Attainment of Programme Outcome

B.Sc Chemistry

CO, PO and PSO Mapping

Name of the Course: Chemistry

Blueprint of the question paper	**Section**	**Unit I**	**Unit II**	**Unit III**	**Unit IV**	**Unit V**
	Section A	2	2	2	2	2
	Section B Any FIVE	2	2	1	1	1
	Section C Either OR	2	2	2	2	2
	Section D Any THREE	1	1	1	1	1

SEMESTER- I			
Part III	**Core I General Chemistry - I**		
Course Code :21UCHC11	**Hrs/Week:6**	**Hrs/ Sem: 90**	**Credits:5**

Objectives

- To apply methods of balancing redox reactions
- To communicate the concepts and results of their laboratory experiments clearly and concisely to both chemists and non-chemists through effective writing and oral communication skills
- To inculcate the students the basic principles and concepts in Chemistry.
- To understand the basic chemical principles in Inorganic, Organic and Physical Chemistry.

UNIT I: Periodic Properties and Concept Of Electron Transfer

Modern periodic law- long form of periodic table – merits and demerits– Abundance of elements- cosmic, terrestrial and relative abundance – classification of elements based on their electronic configuration- Major trends in periodic table – Slater's rule- calculation of effective nuclear charge - periodic properties – trends in ionic and covalent radii , ionization energy, electron affinity and electro negativity –factors affecting ionization energy, electron affinity and electro negativity- scales of electro negativity – Alfred-Rochow's scale – Pauling scale – Mulliken approach – applications of electro negativity.

Concept of electron transfer -Oxidation and reduction – Oxidation number concept of oxidation and reduction- Rules for assigning oxidation number –Electronic concept in inorganic reactions – Redox reactions – oxidant- Important Oxidants and their reduction half reaction – Fe(III) and $KMnO_4$–Reductant -important reductants and their oxidation half reaction Fe(II) and oxalic acid. Methods of balancing redox reactions ion electron method, oxidation number method.

UNIT II: Basic Concepts of Organic Chemistry

Classification and nomenclature of organic compounds – Open chain and closed chain compounds- systems of naming organic compounds- rules of IUPAC system of nomenclature branched alkanes, cyclo alkanes – alkenes, alkynes and substituents-compounds having functional groups, poly functional groups.

Molecular weight determination of organic acids and bases by silver salt and platinic chloride methods. Problems arriving empirical and molecular formula using percentage composition of elements and molecular weight.

Structural formula – Shapes of organic molecules. sp^3, sp^2 and sp hybridization in organic compounds with suitable examples.

Polar effects – Inductive (+I, –I), Electromeric effect-Resonance/Mesomeric effect (+R, -R, +M, –M) – examples- Hyper conjugation (Baker Nathan effect) and steric effect.

Bond fission – homolytic and heterolytic fission. Reaction intermediates – carbocation, carbanion, free radicals and carbenes – their generation, shapes and stability. Types of reaction-substitution- elimination –addition – polymerisation-definition and examples.

UNITIII: Basic Quantum Chemistry

Dual character of an electron-de Broglie equation- Heisenberg's uncertainty principle-Introduction to quantum mechanics-fundamental postulates-Schrodinger wave equation- – eigen value – eigen function – significance of ψ and ψ^2-charge cloud concept and orbitals-Shapes of s, p and d atomic orbitals-nodal planes-g and u character in atomic orbitals-Radial and angular parts of the wave functions and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation)-radial and angular nodes and their significance.

Quantum numbers-origin-principal – orbital – angular momentum and spin quantum number-Significance of quantum numbers-Rules for filling electrons in various orbitals-Pauli's exclusion principle-Hund's rule-Aufbau principle- sequence of filling up of orbitals-schematic representation of electronic configuration- anomalous electronic configurations.

UNIT IV: Nuclear Chemistry

Isotopes, isobars and isotones – unit of radioactivity--half-life period – radioactive equilibrium – SoddyFajan's displacement law – Theory of radioactivity – radioactive series – artificial transmutation of elements – natural and induced radioactivity – Constitution of nuclei – stability of nuclei and (n/p) ratio – magic number, mass defect, mass energy relationship, binding energy and calculation of binding energy from mass defect-nuclear fusion and fission reactions – Plutonium and Hydrogen bombs – applications of Radioactivity in medicine-industry-agriculture– tracer technique- carbon dating-rock dating-neutron activation analysis-particle accelerators: linear accelerator – cyclotron.

UNIT V: Analytical Methods

Analytical Chemistry - Chemical Analysis - Types of Chemical Analysis – Qualitative and Quantitative Analysis- Volumetric Analysis – Principle – Standard Solutions – Normality and Molarity – Principles of Titrations – Theory of Indicators - Types of Titrations – Acidimetry, Alkalimetry, Permanganometry, Dichrometry, Iodometry, Argentometry, Complexometry.

Principles of gravimetric analysis – precipitation methods – conditions of precipitation – coprecipitation and post precipitation

Qualitative Inorganic Analysis – Dry Test, Flame Test, Wet Test – Common ion effect and solubility product- Testing of Simple and Interfering Acid Radicals- Test for sulphide, sulphate, nitrate (brown ring test), bromide and iodide (silver nitrate test),chloride and chromate (chromyl chloride test), oxalate and fluoride (calcium chloride test), borate (ethyl borate test), phosphate (ammonium molybdate test) – Elimination of Interfering Acid Radicals

– Chromate-Oxalate- fluoride – phosphate -Identifying the Groups of Basic Radicals – Testing of the Basic Radicals belonging to different Groups - Test for lead, copper, cadmium, antimony, bismuth, cobalt, nickel, manganese, zinc, barium, strontium, calcium, magnesium and ammonium-

Error analysis: Accuracy – Precision – Error – Types of Errors – Mean – Median – Mode – Standard Deviation – Variance – Normal Distribution Curve

Text Books:

1. Puri B.R, Sharma L.R., Kalia K.C.. *Principles of Inorganic Chemistry*. Delhi : Milestone publishers and distributers, 2010.
2. Tewari K.S, Vishnoi N.K, Mehrotra S.N. *A Text Book of Organic Chemistry*. Vikas Publishing2nd Revised Editions 1998.
3. ArunBahl, B.S.Bahl, G.D.Tuli.*Essentials of Physical Chemistry*.New Delhi:S.Chand and Company Ltd.,Revised edition 2008.

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Books for Reference:

1. Puri , Sharma B.R, , Madan L.R S. Pathania. *Principles of Physical Chemistry*. Vishal Publishing Co, 2008.
2. Arun Bahl and Bahl B.S. *Advanced Organic chemistry*.S.Chand and Company Ltd., Reprint 2005.
3. Tewari N. *Advance Organic Reaction mechanism Books and allied (P) Ltd*. Kolkata : Second revised edition 2005.
4. Jain M. K and Sharma S. C. *Modern Organic Chemistry*. Vishal Publishing Company, 2008.

Course Outcome

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO 1	explain the periodic properties of the different groups of compounds focusing on production methods.	1	Un
CO 2	arrange the nomenclature of different class of organic compounds and identify polarization of a bond with electronegativity.	1,3	Re
CO 3	discuss the fundamental concept of quantum mechanics.	1	Un

CO 4	understand quantum numbers and to know the rules for filling up of orbitals and predict electronic arrangement in orbits.	4	Un
CO 5	explain the basis of fundamental particles, nuclear forces, nuclear stability, natural and artificial radioactivity thereby apply the theory of radioactivity and nuclear reactions in various fields.	1,5	Un
CO 6	apply the knowledge about interfering radicals, common ion effect and solubility product.	8	Ap

21UCHC11 General Chemistry – I

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	2	2	2	3	3	3	**2.6**	3	3	2	2	3	2	3	3	**2.6**
CO-2	2	3	2	3	2	3	3	3	**2.6**	3	2	3	2	2	2	3	3	**2.5**
CO-3	3	3	2	2	2	3	3	3	**2.6**	3	3	3	2	3	3	2	3	**2.8**
CO-4	3	3	2	3	2	2	3	3	**2.6**	3	3	3	2	3	3	2	3	**2.8**
CO-5	3	2	2	3	3	2	3	3	**2.8**	3	3	3	2	3	2	3	3	**2.8**
CO-6	3	3	3	3	3	3	3	3	**2.6**	3	3	3	3	3	2	3	3	**2.9**
Average	2.8	2.8	2.2	2.7	2.3	2.8	3	3		3	3	3	2.2	2.8	2.3	2.7	3	
PO Mean									2.6	PSO Mean								2.8
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

SEMESTER I			
Skill Enhancement Course – I Professional English for Chemistry - I			
Course Code: 21UCHPE1	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

OBJECTIVES:

- To enhance the language skills of first year chemistry students.
- To acquire knowledge about the effective communication.
- To create competence level of I year students.

UNIT 1: Communication

Listening: Listening to audio text and answering questions - Listening to Instructions

Speaking: Pair work and small group work.8

Reading: Comprehension passages –Differentiate between facts and opinion

Writing: Developing a story with pictures.

Vocabulary: Register specific - Incorporated into the LSRW tasks

Why Carrot is orange in colour? - Antoine Lavoisier -Father of Chemistry - The invention of Saccharine - Invention of Hydroxychloroquinone - Marie Curie.

UNIT 2: Description

Listening: Listening to process description-Drawing a flow chart.

Speaking: Role play (formal context)

Reading: Skimming/Scanning- Reading passages on products, equipment and gadgets.

Writing: Process Description –Compare and Contrast Paragraph-Sentence Definition and Extended definition- Free Writing.

Vocabulary: Register specific -Incorporated into the LSRW tasks.

The spirit of chemical sciences- the effect of greenhouse gas emission- History of matches and lighters, Invention of Vaseline.

UNIT 3: Negotiation Strategies

Listening: Listening to interviews of specialists / Inventors in fields (Subject specific)

Speaking: Brainstorming.(Mind mapping). Small group discussions (Subject – Specific)
Reading: Longer Reading text.

