (emulsions)-definition with example-types of emulsions, Liquids in solids (gels)-definition with example- types-elastic, non-elastic-general application of colloids.
Unit III	**SOLID STATE** Crystalline and amorphous solids – isotropy- laws of symmetry of crystals - crystal systems - unit cell - space lattice - Bravais lattices - Miller indices- Bragg's equation, derivation and applications - determination of structure of crystals by X-ray diffraction methods - rotating crystal and powder method, structure of NaCl, KCl. Types of crystals-molecular, covalent, ionic, metallic crystals- Imperfections in a crystal - Schottky defects, Frenkel defects.
Unit IV	**ATOMIC STRUCTURE AND WAVE MECHANICS** Rutherford's Atomic model – Planck's Quantum Theory of radiation - photoelectric Effect – Bohr theory – Sommerfield Extension of Bohr theory – wave mechanical concept of atom – Dual character of Electron. de Broglie equation– Heisenberg's uncertainty principle - Davisson – Germer Experiment.– Schrodinger wave Equation (no derivation)– significance of Ψ and Ψ2 - Quantum numbers– Hund's rule-Aufbau principle – Pauli's exclusion principle – Electronic configuration up to atomic no 30.

Unit V	**UNIT V NUCLEAR CHEMISTRY** Natural radioactivity - detection and measurement of radioactivity –Geiger Muller counter – Geiger Nuttal rule - rate of disintegration and half- life period - average life period – nuclear stability, n/p ratio, magic number, mass defect and binding energy - liquid drop model – shell model - isotopes, isobars, isotones and isomers. Artificial radioactivity - nuclear fission and nuclear fusion – mechanisms – applications - differences – Stellar energy - nuclear reactors - hazards of radiations - fertile and fissile isotopes. Applications of radioisotopes –Medicine and agriculture.
Text Books	1. Arul Bahl , B.S Bhal, G.T Tuli , Essentials of Physical Chemistry, 27 th edition, S.Chand publishing. 2. Puri, Sharma and Pathania, Elements of physical chemistry, Vishal Publishing Co. 3. Peter Atkins, Julio De Paula, Atkins Physical chemistry, Oxford UniversityPress. 4. Samuel.H.Maron, Carl F. Pruttol, Principles of Physical Chemistry, Oxfordand IBH publishing Co Pvt Ltd. 5. Samuel Glastone, Source book of Atomic Energy, East West press.
References	1. P. L. Soni, O. P. Dharmarha, U. N. Dash, Textbook of Physical Chemistry, S. Chand & Sons. 2. G.W. Castellan, Physical Chemistry, 3rd edition, Addison-Wesley. 3. P.W. Atkins, Julio de Paula, Physical Chemistry, 8th edition, Oxford University Press. 4. Advanced Physical Chemistry - Gurdeep Raj, Goel Publishing House. 5. Physical Chemistry, G.M.Barrow, Tata McGraw Hill. 6. Source book of Atomic Energy.Samuel Glastone, East west press

PC/ 2021-24 / UG /Part - III/ B.Sc. Chemistry / Semester – I

Allied	Sub Code	ALLIED CHEMISTRY -I (FOR ZOOLOGY)	Hrs./ Week	Credits:
1	21UCHAZ11		4	4

COURSE OBJECTVES	• To learn about vitamins and biological function. • To learn the food additives and methods of preservation. • To study about photochemical reactions. • To learn about the importance of polymer and polymer science. • To study about lubricants and some cosmetics in the modern world
COURSE OUTCOME	• Discuss about the biological role of vitamins and minerals. • Explain the various Food additives and their importance. • Describe various photochemical reactions. • Know the importance of polymer and their applications • Understand the chemistry behind the lubricants and cosmetics
Unit I	**HEALTH CHEMISTRY** Vitamins: Definition-Classification – Water soluble vitamins and Fat soluble vitamins (A,D,E and K)– Sources, Biological functions, Deficiency diseases. Minerals: Major minerals (Macro minerals)-Biological functions-Sources. Essential elements in biological systems
Unit II	**FOOD CHEMISTRY** Food additives-Definition, Functional characteristics-permitted food additives and their role-Antioxidants, stabilizers, flavours, sweeteners, emulsifiers, thickeners, food colorants. Preservatives-Definition & example. Methods of food preservation-heat, cold, radiation.
Unit III	**PHYSICAL CHEMISTRY - PHOTOCHEMISTRY** Definition-comparison between thermal and photochemical reactions-Laws of photochemistry- Beer Lambert's law-Grothus Draper law-Einstein's law-fluorescence, phosphorescence, thermoluminescence, chemiluminescence and bioluminescence-definition with examples-photosensitisation.
Unit IV	**POLYMER CHEMISTRY** Definition- Monomers, Oligomers and Polymers - Classification of polymers-natural, synthetic linear, cross linked and network- plastics, elastomers, fibres-homopolymers and co-polymers Thermoplastics: polyethylene, polypropylene, polystyrene, polyacrylonitrile, poly vinyl chloride, nylon and polyester - natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.
Unit V	**APPLIED CHEMISTRY** Lubricants-classification-criteria of good lubricating oils-synthetic lubricating oils-poly glycols and poly alkene oxides-greases or semi-solid lubricants-examples-solid lubricants-graphite Preparation and uses of shampoo, nail polish, sun screens, tooth powder, tooth paste, boot polish, moth ball and chalk piece
Text Books	1. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing House,New Delhi. 2. Sivasankar B, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi. 3. Swaminathan M. Textbook on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore. 4. K.K.Rohatgi Mukherjee, Fundamentals of photo chemistry, Wiley Eastern Ltd, New Delhi. 5. Alex V Ramani, Food Chemistry, MJP publishers.

References	1. Swaminathan M. Advanced Text Book on Food and Nutrition, volume I and II Printing and Publishing CO., Ltd., Bangalore. 2. Fundamentals of Foods and Nutrition – Mudambi. R. Sumathi, and Rajagopal, M.V. Willey Eastern Ltd, Madras 3. K.K.Rohatgi Mukherjee, Fundamentals of photochemistry (Revised edition), WileyEastern Ltd. 4. Malcom P. Stevens, Polymer Chemistry – An Introduction. 5. V.R. Gowariker, Polymer Science, Wiley Eastern.

PC/ 2021-24 / UG /Part – III/ B.Sc. Chemistry / Semester – II

Core	Sub Code	INORGANIC CHEMISTRY- II	Hrs./ Week	Credits:
3	21UCHM21		4	4

COURSE OBJECTIVES	• To study the chemistry of noble gases • To know the basic principles of metallurgy and the chemistry of d-Block elements. • To learn the chemistry of f-Block elements • To learn the basic analytical methods
COURSE OUTCOME	• Explain the chemistry of noble gases • Describe the basic principles of metallurgy • Identify various d-Block elements and its compounds. • Know the chemistry of f-Block elements • Understand the fundamentals of analytical methods
Unit I	**NOBLE GASES** Occurrence – isolation of noble gases from the atmosphere – separation of the gases from one another – general physical properties – special properties of helium – isotopes of helium – uses of noble gases – importance of inert gases in theoretical chemistry – chemical properties – xenon chemistry: preparation and properties of fluorides, oxides and oxofluorides of xenon – xenates and perxenates – xenon fluoride complexes – structure and bonding in xenon compounds. Fluorides of Krypton and Radon – hydrates and clathrates of noble gases – uses of clathrate compounds.
Unit II	**METALLURGY** Occurrence of metals- Ores and minerals –Mineral wealth of India- principles of metallurgy-concentration of ores – froth floatation, magnetic separation, calcination, roasting and smelting. Purification of metals – electrolysis, zone refining, van Arkel deBoer methods. Extraction of the following metals in pure form – Li, Ti, V and U.
Unit III	**CHEMISTRY OF d – BLOCK ELEMENTS** Occurrence, General characteristics of d- Block elements – Group study of Titanium, Vanadium, Iron, Coinage and Zinc group metals. Important compounds of transition metals: Ziegler – Natta catalyst. Prussian blue, Sodium nitroprusside, Turnbull's blue, Nickel DMG complex, Wilkinson's Catalyst- $KmnO_4$ and $K_2Cr_2O_7$.
Unit IV	**CHEMISTRY OF f- BLOCK ELEMENTS** Occurrence, General characteristics of f-block elements, Synthetic elements, comparative account of lanthanides and actinides – oxidation states, magnetic properties, colour and spectra – separation by ion exchange and solvent extraction methods – lanthanide contraction — preparation, properties and uses of ceric ammonium sulphate, thorium dioxide, thorium nitrate, uranium hexafluoride, uranylacetate.
Unit V	**THEORY OF INORGANIC PRACTICALS** Types- Qualitative and Quantitative analysis: **Qualitative Analysis**: Solubility product and common ion effect – Definition- applications in the precipitation of cations – Interfering acid radicals and their elimination (oxalate, fluoride, borate, phosphate, chromate, arsenite and arsenate). **Titrimetric methods of analysis:** Concentration terms: Molarity, molality, normality, wt% ppm, mole fraction. Primary and secondary standard, criteria for primary standard, preparation of

	standard solution, standardization of solutions. Types of titrations- acid-base, redox, iodometric, iodimetric, precipitation and complexometric titrations- Limitations of volumetric analysis. **Gravimetric analysis**: Precipitation from homogeneous solution- precipitants –conditions for precipitation – co-precipitation and post precipitation – washing of precipitates. Minimisation of errors.
Text Books	1. B.R.Puri, L.R.Sharma, K.C.Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi. 2. P.L.Soni, Text Book of Inorganic Chemistry, 20th Edition. 3. R.D.Madan, Modern Inorganic Chemistry, S.Chand and company, 13th edition. 4. J.D.Lee, Concise Inorganic chemistry, 5th edition, Blackwell science, London. 5. F.A.Cotton, G.Wilkinson, C.Murillo and M.Bochman, Advanced Inorganic Chemistry,Wiley India, 6th edition.
References	1. Concise coordination chemistry – R. Gopalan, V. Ramalingam, Vikas publishing House, PVT LTD, 2001, New Delhi. 2. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denny, Vogel's Text book of Quantitative Chemical Analysis, 5th Edn., ELBS. 3. D.A.Skoog and D.M.West, Fundamentals of Analytical Chemistry, Holler Saunders College publishing, USA.VI Ed.

PC/ 2021-24 / UG /Part – III/ B.Sc. Chemistry / Semester – II

Core	Sub Code	ORGANIC CHEMISTRY-I	Hrs./ Week	Credits:
4	21UCHM22		4	4

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COURSE OBJECTIVES	• To study the nomenclature of organic compounds. • To learn general preparation methods, reaction and mechanism of alkanes, alkenes, alkynes & alcohols. • To study the synthesis of organometallic compounds and organo sulfur compounds.
COURSE OUTCOME	• Identify the organic compounds and name them. • Design the general preparation methods, reaction and mechanism of alkanes and alkenes, • Know about alkynes & alcohols. • Discuss the types of reactions and halogen compounds • Describe the synthesis of organometallic compounds and thioethers
Unit I	**CLASSIFICATION AND NOMENCLATURE** Classification of organic compounds – based on the nature of carbon skeleton – functional groups – classification of C and H atoms of organic compounds.(primary, secondary, tertiary) IUPAC system of nomenclature of common organic compounds (upto C-10) – alkanes, alkenes, alkynes, cycloalkanes, bicycloalkanes with and without bridges . Naming of organic compounds with one functional group – halogen compounds, alcohols, phenol, aldehydes, ketones, carboxylic acids and its derivatives, cyano compounds, amines and nitro compounds (only aliphatic). Naming of compounds with two functional groups. Structural isomerism – types with examples
Unit II	**ALKANES & ALKENES** **Alkanes:** General methods of preparation – Wurtz reaction, reduction, Corey House method- Reactions: Mechanism of halogenation, free radical substitution, sulphonation, nitration, oxidation. **Alkenes**: General methods of preparation- dehydrogenation, dehydrohalogenation, dehydration, Hoffmann and Saytzeff's rules- Reactions: Mechanism of addition of hydrogen halide (Markownikoff's rule), hydrogen bromide (peroxide effect), hydroboration and ozonolysis.
Unit III	**ALKYNES & ALCOHOLS** **Alkynes**: Terminal and non-terminal alkynes- Acidic nature of acetylenic hydrogen atom- Reactions of alkynes. **Alcohols:** Distinction between primary, secondary and tertiary alcohols-nitroglycerol, dynamite estimation of hydroxyl groups-mechanism of dehydration of alcohols, preparation and properties of allyl alcohol
Unit IV	**HALOGEN DERIVATIVES** Type of reactions – substitution, addition, elimination and polymerisation reactions – SN^1 and SN^2 mechanisms – E^1 and E^2 mechanisms- Hoffmann's and Saytzeffs rule-preparation, properties and uses of chloroform, carbon tetrachloride, vinyl chloride and allyl chloride- preparation and uses of westron, westrosol, freon and chloroprene

Unit V	**REAGENTS IN ORGANIC CHEMISTRY AND ORGANOSULPHUR COMPOUNDS** Preparation, structure and synthetic uses of Grignard reagent-preparation and reactions of methyl lithium, diethyl zinc, tetraethyl lead and tetramethyl tin-Reformatsky reaction. Preparation and properties of thioalcohols and thioethers-sulphonal-mustard gas and sulphones.
Text Books	1. K.S.Tewari and N.K.Vishnoi, A Text Book of Organic Chemistry, Vikas Publishing House Pvt Lyd, Reprint. **2.** Arun Bahl and B.S.Bahal, Advanced Organic Chemistry, S.Chand and Sons **3.** M.K.Jain and S.C.Sharma, Modern organic Chemistry, Visal Publishing Co. 4. Tewari, Advanced Organic Reaction Mechanism, Third Edition, Book and allied (P) Ltd. **5.** I.L.Finar, Organic chemistry, Volume 1, ELBS, Longmans.
References	1. Organic Chemistry – Bhupinder Mehta and Manju Mehta – PHI Learning Pvt Ltd. 2. Morrison and Boyd. Organic Chemistry, Pearson publication, 3. Mehta. B. and Mehta.M., Organic Chemistry, Prentice–Hall of India Private limited. 4. Soni. P.L. and Chawla. H.M.,Textbook of Organic Chemistry , Sultan Chand and Sons.

PC/ 2021-24 / UG /Part – III/ B.Sc. Chemistry / Semester – II

Allied	Sub Code	ALLIED CHEMISTRY-II (FOR ZOOLOGY)	Hrs./ Week	Credits:
2	21UCHAZ21		4	4

COURSE OBJECTIVES	• To learn about characteristics and composition of milk • To understand the importance of nuclear chemistry • To study about bio chemistry • To have an elementary idea on industrial chemistry • To study about common diseases and drugs
COURSE OUTCOME	• Describe about characteristics and composition of milk • Analyse nuclear stability and nuclear reaction. • Summarize stability and structure of biomolecules. • Realise the importance of chemistry in industry. • Identify common diseases and drugs.
Unit I	**DAIRY CHEMISTRY** Milk-Definition –Constituents(Major and Minor) and Chemical Composition- General properties of milk (Colour, Flavour, Acidity, pH, Density and Specific Gravity, Specific heat, Conductivity and Freezing point)- Milk Fat-Its Properties like Acid Number, Saponification Number, Iodine Number and Reichert-Meissel Number(Definition and significance only) Factors affecting the composition of milk..
Unit II	**NUCLEAR CHEMISTRY** Nuclear stability – n/p ratio – packing fraction – mass defect – binding energy – isotopes, isobars, isotones with examples. Group displacement law – radioactive series – Nuclear fission, fusion – Application of radio isotopes –C-14 dating.
Unit III	**BIO CHEMISTRY** Amino acids-classification-amphoteric nature-isoelectric point- Proteins-classification according to composition, solubility and shape- colour reactions- Nucleic acids-nucleocides, nucleotides-DNA-structure of DNA-RNA
Unit IV	**INDUSTRIAL CHEMISTRY** Fuel gases – Water gas, Producer gas, L.P.G, Gobar gas and Natural gas. Fertilizers – N.P.K and mixed fertilizers. Soaps and detergents – an elementary idea of soaps and detergents. Cement and glass: Portland cement-manufacture only. Manufacture of glass- types and uses borosilicates –photochromic and safety glass.
Unit V	**PHARMACEUTICAL CHEMISTRY** Common diseases – infective diseases – insect borne –air borne – water borne – hereditary diseases. Definition and examples of analgesics, antipyretics, sulpha drugs, antimalarials and, antibiotics. Diabetes – causes – hyper and hypoglycemic drugs. Indian medicinal plants – tulsi, neem, keezhanelli- their importance
Text Books	1. N.K Roy and D.C. Sen, A Text book of practical Dairy chemistry 2. Fundamentals of Dairy chemistry - Wond. F.P. Springer. 3. Outlines of Dairy Technology - Sukumar De. – Oxford University Press.Puri, Sharma and Pathania, Elements of physical chemistry, Vishal Publishing Co. 4. Arniker H .J. Essentials of Nuclear Chemistry, IV Edition, New Age International Ltd., New Delhi.