Writing: Essay Writing (250 words)

Vocabulary: Register specific - Incorporated into the LSRW tasks

Alfred noble- his life and work- The soap Bubble- an introduction to nuclear chemistry- Synthetic polymers -biomass and biofuels.

UNIT 4: Presentation Skills

Listening: Listening to lectures.

Speaking: Short talks.

Reading: Reading Comprehension passages

Writing: Writing Recommendations Interpreting Visuals inputs

Vocabulary: Register specific -Incorporated into the LSRW tasks

Bhopal disaster - Xrays- J.J. Thomson Biography and Noble prize - Invention of Anaestheia - Acid Base Chemistry - Home Volcanoes. .

UNIT 5: Critical Thinking Skills

Listening: Listening comprehension- Listening for information.

Speaking: Making presentations (with PPT- practice).

Reading: Comprehension passages –Note making.

Comprehension: Motivational article on Professional Competence, Professional Ethics and Life Skills)

Writing: Problem and Solution essay– Creative writing –Summary writing

Vocabulary: Register specific - Incorporated into the LSRW tasks

First hydrogen bomb –Detecting Hazards - How molecules are formed ? - Industrial chemistry- Food Adulteration.

References:

Britannica, T. E. (Ed.) Marie Curie from Encyclopædia Britannica, (2020, April 16).

Wikipedia, T. E. (Ed.).. Marie Curie, (16, June 2020)

https://en.wikipedia.org/wiki/Carrot

https://www.historyofinformation.com/detail.php?id=2928

https://www.britannica.com/biography/Antoine-Lavoisier

Audio and Video link

Course Outcome

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	discuss their capability in using the language English in Chemistry.	8	Un
CO 2	express the Language in a confident manner.	8	Un
CO 3	analyse the need of the English language and its role.	8	An
CO 4	demonstrate the importance of writing English.	8	Ap
CO 5	interpret the importance of listening and to develop knowledge and to improve competency..	8	Cr, Ev

CO 6	identify the professional skills and identify the language level by themselves.	8	Re

21UCHPE1 Professional English for Chemistry - I

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	2	3	3	3	2	2	2	**2.5**	3	3	3	2	3	2	2	2	2.5
CO-2	3	3	3	3	3	2	2	2	**2.6**	3	2	3	3	3	2	2	2	2.5
CO-3	3	3	3	3	2	3	1	2	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-4	3	2	3	3	3	3	1	2	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-5	3	3	3	3	3	2	1	2	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-6	3	3	3	3	2	2	1	1	**2.3**	3	3	3	2	3	3	2	2	**2.6**
Average	**3**	**2.6**	**3**	**3**	**2.6**	**2.3**	**1.3**	**1.8**		**3**	**2.8**	**3**	**2.6**	**3**	**2.1**	**2**	**2**	
PO Mean									**2.5**	PSO Mean								**2.6**
Strength of PO Correlation				Strong						Strength of PSO Correlation				Strong				

SEMESTER I			
Part III Allied – I	**Allied Biochemistry -I**		
Course Code: 21UCBA11	**Hrs/Week : 4**	**Hrs/ Sem : 60**	**Credits : 3**

OBJECTIVES:

- To acquire knowledge about the chemical composition of life.
- To understand fundamental biochemical processes.
- To knowledge about vitamins and their deficiency.
- To study the functions of hormones.

UNIT I: Introduction to Biochemistry

Introduction to biochemistry - scope – chemical composition of life – elements of life – water – biological importance – Energy requirements of the body – Measurement of energy value of foods – Determination of energy requirement of man – Direct method, Indirect method, Respiratory quotients (RQ) of food stuffs – Total heat production – Significance of RQ Basal metabolism – Definition – Conditions for measurement – Factors influencing, Measurement, Significance, Specific dynamic action.

UNIT II : Bioenergetics

Introduction – Importance of bioenergetics - Energy and work – thermodynamic principles - Biological reactions – Exergonic reaction – Endergonic reaction – Energy and its forms - Energy rich compounds – Adenosine triphosphate – Guanosine triphosphate – Uridine triphosphate – Cytidine triphosphate – Acyl phosphate - Energy coupling.

UNIT III : VITAMINS

Introduction – definition - Sources of vitamin – Deficiency diseases – provitamins – biological functions - Properties of Vitamins – Classification of vitamins - water soluble (Vitamin B_1, B_2, B_3, B_5, B_6, B_7, B_9 and B_{12}Vitamin C) and fat soluble vitamins (Vitamin – A, D, E and K) and their composition, functions and deficiency symptoms.

UNIT IV :Hormones

Introduction –Definition – Properties – Biological Functions – Chemical Nature – Hormones secreting glands – Hormones producing organs and their functions - Classification of hormones: based on chemical nature – Functions of Hormones – Plant hormones(Auxins, Gibberllins, Cytokinins, Ethylene, Traumatic acid, Absicisic acid, Morphactins) – Animal hormones (STH, TSH, FSH, LH, LTH, Insulin)

UNIT V : Antibiotics

Introduction – Definition – Antibiotics affecting cell wall synthesis (pencillin, cephalosporin) – Antibiotics affecting the cytoplasmic membrane – Antibiotics interfering with Nucleic acid function – Antibiotics inhibiting protein synthesis (streptomycin, erythromycin, neomycin)– Antibiotics affecting enzyme systems – Drug resistance.

Text Books:

1. Dulsy Fatima, Narayanan L.M, MeyyanPillai R.P, Nallasingam K, Prasanna Kumar S and Arumugam N. *Biochemistry*.Saras Publications, 2010.
2. Patricia trueman.*Nutritional Biochemistry*. MJP publisher, 2011.
3. Veerakumari L. *Biochemistry*. MJP Publishers, 2010.

Books for Reference:

1. Dr. Deb A.C. Concepts of *Biochemistry.*Kolkatta:New Central Book Agency, 2001.
2. Powar C.B, Chatwal G.R, *Biochemistry.* Himalaya Publishing Ltd, 2002.

Level of Correlation between PO's, PSO's and CO's

Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	express chemical composition and the elements of life.	1,2	Un
CO 2	evaluate the importance of bioenergetics.	1	Ev
CO 3	demonstrate about the various energy rich compounds such as adenosine triphosphate, guanosine triphosphate, uridine triphosphate, cytidine triphosphate and acyl phosphate.	6	Ap
CO 4	distinguish water soluble and fat-soluble vitamins and analyze their composition, functions and deficiency symptoms.	2	An
CO 5	generate the knowledge on hormones producing organs and their functions and to know about the plant as well as animal hormones.	5	Cr ,Re
CO 6	evaluate the antibiotics role in affecting cell wall synthesis, cytoplasmic membrane and enzyme systems.	2,7	Ev

21UCBA11 Allied Biochemistry -I

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	2	3	3	3	2	2	2	**2.5**	3	3	3	2	3	2	2	2	2.6
CO-2	3	3	3	3	3	2	2	2	**2.6**	3	2	2	2	3	2	2	2	2.5
CO-3	3	3	3	3	2	3	1	2	**2.5**	3	3	2	2	3	2	2	2	2.6
CO-4	3	2	3	3	3	3	1	2	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-5	2	2	3	3	3	2	1	2	**2.2**	3	3	2	2	3	2	2	2	2.6
CO-6	2	2	2	2	2	2	1	1	**2.2**	3	3	3	2	3	3	2	2	**2.3**
Average	**2.6**	**2.3**	**2.8**	**2.8**	**2.6**	**2.3**	**2.3**	**2.3**		**3**	**2.8**	**3**	**2.8**	**2.8**	**2**	**2**	**2**	
PO Mean									**2.4**	PSO Mean								**2.5**
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

SEMESTER- II			
Part III Core II General Chemistry-II			
Course Code :21UCHC22	**Hrs/Week:6**	**Hrs/ Sem: 90**	**Credits:5**

Objectives

- To recall the basic methods of purification of ores.
- To understand the basic concepts of Stereochemistry.
- To know the importance of halogen compounds.
- To have an idea about the properties of alkenes, alkynes and aromatic substitution.
- To acquire knowledge in colligative properties.

UNITI: General Principles of Extraction of Metals

Minerals and ores -different steps of metallurgy – crushing and grinding of the ore – concentration of the ore – hand picking - gravity separation (Hydraulic Washing) -

electromagnetic separation – electrostatic separation – froth flotation process – leaching-calcination – roasting –difference between calcination and roasting – reduction to free metals – reduction by displacement, thermal decomposition, carbon (smelting), heating in air, an electro positive metal (Gold Schmidt's aluminothermic process) – Kroll's process. Refining of impure metals – thermal refining - distillation, liquation – vapour phase refining - Van Arkel process - Mond's process- electrolytic process- zone refining process. Elingham diagram-Types of furnaces – Fuel fired – blast, reverberatory, vertical retort and muffle – Electric furnace – Arc furnaces – types - resistance furnace.

UNIT II: s and p Block Elements

General characteristics of IA and IIA group elements – diagonal relationship of lithium with magnesium – anomalous behaviour of lithium and beryllium – extraction of lithium and beryllium. Sodium carbonate and sodiumbicarbonate – manufacture – properties and uses – principle of fire extinguisher.Boron – classification and nomenclature of boron hydrides – preparation, structure and uses of diborane – boron trihalides as Lewis acid – relative strength of boron trihalides. Oxo compounds of boron – ortho boric acid – preparation, properties and uses Borax bead test. Carbides – Classification with examples – Preparation, Properties, uses and structure of Calcium Carbide, Boron Carbide, Aluminium Carbide and Silicon Carbide – Preparation, Properties and uses of Carbonyl Chloride and Carbon disulphides.Halogens - Peculiarities of fluorine – manufacture of fluorine – etching on glass. Hydrides of halogens (hydrogen halides) - Interhalogen compounds – preparation and structure of interhalogen compounds. Pseudohalogenpolyhalides and basic nature of iodine.

UNIT III: Stereochemistry

Stereoisomerism – Optical activity of compound with one and two chiral centres. Elements of symmetry – Plane of symmetry, axis of symmetry and centre of symmetry. Enantiomers and diastereo isomers (d, 1 and meso forms) with examples – asymmetric and dissymmetric molecules.

Conventions used in stereochemistry: Newman, Sawhorse and Fischer notations and their interconversions.

Cahn Ingold Prelog conversion DL and RS configuration.-notations for compounds containing more than one asymmetric C-atoms racemisation and methods of resolution of racemic mixture – Walden inversion – Stereochemistry of diphenyl compounds and allenes with examples. Geometrical isomerism – Definition – cis – trans and syn – anti concept E-Z notation. conformational analysis of cyclohexane.

UNIT IV: Hydrocarbons and Halogen Compounds

Alkenes – Mechanism of addition reaction to alkenes – Markanikow's rule- Peroxide effect epoxidation – ozonolysis. Dienes Classification –Conjugated dienes –(1,2 &1,4-addition)- Diel's Alder reaction. Alkynes – terminal & non-terminal alkynes – acidic nature of acetylenic hydrogen atom. Aromatic hydrocarbon- Concept & Condition – Huckel's Rule- Aromatic, antiaromatic & non- aromatic compounds – Mechanism of aromatic electrophilic & Nucleophilic substitution reactions- Orientation (Electronic concept) – direct influence of substitution o,m & p directing – Benzyne mechanism.

Aliphatic halogen compounds –Mechanism of S_N1, S_N2, E1, E2 reaction – Halogen derivatives- Preparation and properties of Vinyl chloride – Allyl chloride – Preparation & uses of Chloroprene- Aromatic halogen compounds – Preparation and reaction of benzyl chloride – Nuclear & Side chain halogen compounds distinction- relative reactivities of alkyl,aryl, vinyl and allyl halides.

UNIT V: Colligative Properties

Definition- lowering of Vapour Pressure-- Raoult's Law - measurement of vapour pressure lowering-– Ostwald and Walker's Dynamic method – Elevation of boiling point and its determination- Landsberger –walker method. Depression of freezing point and its

determination –Rast's Camphor method –Abnormal molecular masses of electrolytes –

Relation between Van't Hoff factor and degree of association and dissociation

Osmosis-Definition - -Some Interesting Experiments Demonstrating Osmosis-Silica Garden- Semipermeable Membranes -Preparation of Cupric Ferrocyanide Membrane -Osmotic Pressure -Kidney Dialysis-Determination of Osmotic Pressure-Berkeley And Hartley's Method –Modern Osmometer –Isotonic Solutions -Theories of Osmosis -Membrane Solution Theory - Vapour Pressure Theory- Reverse Osmosis-Desalination of Sea Water By Hollow-Fibre Reverse Osmosis-Nanotube Membranes- Laws of Osmotic Pressure –Boyle Van't Hoff Law For Solutions - Charles'-Van't Hoff Law For Solutions- Van't Hoff Equation For Solutions - Avogadro-Van't Hoff Law For Solutions -Van't Hoff Theory of Dilute Solutions - Calculation

of Osmotic Pressure-Determination of Molecular Weight –Relation Between Vapour Pressure And Osmotic Pressure Osmotic Pressure of Electrolytes.

Text Books:

1. Puri B.R, Sharma L.R, Kalia K.C . *Principles of Inorganic Chemistry*.Delhi:Milestone Publishers and distributers, 2010.
2. Tewari K.S, Vishnoi N.K, Mehrotra S.N . *A Text Book of Organic Chemistry*. 2nd Revised Editions, 1998.
3. Kalsi P.S .*Stereochemistry Conformation and Mechanism*.New Age International, 2005.
4. ArunBahl, Bahl B.S, Tuli G.D . *Essentials of Physical Chemistry*.New Delhi:S.Chand and Company Ltd.,Revised edition 2008.

Books for Reference:

1. Puri B.R, Sharma L.R, Madan Pathania S. *Principles of Physical Chemistry*. Vishal Publishing Co. 2008.
2. Arun Bahl and Bahl B.S. *Advanced Organic chemistry*.S.Chand and Company Ltd. Reprint, 2005.

3.Tewari N. *Advance Organic Reaction mechanism*.Kolkata: Books and allied (P) Ltd.Second revised edition 2005.

4. Jain M. K and Sharma S. C. *Modern Organic Chemistry*. Vishal Publishing Company, 2008.

Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	recall the methods of purification of ores	1	Re
CO 2	illustrate the concept behind the different types of furnaces	1	Un
CO 3	explain the general characteristics and digital relationship of alkali and alkaline earth metals and discuss the preparation and uses of some alkali and alkaline earth metal compounds	2, 3	Un
CO 4	interpret the elements of symmetry, chirality, Newman projection ,Sawhorse & Fischer formulae and apply the Cahn	1, 2	Un, Ap

	Ingold Prelog rule for ascertaining the geometric configuration (cis or trans and/or E or Z)		
CO 5	predict the mechanism of aromatic substitution reactions and effect of o, m& p directing group and compare terminal & non-terminal alkynes, the acidic nature of acetylenic hydrogen	3, 6	Ap, An
CO 6	apply the principle of colligative properties in day to day life like kidney dialysis, reverse osmosis and describe the experimental methods of determining the colligative properties	4,5	Re Ap

21UCHC21 General Chemistry-II

	PO									**PSO**								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	3	2	2	3	2	3	**2.6**	3	3	2	2	3	2	3	3	**2.6**
CO-2	3	3	3	2	2	3	2	3	**2.6**	3	3	3	2	3	2	3	3	**2.8**
CO-3	3	3	3	2	2	3	3	3	**2.8**	3	3	2	2	3	2	3	3	**2.8**
CO-4	3	3	3	2	2	3	2	3	**2.6**	3	2	3	2	3	3	2	3	**2.6**
CO-5	3	2	3	2	2	3	2	3	**2.6**	3	3	3	2	3	2	3	3	**2.8**
CO-6	3	2	3	3	2	3	3	3	**2.6**	3	3	2	3	3	2	3	3	**2.8**
Average	3	2.7	3	2.2	2	3	2.3	3		3	2.8	2.5	2.2	3	2.2	2.8	3	
PO Mean									**2.6**	PSO Mean								**2.7**
Strength of PO Correlation				Strong						Strength of PSO Correlation				Strong				

SEMESTER II			
Skill Enhancement Course II Professional English for Chemistry II			
Course Code: 21UCHPE2	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Objectives:

- To elevate the students creativity and innovation skills.
- To mould the students to develop employability skills.
- To enhance the mind flexibility to meet the workplace competence.
- To improve the writing reports and language skills.

Unit 1: Communicative Competence

Listening – Listening to two talks/lectures by specialists on selected subject specific topics - (TED Talks) and answering comprehension exercises (inferential questions).

Speaking: Small group discussions (the discussions could be based on the listening and reading passages- open ended questions.

Reading: Two subject-based reading texts followed by comprehension activities/exercises

Writing: Summary writing based on the reading passages.

Nano technology and applications, Natural and Artificial dyes, Green chemistry and its applications.

Unit 2: Persuasive Communication

Listening: Listening to a product launch- sensitizing learners to the nuances of persuasive communication.

Speaking: Debates – Just-A Minute Activities.

Reading: Reading texts on advertisements (on products relevant to the subject areas) and answering inferential questions.

Writing: Dialogue writing- writing an argumentative /persuasive essay.

Process of photosynthesis- Alchemist - Periodic table for Chemist, Cements.

Unit 3: Digital Competence

Listening to interviews (subject related)

Speaking: Interviews with subject specialists (usingvideo conferencing skills)

Creating Vlogs (How to become a vlogger and use vlogging tonurture interests – subject

related)

Reading: Selected sample of Web Page (subject area)

Writing: Creating Web Pages.

Reading Comprehension: Essay on Digital Competence for Academic and Professional Life.

The essay will address all aspects of digital competence in relation to MS Office and how they can be utilized in relation to work in the subject area.

Polymers - Applications of Spectroscopy -fly ash bricks, Composites, Chemistry – The Central Science.

Unit 4: Creativity and Imagination

Listening to short (2 to 5 minutes) academic videos (prepared by EMRC/ other MOOC videos on Indian academic sites .

Speaking: Making oral presentations through short films – subject based

Reading: Essay on Creativity and Imagination (subject based)

Writing – Basic Script Writing for short films (subject based)

- Creating blogs, flyers and brochures (subject based)
- Poster making – writing slogans/captions(subject based)

Photochemistry, Environmental Chemistry, Glass, Abrasives

Unit 5: Workplace Communication& Basics of Academic Writing

Speaking: Short academic presentation using PowerPoint.

Reading & Writing: Product Profiles, Circulars, Minutes of Meeting.

Writing an introduction, paraphrasing.

Punctuation(period, question mark, exclamation point, comma, semicolon, colon, dash, hyphen, parentheses, brackets, braces, apostrophe, quotation marks, and ellipsis)

Capitalization (use of upper case)

Role of Chemist,Antibiotics, Industrial Chemistry, Paints.