	5. C.B Power, G.R Chatwal, Bio chemistry, Himalaya publishing House, 4th edition, Reprint. 6. B.K Sharma, Industrial Chemistry, Goel publishing, 1st revised edition, 1993. 7. Dr.S. Lakshmi, Pharmaceutical Chemistry, Sultan chand & sons, New Delhi. 8. V.K. Ahluwalia and Madhu Chopra, ―Medicinal Chemistry‖, Ane Books, New Delhi.
References	1. Robert Jenness and Patom.S., Principles of Dairy Chemistry, Wiley, New York. 2. Puri, Sharma & Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors. 3. P.L. Soni, Text book of Inorganic Chemistry, Sultan Chand and Sons. 4. Morrison & Boyd, Organic Chemistry, Vith ed, Prentice Hall of India Pvt. Ltd., New Delhi. 5. J. L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry, S. Chand and Company Ltd.,New Delhi.

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Major Practical	Sub Code	INORGANIC QUANTITATIVE ANALYSIS (VOLUMETRIC METHOD)	Hrs./ Week	Credits:
1	21UCHMP1		2	2

COURSE OBJECTIVES	• To enable the students to acquire the quantitative skills in volumetric analysis. • At the end of the course, the students should be able to plan experimental projects and execute them.
COURSE OUTCOME	• Acquire quantitative skills in volumetric analysis. • Able to form experimental design. • Understand the ethical standards • Apply the concepts of chemistry and mathematics • Summarize the results obtained through the experiment
SYLLABUS	**Acidimetry and alkalimetry** 1. Estimation of oxalic acid – Std. oxalic acid 2. Estimation of Na_2CO_3 – Std. Na_2CO_3 **Permanganometry** 3. Estimation of sodium oxalate – Std. oxalic acid 4. Estimation of ferrous ammonium sulphate – Std. ferrous ammonium sulphate **Iodometry** 5. Estimation of copper – Std. copper sulphate 6. Estimation of $K_2Cr_2O_7$ – Std. $K_2Cr_2O_7$ **Dichrometry** 7. Estimation of ferrous iron – Std. ferrous ammonium sulphate 8. Estimation of $K_2Cr_2O_7$ – Std. $K_2Cr_2O_7$ **Complexometry** 9. Estimation of Zn – Std. $ZnSO_4$ 10. Estimation of Pb – Std. $ZnSO_4$ 11. Estimation of Mg – Std. $ZnSO_4$
EVALUATION	**Internal- 50 marks** • 25 Marks- Regular class work • 25 Marks – Model test **External – 50 marks** • 10 Marks- Record • 10 Marks- Procedure • 30 Marks- Experiment Duration: 3 hours
Text Books	1. G.H.Jeffery, J.Bassett, J.Mendham, R.C.Denny, Vogel's Text book of Quantitative Chemical Analysis, 7th edition, ELBS, ongmans England.
References	1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic principles of practical Chemistry, 2nd Edt, Sultan Chand & sons publisher. 2. A. I. Vogel, "Quantitative Inorganic Analysis", ELBS, 3rd Edition,

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Allied Practical	Sub Code	INORGANIC QUANTITATIVE ANALYSIS (VOLUMETRIC METHOD)	Hrs./ Week	Credits:
1	21UCHAP1		2	2

COURSE OBJECTIVES	• To enable the students to acquire the quantitative skills in volumetric analysis
COURSE OUTCOME	• Acquire quantitative skills in volumetric analysis. • Able to form experimental design. • Understand the ethical standards • Apply the concepts of chemistry and mathematics • Summarize the results obtained through the experiment
SYLLABUS	**Acidimetry and alkalimetry** 1. Estimation of oxalic acid – Std. oxalic acid 2. Estimation of Na_2CO_3 – Std. Na_2CO_3 3. Estimation of hydrochloric acid – Std. oxalic acid **Permanganometry** 4. Estimation of ferrous ammonium sulphate – Std. ferrous ammonium sulphate 5. Estimation of oxalic acid – Std. oxalic acid 6. Estimation of ferrous sulphate – Std. oxalic acid **Iodometry** 7. Estimation of $K_2Cr_2O_7$ – Std. $K_2Cr_2O_7$ **Dichrometry** 8. Estimation of ferrous iron – Std. ferrous ammonium sulphate **Complexometry** 9. Estimation of Zn – Std. $ZnSO_4$ 10. Estimation of Mg – Std. $ZnSO_4$
EVALUATION	**Internal- 50 marks** • 25 Marks- regular class work • 25 Marks – Model test **External – 50 marks** • 10 Marks- Record • 10 Marks- Procedure • 30 Marks- Experiment Duration: 2 hours
Text Books	1. G.H.Jeffery, J.Bassett, J.Mendham, R.C.Denny, Vogel's Text book of Quantitative Chemical Analysis, 7th edition, ELBS Longmans England.
References	1. V.Venkateswaran, R.Veerasamy, A.R.Kulandaivelu, Basic principles of Practical Chemistry, 2nd Edt, Sultan Chand & sons publisher. 2. A. I. Vogel, "Quantitative Inorganic Analysis", ELBS, 3rd Edition.

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Core	Sub Code	ORGANIC CHEMISTRY- II	Hrs./ Week	Credits:
5	21UCHM31		4	4

COURSE OBJECIVES	• To learn about carbonyl compounds • To compare ethers and organosulphur compounds • To understand the importance of carbanions in synthetic organic chemistry • To understand the migration of proton within the molecule • To understand alicyclic compounds
COURSE OUTCOME	• Compare structure and reactivity of aldehydes and ketones • Determine the chemistry of carboxylic acids and derivatives. • Know about ether and sulphonic acids and their derivatives • Compare the reactivity of methylene compounds • Explain the stability and conformation of alicyclic compounds
Unit I	**ALDEHYDES AND KETONES** Structure and Reactivity of Carbonyl Group: Relative reactivities of aldehydes and ketones Mechanism: Nucleophilic addition reaction (HCN, $NaHSO_3$, Grignard reagent), aldol and crossed aldol condensation, Knoevenagal reaction. Reactions: Wolff-Kishner reduction, Wittig reaction, MeerweinPonndorfVerley reduction.Examples:Chloral, acrolein, crotonaldehyde and succinaldehyde (Preparation, properties and uses).
Unit II	**CARBOXYLIC ACIDS & ACID DERIVATIVES** Monocarboxylic acid:Definition with example. Structure: Carboxylic acid and carboxylate anion. Strength: Relative acidity of monocarboxylic acids and effect of substituents on acidity. Reaction: Hell – Volhard – Zelinsky reaction- action of heat on hydroxy acids. Preparation, properties and uses.: Lactic acid and citric acid Dicarboxylic acids: Definition with example-action of heat. Preparation, properties and uses: Oxalic acid, succinic acid, acid anhydride. Amides: Definition with example. Urea: Preparation, properties and structure. Esters: Definition with example. Mechanism: Esterification and ester hydrolysis.
Unit III	**Ethers**-Preparation from alcohol, Williamson synthesis, oxymercuraion-Reactions (auto oxidation, with acids (mechanism), chlorination, substitution). Epoxide-ethylene oxide-preparation (oxidation, cyclisation)-mechanism of epoxide formation- Reactions (Ring opening in acidic and basic medium with mechanism, isomerization with mechanism)-crown ethers as phase transfer catalysts. **Sulphonic acids and their derivatives**: Benzene sulphonic acid-preparation (sulphonation with mechanism)-Reactions (salt formation, acid chloride formation, ring substitution, desulphonation. Benzene sulphonyl chloride- preparation (using PCl_5, direct chloro sulphonation)-reaction (with H_2O, NH_3, alcohol, phenol, Friedal-Crafts reaction, reduction)Sulphanilic acid- Preparation (using H_2SO_4)-Reaction (bromination) Sulfonamides-Preparation (using NH_3)-Reactions (with aqueous acid, alkali , HNO_3)

Unit IV	**REACTIVE METHYLENE COMPOUNDS & TAUTOMERISM** Active Methylene Group: Definition with example-Reactivity of methylene groups. Preparation and synthetic uses: diethyl malonate and ethyl acetoacetate. Tautomerism: Definition with example. Types:Keto – enol, amido – imido, nitro – acinitro and oxime – nitroso.
Unit V	**ALICYCLIC COMPOUNDS** General: Nomenclature-preparation–chemical properties. Stability: Baeyer's strain theory – Sachse-Mohr theory – Coulson and Moffit's concept. Conformation: Cyclohexane and monosubstituted cyclohexane. Largering compounds (Examples): Civetone and muscone (synthesis and structure –structure elucidation not necessary).
Text Books	1. K.S. Tewari, N.K. Vishil, S.N. Mehotra – A text book of org. chem – 1st edition,Vikas Publishing House Pvt Ltd.,New Delhi. 2. P.L. Soni, Text Book of Organic chemistry, S.Chand and Sons, New Delhi. 3. Bahl and ArunBahl, Organic Chemistry, S.Chand and Sons, New Delhi. 4. M.K. Jain and S. C. Sharma, Modern Organic Chemistry 5. Organic Chemistry – R.T.Morrison and Boyd – Prentice Hall
References	1. Advanced General Organic Chemistry - SachinK.Ghosh - Books and Allied (P) Ltd 7. Organic Chemistry – Bhupinder Mehta and Manju Mehta - PHI Learning Pvt Ltd. 2. Morrison and Boyd. Organic Chemistry, Pearson publication, 7th edition. 3. Mehta. B. and Mehta.M., Organic Chemistry, Prentice–Hall of India Private limited. 4. Soni. P.L. and Chawla. H.M.,Textbook of Organic Chemistry , Sultan Chand and Sons, 28th edition. 5. Finar. I.L., Organic Chemistry, ELBS publication.

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Skill Based	Sub Code	AGRO CHEMISTRY	Hrs./ Week	Credits:
1	21UCHS3A		2	2

COURSE OBJECTIVES	• To know the chemical behind agriculture • To understand the chemistry of agriculture
COURSE OUTCOME	• Gain knowledge of fertilizer and manures • Knowledge on choice of agrochemicals • Understand the role of chemicals in agriculture • Understand the role of soil forming factors and process in soil formation • Compare the physical and chemical properties of soil and their impact on plant.
Unit I	**FERTILIZERS AND MANURES** Fertilizers: Definition with example. Nutrients: macro and micro (definition, role on plant growth) Types of Fertilizers: complex, mixed &bio and Bio (definition, composition and role on plant growth) Examples: urea, muriate potash and triple superphosphate (manufacture). Manures: Definition with example. Types: bulky organic, farm yard, oil cakes, blood meal, fish (definition, composting process, handling and storage).
Unit II	**PESTICIDES, FUNGICIDE AND OTHERS** Pesticides: Definition with example, general methods of application – Benefits of pesticides – Potential hazards. Safety measures –first aid. Classification: based on the use and chemical composition. Insecticides :Definition with example Examples: plant products-nicotine, inorganic– borates and Organic– D.D.T., BHC (preparation, mode of action and uses). Fungicide:Definition with example. Examples: sulphur compound, Bordeaux mixture (preparation, mode of action and uses). Herbicides, Acaricides, Rodenticides, Attractants and Repellents: Definition with example.
Unit III	**CHEMISTRY OF SOIL-I** Soil: Definition, origin, constituents. Process: soil formation, weathering of rocks.
Unit IV	**CHEMISTRY OF SOIL-II** Physical Aspects of Soil: soil texture, pore space, bulk density, particle density, colour, surface area, soil colloids, plasticity, shrinkage, flocculation and deflocculation, soil air, soil temperature (definition and their importance in plant growth)Types: acid, alkaline and saline (definition, diagnosis)
Unit V	**CHEMISTRY OF SOIL –III** Soil Testing: concept and objectives. Soil Sampling: concept, objectives, tools, collection, processing, dispatch. Estimation: total organic compound, available nitrogen and phosphorus. Determination: pH, EC, moisture content.

Text Books	1. A text book of soil science – Daji.A, Asia Publishing House, Madras. 2. Textbook of soil chemical Analysis – Hesse,P.R.A John Murray Newyork. 3. Textbook of soil science – Biswas,T.D and Mukherjee,S.K.Second edition, Tata McGraw-Hill Education 4. Chemistry for agriculture and ecology-Y.MidoM.Satake, Discovery PublishingHouse. **5.** Soil fertility &fertilisers – Samuel L.Tisdale,WernerL.Nelson, James D.Beaton,John L.Havlin. Fifth edition, Macmillan
References	1. Nature and properties of soils-Harry, O Buckman N Yle C. Brandy, Macmillan 2. Insecticides, Pesticides and Agro based Industries – R.C.Paliwal, K.Goel, R.K.Gupta, Small Business Publications. 3. Handbook on Feritilizer Technology by Swaminathan and Goswamy, 6th ed. FAI.

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Skill Based	Sub Code	CHEMISTRY OF CONSUMER PRODUCTS	Hrs./ Week	Credits:
1	21UCHS3B		2	2

COURSE OBJECTIVES	• To know about chemicals used in day to day life. • To understand and apply the knowledge of chemistry and make a bride between society and industry
COURSE OUTCOME	• Know about chemicals used in day to daily life. • Apply the knowledge of chemistry and make a bridge between society and industry • Know the role of chemicals in our life • Analyse the action of chemicals used in our daily life • Describe the costume industries in India
Unit I	**SOAPS** **Soap:** Definition with example, saponification of oils and fats, manufacture, cleaning action. **Type:** Toilet soaps, Medicated soaps, Herbal soaps, Soft soaps and Shaving soaps (ingredients used and their functions). **ISI:** Specifications, testing procedures and limits.
Unit II	**DETERGENTS** **Detergents**: Definition with example, ingredients and their functions, cleaning action, comparison of soaps and detergents, biodegradation, environmental effects, ISI specifications, testing and limits. **Types**: anionic, cationic and neutral; solid and liquid (definition, example and uses).
Unit III	**SHAMPOOS** **Shampoo**: Definition with example, ingredients and their functions, ISI specifications, testing and limits. **Types:** anti-dandruff, anti-lice, herbal and baby shampoos. **Manufacture:** SLS and SLES, conditioners-Coco betaines or coco diethanol amides
Unit IV	**SKIN PREPARATIONS** **Face and Skin Powders:** Definition with example, ingredients and their functions, hazards, ISI specifications, testing and limits. **Face and Skin Cream**: Definition with example, ingredients and their functions-Sun screen, UV absorbers, skin bleaching agents, turmeric and neem preparations, vitamin oil, hazards, ISI specifications, testing and limits **Nail polishes**: Definition with example, nail polish removers, ingredients and their functions, hazards, ISI specifications, testing and limits. Lipsticks, eyebrow pencils definition with example, Ingredients and their functions, hazards, ISI specifications, testing and limits.
Unit V	**COSTUME INDUSTRY** Leading firms, brand names, choosing the right product. Packing regulations. Marketing. Licensing – drug license – legal aspects. GMP – ISO 9000/12000 – consumer education. Evaluation of the product – advertisements.
Text Books	1. GobalaRao.S , Outlines of chemical technology, Affiliated East West press. 2. Kafaro, Wasteless chemical processing, Mir publishers. **3.** Sawyer.W, Experimental cosmetics, Dover publishers, New york.

References	1. Applied Chemistry, K. Bagavathi Sundari, MJP publishers. 2. J.V.Simons, Science and Beauty Business Vol-1, Macmilan Education Ltd. 3. B.K. Sharma, Industrial Chemistry, Goel publishing & Co. 4. Latest Cottage Industries 20th Edition by Mohan Malhotra

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Allied	Sub Code	ALLIED CHEMISTRY - I	Hrs./ Week	Credits:
1	21UCHAP11		4	4

COURSE OBJECTIVES	• To learn about atomic structure and bonding. • To learn the reactions of hydrocarbons. • To study about photochemical reactions. • To learn about the importance of polymer and polymer science. • To study about lubricants and some cosmetics in the modern world.
COURSE OUTCOME	• Know about atomic structure and bonding. • Explain the preparation and reactions of hydrocarbons. • Describe various photochemical reactions. • Know the importance of polymer and their applications • Understand the chemistry of various products used in day today life.
Unit I	**INORGANIC CHEMISTRY** Atomic structure: electronic configuration - Aufbau principle - Pauli's exclusion principle- Hund's rule. Bonding: electrovalent, covalent, hydrogen bonds-orbital overlap - s-s, s-p. Hybridization and VSEPR theory - CH_4, $BeCl_2$, BF_3, NH_3, H_2O, PCl_5, IF_5.
Unit II	**ORGANIC CHEMISTRY** **Hydrocarbon** Organic compounds-classification-functional groups and names. **Alkanes**: General methods of preparation of alkane- wurtz reaction, hydrogenation of alkenes.Reactions: substitution, oxidation. **Alkenes:** general methods of preparations- dehydrogenation,-dehydrohalogination. Reactions: addition- (Markonvikov's rule) – oxidation, ozonolysis **Alkyne**:Preparationdehydrohalogenation-dehydrogenationReactions:Addition,oxidation, ozonolysis.
Unit III	**PHYSICAL CHEMISTRY - PHOTOCHEMISTRY** Definition-comparisons between thermal and photochemical reactions-Laws of photochemistry- Beer Lambert's law-Grothus Draper law-Einstein's law-Quantum yield-low and high quantum yield determination of quantum yield-fluorescence, phosphorescence, thermoluminescence, chemiluminescence and bioluminescence-definition with examples-photosensitisation.
Unit IV	**POLYMER CHEMISTRY** Definition- Monomers, Oligomers and Polymers - Classification of polymers-natural, syntheticlinear, cross linked and network- plastics, elastomers, fibres-homopolymers and co-polymers Thermoplastics: polyethylene, polypropylene, polystyrene, polyacrylonitrile, poly vinyl chloride, nylon and polyester - Thermosetting Plastics : phenol formaldehyde and epoxide resin- Elastomers: natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.
Unit V	**APPLIED CHEMISTRY** Lubricants-classification-criteria of good lubricating oils-synthetic lubricating oils-poly glycols and poly alkene oxides-greases or semi-solid lubricants-examples-solid lubricants-graphite Preparation and uses of shampoo, nail polish, sun screens, tooth powder, tooth paste, boot polish, moth ball and chalk piece.