References:

1. https://www.nano.gov/you/nanotechnology-benefits
2. https://www.google.com/search?q=natural+and+artificial+dyes&rlz=1C1CHBD_enIN868IN868&oq=natural+and+artificial+dyes&aqs=chrome..69i57j0i22i30l3j0i390l2.1894j0j7&sourceid=chrome&ie=UTF-8
3. https://en.wikipedia.org/wiki/Photosynthesis

4. https://en.wikipedia.org/wiki/Periodic_table
5. https://www.psd1.org/cms/lib/WA01001055/Centricity/Domain/30/The_Spirit_of_Chemical_Science.pdf
6. https://en.wikipedia.org/wiki/The_Alchemist_(novel)
7. https://www.livescience.com/60682-polymers.html#:~:text=Polymers%20are%20materials%20made%20of,tough%2C%20like%20epoxies%20and%20glass.
8. https://en.wikipedia.org/wiki/Pharmaceutical_industry

Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	express the Language without fear.	8	Un
CO 2	apply easily into the workplace environment.	8	Ap
CO 3	develop the real values of English and to identify the hidden potential of their own competence.	8	Cr
CO 4	evaluate with the comprehensional activities and exercises.	8	Ev
CO 5	identify themselves attend the interview with boldness and enthusiastically.	8	Re
CO 6	analyse the impact of English in education.	8	An

21UCHPE2 Professional English for Chemistry - II

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	2	3	3	3	3	3	3	**2.5**	3	3	3	2	3	2	2	2	2.9
CO-2	3	3	3	3	3	2	2	2	**2.6**	3	2	3	3	3	2	2	2	2.6
CO-3	3	3	3	3	2	3	1	3	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-4	3	2	3	3	3	3	1	3	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-5	3	3	3	3	3	2	1	2	**2.5**	3	3	3	3	3	2	2	2	2.5
CO-6	3	3	3	3	2	2	1	2	**2.3**	3	3	3	2	3	3	2	2	**2.3**
Average	**3**	**2.6**	**3**	**3**	**2.6**	**2.3**	**1.3**	**1.8**		**3**	**2.6**	**3**	**3**	**2.6**	**2.5**	**1.5**	**2**	
PO Mean									**2.5**	PSO Mean								**2.6**
Strength of PO Correlation				Strong						Strength of PSO Correlation				Strong				

SEMESTER II			
Part III Allied - I	**Allied Biochemistry –II**		
Course Code: 21UCBA21	**Hrs/Week : 4**	**Hrs/ Sem : 60**	**Credits : 3**

OBJECTIVES:

- To achieve broad based knowledge in concepts and principles of biochemistry.
- To provide an opportunity in acquiring knowledge about nutritional biochemistry.
- To understand the various pathways involved in cell respiration.
- To grasp in-depth knowledge about the biochemistry of blood and respiration.
- To familiarize the learners with the techniques involved in biochemistry.

UNIT I: Nutritional Biochemistry

Nutritive value of Milk – Egg – Meat - Fish – Vegetable food (Cereals, Pulses, Nuts, Roots and Tubers, Green leafy vegetables) – Fruits – Tea – Coffee – Cocoa – Alcohol – Principles in balancing a diet - Bioavailability – absorption –effect of drugs on food intake, body weight, nutrient requirements and growth, vitamins and minerals – Energy yielding, Body building and Protective foods.

UNIT II: Cell Respiration and Biological Oxidation

Introduction – Importance of Biological oxidation – Theories of biological oxidation : oxygen activation theory, hydrogen activation theory – Hydrogen acceptors – Nicotinamide nucleotide – Flavin nucleotide – Cytochrome – Sites – Pathways – Oxidative decarboxylation – Electron transport system – Oxidative Phosphorylation – Energetics of Biological oxidation.

UNIT III: Biochemistry of Blood

Introduction –Composition -Colour of Blood - Functions of Blood – (Homeostatic functions, Blood as transport system)- Red Blood Cells – White Blood Cells– Blood Platelets – Plasma – Plasma proteins – Albumin, Globulin (alpha, beta and gamma), Fibrinogen – Functions of plasma proteins - Blood groups – Prevention of Blood Loss -Hemoglobin – Variation in structure Hemoglobin with reduced solubility, altered oxygen affinity.

UNIT IV: Minerals

Introduction – Classification (Macro elements, Micro elements) –Functions, Distribution, Content level in blood , sources, Recommended Dietary allowances, Absorption and excretion, Factors affecting absorption, Deficiency Disease of Calcium, Phosphorous, Sodium, Potassium, Iron, Copper, Iodine, Fluorine, Zinc and Chromium.

UNIT V: Biochemical Techniques

Introduction –Cell Fractionation (Homogenization, Centrifugation) - Centrifuge – Principle, types – Hand Centrifuge, High Speed Centrifuge – pH meter – Principle, Electrodes used, Applications – Microscopy: Optical and electron Microscope – comparison – Ion probe analysis – Electrophoresis – Paper electrophoresis, Gel electrophoresis –Applications.

Text Books:

1. Dulsy Fatima, Narayanan L.M, MeyyanPillai R.P, Nallasingam K, Prasanna Kumar S and Arumugam N. *Biochemistry*. Saras Publications, 2010.
2. Patricia trueman.*NutritionalBiochemistry*. MJP publisher, 2011.
3. Veerakumari L. *Biochemistry*. MJP Publishers, 2010.

Reference Books:

1. Dr. Deb A.C.*Concepts of Biochemistry.*Kolkata: Central Book of Agency, 2001.
2. Powar C.B, Chatwal G. R. *Biochemistry*. Himalaya Publishing Ltd, 2002.

Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	discuss in detail about the nutritional values of milk, egg, meat, fish, vegetable foods, fruits, tea, coffee, cocoa and alcohol.	1	Un
CO 2	demonstrate the theories of biological oxidation decarboxylation, electron transport system and oxidative phosphorylation.	5	Ap
CO 3	describe the functions of blood and to discuss in brief about red blood cells, white blood cells, blood platelets, plasma and plasma protein.	6	Re
CO 4	evaluate how the minerals are important in our life interpret the various minerals and their recommended levels in food.	1	Ev
CO 5	analyse the relation between optical and electron microscope.	2	An
CO 6	develop the knowledge on instrumentation technique and to generate the real applications.	2	Cr

21UCBA21 Allied Biochemistry –II

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	2	3	3	3	2	2	2	**2.5**	3	3	3	2	3	2	2	2	2.5
CO-2	3	3	3	3	3	2	2	2	**2.6**	3	2	3	3	3	2	2	2	2.5
CO-3	3	3	3	3	2	3	1	2	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-4	3	2	3	3	3	3	1	2	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-5	3	3	3	3	3	2	1	2	**2.5**	3	3	3	3	3	2	2	2	2.6
CO-6	3	3	3	3	2	2	1	1	**2.3**	3	3	3	2	3	3	2	2	**2.6**
Average	**3**	**2.6**	**3**	**3**	**2.6**	**2.3**	**1.3**	**1.8**		**3**	**2.8**	**3**	**2.6**	**3**	**2.1**	**2**	**2**	
PO Mean									**2.5**	PSO Mean								**2.6**
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

SEMESTER I & II			
Allie Practical – I	**Allied Biochemistry Practical**		
Course Code:21UCBAR1	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 1**

OBJECTIVE:

- To train the students to get a clear idea on qualitative analysis of biomolecule.
- To understand the volumetric analysis estimation of biomolecule.
- To know the basic concepts of saponification number and pH metre.

Qualitative and Quantitative Analysis

Analysis of Simple Biomolecule

I. Qualitative analysis of carbohydrates.
II. Qualitative analysis of amino acids.
III. Colour reactions of Proteins.

Volumetric Analysis

I. Estimation of Glycine by formal titration.
II. Estimation of Ascorbic acid.
III. Estimation of Protein by Biuret method.
IV. Determination of Saponification number of oil.
V. Estimation of Carbohydrate by anthrone method.
VI. Preparation of Buffer and Determination of its pH using pH meter.

BOOKS FOR REFERENCE:

1. Arthur D. Vogel.*Vogel's Textbook of Quantitative Chemical Analysis*.sixth Edition. 2004.
2. Raghupati Mukhopadhyay, PratulChatterjee. *Advanced Practical Chemistry*. Books and Allied (P) Ltd., Third Edition.2007.

Course Outcomes

CO No.	Upon completion of this course, students will be able to	PSOs addressed	CL
CO 1	Learn the concept of various titrations.	1	Un
CO 2	Calculate the concentrations of unknown solutions.	5	Ap
CO 3	Understand the saponification value and pH values.	6	Re
CO 4	Identify the presence of biomolecules.	1	Ev
CO 5	Analyse their skill in the biomolecule analysis	2	An
CO 6	Develop the skill to understand the role of biomolecules.	2	Cr

21UCBAR1 Allied Biochemistry Practical

	PO									**PSO**								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	2	3	3	2	3	3	2.8	3	3	3	3	3	2	3	3	3
CO-3	3	3	3	2	3	3	2	3	2.8	3	3	3	3	3	3	3	3	3
CO-4	2	3	3	3	3	2	3	3	2.8	3	3	3	3	3	3	3	3	3
CO-5	3	3	2	3	2	3	3	3	2.8	3	3	3	3	3	2	3	3	2.9
CO-6	3	3	3	2	3	3	2	3	2.9	3	3	3	3	3	2	3	3	2.9
Average	3	3	2.7	2.7	2.8	2.5	2.5	3		3	3	3	3	3	2.3	3	3	
PO Mean									**2.9**	PSO Mean								**3**
Strength of PO Correlation				Strong						Strength of PSO Correlation						Strong		

SEMESTER I & II			
Core Practical I	**Quantitative Analysis**		
Course Code : 21UCHCR1	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

QUANTITATIVE ANALYSIS (VOLUMETRIC METHODS)

A double titration involving the preparation of a primary standard, standardization of the link solution, making up of the given solution and its estimation. Concepts of acids, bases, oxidants, complex formation — Theory of Indicators. (Use of digital balance is permitted).

TITRIMETRIC QUANTITATIVE ANALYSIS:

	Substance to be estimated	**Primary Standard**
I Acidimetry and alkalimetry.	1. NaOH/ Na_2CO_3	Na_2CO_3
	2. HC1/H_2SO_4 /oxalic acid	Oxalic acid
II Permanganometry	3. Oxalic acid	Oxalic acid
	4. Mohr's salt	Mohr's Salt
	5. Fe^{2+} Mohr's Salt	
III Dichrometry - External indicator method		
	6. Fe^{2+} Mohr's Salt	
IV Iodometry	7.$CuSO_4$ /$K_2Cr_2O_7$	$K_2Cr_2O_7$
	8. $KMnO_4$	$CuSO_4$
V Complexometry	9. Zn^{2+}	$ZnSO_4.7H_2O$
	10. Pb^{2+} $Pb(NO_3)_2$	
	11. Mn^{2+}	$MnSO_4.H_2O$
	12. Ni^{2+}	$ZnSO_4.7H_2O$

VI Estimation of Phenol /Aniline

VII Course work (Not for external examination)

1. Estimation of acetic acid in vinegar samples.

2. Estimation of oxalate content in vegetables and fruits such as tomato, guava, grapes, etc.
3. Estimation of sodium carbonate and sodium Bicarbonate in a mixture.
4. Estimation of Total Hardness of water.