Text Books	1. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of inorganic Chemistry,28th edition, vallabh Publication, New Delhi. 2. P.L.Soni, Text book of inorganic chemistry. Sultan chand and sons, New Delhi. 3. Arun Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand and Sons, 1st edition. 4. M.K.Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co, 4th edition. 5. K.K.Rohatgi Mukherjee, Fundementals of photo chemistry, Wiley Eastern Ltd, New Delhi.
References	1. Morrison and Boyd., Organic Chemistry, Pearson publication, 2. Mehta. B. and Mehta.M., Organic Chemistry, Prentice–Hall of India Private limited. 3. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry. 4. Malcom P. Stevens, Polymer Chemistry – An Introduction 5. V.R. Gowariker, Polymer Science, Wiley Eastern. 6. Sawyer.W, Experimental cosmetics, Dover publishers, New York.

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Generic Elective (Non Major)	Sub Code	WATER MANAGEMENT	Hrs./ Week	Credits:
1	21UCHN3A		2	2

COURSE OBJECIVES	• .To realize the importance of quality water in day to day life • To understand the process of conversion impure water into pure water
COURSE OUTCOME	• Realize the importance of quality water in day to day life • Knowledge about water quality parameters • Analyse the techniques of water purification • Gain knowledge on waste water treatment. • Realise the importance of restoration and management of Indian river
Unit I	**WATER POLLUTION** Water Pollution: Definition with example, water pollutants Sources: sewage and domestic wastes, industrial effluents, agricultural discharges, detergents, disease causing agents and radioactive materials, eutrophication. Effects of water pollution, Remedial measure
Unit II	**WATER QUALITY PARAMETERS** Physical, Chemical and Biological Water Quality Parameters: definition and application. Water Quality Standards for Drinking Water: BIS and WHO. Determination: PHs, total hardness, dissolved Oxygen, acidity and alkalinity.
Unit III	**WATER PURIFICATION** Purification of Water for Drinking Purposes: sedimentation, filtration and disinfection. Desalination: reverse osmosis. Purification of water for industrial purposes: water softening-permutit process and ion-exchange process.
Unit IV	**WASTE WATER TREATMENT** Elementary Ideas of Waste Water Treatment: pre-treatment, primary treatment, secondary treatment (aerobic and anaerobic processes), tertiary treatment (evaporation, adsorption and chemical precipitation).
Unit V	**RESTORATION AND MANAGEMENT** Lakes and rivers : Importance Indian rivers :Stresses on them and their effects Restoration: A case study Ganga Action Plan: objectives implementation and drawbacks. Rain water harvesting and water recycling : Definition and Methods Act: The water Prevention and control of Pollution Act 1974.
Text Books	1. A. K. De, Environmental Chemistry, Wiley Eastern Ltd., New Delhi. 2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut. 3. R. K. Trivedy and P. K. Goel, Chemical and biological methods for water pollution studies, Environmental Publications, Karad, India. 4. BIS, Specification for drinking water, Bureau of Indian Standards, New Delhi **5.** WHO, International standards for drinking water, World Health Organization, Geneva.

References	1. S.S. Dara, A Textbook of Environmental Chemistry and Pollution Control, S. Chand and Sons, New Delhi. 2. Manhan, S. E. Fundamentals of Environmental Chemistry. CRC Press.

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Generic Elective (Non Major)	Sub Code	TEXTILE CHEMISTRY	Hrs./ Week	Credits:
1	21UCHN3B		2	2

COURSE OBJECIVES	• To know about chemicals used in textile industry. • To understand the chemistry and chemical process involve in textile industry
COURSE OUTCOME	• Classify natural fibres • Understand the chemistry and chemical process involve in textile industry. • Describe impurities and processing of cotton • Knowledge about dyeing • Know about finishing of textile materials
Unit I	**NATURAL FIBRES** General classification of fibres-chemical structure, production, properties and uses of the following natural fibres (a)natural cellulose fibres (cotton and jute) (b) natural protein fibre (wool and silk).
Unit II	**ARTIFICIAL FIBRES** Chemical structure, production, properties and uses of the following synthetic fibres. (i) Man made cellulosic fibres (Rayon, modified cellulose fibres) (ii) Polyamide fibres (different types of nylons) (iii) Poly ester fibres.
Unit III	**PROCESSING OF RAW COTTON** Impurities in raw cotton and grey cloth, wool and silk- general principles of the removal – Scouring – bleaching – Desizing – Kierboiling-Chemicking.
Unit IV	**DYEING** Dyeing - Dyeing of wool and silk –Fastness properties of dyed materials – dyeing of nylon, terylene and other synthetic fibres.
Unit V	**PROCESSING OF FABRICS** Finishing- Finishes given to fabrics- Mechanical finishes on cotton, wool and silk, method used in process of mercerizing –Anti-crease and Anti-shrink finishes –Water proofing.
Text Books	1. Chemical Technology of fibrous Materials – F.sadov, M.Horchagin and A.Matetshy, Mir Publishers. 2. The Identification of Textile Fibres – Bruno Nuntak. 3. Introduction to Textile Science -3rd edition, MaryoryL.Joseph. 4. Textile Chemistry –Vol.IIR.H.Peters, Elserier, Avesterdam. **5.** Dyeing and chemical Technology of Textile fibres-5th Edition, E.R.Trotman,Charles Griffin & Co Ltd
References	1. 1. Two-for-One Technology and Technique for Spun Yarn by Dr. H. S. Kulkarni and Dr. H. V. S. Murthy. 2. Cotton Spinning By Ganesh and Garde. 3. Chemical technology of fibrous material by F. Sadov 4. Basic Principles of Textile Colouration by Arthur D Broadbent, SDC 5. Chemical processing of synthetic fibres by Dr. K. V. Datye& A. A. Vaidya

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Generic Elective (Non Major)	Sub Code	DAIRY CHEMISTRY	Hrs./ Week	Credits:
1	21UCHN3C		2	2

COURSE OBJECTIVES	• To learn the composition and properties of milk • To understand the chemical composition of milk and milk processing. • To know the chemistry of cream and butter • To study to fermented milk products • To know the condensed milk and dairy detergents
COURSE OUTCOME	• Study the properties of milk • Describe the processing milk • Understand the definition and classification of milk products • Analyse the fermentation process of milk • Understand the difference between milk
Unit I	**PROPERTIES OF MILK** Definition, Composition, Milk lipids, Milk proteins, vitamins and minerals. Factors affecting the composition of milk - adulterants, preservatives, and neutralizer - examples and their detection.
Unit II	**PROCESSING OF MILK** Destruction of microorganisms in milk – physicochemical changes during processing – boiling, pasteurization – pasteurization types – bottle pasteurization –batch pasteurization – HTST (High Temperature Short Time) – vacuum pasteurization –(UHT) Ultra High Temperature Pasteurisation
Unit III	**MILK PRODUCTS-I** Milk Products: Cream - definition, classification – manufacturing - chemistry of creaming process - physico–chemical properties – separation of cream , estimation of fat in cream , Butter - definition, classification, composition, theory of churning, desibutter, salted butter. Ghee - major constituents, common adulterants and their detection
Unit IV	**MILK PRODUCTS-II** Fermented milk products - fermentation of milk - definition and conditions. Ice creams - definition, composition, types, manufacture of ice - cream, stabilizers, emulsifiers, and their role, milk powder - definition, process of making milk powder
Unit V	**CONDENSED MILK AND DAIRY DETERGENTS** Condensed milk – definition, classification and differences between condensed milk and skim – condensed milk – sanitation - pasteurization – nutritive value of milk – difference between cow milk and bauffalo milk- milk enzymes. Dairy Detergents: Definition-characteristics classification-washing procedure (modern method) sterilization-chloramin-T and hypochlorite solution.
Text Books	1. Applied Chemistry-K.Bagavathi Sundari MJP Publishers Chennai. 2006. 2. Principles of Dairy technology - Robert Jenness, Wiley, New York
References	1. Indian Dairy Products - Rangappa and Acharya, K.T. Asia Publishing House, Bombay, India. 2. Fundamentals of Dairy Chemistry - Wond. F.P. Springer. 3. Outlines of Dairy Technology - Sukumar De. – Oxford University Press. 4. Applied chemistry for home science & aAllied science - T.Jacob, Mcmillan.

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Core	Sub Code	PHYSICAL CHEMISTRY –II	Hrs./ Week	Credits:
6	21UCHM41		4	4

COURSE OBJECTIVES	• To understand the basic concepts of thermodynamics • To understand chemical equilibrium • To know about solutions and surface chemistry
COURSE OUTCOME	• Understand the first law of thermodynamics • Analyse the kinetics of chemical reactions • Know about solutions and surface chemistry • Illustrate the types and characteristics of solutions • Discuss the types of adsorption and its applications
Unit I	**THERMODYNAMICS-I** First Law of thermodynamics: Statement and mathematical formulation Important Definitions: Internal energy, enthalpy, C_v, C_p, relationship between C_p and C_v. Derivations based on I Law: Calculation of work, heat, internal energy change and enthalpy change for the expansion of an ideal gas under reversible isothermal and adiabatic conditions. Applications: Joule- Thomson effect, Joule-Thomson coefficient and its significance, derivation of the expression for Joule-Thomson coefficient, inversion temperature, Kirchoff's equation and its applications.
Unit II	**CHEMICAL KINETICS** Important Definitions: Rate, rate laws, rate constant, order, molecularity Rate of reactions: Expression, measurements, factors- Effect of temperature. Order of reactions (I, II, III and Zero): Definition with example, expression, derivation, determination. Activation Energy: Definition, Arrhenius equation. Theories of reaction rates: Collision theory, Lindemann theory and ARRT
Unit III	**CHEMICAL EQUILIBRIUM** Chemical Equilibrium: Definition, nature. Equilibrium Constants: Definition, types-K_p, and K_c, thermodynamic derivations, relations between K_p& K_c, temperature and pressure dependence. Law of Mass Action: definition, application to homogenous and heterogenous equilibrium. Le-Chatelier Principle: Definition, application to homogenous equilibrium (dissociation of HI, PCl_5, formation of NH_3) and heterogenous equilibrium (dissociation of $CaCO_3$, $CuSO_4.5H_2O$),effect of inert gas on equilibrium

Unit IV	**SOLUTIONS** Solutions: Definition Methods for Expressing Concentration: molarity, molality, molefraction, normality, mass fraction, parts per million. Types of Solutions: Solution of Gases in Liquid: Definition, solubility of gases in liquids, Henry's law – statement and limitations. Solution of Liquids in Liquid: definition, Binary Liquid Mixture: Definition, ideal and non-ideal solutions, Raoult's law, deviation from ideal behaviour, pressure–composition and temperature–composition diagrams. Completely Miscible Binary Solutions: definition with example, Separation: Fractional distillation (definition and explanation with an example); Azeotrope: definition with example, nature, azeotropic distillation (explanation with an example); Partially Miscible Liquids: Definition, consolute temperature, Critical Solution Temperature (CST): definition with example, system with upper, lower and upper and lower CST (definition and explanation with an example).
Unit V	**UNIT-V SURFACE CHEMISTRY** Adsorption: Definition Types: Physisorption and Chemisorption Adsorption of Gases by Solids (Adsorption Isotherms): Freundlich, Langmuir and BET (definition, derivation and applications). Applications of Adsorption: General, adsorption indicators. Catalyst: Definition with example, general characteristics. Catalysis: Types – phase transfer, acid base, Enzyme Catalysis – definition with example, mechanism and kinetics of Enzyme Catalysis , Michaelis-Menten equation.
Text Books	1. Principles of physical chemistry – Puri, Sharma and Pathania, Millennium Edition, Vishal Publishing Co 2. Text Book of physical chemistry – P.L. Soni – Sultan Chand, New Delhi. 3. Atkins' Physical chemistry, 9th Edition, Oxford University Press. 4. Advanced Physical Chemistry – Gurdeep Raj, Goel Publishing House. **5.** Physical Chemistry, G.M.Barrow, Tata McGraw Hill.
References	1. Castellan. G.W., Physical Chemistry, Addison-Wesley, 3rd edition. 2. Atkins. P.W. and De Paula. J., Physical Chemistry, Oxford University press, 8th edition. 3. Glasstone. S., A Textbook of Physical Chemistry, Macmillan (India) Ltd. 4. Chemical Kinetics-K. J. Laidler, Tata McGraw Hill Publishing Company, NewDelhi

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Skill Based	Sub Code	CHEMISTRY IN MEDICINE	Hrs./ Week	Credits:
2	21UCHS4A		2	2

COURSE OBJECIVES	• To have knowledge of Common diseases. • To know the drugs used for diseases. • To know chemotherapy
COURSE OUTCOME	• Have knowledge of Common diseases. • Know about the drugs used for diseases. • Discuss the sources, type of drugs chemotherapy • Create awareness about common disease • Describe & communicate role of chemicals in healthy living
Unit I	**INTRODUCTION** Common diseases – infective diseases – insect – borne, air – borne and water-borne – hereditary diseases – Terminology – drug, pharmacology, , absorption of drugs – factors affecting absorption –therapeutic index (Basic concepts only)
Unit II	**DRUGS** Various sources of drugs, pharmacologically active constituents in plants, Indian medicinal plants – tulsi, neem, keezhanelli – their importance – Classification of drugs – biological, chemical (Structure not required)– factors affecting metabolism of drugs. (Basic concepts only)
Unit III	**CHEMOTHERAPY** Drugs based on physiological action, definition and two examples each of anesthetics- General and local – analgesics – narcotic and synthetic – Antipyretics and anti-inflammatory agents – antibiotics – Penicillin, Streptomycin, Antivirals, AIDS – symptoms, prevention.
Unit IV	**COMMON BODY AILMENTS** Diabetes – Causes, hyper and hypoglycemic drugs – Blood pressure – Sistolic & Diastolic Hypertensive drugs – Cardiovascular drugs –HDL, LDL cholesterol lipid lowering drugs. (Structure not required)
Unit V	**HEALTH PROMOTING DRUGS** Vitamins A,B, C, D, E and K – micronutrients Na, K, Ca, Cu, Zn and I, Medicinally important inorganic compounds of A1, P, As, Hg and Fe, Examples and applications, Agents for kidney function (Aminohippuric acid). Agents for liver function (Sulfo bromophthalein), antioxidants, treatment of ulcer and skin diseases.
Text Books	1. Practical Biochemistry – David Plummer – 2005, Tata McGraw-Hills PublishingCompany. 2. Text Book of Pharmaceutical Chemistry – Jeyashree Gosh, S.Chand and Company, New Dehi. 3. Medicinal Chemistry – G.R.Chatwal, Himalaya Publishing House, New Delhi. **4.** V.K. Ahluwalia and Madhu Chopra, ―Medicinal Chemistry‖, Ane Books, New Delhi.

References	1. G L David Krupadanam, D Vijaya Prasad, K Varaprasad Rao, K L N Reddy C Sudhakar, Drugs, Universities Press, Hyderabad. 2. Graham Patrick, Instant notes – Medicinal chemistry, PragatiPrakashan Viva books (pvt) Ltd. 3. Alka& Gupta, Medicinal chemistry, PragatiPrakashan, II Edn . 4. Sekharmukhopadhyay, Pharmaceutical selling-A text book, Sterling publishers private Ltd.

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Skill Based	Sub Code	INDUSTRIAL CHEMISTRY	Hrs./ Week	Credits:
2	21UCHS4B		2	2

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COURSE OBJECIVES	• To gain knowledge about systems of units and conversion factor • To understand utilities in chemical industries • To know the severity of corrosion and methods of preventing it • To study the industrial process of silicate industry • To acquire the knowledge about the unit process
COURSE OUTCOME	• Gain knowledge about systems of units and conversion factor • Outline fuels, explosives, nuclear fuels • Know the severity of corrosion and methods of preventing it • Know the industrial process & ethics of silicate industry • Acquire the knowledge about the unit process
Unit I	**UNITS AND DIMENSIONS, MATERIAL BALANCE** Fundamental and derived quantities – System of unit – significance of dimensional analysis – forces – weight – volume – pressure – work – energy – power. Basic chemical calculations: Atomic mass – Molar mass – concept of mole, gmol, comparison of liquid mixtures and gaseous mixtures, percentage of mass, volume and mol – ideal gas laws – Dalton's law Material balance without chemical reaction: Material balance equation – transient and steady state – simple material balance with and without recycle and bypass or chemical engineering operations such as evaporation, drying, filtration, extraction and crystallization.
Unit II	**FUELS** Fuels – types of fuels – calorific values – ignition point – pyrometric effect – explosives range – Flue gas analysis by Orsat's method – explosives – classifications – low explosives – initiating explosives – high explosives – rocket propellants – nuclear fuels
Unit III	**CORROSION AND PROTECTIVE COATING** Introduction – severity of corrosion – chemical and electrochemical corrosion – mechanism – factors influencing corrosion – control of corrosion – cathodic and anodic protection. Paints – characteristics of paint – constituents of paints – pigments – vehicles – thinners – driers – fillers – plasticizers – anti skinning agents – their function and properties. Metallic coating — polishing – galvanizing – tinning – electroplating.
Unit IV	**SILICATE INDUSTRY** Refractories – requirements of refractories – properties of refractories – solid refractories – fire clay refractories – magnesite refractories, dolomite bricks, graphite refractories, zirconia refractories, silicon carbide. Abrasives – classifications – natural (diamond, corundum, emery, garnet, quartz and flint) and artificial (carborundum, alundum, boron carbide, metallic abrasives). Uses of abrasives – cement manufacture – setting and hardening of cements, Industrial ethics

Unit V	**UNIT PROCESSES IN ORGANIC MANUFACTURE** Sulphonation – uses and applications of sulphonates and sulphates – sulphonating agents – sulphur trioxide – organic complexes – chemical and physical factors in sulphonation – commercial sulphonation of benzene – batch vs continuous sulphonation. Oxidiation – types of oxidation reactions – oxidizing agents – permanganate and dichromate – liquid phase oxidation – vapour phase oxidation – commercial manufacture of acetic acid.
Text Books	1. Industrial Chemistry, B. K. Sharma, Goel Publishing House,Meerut. 2. Industrial Chemistry, B. N. Chakrabarthy, Oxford & IBH Publishing Co. Pvt. Ltd.Calcutta. 3. Unit Operations I & II K. A. Gavhane, Nirali Prakashan, Pune. 4. Unit Processes in Organic Synthesis, P. H. Groggins, Tata McGraw-Hill PublishingCompany limited, New Delhi. 5. Stoichiometry – B. Z. Bhatt and S. M. Vora.
References	1. Engineering Chemistry, Jain and Jain. 2. G. Mahapatra, Elements of Industrial Chemistry, Kalyani Publishers, New Delhi 3. Stanley e. Mahanen, introduction to industrial chemistry. 4. Stoichiometry – B. Z. Bhatt and S. M. Vora. 5. Engineering Chemistry, Jain and Jain

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Allied	Sub Code	ALLIED CHEMISTRY – II	Hrs./ Week	Credits:
2	21UCHAP21		4	4

COURSE OBJECTIVES	• To learn about aromatic compounds • To understand the importance of nuclear chemistry • To study about bio chemistry • To have an elementary idea on industrial chemistry • To study about common diseases and drugs
COURSE OUTCOME	• Define about aromatic compounds. • Analyse nuclear stability and nuclear reaction. • Summarize stability and structure of biomolecules • Realise the importance of chemistry in industry • Identify common diseases and drugs.
Unit I	**ORGANIC CHEMISTRY** **Aromatic compounds** General characteristics of aromatic compounds – aromaticity – Huckel's rule with examples- non – benzenoid aromatic compounds (definition and examples only) Preparation, properties and structure of benzene, naphthalene and anthracene.
Unit II	**NUCLEAR CHEMISTRY** Nuclear stability – n/p ratio – packing fraction – mass defect – binding energy – isotopes, isobars, isotones with examples. Separation of isotopes by diffusion method – group displacement law – radioactive series – Nuclear fission, fusion – Application of radio isotopes (radio diagnosis and therapy, C-14 dating).
Unit III	**BIO CHEMISTRY** Carbohydrates –definition and classification – synthetic sweeteners. Amino acids – classification – amphoteric nature – isoelectric point. Proteins – classification according to composition, solubility and shape – colour reactions – biological action. Nucleic acids – purines, pyrimidines, nucleocides, nucleotides – DNA – structure of DNA – RNA – different types of RNA
Unit IV	**INDUSTRIAL CHEMISTRY** Fuel gases – Water gas, Producer gas, L.P.G, Gobar gas and Natural gas. Fertilizers – N.P.K and mixed fertilizers. Soaps and detergents – an elementary idea of soaps and detergents. Cleansing action of soaps and detergents. Cement and glass: Portland cement-manufacture only. Manufacture of glass- types and uses borosilicates –photochromic and safety glass.
Unit V	**PHARMACEUTICAL CHEMISTRY** Common diseases – infective diseases – insect borne –air borne – water borne – hereditary diseases. Definition and examples of analgesics, antipyretics, sulpha drugs, antimalarials and, antibiotics. Diabetes – causes – hyper and hypoglycemic drugs. Indian medicinal plants – tulsi, neem, keezhanelli- their importance
Text Books	1. Arun Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand and Sons. 2. Puri, Sharma and Pathania, Elements of physical chemistry, 4th Edition, Vishal Publishing Co. 3. C.B Power, G.R Chatwal , Bio chemistry , Himalaya publishing House, Reprint. 4. B.K Sharma , Industrial Chemistry, Goel publishing, 1st revised edition. **5.** Dr.S. Lakshmi, Pharmaceutical Chemistry, Sultan chand & sons ,

References	1. Puri, Sharma & Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors. 2. P.L. Soni, Text book of Inorganic Chemistry, Sultan Chand and Sons. 3. Morrison & Boyd, Organic Chemistry, Vith ed, Prentice Hall of India Pvt. Ltd., New Delhi. 4. J. L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry, S. Chand and Company Ltd.,New Delhi.

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Generic Elective (Non Major)	Sub Code	APPLIED CHEMISTRY	Hrs./ Week	Credits:
2	21UCHN4A		2	2

COURSE OBJECIVES	• To acquire knowledge about the chemicals used in day to day life • To understand the role of polymers in life • To know about the role of chemicals in our daily life
COURSE OUTCOME	• Acquire knowledge about the cleansing action of soaps • Differentiate artificial and natural fertilizer and communicate to the society • Understand the role of polymers in the life • Explain the role of chemicals in therapy • Know about the role of chemicals in our daily life
Unit I	**UNIT I – SOAPS AND DETERGENTS** Soaps: Definition-classification-raw materials used in the manufacture of soap – manufacture of toilet soap. Detergents: Definition –various types with examples- advantages of detergents over soaps –cleansing action of soap.
Unit II	**UNIT II- FERTILIZERS** Definition-characteristics of a good fertilizer- role of nitrogen, potassium and phosphorous in plant growth – natural fertilizers- chemical fertilizers: urea, muriate of potash and triple superphosphate – mixed fertilizers – biofertilizers – advantages of biofertilizers.
Unit III	**UNIT III – POLYMERS** **Fibers**: Classification –uses of terylene, nylon and orlon. **Resins**: Natural resins- synthetic resins-type-uses of fevicol, quick fix, araldite, glyptal and Bakelite. **Plastics:** classification- differences between thermoplasts and thermosets. Advantages ofplastics-uses of polythene, PVC, polystyrene, Teflon and thermocole. **Rubber:** Types-defects in natural rubber-vulcanization-synthetic rubbers- uses of neoprene, thiocol, butyl rubber, silicone rubber and foam rubber.
Unit IV	**UNIT IV – CHEMICALS IN PHARMACY** Definition and therapeutic uses of the following (an elementary study only) **Antiseptics:** alum, boric acid **Mouth washes:** Hydrogen peroxide **Antacids:** Aluminium hydroxide **Analgesics:** Aspirin, paracetamol **Antibiotics:** Penicillins, tetracyclines **Haematinics:** Ferrous fumerate, ferrous gluconate **Laxatives:** Epsom salt, milk of magnesia **Sedatives:** Diazepam
Unit V	**UNIT V – CHEMICALS IN DAY-TO-DAY LIFE** An outline of the preparation and uses of the following articles. Tooth powder, tooth paste, writing inks, gum paste, boot polish, talcum powder, chalk crayons, agar battis, phenyl and moth balls.

Text Books	1. .B. K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut. 2. Jeyashree Gosh, A text book of Pharmaceutical Chemistry, S. Chand and Company,NewDelhi. **3.** B. N. Chakrabarty, Industrial Chemistry, Oxford and IBH Publishing Co. Pvt.Ltd.,Calcutta.
References	1. Applied Chemistry, K. Bagavathi Sundari, MJP publishers 2. Contemporary Polymer Chemistry, Harry R. Allcock, Frederick W. Lampe, James E. Mark, 3rd edition, Pearson Prentice hall.

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Generic Elective (Non Major)	Sub Code	HEALTH CHEMISTRY	Hrs./ Week	Credits:
2	21UCHN4B		2	2

COURSE OBJECIVES	• To know the essentials of health and drugs. • To learn the functions of enzymes, hormones and body fluids • To know common diseases and their treatment
COURSE OUTCOME	• Knowledge about the essentials of health and drugs. • Know about role of enzymes • Point out the chemistry of body fluids • Illustrate the functions of enzymes, hormones and body fluids • Create awareness about common disease and pandemic disease
Unit I	**HEALTH** Definition: Food, Food Pyramid – Health-Hygiene- mal, under and over nutrition, their causes, diseases and remedies, sanitation- Water: Role of water in the body, its requirement, maintenance of water balance
Unit II	**DRUGS** Drugs – Types of drugs-depressant, anticonvulsant, narcotics, antipyretics, antibiotics, antiseptics, analgesics, muscle relaxants and cardiovascular and vaso depressants, steroids (Only Applications).
Unit III	**BODY FLUIDS** Blood volume, groups, coagulation, blood pressure, anaemia, blood sugar, haemoglobin, lymph, Chemistry of urine, Functions of body fluids
Unit IV	**ENZYMES AND HORMONES** Types of enzymes and enzyme action, Factors affecting enzyme action, enzyme regulation, Characters of hormones action, examples of essential hormones, regulation of harmones
Unit V	**COMMON DISEASES** Common diseases – Jaundice, vomiting, fever, night blindness, ulcer, whooping cough, dengue, corona and diabetes.
Text Books	1. Deb A C, Fundamentals of Biochemistry, New Central Book Agency, Calcutta. 2. Satake M and Mido Y, Chemistry for Health Science, Discovery Publishing House,New Delhi. 3. Jayashree Ghosh, A Text book of Pharmaceutical Chemistry, S. Chand and Co.Ltd. 4. Ashutosh Kar, Medicinal Chemistry, Wiley Easterns Limited, New Delhi. 5. Sailesh Rathod, COVID-19, A book about the corona virus. Information on symptoms and precautions
References	1. Medicinal Chemistry – G.R.Chatwal, Himalaya Publishing House, New Delhi. 2. V.K. Ahluwalia and Madhu Chopra, ―Medicinal Chemistry‖, Ane Books, New Delhi. 3. Ganellin c.r, roberts s.m, medicinal chemistry, the role of organic chemistry in drug research, Elsevier..

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Generic Elective (Non Major)	Sub Code	BASIC CLINICAL AND PHARMACEUTICAL CHEMISTRY	Hrs./ Week	Credits:
2	21UCHN4C		2	2

COURSE OBJECTIVES	• To know clinical hygiene and biochemical analysis • To classify common drugs • To understand the biological importance of enzymes • To study about body fluids
COURSE OUTCOME	• Know clinical hygiene and biochemical analysis • Classify common drugs • Understand the biological importance of enzymes • Analyse the importance of blood in our body • Describe and recognise genetic engineering
Unit I	**CLINICAL HYGIENE AND BIOCHEMICAL ANALYSIS** Definition of health. Ryde of WHO. Sterilization of surgical instruments. Disinfectants, antiseptics, sanitation. Biochemical analysis of urine, serum and fecal matter. Treatment for specific poisons-acids, alkalis, arsenic and mercury compounds
Unit II	**COMMON DRUGS** Types of drugs and their modes of action : Depressant drugs (special reference to sedatives and hypnotics).-Anticonvulsant drugs (sodium valproate, hydantoins).-Narcotic analgesics (only morphine compds).-Antipyretic analgesics (acetyl salicyclic acid, p – amino – phenol derivatives).-Muscle relaxants.-Cardiovascular drugs-nitrates, calcium channel blockers.
Unit III	**ENZYMES** Classification, specificity. Coenzymes, Cofactor, ATP, Mechanism of enzyme action and Immobilisation of enzymes, factors affecting enzyme activity
Unit IV	**HEMATOLOGY** Blood volume, blood groups, coagulation of blood. Plasma lipo protiens. Blood pressure. Arteriosclerosis, diseases affecting red cells: Hyperchromic and hypochromic anaemia. Blood transfusion. Blood sugar and diabetes. Medicine used to control blood pressure and blood sugars
Unit V	**BIOTECHLONOGY** Heredity, recombinant DNA, Genetic engineering and its possible hazards, Gene splicing, manufacture of interferon and human insulin (Humulin), Drug manufacture based on fermentation(only antibiotics)
Text Books	1. Jayashree Ghosh, A text book of Pharmaceutical Chemistry, S.Chand and Co. Ltd. 2. S.C. Rastogi, Biochemistry, Tata McGraw Hill Publishing Co. **3.** Ashutosh Kar, Medicinal Chemistry, Wiley Eastern Limited, New Delhi.

References	1. O.Le Roy, Natural and synthetic organic medicinal compounds, Ealemi. 2. B.L. Oser, Hawk's physiological chemistry, 14th edition, Tata-McGraw – Hill Publishing Co.Ltd. 3. O. Kleiner and J. Martin, Bio-Chemistry, Prentice-Hall of India(P) Ltd, New Delhi.

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Major Practical	Sub Code	INORGANIC QUALITATIVE ANALYSIS	Hrs./ Week	Credits:
2	21UCHMP4		2	2

COURSE OBJECTIVES	• To enable the students to understand various procedures in salt analysis. • To create an awareness on eco-friendly approach in salt analysis
COURSE OUTCOME	• Understand various procedures in salt analysis. • Aware on eco- friendly approach in salt analysis • Know about types of radicals • Analyse different radicals • Employ laboratory skills to analyse the radicals
SYLLABUS	**Qualitative analysis of Inorganic salt mixtures containing two acid radicals (one should be an interfering radical) and two basic radicals** 1. **Acid Radicals** **Simple Acid Radicals:** Carbonate, Nitrate, Sulphate, Chloride and Bromide. **Interfering Acidic Radicals:** Borate, Fluoride, Oxalate and Phosphate. **2. Basic Radicals** Group I : Lead Group II : Copper, Cadmium, Bismuth. Group III : Ferric iron Group IV : Cobalt, Nickel, Manganese. Group V : Barium, Strontium Group VI : Magnesium, Ammonium.
EVALUATION	**Internal- 50 marks** 25 marks- regular class work 25Marks – Model test **External – 50 marks** 10 Marks- Record 40Marks- Result Duration:3 hour
Text Books	1. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai.
References	2. Vogel's Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London.

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Core	Sub Code	ORGANIC CHEMISTRY-III	Hrs./ Week	Credits:
7	21UCHM51		6	4

COURSE OBJECTIVES	• To understand about stereochemistry • To understand aromaticity • To know about dyes
COURSE OUTCOME	• Integrate the concept of Stereoisomerism • Understand the concept of aromaticity & principles of aromatic substitution reactions. • Know about properties and synthesis of phenols, aromatic aldehydes, ketones and acids • Knowledge about mechanism of different reactions • Classify drugs and explain theory of drugs
Unit I	**STEREOCHEMISTRY** Stereoisomerism-Definition-Classification into optical and geometrical isomerism. Projection formulae-Fischer, Flying wedge, Sawhorse and Newman Projection formulae – notation of optical isomerism- D-L –notation-Cahn-Ingold-Prelog rules- R-S notation for optical isomers. Optical isomerism-Optical activity – optical and specific rotation-condition for optical activity-asymmetyric centre - chirality-achiral molecules-meaning of (+) and (-) .Elements of symmetry-Racemisation-methods of racemization-Resolution-methods of resolution (mechanical, seeding, biochemical and conversion to diastereo isomers) asymmetric synthesis (partial and absolute synthesis) optical activity in compounds not containing asymmetric carbon atoms. Biphenyls, allenes and spiranes. Geometrical isomerism, cis, trans, syn anty and E,Z notations, geometrical isomerism in maleic and fumeric acid and ansymmetrical keto oximes. Methods of distinguishing geometrical isomerism using melting point, dipole moment, dehydtration and cyclisation.
Unit II	**AROMATICITY & AROMATIC SUBSTITUTION** Aromaticity – definition – Huckel's rule – consequence of aromaticity – stability, carbon-carbon bond lengths of benzene, resonance energy and participation of substitution vs addition – examples. Non-benzenoid aromatic compounds Aromatic electrophilic substitution – general pattern of the mechanism, role of σ and π complexes, Mechanism of nitration, halogenation, sulphonation and Friedel-Crafts reaction. Activating and deactivating substituents, orientation in mono substituted benzenes, ortho/para ratio-Orientation- Korner's absolute method, dipole moment method – direct influence of substituents – rules of orientation - Aromatic Nucleophilic substitutions- unimolecular, bimolecular and benzyne mechanisms.
Unit III	**PHENOLS, AROMATIC ALDEHYDES, KETONES AND ACIDS** **Phenols**, Acidic character of phenols- effect of substituents on acidity of phenols - Mechanism of Kolbe's reaction and Reimer-Tiemenn reaction. Preparation of cresols, catechol, resorcinol, quinol and euginol. Aldehydes and ketones - Preparation and uses of cinnamaldehyde, Coumarin, vanillin, Michler's ketone, p-benzoquinone - Quinone mono oxime tautomerism.