BOOKS FOR REFERENCE:

1. Arthur D. Vogel.*Vogel's Textbook of Quantitative Chemical Analysis*. Longman's Green & Co Ltd, London, sixth Edition2004.
2. RaghupatiMukhopadhyay, Pratul Chatterjee.*Advanced Practical Chemistry*. Books and Allied (P) Ltd., Third Edition 2007.

21UCHCR1 Quantitative Analysis

	PO									**PSO**								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	2	3	3	2	3	3	2.8	3	3	3	3	3	2	3	3	3
CO-3	3	3	3	2	3	3	2	3	2.8	3	3	3	3	3	3	3	3	3
CO-4	2	3	3	3	3	2	3	3	2.8	3	3	3	3	3	3	3	3	3
CO-5	3	3	2	3	2	3	3	3	2.8	3	3	3	3	3	2	3	3	2.9
CO-6	3	3	3	2	3	3	2	3	2.9	3	3	3	3	3	2	3	3	2.9
Average	3	3	2.7	2.7	2.8	2.5	2.5	3		3	3	3	3	3	2.3	3	3	
PO Mean									**2.9**	PSO Mean								**3**
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

SEMESTER- III			
Skill Based Elective	**Agricultural Chemistry**		
Course Code : 21UCHS31	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Objectives:

- To facilitate the students to know the basic knowledge about agriculture and soil
- To realize the importance of agriculture
- To understand the chemistry behind fertilizers and pesticides
- To get an idea about vermin composting
- To analyze the quality of drinking water
- To know the various water treatment methods

Unit I: Soil Nature and Plant Nutrients

Saline, alkali and acid soils. Buffering capacity of soil - Soil reclamation. Liming of soil – measurement of soil pH - Soil fertility – essential plant nutrients and their functions – deficiency symptoms – macro and micro nutrients& their functions.

Unit II: Fertilisers

Natural and synthetic manures-qualities of a good fertilizer- classification of fertilizers – nitrogeneous fertilizers - Preparation and importance of urea-calcium cyanamide - super phosphate-triple super phosphate- potassium chloride-potassium nitrate - DAP, mixed fertilizers (NPK) and human effluent from gobar gas plant as a manure. Vermiculture -vermi compost.

Unit III: Pesticides

Pesticides, Insecticides, Repellants, Fungicides- Definition-classification – on the basis of their mode of action, target organisms they control, method of application- environmental hazards - preparation and uses ofDDT, BHC, lead arsenate,bordeaux mixture. Biopesticides – definition – examples – applications.

Unit IV: Water Quality Parameters Water quality standard for drinking water (WHO)- Water quality parameters-pH, EC, alkalinity, Total acidity, hardness, DO, BOD, COD, Methaemoglobinemia) – Eutrophication- Case studies- Hg, As, and Cd. (Minamata, arsenic poison in West Bengal, Itai-itai)

Unit V: Water Treatment Methods

Waste water treatment-methods and equipments used-preliminary treatment (screening, skimming) - primary treatment (sedimentation, coagulation) - secondary treatment (trickling filters, oxidation pond, anaerobic digestion)-tertiary treatment (adsorption, ion-exchange, reverse osmosis, electrodialysis, disinfection)-treatment of water of municipal purposes-domestic sewage treatment-industrial waste water treatment.

Hands on Training:

1. Analysis of carbon, nitrogen, potassium, phosphorous, zinc and calcium in soil using mini lab for soil analysis.

2. Determination of BOD and COD of water samples

3. Determination of pH and conductivity of water from different sources.

4. Determination of DO and hardness of water.

Industrial Visit:

A visit may be made to an industry or a premier institution.

*A report of the industrial visit may be submitted as an assignment.

Course Outcome:

CONo.	Upon completion of this course, students should be able to	PSO addressed	CL
CO- 1	identify the importance of soilconstituents and have an overview of the macro and micronutrients to promote agriculture.	1, 7	Re
CO- 2	compare the preparation and importance of chemical fertilizers and biofertilisersin agriculture	1, 7	Un
CO-3	aware of eco friendly vermi compost and gobar gas	2, 3	An,Cr
CO- 4	realize the importance of pesticides and rationalise their environmental hazards	1, 7	Ap
CO-5	understand the water quality standards and water quality parameters and analyse the case studies of heavy metal pollution like Hg, As, and Cd.	1,2,7	Un

CONo.	Upon completion of this course, students should be able to	PSO addressed	CL
CO-6	understand the processes used for purification of municipal water and treat waste water by using different methods	4,7	Un, Cr

Text Books:

1. Jayashree Ghosh. *Text Book of Pharmaceutical Chemistry*. New Delhi:S. Chand and company, 2003.
2. BagavathiSundari K . *Applied Chemistry*. MJP Publishers, 2008.

Books for Reference:

1. Sharma B. K . *Industrial Chemistry*. Goel Publishing House. Fifth Edition, 1993-94.
2. Sindhu P.S. *Environmental Chemistry*. New Age International Publishers, 2010.
3. Dr Joshi. S.R *Biopesticides- A Biotechnological Approach*. New Age International (P) Ltd., Publishers, 2020.

21UCHS31 Agricultural Chemistry

	PO									PSO								
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Avg	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	Avg
CO-1	2	3	3	2	3	3	3	3	2.8	2	3	3	3	3	3	3	3	2.9
CO-2	3	3	3	2	3	3	2	3	2.8	2	3	3	3	2	3	3	3	2.8
CO-3	3	2	3	3	2	3	3	3	2.8	3	3	3	3	2	3	3	3	2.9
CO-4	3	3	3	2	3	3	3	3	2.9	3	3	3	3	2	3	3	3	2.9
CO-5	3	3	3	2	3	2	3	3	2.8	2	3	3	3	2	3	3	3	2.8
CO-6	3	2	3	3	3	2	3	3	2.8	3	3	3	3	2	2	3	3	2.8
Average	2.8	2.7	3	2.3	2.8	2.7	3	3		2.5	3	3	3	2	2.8	3	3	
PO Mean									**2.8**	PSO Mean								**2.9**
Strength of PO Correlation				Strong						Strength of PSO Correlation						Strong		

SEMESTER III			
Part III Skill -based Elective Dairy Chemistry			
Course Code :21UCHS32	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Objective:

- To know the composition and properties of milk.
- To understand processing techniques of milk.
- To get hand-on experience by preparing some milk products.

Unit I: Milk and its Components

Milk – definition – composition and constituents of milk – factors affecting the composition of milk – properties of milk – physical state – flavour – aroma – acidity – density – viscosity – boiling point – freezing point – estimation of acid number – saponification number – iodine number – RM number – estimation of fat in milk – Babcock method – Majonnier method – nutritive value of milk.

Unit II: Processing Techniques

Milk processing – clarification – pasteurization – definition – effects of pasteurization – role of phosphate in pasteurization – types of pasteurization – bottle pasteurization – batch pasteurization – High Temperature Short Time (HTST) pasteurization – vacuum pasteurization –Ultra High Temperature (UHT) pasteurization, Homogenization – definition – factors influencing homogenization.

Unit III: Special Milks

Non-Fermented milks – definition and manufacture of special milks – sterilized milk – flavoured milk – irradiated / vitaminised milk – standardised milk – reconstituted milk – recombined milk – toned milk – condensed milk.

Fermented milk – definition and manufacture – manufacture of special milks – cultured butter milk – Acidophilus milk – Yoghurt (Firmbodied milk).

Unit IV: Fermented Milk Products

Cream – definition – classification – types of cream – manufacture of canned cream and frozen cream – separation of cream.

Butter – definition – composition – classification – manufacture – churning operation – overrun – types – estimation of acidity of butter – estimation of moisture content in butter.

Ghee – definition – composition – various adulterants of ghee.

Unit V: Laboratory Work

1. Determination of acid number, saponification number, iodine number and R.M.number of milk.
2. Determination of pH of milk.
3. Estimation of fat and total solids in milk.
4. Separation of milk protein from milk.

Books for Reference:

1. Siva Sankar B. *Food processing and preservation*. New Delhi:Prentice, Hall of India Pvt.Ltd., 2002.
2. BagavathiSundari K . *Applied Chemistry.* MJP Publishers.Chennai: Tamil Nadu Book House, 2019.
3. Morris B. Jacobs. *The Chemical Analysis of Foods and Food products*. Third Edition, CBS Publishers & Distributors,2018 .
4. Jayashree Ghosh. *Fundamental concepts of Applied chemistry.*New Delhi:S. Chand & company Ltd, 2006.

Course Outcome:

CO. No.	Upon completion of this course, students should be able to	PSO addressed	CL
CO - 1	know the quality parameters of milk	1,5	Re
CO - 2	categorize the types of different types of milk processing techniques	1, 3	An
CO - 3	understand the theory behind non fermented milks	1, 2	Un
CO - 4	determine the different constituents in milk	2, 4	Ap
CO - 5	estimate fat and solids in milk	5	Ap
CO - 6	assess the properties of different milk products	1 , 7	Ev

21UCHS32 Diary Chemistry

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	2	2	2	3	3	3	**2.6**	3	3	2	2	3	3	3	3	**2.8**
CO-2	2	3	2	3	2	2	3	3	**2.5**	3	2	3	2	2	2	3	3	**2.5**
CO-3	3	3	2	2	2	3	2	3	**2.5**	3	2	3	3	2	3	3	3	**2.8**
CO-4	3	3	2	3	3	2	2	3	**2.6**	3	3	3	2	3	2	2	3	**2.6**
CO-5	3	2	2	3	3	2	3	3	**2.6**	3	3	3	2	3	2	3	3	**2.8**
CO-6	3	3	2	3	3	3	2	3	**2.8**	3	3	3	3	2	3	3	3	**2.9**
Average	2.8	2.8	2	2.7	25	2.7	2.5	3		3	2.7	2.8	2.3	2.5	2.5	2.8	3	
PO Mean									2.6	PSO Mean								2.7
Strength of PO Correlation				Strong						Strength of PSO Correlation						Strong		

SEMESTER III	
Self Study	**Chemistry for Competitive Examination**
Course Code :21UCHSS3 (Compulsory)	**Credits : 2**

Unit I: Purification and Analysis of Organic Compounds

Organic chemistry- Sources of organic compounds. Purification - of organic compounds- Chemical methods of purification- Criteria of purity-Qualitative analysis - detection of elements-Detection of and nitrogen, sulphur, halogens phosphorus - Test for nitrogen - Test for Sulphur - Test for halogens – Beilsteintest for halogen - Test for phosphorus- Quantitative analysis - Estimation of carbonand hydrogen - Estimation of nitrogen - Detection of metals- Separation of mixtureinto components.

Unit II: Structure of Atoms

Atoms – Definition – Dalton's atomic theory - sub atomic particles - charges of sub - atomic particles discoveries of subatomic particles - atomic and mass number - isotopes - symbols for elements - principles governing filling up of electrons in the orbitals - Electronic configurations of first twenty elements. Rutherford; J.J Thomson and Bohr's atomic models - valency; formula and naming of compounds - Molecular mass and mole concept.

Unit III: Classification of Elements and Periodicity of Properties

Classification of elements Doberiner, Newlands, Mendeleev and modern Periodic tables - Groups & Periods - classifications of elements into s, p, d and f block with examples periodicity of properties - metallic character, atomic - ionic radii,. ionization potential energy, electron affinity and electronegativity.

Unit IV: Chemical Bonding and Non - Metals

Need for the Chemical bond formation - introduction to ionic bond, covalent bond, coordinate bond and metallic bond - ionic bond formation - definition, and explanation using NaCl, - covalent bond - definition and explanation using H_2, O_2, N_2, CH_4, Properties of ionic and covalent compounds Noble gases and their applications - Halogens and their applications preparation and uses of hydrogen, phosphorus and sulphur, Differences between diamond and graphite.- Fullerenes.

Unit V: Biochemistry

Amino acids – Classification – Properties - Zwitter ion structure- Isoelectric point - Chemical properties - Synthesis of amino acids – Proteins - Importance of proteins - Composition of proteins - Classification of proteins - Tests for proteins - Properties of proteins – Drugs - Therapeutic index - Sulpha drugs – Arsenicals - Antipyretics and analgesics – Antimalarials – Antibiotics - Vitamins – Definition – Classification – Provitamins - Physiological action –

Vitamin A, Vitamin. A2,Vitamin D, Vitamin E, Vitamin B-complex, Vitamin C - Hormones - Enzymes - Nucleic acids - Viruses - Metal ions in biological systems.

Books for References:

1. Arun Bahl and Bahl B.S. *Advanced Organic Chemistry*.S.Chand and Company Ltd., Reprint, 2017.
2. Puri B.R, Sharma L.R, Kalia. K.C. *Principles of Inorganic Chemistry* Paperback 7 Vishal Publishing Co. 33rd edition, December 2020.
3. Sathyanarayana U and Chakrapani U. *Essentials of Biochemistry*. Elsevier,2021.

SEMESTER- IV			
Skill Based Elective I	**Medicinal Chemistry**		
Course Code : 21UCHS41	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Objectives:

- To inculcate the basic knowledge about classification drugs and their mode of action.
- To rationalize the causes and curative measures of common diseases.
- To know about the first aid to be done during emergency.
- To create an awareness about hypertension and cardiovascular drugs.
- To get an idea about diabetes and hypoglycaemic agents.

Unit I: Classification and mechanism of drug action

The nature and sources of drugs-Classification of drugs – biological Classification –(drugs acting on central nervous system and peripheral nervous system, Chemotherapeutic drugs, pharamcodynamic agent, metabolic diseases and endocrine function) and chemical classification.

Mechanism of action-actions at extracellular and cellular site-Drug receptors and biological responses-Chemistry of drug receptor binding-covalent bond- hydrogen bond- Van der Waals forces.

Unit II: Causes of common diseases and their treatment by drugs

Common diseases and their treatment: Insect borne diseases-malaria, filariasis, plague, Air borne diseases-diphtheria, whooping cough, influenza, measles, mumps, common cold, tuberculosis (T.B)

Water borne diseases-cholera, typhoid, dysentery, Disorder of digestive system-Jaundice

Unit III: Clinical chemistry cum Hands on Training

Determination of sugar (glucose) in serum-Folin and Wu' s method — -determination of serum cholesterol -Sackett' s method for total cholesterol --tests for cholesterol — estimation of glucose in urine -Benedict's test

Important rules of First aid- First aid for cuts, abrasions and bruises-bleeding-fractures-fainting composition of first aid box — some common poisons and their antidotes

Unit IV: Blood pressure and cardio vascular drugs

Blood pressure-types and treatment -Hypertension-primary and secondary hyper tension treatment, hypo tension.

Functions and uses of the following drugs

Cardiovascular drugs-antiarrhythmic drugs-quinidine-antihypertensive agents- (hypotensive drugs) — clonidine and reserpine.

Definition forAngiogram andAngioplast.

Unit V: Diabetes and hypoglycemic agents

Diabetes types – Diabetes insipidus and diabetes mellitus – control of Diabetes –oral hypoglycemic agents –sulphonyl urease -tolubutamide, chlorpropamide, biguanides-phenformin and metformin.

Text Books:

1. Jayashree Ghosh.*Text Book of Pharmaceutical Chemistry.*New Delhi:S.Chand and company, 2003.

2. BhagavathiSundari. *Applied Chemistry*. MJP Publishers, 2008.

Books for Reference:

1. Jayashree Ghosh.*Fundamental Concepts of Applied chemistry*.New Delhi:S.Chand and Company, 2006.

2. Dr. Abhishek Tiwari, Dr.Biswa Mohan Sahoo, Dr. Rajesh Shukla.*Pharmaceutical Chemistry.*NiraliPrakashan,2021.

3. Ashutosh Kar.*Medicinal Chemistry*.New Delhi: New age International (P) Limited, 2004.

Course Outcome:

CO No.	**Upon completion of this course, students should be able to**	**PSO addressed**	**CL**
CO- 1	have an understanding about the classification of drugs and their mode of action.	1,4	Un

CO- 2	know the causes of common insect borne, air borne and water borne diseases and get an idea about the treatment for common diseases.	4, 5,7	Re
CO- 3	estimate the sugar and cholesterol levels in blood.	4, 5, 7	Ev
CO-4	aware about first aid rules and first aid box.	4	Ap
CO-5	know the types of blood pressure, treatment methods and about the cardiovascular drugs.	1,2,4,5	Un
CO-6	know about diabetics, its treatment methods and get an idea about some anti-convulsant agents.	4, 5	Re

21UCHS41 Medicinal Chemistry

	PO									PSO								
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Avg	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	Avg
CO-1	2	3	3	2	3	3	3	3	2.8	2	3	3	3	3	3	3	3	2.9
CO-2	3	3	3	2	3	3	2	3	2.8	2	3	3	3	2	3	3	3	2.8
CO-3	3	2	3	3	2	3	3	3	2.8	3	3	3	3	2	3	3	3	2.9
CO-4	3	3	3	2	3	3	3	3	2.9	3	3	3	3	2	3	3	3	2.9
CO-5	3	3	3	2	3	2	3	3	2.8	2	3	3	3	2	3	3	3	2.8
CO-6	3	2	3	3	3	2	3	3	2.8	3	3	3	3	2	2	3	3	2.8
Average	2.8	2.7	3	2.3	2.8	2.7	3	3		2.5	3	3	3	2	2.8	3	3	
PO Mean									**2.8**	PSO Mean								**2.9**
Strength of PO Correlation				Strong						Strength of PSO Correlation						Strong		

SEMESTER IV			
Core Skill Based	**Forensic Chemistry**		
Course Code :21UCHS42	**Hrs./Week:2**	**Hrs/ Sem 30**	**Credits:2**

Objectives:

- To know the origin of forensic science.
- To understand the methods of finger print detection.
- To study different ways in blood stain analysis.
- To understand the drug test methods.
- To learn the nature of investigations in arson sites.

Unit I: Origin of forensic science

Introduction – Early years of forensic science – - sampling in crime sites - detecting nicotine in human body- Stas –Otto test - Advances in nineteenth century- guaiac test – hydrogen peroxide test - Marsh test- detecting arsenic in human body –- rifling- finger printing of bullets - scope of forensic science – criminalistics

Unit II: Finger printing

Introduction- History of finger printing - General principles of finger printing – forms of finger prints - Finger printing systems- Henry system- Integrated automated fingerprint identification system-finger printing detection - Chemicals found in eccrine secretions – powder test – chemical test- silver nitrate test - light test

Unit III: Forensic serology

Introduction- Blood types – research by Landsteiner – properties of four blood groups – rules for blood transfusions – testing for blood types -polymorphic proteins and isoenzymes- proteins and enzymes in blood stain analysis – calculation of frequencies based on blood specimen-characterization of blood stains – blood stain patterns – Adlers' test – luminol test – testing for semen and saliva

Unit IV: Toxicology and drug testing

Introduction - Alcohol and the human body – metabolism of alcohol – behavioral effects of varying levels of blood alcohol concentrations– Testing for blood alcohol concentration-drunkometer – intoximeter – breath analyzer- saliva test – Testing for drugs- marquis test – testing for poisons – confirmatory tests.

Unit V: Arson and explosives investigations

Arson as an economic and social problem – Arson investigations – heat of combustion of some fuels – conditions for combustion – ignition temperature – flash points – flammable range of common fluids- onsite investigation of accelerant residues – Explosive investigations- classifications of explosives – colour tests for some common explosives.