	Mechanism of Cannizaro reaction, benzoin condensation, Perkin reaction, Claisen reaction, Knovenagel reaction,Gattermann aldehyde synthesis and Houben – Hoesch synthesis. Aromatic acids - Ortho effect, preparation of mandelic acid, cinnamic acid and anthranilic acid. Preparation and uses of benzene-1,2- dicarboxylic acid, benzene-1,3- dicarboxylic acid and 1,4-dicarboxylic acid.
Unit IV	**REARRANGEMENTS** Rearrangement to electron-deficient carbon – 1,2 shift (Wagner-Meerwein rearrangement, pinacol - pinacolone rearrangement,Wolff rearrangement in Arndt-Eistert synthesis, benzil-benzilic acid rearrangement).Aromatic rearrangements from oxygen to ring carbon (Fries rearrangement, Claisen rearrangement and benzidine rearrangement). Rearrangement to electron-deficient nitrogen (Beckmann rearrangement, Schmidt rearrangement, Hofmann rearrangement, Curtius rearrangement). Rearrangement to electron-deficient oxygen (Baeyer-Villiger oxidation, hydroperoxide rearrangement,cumene hydroperoxide-phenol rearrangement), Dakin reaction
Unit V	**DYES** Dyes - theory of colour and constitution - chromophore, auxochrome, classification - (according to application and structure) - preparation and uses of azo dyes - methyl orange, triphenyl methane dyes, malachite green, indigo dyes - Indigotin, anthraquinone dyes - alizarin, phthalein dyes.
Text Books	1. Textbook of Organic Chemistry - P.L.Soni - Sultan Chand 2. Advanced organic Chemistry - B.S.Bahl - S. Chand 3. Principles of Organic Chemistry - A.K.Bansal - New Age 4. A Textbook of Organic Chemistry - A.K.Bansal - New Age 5. Organic Chemistry - I.L.Finar - Volume I & II - Addision Welsey 6. Organic Chemistry - R.T.Morrison and Boyd - Prentice Hall 7. Stereochemistry of Organic Compounds - D.Nasipuri - New Age 8. Stereochemistry, Conformation and Mechanisms - Kalsi New Age 9. Advanced General Organic Chemistry - Sachin K.Ghosh - Books and Allied (P) Ltd
References	1. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley And Sons, New York, 2. S. H. Pine, Organic Chemistry, 5th Edition, McGraw Hill International Edition, Chemistry Series, New York. 3. Sehan. N. Ege, Organic Chemistry, Structure and Reactivity, 3rd Edition, A.I.T.B.S., New Delhi. 4. Hendrickson, Cram and Hammond, Organic Chemistry, 3rd Edition, McGraw-Hill Kogakusha, Limited. 5. 5. Francis A. Carey, Organic Chemistry, 3rd edition, Tata-McGraw Hill Publications, NewDelhi.

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Core	Sub Code	PHYSICAL CHEMISTRY-III	Hrs./ Week	Credits:
8	21UCHM52		6	4

COURSE OBJECTIVES	• To understand chemical kinetics, thermodynamics, electrochemistry • To understand group theory
COURSE OUTCOME	• Recognize the basic terms of thermodynamics • Know the applications of thermodynamics • Explain the basic principles and applications of electrical conductance • Classify cells and calculate(solve problems related to) EMF of various electrodes • Understand the concept of symmetry and point groups
Unit I	**THERMODYNAMICS-II** **Second Law of thermodynamics:** Need, statement. **Entropy:** Definition, state function, physical significance, Clausius inequality, **Entropy change**: In terms of T,V and T,P, In reversible and irreversible processes, isothermal transformation, phase transition, mixing of ideal gases. **Free Energy:** definition, work function A and free energy function G, general conditions of equilibrium and spontaneity, physical significance of dA and dG, T and P dependence of G, variation of G during isothermal change, Gibbs Helmholtz equation.
Unit II	**THERMODYNAMICS-III** **II Law-Applications:** Van't Hoff isotherm and isochore - Clapeyron equation-Clapeyron-Clausius equation-Applications of Clapeyron-Clausius equation. **Partial Molar Properties:** Partial molar free energy, Chemical Potential:definition, variation of chemical potential with T and P, Gibbs Duhem equation **III Law:** Statement, Nernst heat theorem, exception to third law, experimental verification of the law. **III Law-Applications:** Residual entropy, evaluation of absolute entropy from heat capacity measurements, concept of fugacity and activity, activity coefficient, standard states.
Unit III	**ELECTROCHEMISTRY-I** **Conductance:** Conductor, Types-metallic and electrolytic, specific, equivalent and molar conductance, measurement, cell constant, variation of conductance with dilution. **Electrolytes:** Definition, types– strong and weak. **Weak Electrolytes:** Degree of dissociation, determination of ionic product of water. **Strong Electrolytes:** Conductance– Debye – Huckel – Onsager theory, verification of Onsager equation, Wein and Debye–Falkenhagen effect **Migration of ions:** Transport number, determination by Hittorf and moving boundary methods, **Kohlrausch's law**–definition and expression, applications, calculation of equivalent conductance for weak electrolytes, Ionic mobilities. Walden rule. **Applications of Conductance Measurements:** Determination of solubility of sparingly soluble salts, conductometric titrations.

Unit IV	**ELECTROCHEMISTRY–II** **Electrode:** Definition with example, **Types** – Standard Hydrogen electrode, calomel electrode, Derivation of Nernst equation for EMF of electrode, electrode potentials, standard reduction potentials, electro chemical series. **Cell:** Definition with example, **Types:** reversible and irreversible cells, EMF measurement, Derivation of Nernst equation for EMF of cell, Application of Gibbs –Helmholtz equation to galvanic cells calculation of thermodyamic quantities. **Concentration cells**: Definition, **Types -** electrode concentration cells, electrolyte concentration cells **Application of EMF Measurements:** pH using hydrogen and glass electrodes, potentiometric titrations. LJP expression –polarization – over voltage- decomposition voltage.
Unit V	**GROUP THEORY** **Concept of symmetry in chemistry**: Symmetry operations and symmetry elements – rotational axis of symmetry and types of rotational axes - planes of symmetry and types of planes -improper rotational axis of symmetry- identity element. **Groups and their basic properties**: Types of groups, Abelian and cyclic groups **Point groups:** Classification of molecules into point groups - the symmetry operations of a group – C_{2v} and C_{3v} point groups - group multiplication tables.
Text Books	1. B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Jalandhar. 2. P.L. Soni, O.P. Dharmarha & U.N. Dash, Text book of Physical Chemistry, 22ndEdn., Sultan Chand & Sons, New Delhi 3. Essentials of Physical Chemistry– B.S.Bahl, Arun Bahl, G.D.Tuli, Reprint,S.Chand & Company Ltd., New Delhi-110055. 4. Physical Chemistry volumes I & II- S.Pahari,New Central Book Agency,Kolkotha. 5. Physical Chemistry-G.M.Barrow, Tata McGraw Hill Publishing Company,NewDelhi. 6. Physical Chemistry-G.K.Vemulapalli, Prentice Hall of India. Group theory and its Chemical Applications - P.K.Bhattacharya - Himalaya publishing House.
References	1. Gilbert. W. Castellan, Physical Chemistry, Narosa publishing house, third edition. 2. Irving M. Klotz and Robert M. Rosenberg, Chemical Thermodynamics, John Wiley and sons, Inc. 3. J. Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and CO. 4. K. L. Kapoor, A Textbook of Physical chemistry, (volume-2 and 3) Macmillan, India Lt.

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Discipline Specific Elective	Sub Code	POLYMER CHEMISTRY	Hrs./ Week	Credits:
1	21UCHM5A		4	4

COURSE OBJECTIVES	• To know the concept of polymerization and types of polymers • To understand the characteristics of polymers • To acquire knowledge about the polymerization techniques and polymer processing • To know the chemistry of individual polymers • To have an idea about the recent advances in polymer sciences
COURSE OUTCOME	• Know about classification of polymers • Explain the physical characteristics of polymers • Discuss the polymerization techniques and process • Describe the chemistry of some commercial polymers • Recognize the applications of polymers
Unit I	**INTRODUCTION TO POLYMERS** Definition - Monomer, polymer and polymerisation - classification of polymers on the basis of Origin - Natural, semi synthetic, synthetic, Physical properties and applications - Rubbers, plastic, fibres. Thermal response - thermoplastics, thermosetting plastics, Structure - Homopolymers (linear, branched, cross link or network), Copolymers (Random, Alternate, Block, Graft) - Crystallinity – crystalline, non-crystalline (amorphous), semi-crystalline, mode of polymerisation - Addition, Condensation Polymerisation (definition and examples only) -Methods of polymerization - Bulk, Solution, Suspension Polymerisation (definition and examples only) – chemistry of polymerisation, Chain polymerization, free radical, ionic, co-ordination, step polymerization
Unit II	**CHARACTERISTICS OF POLYMERS** Glass transition temperature (Tg) - definition – Factors affecting Tg – relationships between Tg and molecular weight and melting point. Importance of Tg. Molecular weight of polymers. Number average, weight average (problems), sedimentation and viscosity average molecular weights. Molecular weights and degree of polymerization - chemical reaction - hydrolysis - hydrogenation - addition - substitution – cross-linking, vulcanisation and cyclisation reactions. Polymer degradation - basic idea of thermal, photo and oxidative degradation of polymers.
Unit III	**POLYMERIZATION TECHNIQUES AND PROCESSING** Bulk, solution, suspension, emulsion, melt condensation and interfacial poly condensation polymerizations. Polymer processing - calendaring - die-casting, rotational casting - compression moulding - injection moulding - blow moulding - extrusion moulding and reinforcing.
Unit IV	**CHEMISTRY OF SOME COMMERCIAL POLYMERS** Preparation, properties and uses of the following polymers. Thermoplastics, polyethylene, polypropylene, polystyrene, polyacrylonitrile, polyvinyl chloride, nylon, polyester. Thermosetting plastics: Phenol formaldehyde resin, urea formaldehyde resin,

	melamine formaldehyde, epoxy resin, polycarbonate. Elastomers: Natural rubber and synthetic rubber, Styrene and neoprene rubber
Unit V	**ADVANCES IN POLYMER** Biopolymers - Biomedical polymers - contact lens, dental polymers, artificial heart, kidney, skin and blood cells - High temperature and fire resistant polymers - silicones - conducting polymers - (elementary idea) - polysulphur nitrile, polyphenylene, polypyrrole and polyacetylene. Polymer industry in India.
Text Books	1. V.R. Gowarikar, N.V. Viswanathan and J. Sreedhar. Polymer Science, Wiley Eastern. 2. F.N. Billmeyer, Textbook of Polymer Science, Wiley Interscience. 3. Material Science II edition, P.K. Palanisamy SCITECH Publications India Pvt., Ltd., Chennai-600001. 4. Engineering Chemistry, V Srinivasan, S.D. Uma Maheshwari, M. Meena. SCITECH Publications India Pvt., Ltd., Chennai-600001. 5. Introduction to Organic Chemistry. John McMurry Brooks/cole Cenage Learning India Private Limited. First Reprint. 6. Modern Chemistry, David. W. Oxtoby, H.P. Gills, Alan Campion Brooks/cole Cenage Learning India Private Limited. First Reprint.
References	1. 1.Contemporary Polymer Chemistry, Harry R. Allcock, Frederick W. Lampe, James E. Mark, 3rd edition, 2005, Pearson Prentice hall. (Unit – 2) 2. G.S. Misra, Introductory Polymer Chemistry, New Age International (Pvt) Limited. 3. Malcom P. Stevens, Polymer Chemistry – An Introduction

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Discipline Specific Elective	Sub Code	BIOCHEMISTRY	Hrs./ Week	Credits:
1	21UCHM5B		4	4

COURSE OBJECTIVES	• To enable the student to develop a sound knowledge of fundamental concepts in biochemistry. • To enumerate the molecular motif of a living cell, structural and functional hierarchy of biomolecules. • To emphasis on the various aspects of metabolism and interrelationship of metabolic events.
COURSE OUTCOME	• Describe the structure, classification and stereochemistry of amino acids, proteins. • Discuss and distinguish the composition of lipids. • Know the classification and mechanism of inhibition of enzymes. • Classify carbohydrates, analyze their structure and explain the reactions of mono, di and polysaccharides • Understand classification and structure of nucleic acids
Unit I	**AMINO ACIDS AND PROTEINS** **Living Cell** – Plant and Animal cell. Cell membrane – organelles – functions of major subcellular components – Anabolism and catabolism and their relation to metabolism. **Amino acids** – classification –Synthesis of amino acids and their identification. Peptide bond- stereochemistry, synthesis of peptides by solution and solid phase techniques. **Proteins** – classification – properties - 3D structure - determination of amino acid sequence –denaturation and renaturation of protein molecules. Separation and purification of proteins – dialysis – gel filtration - electrophoresis. Catabolism of amino acids: Transamination, oxidative deamination, decarboxylation. The urea cycle and other possibilities of detoxification of ammonia.
Unit II	**ENZYMES** Nomenclature, classification and properties-specificity, factors influencing enzyme action. Mechanism of enzyme action – Lock and Key model and induced fit models. Coenzymes – cofactors – prosthetic groups of enzymes (TPP, NAD, NADP, FAD, ATP). Their importance in enzyme action. Mechanism of inhibition (competitive, non- and uncompetitive and allosteric).Immobilization of enzymes. Enzyme specificity
Unit III	**LIPIDS** Classification - neutral lipids, Phospho lipids (lecithines, cephalins, plasmalogens) andglycolipids – importance, synthesis and degradation. Fatty acids – saturated, unsaturated fatty acids, EFA. Properties – Hydrolysis-acid number,saponification number. Auto-oxidation (Rancidity), addition reactions-Iodine value,Polenske number, Reichert-Meissl number, acetyl number. Hydrogenation Cholesterol – biosynthesis. Bile salts derived from cholesterol.Metabolism: Oxidation of glycerol – _-oxidation of fatty acids; biosynthesis of lipids –

	synthesis of fatty acids and synthesis of triglycerides.
Unit IV	**CARBOHYDRATES** Classification – reducing and non-reducing sugars. Glucose: structure-conformation – Stability Carbohydrates of the cell membrane – starch, cellulose and glycogen. (Structure and utility) Metabolism: Glycolysis and its reversal; TCA cycle. Relation between glycolysis and respiration. Principles of bioenergetics, electron transport chain and oxidative phosphorylation.
Unit V	**NUCLEIC ACIDS** Nucleosides and nucleotides – purine and pyrimidine bases. Nucleic acids Difference between DNA and RNA. Classification of RNA. Biosynthesis of DNA: Replication. Biosynthesis of mRNA: Transcription. Genetic code – mutations and mutants. DNA repair. Biosynthesis of proteins. DNA sequencing and PCR, recombinant DNA technology, DNA polymorphism
Text Books	*1.* Lehninger, Principles of Biochemistry, Fourth Edition, by David L. Nelson and Michael M. Cox, Worth Publishers, New York. *2.* L. Veerakumari, Biochemistry, MJP publishers, Chennai. *3.* Lubert Stryer, Biochemistry, W. H. Freeman and company, New York. *4.* Robert L.Caret, Katherine J. Denniston, Joseph J. Topping, Principles and Applications of organic and biological chemistry, WBB publishers, USA. *5.* J. L. Jain, Biochemistry, Sultan Chand and Co. *6.* Mazur and B. Harrow, Text book of biochemistry, 10th Edition, W.B. Saunders Co.,Philadelphia. *7.* 7. Paula Yurkanis Bruice, Organic chemistry, 3rd Edition, Pearson Education, Inc. (Singapore), New Delhi, reprint.
References	1. R. T. Morrison & R. N. Boyd, Organic Chemistry, Pearson publication, 7th edition. 2. B. Mehta & M. Mehta, Organic Chemistry, Prentice – Hall of India Private limited. 3. P. L. Soni & H. M. Chawla,Textbook of Organic Chemistry, Sultan Chand and Sons, 28th edition. *4.* I. L. Finar, Organic Chemistry, Vol.I, ELBS publication, 6th edition.

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Discipline Specific Elective	Sub Code	BIOINORGANIC CHEMISTRY	Hrs./ Week	Credits:
1	21UCHM5C		4	4

COURSE OBJECTIVES	• To study the significance of metal ions' transport and storage, • To study a few metallo enzymes, • To study electron transfer proteins, • To study oxygen transport and activation proteins, • To study the fundamentals of supramolecular chemistry
COURSE OUTCOME	• Understand the importance of metals in biology • Know about metallo porphyrins • Describe about metallo enzymes and their functions • Discuss about metals in therapeutic uses • State about supramolecular chemistry
Unit I	**METAL IONS IN BIOLOGY** Metal ions in biology- Essential and trace elements in biological system – biological importance and toxicity of elements such as Fe , Cu , Zn , Co , Mo , W , V , Mn , and Cr in biological system and their vital role in the active site- Ion transport mechanism in cell membrane – Na and K pumps- Ionophores
Unit II	**METALLO PORPHYRINS** Chlorophyll – photosynthetic electron transport sequence – biological electron carriers : iron sulphur proteins-ferredoxin, rubridoxin and cytochromes , cytochromes and blue copper proteins – oxygen carriers: haemoglobin and myoglobin dioxygen binding - co-operativity in haemoglobin - the Bohr effect -, Vitamin B12 and cytochrome P 450-mechanism of action
Unit III	**METALLO ENZYMES** Role of Zinc in enzyme chemistry-Zinc finger, Zinc twist and zinc cluster Structure and functions of Metallo proteins and enzymes - superoxide dismutase, carbonic anhydrase carboxypeptidase A, Catalase, LADH, and Peroxidase.
Unit IV	**METALS AND HEALTH** Application of therapeutic chelating agents- Metal-based drugs cis-platin, carboplatin, platinum anti-cancer drugs, gadolinium MRI contrast agents, Gold and arithritic agents – auranofin, solganol, myochristin, Toxicity of metals–Cd, Hg and Cr-bio metyhylation of mercury
Unit V	**SUPRAMOLECULAR CHEMISTRY** Concepts of supramolecular chemistry. – Host-Guest concept- Various types of non-covalent interactions. Hydrogen bonds, C-H…X interactions, Halogen bonds. π – π interactions,non – bonded interactions. Various types of molecular recognition- Cations, Anions and Neutral guests – Supramolecular Devices and Sensors: Various types of supramolecular devices
Text Books	1. Lippard, S.J. & Berg, J.M., Principles of Bioinorganic Chemistry Panima Publishing Company. 2. Cotton, F.A., Wilkinson, G., & Gaus, P.L. Basic Inorganic ,Wiley India, 3. Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry,

	Principles of Structure and Reactivity 4 th Ed., Harper Collins, Pearson. 4. Greenwood, N.N. & Earnshaw, A. Chemistry of the Elements 2 nd Ed, Elsevier, (Ziegler Natta Catalyst and Equilibria in Grignard Solution). JW Steed and JL Atwood Supramolecular Chemistry 2nd Ed. Wiley.
References	1. Lee, J.D. Concise Inorganic Chemistry 5 th Ed., John Wiley and sons. 2. Powell, P. Principles of Organometallic Chemistry, Chapman and Hall. 3. Shriver, D.D., Atkins, P. and Langford, C.H., Inorganic Chemistry 2 nd Ed., Oxford University Press. 4. David E Fenton, Bio coordination chemistry, oxford science publications. 5. Asim K. Das, Bioinorganic Chemistry, Books and allied (P) Ltd.