Text book:

1. David E. Newton.*Forensic Chemistry*. Library of congress, 2007.

Reference book:

1. Jay A. Siegel.*Forensic chemistry- Fundamentals and applications*. Wiley Blackwell, 2015.

Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	explain the origin of forensic science.	4	Un
CO - 2	distinguish the forms of finger printing.	1	Un
CO - 3	demonstrate the methods used in the detection of finger prints.	5	Ap
CO - 4	describe the different types of blood stains	4, 7	Re
CO - 5	explain the investigations in arson sites.	3, 4	Un
CO - 6	demonstrate the explosive investigations in various sites	4	Ap

21UCHS42 Forensic Chemistry

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	2	2	2	3	3	3	**2.6**	3	3	2	2	3	3	3	3	**2.8**
CO-2	2	3	2	3	2	3	2	3	**2.5**	3	2	3	2	2	2	3	3	**2.5**
CO-3	3	3	2	2	2	3	2	3	**2.5**	3	2	3	3	3	3	2	3	**2.8**
CO-4	3	3	2	3	2	2	3	3	**2.6**	3	3	3	2	3	2	2	3	**2.6**
CO-5	3	2	2	3	3	2	3	3	**2.6**	3	3	3	2	3	2	3	3	**2.8**
CO-6	3	3	2	3	3	3	2	3	**2.8**	3	3	3	3	3	2	3	3	**2.9**
Average	2.8	3	2	2.7	2.3	2.7	2.5	3		3	2.7	2.8	2.3	2.7	2.2	2.5	3	
PO Mean									2.6	PSO Mean								2.7
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

SEMESTER III & IV			
Core Practical II	**Semi-micro Inorganic Qualitative Analysis**		
Course Code :21UCHCR2	**Hrs/Week : 2**	**Hrs/ Sem : 30**	**Credits : 2**

Systematic qualitative analysis of a mixture containing two anions and two cations. One of the anions should be an interfering radical which should be eliminated. The two cations should be of different groups.

Principles of flame testing – concept of solubility and solubility product – concept of pH and Buffer action – common ion effect - theory of testing anions (Simple and interfering) – Principle of grouping of cations –Theory of testing cations.

The combination of mixture containing two halides,(sulphates along with lead, barium, strontium and calcium), (oxalate and carbonate) & (one oxidizing and one reducing group), should be avoided.

Anions:

(i) Carbonate (ii) Sulphide (iii) Sulphate (iv) Chloride (v) Bromide (vi) Iodide.

(vii) Nitrate (viii) Borate (ix) Oxalate (x) Fluoride (xi) Chromate (xii) Phosphate

Cations:

(i) Lead (ii) Copper (iii) Bismuth (iv) Cadmium (v)Antimony (vi) Nickel (vii) Manganese (ix) Zinc (x) Barium (xi) Strontium (xii) Calcium (xiii) Magnesium (xiv) Ammonium.

Course Work:

Detection of sodium and potassium ions by flame photometer

Books for Reference:

1. J. N. Gurtu and R. Kapoor.*Advanced Experimental ChemistryVolume II*. S. Chand & Company Ltd,1980.
2. A.O. Thomas.*Practical Chemistry for B. Sc. Main students*. Scientific Book Centre, Cannanore,1992.

Course outcomes

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	acquire knowledge on the systematic analysis of mixture of salts.	2	Un
CO - 2	identify the cations and anions in the unknown substance.	5	An
CO - 3	Recall the separation of metal ions in to different groups	1,7	Re
CO - 4	assess the role of common ion effect and solubility product in precipitation	5	Ap
CO - 5	identify quality of various samples by determining the anion and cations in them	1,7	Ap
CO - 6	Understand the applications of metal salts in various fields	2,7	Un

21UCHCR2 Semi-micro Inorganic Qualitative Analysis

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	2	3	3	2	3	3	2.8	3	3	3	3	3	2	3	3	3
CO-3	3	3	3	2	3	3	2	3	2.8	3	3	3	3	3	3	3	3	3
CO-4	2	3	3	3	3	2	3	3	2.8	3	3	3	3	3	3	3	3	3
CO-5	3	3	2	3	2	3	3	3	2.8	3	3	3	3	3	2	3	3	2.9
CO-6	3	3	3	2	3	3	2	3	2.9	3	3	3	3	3	2	3	3	2.9
Average	3	3	2.7	2.7	2.8	2.5	2.5	3		3	3	3	3	3	2.3	3	3	
PO Mean									**2.9**	PSO Mean								**3**
Strength of PO Correlation				Strong						Strength of PSO Correlation						Strong		

SEMESTER- IV			
Ability Enhancement Course Yoga and Meditation			
Code: 21UAYM41	**Hrs/Week : 2**	**Hrs/Semester : 30**	**Credits: 2**

Objectives:

- To know the importance of yoga in daily life
- To explore the physical and mental health benefits of yoga.
- To compare the effects of yoga styles on health
- To identify the role of yoga in reducing stress and anxiety.
- To know the value of meditation on emotional well-being.

Course Outcome:

CO.No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO-1	Learn and practice various meditation, yoga methods to transform the ordinary life into a healthy, harmonious life leading to holistic wellbeing.	1	Re, UnUn
CO-2	Create an eco-friendly, loving and compassionate world.	1,5	UnAn
CO-3	Acquire knowledge and skill in yoga for youth empowerment.	5, 8	An
CO-4	Increase their power of concentration	5	Un
CO-5	Learn the causes and ways to overcome fear and sadness.	6, 5, 8	Un,An
CO-6	Create a ecofriendly, loving and compassionate world.	2,5	Un Ap

Unit I: Meditation (6 Hrs)

Meditation – Purposes of meditation– Major types of meditations: Zazen, Mindfulness, Vipasana, Yoga, Self-inquiry, Listening, Qi Gong, Taoist, Tantra– Health benefits of meditation: physical, psychological, spiritual–Meditation and Silence:Silence of the body, mind, heart,and beyond – General methodology of meditation – Tips for better meditation **Exercises**: Practicing Zazen meditation – Self-enquiry meditation exercises

Unit II: Self-Awareness (6 Hrs)

Awareness – Self-awareness – Importance of self-awareness – Shades of self-awareness – Difference between Awareness and Concentration – Power of concentration – Levels of concentration – How to increase concentration? – Beauty of living here and now – Ways to develop your presence – Self-awareness and Ecology: interconnectedness **Exercises**: Body Scan exercise – Self-Witnessing exercise – Eating Raisin with full awareness

Unit III: Yoga (6 Hrs)

Meaning and importance of yoga – Yoga and human physical system – Principles of Yoga – Different types of yoga – Yoga and balanced diet – Yoga and energy balance – Pranayama – Surya namaskaram– Basic asanas for healthy life – Therapeutic benefits of simple yogasanas – Naturopathy for common ailments.

Exercises:Practicing basic Asanas – Doing Sun Salutation

Unit IV: Mindfulness (6 Hrs)

Definition of mindfulness – Three components of mindfulness– Benefits of mindfulness – Mindfulness and Brainwave patterns – Myths about mindfulness – Scientific Facts about mindfulness – Formal method to practice mindfulness – Qualities of Mindfulness – Obstacles for mindfulness – informal ways of practicing mindfulness – Mindfulness to get rid of addictions

Exercises: Practice Mindful Walking –Practice Mindful Talking

Unit V: Heartfulness (6 Hrs)

Attitude to life – Power of positive attitude – Techniques to develop positive attitude – Positive vs negative people – Forms of negative attitude – Heartfulness – Managing fear: Basic 5 fears, Ways to overcome fear–Handling anger: Anger styles, Tips to tame anger – Coping with sadness: Causes and ways to overcome sadness, dealing with depression – Ultimacy of compassion: Compassion to oneself, towards others: Forgiveness, to nature: Seeing God in all

Exercises: Practice Loving-Kindness meditation– Doing compassionate actions

Text Book:

1) Thamburaj Francis. *Meditation and Yoga for Holistic Wellbeing.* Trichy:Grace Publication. 2019.

Books References:

1) Osho. *Meditation the Only Way.* New Delhi: Full Circle Publication, 2009.
2) Thamburaj Francis. *Journey from Excellence to Godliness: Zen Meditation for Transformation.* Grace Publication, Trichy, 2017.

3) Osho. *Awareness: The Key to Living in Balance.* New York: St.Martin's Griffin Publication, 2001.
4) Tolle Eckart.*The Power of Now: A Guide to Spiritual enlightenment.* New World Library, 2004.
5) Swami Gnaneswarananda. *Yoga for Beginners.* Calcutta: Sri Ramakrishna Math, 2010.
6) HanhThichNhat. *The Miracle of Mindfulness: An Introduction to the Practice of Meditation.* Beacon Press, 2016.
7) Kamlesh D. Patel and Joshua Pollock. *The Heartfulness Way: Heart-Based Meditations for Spiritual Transformation.* Westland Publications, 2018.

SEMESTER- V			
Core V (Common Core)	**Material Science**		
Course Code : 21UPCC51	**Hrs/Week : 6**	**Hrs/ Sem : 90**	**Credits : 5**

Objectives:

- To study the different crystal structures and crystal imperfections.
- To understand the usage of the appropriate materials while designing electronic system.
- To enrich the students about the background theory and properties of different materials.
- To classify different magnetic materials.
- To appreciate different methods of synthesis of nanomaterials.

Unit I: Crystal structure and crystal imperfections

Types of solids- Explanation of isotropy-anisotropy. Symmetry of crystals-Plane of symmetry,axis of symmetry,centre of symmetry. Miller indices and determination. Crystal structure-crystal lattice, space lattice .unit cells-Types of crystal systems-Classification of crystals on the basis of bonds-ionic crystal,crystal lattice of NaCl and CsCl. Lattice energy of ionic crystal- (Born-Haber cycle). Molecular crystal-dry CO_2.Covalent crystal- Structure of diamond. Metallic crystal-crystal defect-(vacancy, interstitial, impurity).Semiconductors-solar cell.Liquid crystals-types and its applications.

Unit II: New materials

Shape memory alloys-Phases of shape memory alloys-Types-Characteristics-Applications

Metallic glasses- Glass transition temperature-Preparation-types-properties-applications

Intermetallic compounds-properties-classification-preparation-applications

High temperature materials-properties-types-applications

Biomaterials- Classification-types of dental cement and its applications.

Smart material-Properties-Components-Classification-application

Unit III: X-rays

X rays-Production-Properties-X ray spectra-continuous and characteristic spectrum-Mosley's Law-(Statement, explanation and importance)-Compton effect-Expression for change of wavelength

Diffraction of X-rays-Bragg's law – Derivation of Bragg's equation - Experimental methods of X-ray study– Laue, rotating crystal and powder methods.