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Discipline Specific Elective	Sub Code	ANALYTICAL CHEMISTRY	Hrs./ Week	Credits:
2	21UCHM5D		4	4

COURSE OBJECIVES	• To understand the importance of analytical chemistry. • To know the different types of analytical techniques
COURSE OUTCOME	• Know errors and computational rules • Analyse the characteristics of water • Analyse the characteristics of fuel • Describe electroanalytical techniques • Study the principle, instrumentation and applications of spectroanalytical and thermoanalytical methods
Unit I	**ERRORS AND DATA ANALYSIS** Definition and explanation with examples of the terms – mean, median, mode, range,deviation, mean deviation, relative mean deviation, standard deviation, coefficient ofvariation and variance – accuracy and precision – types of errors – random and systematicerrors – methods of detection and elimination of systematic errors – student's t-test – confidence levels – Q-test for rejection of result – curve fitting – method of least squares –significant figures and computational rules.
Unit II	**WATER ANALYSIS** Sampling and preservation of water samples – physical examination of water : color,odour, turbidity, taste and electrical conductivity – chemical characterisation : pH, acidity, alkalinity, TDS, total, temporary, permanent, calcium and magnesium hardness, chloride, fluoride, DO, BOD, COD, detergents and pesticides – residual chlorine and chlorine demand – Bacteriological examination : total and faecal coliforms.
Unit III	**FUEL ANALYSIS** Solid fuels : coal – classification – proximate analysis : moisture content, ash content,volatile matter and fixed carbon – ultimate analysis : carbon, hydrogen, nitrogen, sulphur and oxygen – grading of coal – comparison of coal and coke – liquid fuels : flash point, aniline point, octane number and carbon residues – gaseous fuels : producer gas and water gas - preparation, uses.
Unit IV	**ELECTROANALYTICAL TECHNIQUES** Electrogravimetry: principle, instrumentation and applications. Coulometry: constant current coulometry –potentiostaticcoulometry – applications – Polarography: principle – experimental assembly – working – advantages and disadvantages of DME – applications to qualitative and quantitative analysis. Amperometric titrations: theory – apparatus – general procedures – applications – advantages.
Unit V	**SPECTROANALYTICAL AND THERMOANALYTICAL METHODS** Spectroanalytical methods : principle, instrumentation and applications of colorimetry, spectrophotometry and fluorimetry – light scattering techniques: nephelometry and turbidimetry.Thermo analytical methods : principle, instrumentation and applications of TGAand DTA – characteristic features of TGA and DTA curves – factors affecting TGA andDTA curves – simultaneous DTA - TGA curves – thermometric titrations.

Text Books	1. D.A.Skoog, D.M.West and Holler, Analytical Chemistry: An introduction, 6th Ed., Saunders College Publising. 2. Gary D. Christian, Analytical Chemistry, 6th Ed., John Wiley & Sons. 3. S.M.Khopkar, Environmental Pollution Analysis, 1st Ed., Wiley Eastern Ltd., 4. APHA, Standard Methods for Estimation of Water and Waste water, 19th Ed.,American Public Health Association. 5. O.P.Vermani and A.K. Narula, Applied Chemistry, 2nd Ed., New Age International Publishers. 6. A.K.Shaha, Combustion Engineering and Fuel Technology, Oxford & IBH Publising Company.
References	1. R. Gopalan, P.S Subramanian, K Rengarajan ,Elements of Analytical Chemistry,Sultan Chand and sons, NewDelhi 2. D.A.Skoog, Holler and Nieman, Principles of Instrumental Analysis, 5th Ed., Saunders College publishing. 3. Hobart H.Willard, Lynne L.Merritt, John A.Dean and Frank A. Settle, Instrumental Methods of Analysis, 7th Ed., CBS Publishers & Distributors Pvt. Ltd.,

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Discipline Specific Elective	Sub Code	MOLECULAR DYNAMICS	Hrs./ Week	Credits:
2	21UCHM5E		4	4

COURSE OBJECTIVES	• To understand the difference between classical mechanics and quantum mechanics,the modern concept of atomic structure and the applications of quantummechanics to pi-electrons in conjugated polyenes. • To know the statistical distribution of thermal energy among molecules. • To understand the photochemical activation and deactivations of molecules.
COURSE OUTCOME	• Understand Transition from classical mechanics to quantum mechanics • Explain principles of quantum chemistry • Know the basic principles of statistical thermodynamics • Understand photo physical processes in electronically excited molecules. • Knowledge of photochemical kinetics
Unit I	**TRANSITION FROM CLASSICAL MECHANICS TO QUANTUM MECHANICS** Classical mechanics: Concepts – failures. Photoelectric effect. Energy distribution in blackbody radiation. Bohr's theory of atom – derivation for energy of an electron in hydrogen like species. Emission spectrum of hydrogen atom – Zeemann effect. **Self-study**: Concept of orbitals and quantum numbers – Pauli's exclusion principle
Unit II	**PRINCIPLES OF QUANTUM CHEMISTRY** Postulates of quantum mechanics. Concepts of operators, Eigen functions, Eigen values. Schrodinger equation. Particle in one-dimensional box - derivation for energy. Application to linear conjugated polyenes (ethylene and butadiene).
Unit III	**BASIC PRINCIPLES OF STATISTICAL THERMODYNAMICS** Thermodynamic probability – macro and microstates, most probable distribution. Maxwell– Boltzmann statistics. Partition function – relation between partition function and energy. Separation of partition function – partition functions for translation. Entropy and probability. Translational entropy: Sackur-Tetrode equation. Residual entropy
Unit IV	**PHOTO PHYSICAL PROCESSES IN ELECTRONICALLY EXCITED MOLECULES** Laws of photochemistry - Jablonski energy level diagram – primary and secondary photochemical processes. Radiationless transition – internal conversion and inter system crossing. Radiative transitions – fluorescence - relation to structure. Phosphorescence –conditions for phosphorescence emission (spin-orbit coupling). Chemiluminscence. Experimental techniques of photochemical reactions – chemical actinometers–quantumyield. Mechanism of photosynthesis

Unit V	**PHOTOCHEMICAL KINETICS** Kinetics of photochemical reactions between hydrogen and chlorine and bromine – rate aw, comparison with thermal reactions. Bimolecular quenching – Stern-Volmer equation – photosensitization. Kinetics of fast reactions - relaxation techniques and flash photolysis.
Text Books	1. R.K. Prasad, Quantum chemistry, new age international (P) Ltd. 2. B.R.Puri and L.R. Sharma,Principles of physical chemistry ,Shoban Lal Nagin Chand andCo., 36 th edition. 3. K.K.Rohatgi Mukherjee, Fundamentals of photochemistry (Revised edition), WileyEastern Ltd. 4. A.W. Adams, Text book of physical chemistry. 5. D.A.McQuarrie and J. D.Simon, Physical Chemistry-A Molecular Approach, Viva Books (P) Ltd. 6. R. A. Alberty , Physical Chemistry (VI edition.) ,Wiley Eastern Ltd.
References	1. S.H.Maron and J.B.Lando, Fundamentals of Physical Chemistry, Macmillan Ltd., Newyork. 2. P.W. Atkins, Physical Chemistry, Oxford University Press. 3. K.L.Kapoor, A Textbook of Physical Chemistry, (Volume-4), Macmillan India Ltd.

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Discipline Specific Elective	Sub Code	ENVIRONMENTAL CHEMISTRY	Hrs./ Week	Credits:
2	21UCHM5F		4	4

COURSE OBJECTIVES	• To know the segments and pollution of environment • To find out the social issues and pollution management
COURSE OUTCOME	• Describe the segments of environment • Identify basic environmental contaminants • Know the energy source and environment • Explore social issues and environment • Understand pollution management
Unit I	**SEGMENTS OF ENVIRONMENT** Atmosphere - composition, particles, ions and radicals in the atmosphere. Hydrosphere – water resources - lithosphere - composition of soil, inorganic and organic compounds, micro and macronutrients in soil. Biosphere.
Unit II	**ENVIRONMENTAL POLLUTION** Definition, causes, effects and control measures of (a) air pollution (b) water pollution (c) soil pollution (d) noise pollution (e) radioactive pollution. Solid waste management: control measures of urban and industrial wastes, integrated waste management of plastics. Disaster management: floods, earthquake, cyclone and landslides
Unit III	**ENERGY SOURCES AND ENVIRONMENT** Classification of fuels and energy sources - conventional (coal, natural gas, fossil fuel) and non - conventional, renewable and non - renewable energy sources - geothermal energy – different types, origin and utilization, solar energy - introduction, direct utilization of solar energy as heat energy through collectors - ocean energy, biomass based energy - bio gas and gobar gas
Unit IV	**SOCIAL ISSUES AND ENVIRONMENT** Urban problem related to energy-Water conservation, Rain water harvesting, watershed management-Resettlement and Rehabilitation of people, Green House Effect-Climate change, Global warming, Acid Rain, Ozone layer depletion, nuclear accidents and holocaust, Environmental production act-Air(prevention and control of pollution) act-Public Awareness
Unit V	**POLLUTION MANAGEMENT** **Water pollution management-**. Chemical Degradation of wastes and Chemicals; Coagulation and flocculation; .Photocatalytic degradation of pollutants; Supercritical water oxidation-Soil Pollution Management; Nuclear Waste Management; Sewage Treatment; .Solid Waste Management
Text Books	1. Asim K.Das, Environmental chemistry with green chemistry, kolkata, book and Allied Pvt. Ltd. 2. Bhatia S.C, Environmental chemistry, Newdelhi, CBS publishers. 3. Gary W.Vanloon& Sephen J.Duffy, Environmental chemistry, New York, oxford University press. 4. B.K. Sharma and H. Kaur, Environmental Chemistry, Goel Publishing

	House, Meerut. 5. H.Kothandaraman and G.Swaminathan. Principles of Environmental Chemistry. B.I. Publications, Chennai, India.
References	1. G. S. Sodhi, Fundamental Concepts of Environmental Chemistry, Narosa Publishing House, New Delhi. 2. Anil Kumar De, Environmental Chemistry, Wiley Eastern Ltd., Second Edition. 3. S.S. Dara, A Textbook of Environmental Chemistry and Pollution Control, 8th Edition, S. Chand and Sons, New Delhi. 4. Eugene R. Weiner Applications of Environmental Chemistry, CRC Press, LLC

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Core	Sub Code	INORGANIC CHEMISTRY-III	Hrs./ Week	Credits:
9	21UCHM61		5	4

COURSE OBJECTIVES	• To study the theories in coordination chemistry • To study the chemistry of metal carbonyls • To understand the role of metal ions in biological systems • To study the basic principles of photoinorganic chemistry
COURSE OUTCOME	• Name coordination compounds, determine structure from physical measurements and explain stability and isomerism in coordination compounds • Understand magnetic properties, stability of complexes • Describe and apply theories of bonding in coordination compounds. • Know about bioinorganic Compounds • Explain the properties and uses of inorganic polymers
Unit I	**COORDINATION CHEMISTRY-I** Introduction: IUPAC nomenclature, Ligands- monodentate, bidentate, and polydentate ligands; coordination sphere; coordination number; nomenclature of mononuclear and dinuclear complexes. Structural and stereoisomerism in tetrahedral, square planar and octahedral complexes.Valance Bond theory – applications of valance bond theory to tetrahedral, square planar and octahedral complexes- Merits and limitations of VB theory.
Unit II	**CO-ORDINATION CHEMISTRY II** Crystal field theory - splitting of d-orbitals in octahedral and tetrahedral complexes -factors affecting the magnitude of crystal field splitting - effects of crystal field splitting - spectrochemical series - applications of CFT - magnetic properties and spectra of transition metal complexes - crystal field stabilization energy and their uses - limitations of CFT - effective atomic number rule - stability of complexes - step-wise and overall stability constants - factors affecting the stability of complexes - determination of stability constants.
Unit III	**CO-ORDINATION CHEMISTRY III** Labile and inert complexes - ligand substitution reactions in octahedral complexes:aquation, base hydrolysis and anation reactions - substitution reactions in square planar complexes - Trans effect - theories of trans effect - mechanism of substitution reactions -redox reactions: inner-sphere and outer-sphere electron transfer reactions.
Unit IV	**BIO INORGANIC CHEMISTRY** Role of alkali and alkaline earth metals in biological system and their transport across the membranes-the effect of excess and deficiency of essential trace metals (Cu, Fe, Co and Zn)- metalloporphyrins- myoglobin and hemoglobin – dioxygen binding – co-operativity in hemoglobin- the Bohr effect-chlorophyll- vitamin B_{12}. Metal complexes of copper, Gold and platinum as therapeutic agents-chelation therapy in metal poisoning.

Unit V	**INORGANIC PHOTOCHEMISTRY** Electronic transitions in metal complexes: selection rules - metal-centered and charge transfer transitions - properties of excited states - bimolecular quenching and energy transfer - photochemical pathways: substitutional, reduction-oxidation and isomerisation processes - photosubsitution reactions of Cr (III) complexes – Adamson's rules – photoredox reactions of Co (III) complexes – photoismerisation in Pt(II) complexes. Photochemical conversion and storage of solar energy: photolytic cleavage of water into H2 and O2 – photoelectrochemical devices: photogalvanic cells and semiconductor based photovoltaic cells.
Text Books	1. J.D. Lee, Concise Inorganic Chemistry 5th Ed., Blackwell Science Ltd., 2. James E. Huheey, Elien A. Keiter and Richard L. Keiter, Inorganic Chemistry: Principles Structure and Reactivity, 4th Ed., Harper College Publisher. 3. F. Albert Cotton, Geoffrey Wilkinson, Carlos A. Marilo and Manfred Bochman,Advanced Inorganic Chemistry, 6th Ed., Wiley Interscience Publication. 4. Fred Basolo and Ralph G. Pearson, Mechanisms of Inorganic Reactions : A study ofmetal complexes in solution, 2nd Ed., John wiley and sons, Inc., 5. David E. Fenton, Biocoordination Chemistry, Ist Ed., Oxford Science Publications. 6. IvanoBertini, Harry B Gray, Stephen J Lippard, Joan Selverstone Valentine,Bioinorganic Chemistry, 1st Ed., Viva Books Pvt. Ltd., 7. J.K. Rohatgi – Mukherjee, Fundamentals of Photochemistry – Wiley Eastern Revised Ed., 8. A.W. Adamson and P.D. Fleischauer, (Editors) Concepts of Inorganic photochemistry,Johnwiley and sons, New York.
References	1. Cotton. F.A., Wilkinson. G. and Paul. L.G., Basic Inorganic Chemistry, John Wiley and Sons, Singapore, 3rd edition. 2. Gopalan. R. and Ramalingam. V., Concise Coordination Chemistry, Vikas Publishing House. 3. Bhagi. A.K. and Chatwal. G.R., Inorganic Polymers, Himalaya Publishing 4.House, Mumbai, 1st edition. 4. Tobe, M. L.; Burgess, J. Inorganic Reaction Mechanisms, Addison Wesley Longman. 5. Arunachalam, S. Inorganic Photochemistry, Kala Publications, Trichirapalli.

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Core	Sub Code	ORGANIC CHEMISTRY-IV	Hrs./ Week	Credits:
10	21UCHM62		5	4

COURSE OBJECTIVES	• To learn about natural products • To understand chemistry of aromatic compounds • To study spectroscopy
COURSE OUTCOME	• Classify carbohydrates, analyse their structure and explain the reactions of mono, di and polysaccharides • Describe the structure, classification and stereochemistry of amino acids, proteins and enzymes. • Identify the general methods structural elucidations and apply them to elucidate the structure of alkaloids and terepenoids • Know heterocyclic compounds
Unit I	**CARBOHYDARATES** Classification-Monosaccharides- constitution of glucose and fructose. Reactions of glucose and fructose – Osazone formation, Mutarotation and its Mechanism, cyclic structure, pyronose and furanose forms. Epimerisation-Chain Lengthening and shortening of aldoses. Interconversions of aldoses and ketoses. Disaccharides- sucrose- reactions and structure. Polysaccharides – starch and cellulose (elucidation of structure not necessary).
Unit II	**AMINO ACIDS AND PROTEINS** Amino acids – Classification, General methods of preparation of amino acids - Properties- Isoelectric point, Zwitter ion- α-amino acids-Synthesis. Proteins – Classification- colour reaction – Structure of proteins- Role of proteins in biological process.
Unit III	**TERPENOIDS AND ALKALOIDS** Terpenes and terpenoids - classification - isoprene rule. Elucidation of structure and synthesis of citral , limonene, menthol, α-terpineol and camphor. Alkaloids: Introduction, classification and general methods for the determination of structure. Structural elucidation and synthesis of conine, piperine and nicotine
Unit IV	**HETEROCYCLIC COMPOUNDS** Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Comparison of basicity of pyridine, piperidine and pyrrole.Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution and mechanism of nucleophilic substitution reaction in pyridine derivatives. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Nepieralski synthesis, mechanism of electrophilc substitution reactions of indole, quinoline and isoquinoline.
Unit V	**ORGANIC SPECTROSCOPY** **UV spectroscopy** - chromophore – auxochrome – blue shift, red shift – hypochromic shift, hyperchromic shift – applications for studying functional

	groups,cis-trans isomerism and nature of double bonds - Woodward-Fischer rules as applied to conjugated enes and alpha and beta unsaturated ketones. **IR spectroscopy**–characteristics of IR absorption frequencies – intermolecular and intramolecular hydrogen bonding – functional group detection. **NMR Spectroscopy** - interpretation of NMR spectra of simple organic compounds such as acetone, anisole, benzaldehyde, isobutene, mesitylene, 1-chloropropane, ethyl methyl ketone, benzyl alcohol, and propionic acid.
Text Books	1. P.L. Soni, Text Book of Organic chemistry, Sultans Chand, New Delhi, 2. Bahl and ArunBahl, Organic Chemistry, S. Chand and Sons, New Delhi. 3. Gurdeep Chatwal, Reaction mechanisms and reagents in organic chemistry 4. O. P. Agarwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub.House. 5. GurdeepChatwal, Chemistry of Organic Natural Products, Vol 1 and 2, Goel Pub.House. 6. Y.R. Sharma, O.P. Vig, Elementary organic absorption spectroscopy – 1st edition,GoelPulishers, Meerut 7. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th Edition, PHI Limited, NewDelhi. 8. Jerry March, Advanced Organic Chemistry, 4th Edition, John Wiley and Sons,New York. 9. S. H. Pine, Organic Chemistry, 5th Edition, McGraw Hill International Edition,Chemistry Series, New York.
References	1. M.K. Jain and S.C. Sharma, Textbook of Organic Chemistry, Vishal publishing Co. 2. R. T. Morrison & R. N. Boyd, Organic Chemistry, Pearson publication, 7th edition. 3. B. Mehta & M. Mehta, Organic Chemistry, Prentice – Hall of India Private limited. 4. P. L. Soni & H. M. Chawla,Textbook of Organic Chemistry, Sultan Chand and Sons, 28th edition,. 5. I. L. Finar, Organic Chemistry, Vol.I, ELBS publication, 6th edition.

PC/ 2021-24 / UG /Part - III/ B.Sc. Chemistry / Semester – VI

Core	Sub Code	PHYSICAL CHEMISTRY – IV	Hrs./ Week	Credits:
11	21UCHM63		6	5

COURSE OBJECTIVES	• To know about basic concepts in spectroscopy • To understand chemical equilibrium and phase equilibrium
COURSE OUTCOME	• Compute the λ_{max} values in UV-visible spectroscopy, identify frequencies of various functional groups in IR spectra and diagnose the fragmentation pattern in mass spectra. • Understand the principle of IR and Raman spectroscopy • Explain the principle, instrumentation and applications of NMR, and Mass spectroscopy • Know Theory of acids-bases • Understand phase rule and phase diagram
Unit I	**I SPECTROSCOPY- I** Introduction – electromagnetic spectrum - various types of molecular spectra - electronic, vibrational and rotational energy levels - Born-Oppenheimer approximation. **Rotational spectroscopy: Rotational** spectra of diatomic molecules - determination of bond length and moment of inertia from rotational spectra - numerical problems - selection rule. **UV-visible spectroscopy:** theory - types of transitions in molecules - selection rules for electronic spectra - factors affecting absorption maximum and intensity – applications.
Unit II	**II SPECTROSCOPY –II** **IR spectroscopy :** theory - stretching and bending vibrations - factors affecting vibrational frequencies - important spectral regions for the characterization of functional groups – finger print region - determination of force constant - qualitative relation of force constant to bond energies - selection rules - modes of vibrations in polyatomic molecules - vibrational modes of H_2O and CO_2 – applications - numerical problems. **Raman spectroscopy:** Principle - Rayleigh and Raman scattering - Stokes and Anti-stokes lines - differences between IR and Raman spectroscopy - mutual exclusion principle –selection rule - applications.
Unit III	**SPECTROSCOPY –III** **NMR spectroscopy:** Theory of NMR, modes of nuclear spin-relaxation process – shielding effect, hyperfine splitting, coupling constants, - chemical shift - factors affecting chemical shift - internal standard, δ and τ scale - NMR spectra of ethanol - applications of NMR. **Mass spectroscopy:** basic principles of mass spectrum - molecular peak - base peak - isotopic peak - meta stable peak - types of fragmentation - Mc-Lafferty rearrangement - applications
Unit IV	**IONIC EQUILIBRIA** The Ostwald's dilution law-experimental verification-limitations-acids and bases-Lewis concept- dissociation of weak acids and weak bases-dissociation

	of water-pH scale-common ion effect- its applications-buffer solution-different types-calculation of pH value of buffer solution. Hydrolysis of salts - salts of weak acids & strong base, salts of weak base and strong acids, salts of weak acid and weak base. Acid base indicators- acid-base titration and use of indicators. Solubility product - Application of solubility product principle.
Unit V	**PHASE EQUILIBRIA** Phase rule - phase, component, degree of freedom - thermodynamic derivation of phase rule, One-component system: Phase diagrams of Water and sulphur systems. Two component system: (i) Simple eutectic: Lead-silver system and potassium iodide-water system. (ii) Formation of compound with congruent melting point: Magnesium – zinc system and ferric chloride – water system. Distribution Law-Statement and thermodynamic derivation-association of the solute in one of the solvents- dissociation of the solute in one of the solvents-applications of the distribution law-solvent extraction.
Text Books	1. Principles of Physical Chemistry - B.R. Puri and Sharma – Shobanlal Nagin Chand & Co., 2. Text Book of Physical Chemistry - P.L. Soni - Sultan Chand. 3. Elements of physical chemistry - Glasstone and Lewis - Macmillan. 4. Physical chemistry - G.W. Castellan - Narosa publishing house. 5. Universal General Chemistry, C.N.R. Rao, Macmillan. 6. Nano: The Essentials Understanding Nano Science and Nanotechnology. T. Pradeep Tata McGraw-Hill Publishing Company Ltd. New Dehli. 7. Introduction to Nano technology, Charles P Poole Jr. & Frank J Owens, Wiley Interscience 8. Kemp, W. Organic Spectroscopy
References	1. Essential of Physical Chemistry, ArunBahl, B.S. Bahl and G.D. Tuli, S. Chand 2. Physical Chemistry, 8th edition, P.W. Atkins and J.De Paula, Oxford University press. 3. Fundamentals of Molecular Spectroscopy, 4th edition, C. N. Banwell, Tata McGraw Hill publications.

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Core Practical	Sub Code	GRAVIMETRIC ESTIMATION & INORGANIC PREPARATIONS	Hrs./ Week	Credits:
III	21UCHMP3		3	2

COURSE OBJECTIVES	• To enable the students to understand the various techniques in gravimetric estimations • To make the students thorough in inorganic complex preparations
COURSE OUTCOME	• Estimate the inorganic compounds quantitatively • Perform effective precipitation • Estimate cations quantitatively by weighing • Analyse biological samples and preservatives quantitatively • Prepare and purify Inorganic compounds
SYLLABUS	**Gravimetric Estimation** 1. Estimation of lead as lead chromate 2. Estimation of barium as barium chromate 3. Estimation of nickel as nickel dimethylglyoximate 4. Estimation of zinc as zinc oxinate 5. Estimation of copper as copper thiocyanate **Inorganic preparations** 1. Preparation of potash alum 2. Preparation of chrome alum 3. Preparation of Prussian blue 4. Preparation of sodium ferrioxalate 5. Preparation of tetramminecopper(II) sulphate 6. Preparation of tristhioureacopper(I)chloridedihydrate 7. Preparation of potassium trisoxalatoferrate(III) 8. Preparation of hexathiourealead(II) nitrate
EVALUATION	**Internal- 50 marks** • 25 Marks- Regular class work • 25 Marks – Model test **External – 50 marks** • 10 Marks- Record • 10 Marks- Procedure • 30 Marks- Experiment Duration: 6 hours
Text Books	1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt. 2. Vogel's Text Book of Quantitative Chemical Analysis. 5th Ed. ELBS/Longman England.
References	3. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand& Company Ltd reprint. 4. V.K.Ahluwalia, SunithaDhingra, AdarshGulate College Practical Chemistry, Universities Press (India) Pvt Ltd.

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Core Practical	Sub Code	ORGANIC ANALYSIS & ORGANIC PREPARATION	Hrs./ Week	Credits:
IV	21UCHMP4		2	3

COURSE OBJECTIVES	• To enable the students to understand the various procedures in organic analysis and organic preparation • To create an awareness on microscale experiments in organic chemistry practical
COURSE OUTCOME	• Analyse the organic compound • Identify the functional groups from variety of sources • Know the preparation of organic compound • State and execute the report of an experiment • Create awareness of the impact of chemistry on the environment
SYLLABUS	**1. Organic analysis** Qualitative analysis of the given organic compound a. Test for aliphatic and aromatic nature of substances b. Test for saturation and unsaturation c. Identification of functional groups (carboxylic acids, phenols, aldehydes, ketones, esters, amines, amides, anilides, nitrocompounds and carbohydrates) d. Preparation of solid derivative to confirm the presence of functional group **2. Organic preparation** 1. Preparation of salicylic acid from methyl salicylate (or) benzoic acid from ethylbenzoate 2. Preparation of benzoic acid from benzamide 3. Preparation of benzoquinone oxime from benzoquinone 4. Preparation of benzoic acid from benzaldehyde 5. Preparation of p-bromoacetanilide from acetanilide 6. Preparation of 2-naphthyl benzoate from 2-naphthol 7. Preparation of picric acid from phenol 8. Preparation of methyl orange from sulphanilic acid 9. Preparation of glucosazone from glucose
EVALUATION	**Internal- 50 marks** • 25 Marks- Regular class work • 25 Marks – Model test **External – 50 marks** • 10 Marks- Record • 05 Marks- Procedure • 35 Marks- Experiments Duration: 6 hours
Text Books	1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt. 2. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co.
References	1. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education. 2. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand& Company Ltd reprint.

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Core Practical	Sub Code	PHYSICAL CHEMISTRY EXPERIMENTS	Hrs./ Week	Credits:
V	21UCHMP5		3	3

COURSE OBJECTIVES	• To enable the students to understand the principles of physical chemistry experiments
COURSE OUTCOME	• Demonstrate and validate theoretical concepts through experiments • Acquire skills in handling various instruments • Plan, conduct and report various experiments • Analyse and interpret experimental data • Apply the knowledge acquired for further research
SYLLABUS	1. Determination of molecular weight of the given substance by Rast macro method 2. Determination of molecular weight of the given substance by Transition temperature method 3. Determination of solubility of a substance at different temperatures and calculation of heat of solution 4. Study of adsorption of oxalic acid on charcoal and verification of Freundlich isotherm 5. Study of phase equilibrium – Simple eutectic 6. Estimation of HCl by conductometric method using standard oxalic acid (to be prepared) and link NaOH 7. Estimation of $MgSO_4$ by conductometric method using standard $MgSO_4$ (to be prepared) and link $BaCl_2$ 8. Estimation of Fe(II) by potentiometric method using standard ferrous ammonium sulphate (to be prepared) and link $KMnO_4$ 9. Estimation of $K_2Cr_2O_7$by potentiometric method using standard $K_2Cr_2O_7$ (to be prepared) and link ferrous ammonium sulphate 10. Determination of equivalent conductance of weak electrolyte and calculation of dissociation constant 11. Comparison of the strengths of acids by studying the kinetics of ester hydrolysis 12. Determination of CST of phenol-water system. Study of the effect of impurity on CST and determination of the strength of unknown
EVALUATION	**Internal- 50 marks** • 25 Marks- Regular class work • 25 Marks – Model test **External -50 marks** • 10 Marks – Record • 10 Marks – Procedure • 30 Marks – Experiment Duration: 6 hours

Text Books	1. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co. 2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt. 3. David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in Physical Chemistry, 5th Edi., McGraw- Hill Book company. 4. Alexander Findlay and J.A. Kitcher. Practical Physical Chemistry, Longmans ***5.*** Y.B. Yadav, Practical Physical Chemistry, Goel publishing house
References	1. B. Viswanathan and P.S. Raghvan, Practical Physical Chemistry, Viva Books Private Ltd., New Delhi. 2. P.C. Kamboj, University Practical Chemistry, Vishal Publishing company, Punjab. 3. Saroj Kr Maity and Naba Kr Ghosh, Physical Chemistry Practical, New Central Book Agency Private Ltd., London.

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Core Project	Sub Code	GROUP PROJECT	Hrs./ Week	Credits:
1	21UPHM6P		6	5

COURSE OBJECTIVES	• To reinforce the concepts with analytical techniques • To provide a platform for students to have hands –on experience with instruments
COURSE OUTCOME	• Analyse a research topic • Acquire analytical skills • Apply the practical skill and knowledge • Design a method for analysis/synthesis • Present a report of their findings
GROUP PROJECT	Students will be divided into group of five. As a group, students will do the project work on a title approved by the respective project supervisor. Students will maintain daily records and present oral reports while doing the project. All the above process will be duly assessed by the project supervisor. They will submit the project report at the end of the semester.
EVALUATION	**Internal Marks** - 50 marks **External Marks - 50 marks** Project presentation -25 marks Project Report -25 marks

EXTRA CREDIT COURSES

PC/ 2021-24 / UG /Part- III/ B.Sc. Chemistry / Extra Credit Course

Extra Credit Course	Sub Code	RESEARCH METHODOLOGY	Credits:
1			1

COURSE OBJECTIVES	• To classify the methods of research. • To apply the knowledge of e-resources in literature search. • To write a scientific report based on the research done • To know Interpretation of Data and Paper Writing
COURSE OUTCOME	• Recognize the purpose of research. • Classify the methods of research. • Apply the knowledge of e-resources in literature search. • Write a scientific report based on the research done • Know Interpretation of Data and Paper Writing
Unit I	**INTRODUCTION AND CHOICE OF THE PROBLEM** Introduction to research process -scientific methods- characteristics of scientific method - formulation of hypothesis – classification of research – fundamental, applied and action – selection of problem - preparing a proposal - research design - methods of research – experimental, historical, case study and survey .
Unit II	**LITERATURE SEARCH** Introduction to chemical abstracts – subject index, substance index, author index, and formula index– importance of impact factor of journals – impact factor analysis - use of e-resources for literature search and downloading – basics of internet services –various sources of abstracts, articles and papers of browsing and downloading.
Unit III	**DATA ANALYSIS** Statistical analysis of data, mean, median and mode, (recall) mean deviation and standard deviation, gaussian distribution, comparison of results – student's *t*-test, f -test, propagation of error-rejection of data, linear least square fit, correlation coefficient.
Unit IV	**PRESENTATION OF REPORT.** Ethics of research - plagiarism - planning the introduction - body of the report, footnotes and endnotes – page and chapter format – margin - indentation – placement of tables and figures and numbering of tables and figures - writing bibliography -books, journals and websites.
Unit V	**INTERPRETATION OF DATA AND PAPER WRITING** Layout of a Research Paper, Journals in Computer Science, Impact factor of Journals, When and where to publish? Ethical issues related to publishing, Plagiarism and Self-Plagiarism.
Text Books	1. Dawson, Catherine, practical research methods, New Delhi: UBS, publishers distributors. 2. Gary d. Christian, analytical chemistry, 6th edition: John Wiley & sons. 3. Gurumani N., Scientific thesis writing and paper presentation, Chennai: MJP publishers.

References	1. John W. Best, Research and Education, 3rd edition, New Delhi: Prentice Hall of India private ltd. 2. Kumar, Ranjit, Research Methodology-a step-by-step guide for beginners, 2nd edition, Singapore: Pearson education.

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Extra Credit Course	Sub Code	ANALYTICAL CLINICAL BIOCHEMISTRY	Credits:
2			1

COURSE OBJECTIVES	• To Know about clinical biochemistry • To analyse the clinical importance of biomolecules
COURSE OUTCOME	• Knowledge about clinical biochemistry • Evaluate the clinical importance of biomolecules • Define enzymes • Create awareness about immunology • Discuss the mechanism of action of harmones
Unit I	**INTRODUCTION TO CLINICAL BIOCHEMISTRY** Definition and scope of clinical biochemistry in diagnosis, collection and preservation of biological fluids (blood, urine & CSF), normal values of important constituents of blood, CSF and urine. Requirements of setting up of clinical laboratory, collection preparation, preservation, and handling of clinical samples, quality control, Safety measures in clinical laboratory.
Unit II	**CLINICAL IMPORTANCE OF BIOMOLECULES** Carbohydrates- Estimation of glucose, blood glucose regulation and role of hormones; diabetic coma, Lipids- lipid profile estimation, hypercholesterolemia, hyperlipoproteinemia- Proteins -albumin, hypoalbuminemia, hypoproteinemia.
Unit III	**CLINICAL ENZYMOLOGY FUNCTIONAL AND NON-FUNCTIONAL PLASMA ENZYMES**. Isoenzymes with examples. Enzyme patterns in acute pancreatitis, liver damage, bone disorder, myocardial infarction and muscle wasting
Unit IV	**TRANSPLANTATION IMMUNOLOGY** Clinical transplantation. Complement deficiencies; Clinical manifestation of C3 deficiency. Paroxymal nocturnal hemoglobinuria. Disorders of Immunoglobulin, Multiple myeloma, Vaccines (Traditional, Recombinant Protein & DNA vaccines)
Unit V	**HORMONES** Definition and different classes of hormones; Thyroid hormone and their mechanism of action; Pituitary hormones and their role in biological systems; Hormone regulation, Role of insulin in modulating blood glucose level
Text Books	1. Clinical biochemistry, metabolic and clinical aspects by William J. Marshall, Stephan K 2. Elsevier science health. 3. Immunology by Richard A. Goldsby, Thomas J. Kindt, Barbara A. Osborne and Janis Kuby. WH Freeman and Co. Ltd. 4. Immunology by Ivan M. Roitt, Jonathan Brostoff and David Male. Publisher: Mosby.

References	1. Fundamentals of Clinical Biochemistry by Teiz, W.B-Saunders Company. 2. Clinical Biochemistry: An illustrated color text 3rd Ed. by Allan Gaw, Micheal Murphy, Robert Cowan, Denis O Reilly, Micheal Stewart and James Shepherd. Churchill Livingtons 3. Introduction to Medical Immunology by Gabriel Virella, Marcel Dekker Inc 4. Basic Immunology: The Functions of the Immune System by Abul K. Abbas and Andrew H. Lichtman. Publisher: Saunders

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Extra Credit Course	Sub Code	CHEMISTRY IN EVERYDAY LIFE	Credits:
3			1

COURSE OBJECTIVES	• To know the characteristics of water • To understand artificial fertilizer & natural fertilizer • To study everyday applications of chemistry
COURSE OUTCOME	• Explain the physical properties and qualities of various water and create awareness of water pollution • Describe the role of agrochemicals • Know the importance of polymers and their appliances • Classify explosives and discuss their role • Knowledge about the dairy products and analyse
Unit I	**WATER** Electrolysis of water – water cycle – air in water – DO – BOD – COD – water pollution – control of water pollution-water treatment- Reverse osmosis-deioniser – Hygroscopy and deliquescence – water in crystals – efflorescence – hard water- soft water – permanent and temporary hardness - removal of hardness
Unit II	**FERTILIZERS AND INSECTICIDES** Classification of fertilizers- natural manures- artificial manures- chemical fertilizers-advantages of artificial fertilizers–bio-fertilizers – insecticides-inorganic insecticides- natural or plant insecticides-organic insecticides (few eg.) Dinitro phenols, DDT, Methoxychlor, BHC
Unit III	**POLYMERS AND MODERN MATERIALS** Fibres: Natural and synthetic fibres- cotton, wool, coir, silk, linen, polyester, Synthetic polymer- organic polymer- inorganic polymer- silicon based polymer and its uses – conducting polymer – biodegradable polymers. Resins: phenol- formaldehyde resins- resins on protective coatings- household appliances –PVC- HDPE-LDPE- Teflon.
Unit IV	**EVERYDAY APPLICATIONS OF CHEMISTRY** Chemistry of cosmetics-Face creams -Face powder -Face creams -Soaps and Shampoos - Chemistry of fuels -Solid fuel-Coal and kinds of coal -Water gas - Complete and incomplete combustion of fuels
Unit V	**DAIRY PRODUCTS** Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages.
Text Books	1. R. Gopalan and S. Sundaram, Fundamentals of Chemistry, Sultan Chand & Sons. 2. G. S. Sodhi, Fundamental Concepts of Environmental Chemistry,

	Narosa Publishing House,New Delhi. 3. D.Ainley,J.N. Lazonby,A.J.Masson, Chemistry in Today's World. 4. B.N. Chakravarthy, Industrial Chemistry, Oxford and IBH Publishing Co, New Delhi. 5. G. Mahapatra, Elements of Industrial Chemistry, Kalyani Publishers, New Delhi. **6.** B.K. Sharma, Industrial Chemistry, Goel publishing & Co.
References	1. I. L. Finar, Organic Chemistry, Vol.I&Vol II, ELBS publication, 6th edition. 2. B. K. Sharma: introduction to Industiral Chemistry, Goel Publishing, Meerut. 3. Handbook on Feritilizer Technology by Swaminathan and Goswamy, 6th ed. FAI 4. P.S. Kalsi, M.R.Manrao, Textbook of Applied Chemistry, Kalyani Publishers.

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Extra Credit Course	Sub Code	RENEWABLE ENERGIES (SOLAR & BIOGAS)	Credits:
4			1

COURSE OBJECTIVES	• To know the renewable energy, solar energy and biogas • Understand Biogas technology • Know the classification design of biogas plant
COURSE OUTCOME	• Explain renewable energy • Describe Solar energy • Know the solar energy technology • Understand Biogas technology • Know the classification design of biogas plant
Unit I	**INTRODUCTION TO RENEWABLE ENERGY** Wind power, Biomass energy, Waste power, Solar thermal power, Geothermal power, Ocean energy (tidal, tide-flow and wave), Ocean energy (OTEC), , Comparison of characteristics and cost of renewables. How we can use the sun, wind, biomass, geothermal resources, and water to generate more sustainable energy.
Unit II	**INTRODUCTION OF SOLAR THERMAL ENERGY** Residential, commercial and industrial applications, solar radiation, heat transfer, plane and concentrated collectors, water heating applications, heating and cooling the buildings, ,thermal industrial applications, Water desalination, Solar thermal energy system
	SOLAR ENERGY TECHNOLOGY Advance topics in solar cell energy, design high efficient solar cells, Reliability of solar thermal energy, Monitor the system efficiency, Maintenance and perfect of the system,
Unit IV	**BIOGAS TECHNOLOGY** Introduction, historical background, digestion process, factors enhancing/ inhibiting biogas production. Bio-chemical and Microbial Aspects: Biogas mechanism, enhancing the biogas production and its purification.
Unit V	**BIOGAS PLANT** Systems, Types of biogas plants, classification, design of a biogas plant (cow dung and organic waste), structural strength, selection of site and size, construction technique material requirement, high rate digesters, night soil linked biogas plan
Text Books	1. Introduction to Renewable Energy, (Energy and the Environment) 2nd Edition, Vaughn C. Nelson and Kenneth L. Starcher. 2. Handbook of Renewable Energy 1st ed. Edition by Walter Leal Filho. 3. Solar-Thermal Energy Systems: Analysis and Design by John R. Howell. 4. Khandelwal, K.C. and S.S Mahdi.; Biogas Technology: A Practical Hand Book, Tata McGraw Hill Pvt. Co. 5. Chawla, O.P., Advances in Biogas Technology, I.C.A.R., New Delhi Rathore N.S., Kurchania A.K., Biomethanation Technology,

	Apex Publications, Udaipur.
References	1. Introduction to Renewable Energy for Engineers 1st Edition,by Kirk D. Hagen. 2. Solar Engineering of Thermal Processes 4th Edition by John A. Duffie (Author), William A. Beckman (Author). 3. Mathur, A.N. and N.S Rathore; Biogas production management and utilizationHimanshu Publication.

CERTIFICATE COURSE IN LAB TECHNOLOGY

PC/ 2021-24 / UG /Part- III/ B.Sc. Chemistry/

Certificate Course in Lab Technology	Sub Code	HAEMATOLOGY AND CLINICAL BIOCHEMISTRY	Credits:
1			

COURSE OBJECTIVES	• To know about haematology • To understand clinical biochemistry
COURSE OUTCOME	• Explain constituents of blood and function of RBC • Demonstrate estimation of Hb, & platelets related disease • Analyse blood and investigation of blood transfusion • Know clinical biochemistry • Point out the function of liver and pancreas
Unit I	**HAEMATOLOGY** Clinical lab Management, First Aid, identification and use of common laboratory glassware and instruments, Cleaning of glassware, medical lab technician code. Preparation of materials for experiments and sample collection. Constituents of blood, Functions of RBC, WBC, Human circulatory system: heart, blood vessel. Platelets and plasma. Anticoagulants, Blood collection techniques through vein puncture and Finger, prick. Haemolysis-haemolytic agents and prevention. Blood born infection, types of anaemia and parasitic diseases . Blood pressure reading.
Unit II	**ERYTHROCYTES, LEUKOCYTES & PLATELETS** **Erythrocytes**: Erythropoiesis, Hb estimation, total RBC count, ESR estimation, PCV, Red cell indices, Reticulocyte count, **Leukocytes**: Leukopoieses, total WBC count, differential Leukocyte count Leukaemia Different types of leukaemia, absolute eosinophil count, abnormal WBC sand leukocyte related diseases. **Thrombocytes (platelets)**: Thrombopoiesis, total platelet count, Bleeding time, clotting time. prothrombin time, activated partial thromboplastin time and platelets related diseases.
Unit III	**BLOOD BANKING** Importance of blood group, Antigen and antibody in different blood groups, Cross matching. Procedure of ABO grouping system. Importance and procedure of Rh typing, ABO sub groups. Anticoagulants used in blood bank-donor selection-Drawing of blood-storage of blood screening the blood. Cross matching-Coomb's test-blood transfusion-Transfusion reaction-Investigation of blood transfusion- Haemolytic disease of Newborn(HDN).
Unit IV	**CLINICAL BIOCHEMISTRY** **Basic Principles of Chemistry**: Reagents- Solution, types of solution:Normal Solutions-Molar solutions-Percent solutions-Buffer solutions -Stock and working solution.-Preparation of normal saline. – pH—Indicators

Unit V	**BIOCHEMICAL TEST PROFILE** Pancreas & Liver function test: direct, indirect bilirubin -total protein, albumin, globulin, alkaline phosphatase, acid phosphotase. SGOT, SGPT, Other functional test: Estimation of Glucose, G.T.T. amylase and gastric juice analysis.
References	1. Medical Lab Technology- Praful B. Godkar 2. Clinical Laboratory methods - Jolm D. Bener 3. Medical Lab Teclmology - Ramnik sood 4. Medical Lab Technology - Anantha Narayanan 5. Clinical chemistry in Diagnosis and Treatment, Ziwa l.F.P. Peter, Mayne P.D. 6. Practical clinical Biochemistry- Verley publications, W. H. Heinemann 7. Medical Biochemistry- A.C. Deb 8. Medical Lab Technology (Vol I-III)- Kanai L. Mukherjee 9. Clinical Diagnosis by Laboratory Examination John A. Kokmmer. 10. Clinical Lab Methods & Diagnosis Vol- Alex C.S.L.Garelt. 11. A New short Text Book of Microbial & Parasitic Infections - B.T. Duerden, T.M.S. 12. Reid, M.S. Jewsbury, D.C. Turk.

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Certificate Course in Lab Technology	Sub Code	MICROBIOLOGY, CLINICAL PATHOLOGY AND PARASITOLOGY MICROBIOLOGY	Credits:
1			

COURSE OBJECTIVES	• To know about Clinical pathology • To understand parasitology microbiology
COURSE OUTCOME	• Describe microbiology lab and infectious disease • Explain stain and bio chemical reaction • Illustrate isolation and characterization of bacteria • Analyse clinical pathology • Knowledge about parasitology
Unit I	**INTRODUCTION –** Management of Microbiology lab, Sterilization methods-Types of culture media. **Instrumentation**: Laminar flow chamber, microscope Autoclave, Incubator, Hot air oven. Basic concepts of infectious disease – Infection – Route of infection-Specimen collection and storage of Urine, Stool, Throat swab, CSF, Sputum, Pus and Blood.
Unit II	**STAINS AND STAINING METHOD** : Simple stain, Special stain, Grams stain, Flagellar stain, Fluorescent stain, AFB stain,. Bio Chemical React ions: Indole production, Methyl red test,Voges-Proskauer test, Urease test, Catalase test, Oxidase reaction, Sugar fermentationtest
Unit III	**ISOLATION & CHARACTERIZATION OF BACTERIA:** Basic features of bacteria -Gram positive bacteria -Gram Negative bacteria- Morphology, pathogenicity and culture characters of Streptococcus pyogenes, Staphylococcus aureus, Corynebacterium diptheriae, Clostridium tetani, Vibrio cholerae, Salmonella typhi, Pseudomonas, Mycobacterium sp., Escherichia coli; proteus spp., Nisseria, shigella, kelbsiella, leptospira.
Unit IV	**CLINICAL PATHOLOGY** Urine Examination: Physical and chemical examination of Urine- Blood test in urine- Specific gravity of Urine- Heat and acetic acid test for Albumin - Rothera's test for acetone, Benedict's test,Test for bile salt and bile pigment- Benzidine test- Urobilinogen- common parasites found in urine- Casts found in urine- Physical examination of stool- Test for occult blood in stool. Smear for microscopic examination- concentration method for stool examination.
Unit V	**PARASITOLOGY** Medical parsitology, Host. Vector, pathogen, Ova, Cyst, Trophozite. Classification of parasites Intestinal parasite: morphology, culture clinical finding diagnostic tool of Giardia, Leishmania, Trypanosoms, Entamoeba, Balantidium Coli ,Ascaris, Tapeworm, round worm, Hook work, Pin worm, liver fluke, Blood born parasites: Plasmodium, Isospora, Toxoplasma,

	Filariasis
References	1. Medical Lab Technology- Praful B. Godkar 2. Clinical Laboratory methods - Jolm D. Bener 3. Medical Lab Teclmology - Ramnik sood 4. Medical Lab Technology - Anantha Narayanan 5. Clinical chemistry in Diagnosis and Treatment, Ziwa l.F.P. Peter, Mayne P.D. 6. Practical clinical Biochemistry- Verley publications, W. H. Heinemann 7. Medical Biochemistry- A.C. Deb 8. Medical Lab Technology (Vol I-III)- Kanai L. Mukherjee 9. Clinical Diagnosis by Laboratory Examination John A. Kokmmer. 10. Clinical Lab Methods & Diagnosis Vol- Alex C.S.L.Garelt. 11. A New short Text Book of Microbial & Parasitic Infections - B.T. Duerden, T.M.S. 12. Reid, M.S. Jewsbury, D.C. Turk.

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Certificate Course in Lab Technology- Practical	Sub Code	LAB IN CLINICAL LABORATORY TECHNOLOGY	Credits:
1			

COURSE OBJECTIVES	• To know about blood groups • To understand analysis in microbiology
COURSE OUTCOME	• Knowledge in blood group and analysis • Analyse blood glucose • Detect pregnancy, urine glucose
Unit I	**HAEMATOLOGY PRACTICALS** 1. Blood collection through vein puncture and Finger prick. 2. Hb estimation 3. Total WBC count- 4. Differential Leukocyte count. 5. Total platelet count. 6. PCV estimation.7. ESR estimation 8. Bleeding time. 9. Clotting time. 10. Prothrombibn time. 11. Blood grouping and Rh typing 12. Cross matching: 13: Bp measurement
Unit II	**CLINICAL BIOCHEMISTRY PRACTICALS** l. Estimation of Blood Glucose 2. Estimation of Blood Urea. 3. Estimation of Serum creatinine 5. Estimation of serum Bilirubin. 6. Estimation of serum Total protein 7. Estimation of serum Albumin.
Unit III	**MICROBIOLOGY, CLINICAL PATHOLOGY AND PARASITOLOGY PRACTICALS** l. Sterilization, 2. Media preparation, 3. Inoculation, 4. Bacterial culture, 5. Gram's staining, 6. Ziehl Neelson staining. l. Urine specific gravity, 2. Urine Albumin (Heat coagulation method) 3. Urine Glucose (Benidict's method 4. Urine Acetone (Nitroprusside method) 5. Urine bile salt(Hays method 6. Urine bile pigment (Fouchet's method) 7. Microscopic examination of urine of normal and abnormal cells. 8. Pregnancy Test (Latex method) 9. Urine reaction. 10. Motion smear (saline and locine
References	1. Medical Lab Technology- Praful B. Godkar 2. Clinical Laboratory methods - Jolm D. Bener 3. Medical Lab Teclmology - Ramnik sood 4. Medical Lab Technology - Anantha Narayanan 5. Clinical chemistry in Diagnosis and Treatment, Ziwa l.F.P. Peter, Mayne P.D. 6. Practical clinical Biochemistry- Verley publications, W. H. Heinemann 7. Medical Biochemistry- A.C. Deb 8. Medical Lab Technology (Vol I-III)- Kanai L. Mukherjee 9. Clinical Diagnosis by Laboratory Examination John A. Kokmmer. 10. Clinical Lab Methods & Diagnosis Vol- Alex C.S.L.Garelt. 11. A New short Text Book of Microbial & Parasitic Infections - B.T. Duerden, T.M.S. 12. Reid, M.S. Jewsbury, D.C. Turk.