Unit IV: Magnetic and dielectric materials

Classification of magnetic materials – Langvein theory of diamagnetism – theory of paramagnetism– Domain theory of ferromagnetism – Antiferro magnetic materials – Application of Different magnetic materials.

Dielectric materials – Types of dielectric materials – different types of electric polarization –- Internal field – Clausius-Mossotti equation – Frequency and temperature dependence of dielectric constant.

Unit V: Nanomaterials

Nanomaterials- Synthesis- Techniques for Synthesis-Plasma arcing, Chemical vapour deposition, Sol gels, Electro deposition, Ball milling –Properties of nano particles and applications-Carbon nanotubes-Structure-Fabrication: Arc method, Pulsed laser deposition-Chemical vapour deposition- Structure- Properties- Applications.

Text Books:

1. Arumugam M. *Material Science*. Anuradha Publication, 2008.
2. Sri Vasta C M & Srinivasan C. *Science of Engineering materials*. New Age International (P) Ltd, Second Edition, 1999.
3. Palanisamy P. K. *Solid state Physics Copyright* (2003).Chennai:Scitech Publication (India) Pvt Ltd, 3rd reprint 2008.
4. Mureghesan R, Kiruthiga Sivaprasath. *Modern Physics*. S.Chand& Co Ltd. 17th Edition, 2013.
5. Dr.Mani. P. *A Text Book of Engineering Physics*.Chennai:Dhanam Publications. Revised Edition, 2008.
6. Marikani A.*Materials Science*. Delhi:PHI Learning Pvt.Ltd. Eastern Economy Edition, 2017.

Books for Reference:

1. Charles Kittel. *Introduction to solid state Physics*. John Wiley and Sons, 2010.
2. Palanisamy P. K. *Material Science*, Chennai: Scitech Publication (India) Pvt Ltd, 2005.
3. Fulekar M.H *Nano Technology Importance and applications*. I.K International Publishing House Pvt Ltd, 2010.

Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO – 1	identify the basic symmetry elements and operations of crystals, distinguish the types of crystal systems and enumerate the various crystal imperfections.	1	Re
CO – 2	rank the properties of new materials like metallic glasses, shape memory alloys, high temperature materials, smart materials and biomaterials and apply them in various walks of life	7	Ev
CO – 3	justify the wave nature of matter and its experimental study and apply Bragg's law for x-ray study.	1,2,3	Ev
CO – 4	distinguish magnetic materials based on susceptibility.	2	An
CO – 5	summarise the uses of magnetic materials in various field.	2	Un
CO – 6	outline the synthesis methods of nano materials.	2	An

21UPCC51-Material Science

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	3	2	2	3	3	3	**2.6**	3	3	2	3	2	2	3	3	**2.6**
CO-2	2	3	2	3	2	3	3	3	**2.6**	3	2	3	3	3	3	3	3	**2.9**
CO-3	3	3	2	2	2	3	3	3	**2.6**	3	3	3	2	3	3	3	3	**2.9**
CO-4	3	3	3	3	2	2	3	3	**2.6**	3	3	3	3	3	2	2	3	**2.8**

CO-5	3	2	2	3	3	3	3	3	**2.8**	3	3	3	3	3	3	3	3	**3**
CO-6	3	3	3	3	3	3	3	3	**3**	3	3	3	3	3	3	3	3	**3**
Average	2.8	2.9	2.4	2.8	2.5	2.6	3	3		3	2.8	2.8	2.8	2.8	2.7	2.8	3	
PO Mean									**2.8**	PSO Mean								**2.9**
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

Name of the Course: Inorganic Chemistry – I

Blueprint of the question paper	Section	Unit I	Unit II	Unit III	Unit IV	Unit V
	Section A	2	2	2	2	2
	Section B Any FIVE	2	2	1	1	1
	Section C Either OR	2	2	2	2	2
	Section D Any THREE	1	1	1	1	1

SEMESTER- V			
Core VI	**Inorganic Chemistry-I**		
Course Code :21UCHC51	**Hrs./Week:4**	**Hrs/ Sem: 60**	**Credits:4**

Objectives:

- To provide the knowledge of d block elements.
- To have a profound understanding of theories of chemical bonding.
- To know the chemistry behind d and f block elements.
- To acquire knowledge about the reactions in non- aqueous solvents.
- To understand the nature of different types of inorganic materials.

SEMESTER- V			
Core VI	**Inorganic Chemistry-I**		
Course Code :21UCHC51	**Hrs./Week:4**	**Hrs/ Sem: 60**	**Credits:4**

Unit I Reactions in non-aqueous solvents

Solvent- definition- water as a universal solvent - classification of solvents – factors affecting the solvating ability– liquid range-dielectric constant – dipole moment and viscosity.

Liquid NH_3 as non aqueous solvent-reason –auto ionisation – ammono acid and bases. Reactions - neutralization, precipitation, solvolysis, complex formation and redox reactions.

Advantages and disadvantages of liquid NH_3 as a solvent.

Liquid SO_2 as non aqueous solvent – reason. Reactions- precipitation, neutralization, solvolysis, complex formation and redox reactions. Advantages and disadvantages of liquid SO_2 as a solvent.

Unit II Theories of Chemical Bonding

Valence bond theory – postulates.

VSEPR Theory Postulates – Geometry of molecules containing only Bond pairs of electrons BeF_2, BF_3, CCl_4, PF_5, SF_6, IF_7. Geometry of molecules containing Bond pairs as well as Lone pairs of electrons. $SnCl_2$, H_3O^+, SF_4, ClF_3, XeF_2, XeF_4, IF_5.

Geometry of Ions – Carbonate ion, Nitrate ion, Sulphate ion, Perchlorate ion, chlorate ion.

Molecular Orbital Theory - The basic principles of molecular orbital theory – Linear combination of atomic orbitals (LCAO). Molecular orbital treatment of Hydrogen molecule H_2, Hydrogen molecule ion H_2^+, H_2^-, O_2^+, O_2^-, O_2^{2-}. Carbon monoxide molecule & Nitric oxide molecule. Term symbols for Diatomic molecules. Molecular orbital's of polyatomic species H_3^+ ion. Walsh Diagram – BeH_2 molecule.

Unit III d- Block Elements

General characteristics of d-block elements – comparative study of Ti, Zr, Hf extraction, properties and uses of titanium-preparation and uses of titanium dioxide and titanium tetrachloride. polyvalency of vanadium. Comparative study of Cr, Mo, W – polyvalency of chromium-extraction, properties and uses of molybdenum and tungsten. Platinum-Extraction, properties and uses. Platinum sponge, Platinum black, platinized asbestos and colloidal Platinum, potassium chloroplatinate. Comparative study of

Cu, Ag, Au.(similarities and dissimilarities)

Unit IV f- Block Elements

General characteristics of lanthanides – separation of lanthanides – precipitation – thermal reaction – fractional crystallization – complex formation – solvent extraction – valency change method – ion exchange method. Extraction of a mixture of lanthanides from monazite sand – applications of lanthanides and their compounds – lanthanide contraction – causes and consequences. General characteristics of actinides – comparison between lanthanides and actinides- extraction of Th and U. Preparation and uses of UF_6 and uranyl acetate.

Unit V Inorganic Polymers

Inorganic polymers – general properties - Classification of inorganic polymers - polymer containing phosphorous – preparation, properties and structure of polyphosphonitrilic chloride - polymer containing sulphur - preparation, properties and structure of polymeric sulphur nitride - polymer containing boron – preparation, properties, structure of borazine, substituted borazine – boron nitride and polycarbonates – polymer containing silicon - preparation, properties, structure and uses of silicone fluids, silicone rubbers and silicon resins. Silicates – classification and structure of silicates.

Text books:

1. Puri B.R, Sharma L.R, Kalia K.C. *Principles of Inorganic Chemistry*.Delhi:Milestone publishers and distributors, 2019 – 2020.
2. Sathya Prakash and Madan R.D. *Advance Inorganic Chemistry*. S Chand and Co, 2019.

Books for Reference:

1. Wahid U Malik, Tuli G.D, Madan R.D. *Selected Topics in Inorganic Chemistry*.S.Chand& Co. Ltd., 2018.
2. Albert Cotton F, Geoffrey Wilkinson, Carlos A. Murillo, Manfred Bochmann. *Advanced Inorganic Chemistry*, John Wiley & Sons. sixth edition, 2016.
3. James E.Huheey, Ellen Keiter, Richard L.Keiter, Okhil K.Medhi. *Inorganic Chemistry-Principles of Structure and Reactivity*. Pearson India Education Services Pvt. Limited, 2020.

Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	extend knowledge about non-aqueous solvents.	1	Un
CO - 2	find the positions of the zero, d– and f block elements in the periodic table.	1	Re
CO - 3	explain the general characteristics of non-aqueous solvents d– and f–block elements and the general horizontal and group trends in them.	1	Un
CO - 4	compare the relative stability of various oxidation states in terms of electrode potential values.	1, 5	An
CO - 5	analyze the reactions of compounds of halogens, d and f block elements.	1, 5	An

CO - 6	summarize the structures, the properties, applications of silicones and silicates.	1, 2	Un

21UCHC51 Inorganic Chemistry I

		PO									PSO			
		PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Avg	PSO-1	PSO-2	PSO-3	
CO-1		3	3	3	2	2	3	2	3	**2.6**	3	3	2	
CO-2		3	3	3	2	2	3	2	3	**2.6**	3	3	3	
CO-3		3	3	3	2	2	3	3	3	**2.8**	3	3	2	
CO-4		3	3	3	2	2	3	2	3	**2.6**	3	2	3	
CO-5		3	2	3	2	2	3	2	3	**2.6**	3	3	3	
CO-6		3	2	3	3	2	3	3	3	**2.6**	3	3	2	
Average		3	2.7	3	2.2	2	3	2.3	3		3	2.8	2.5	
		PO Mean								**2.6**	P			
		Strength of PO Correlation			Strong						Strength of PSO			

SEMESTER- V			
Core VII	**Organic Chemistry II**		
Course Code :21UCHC52	**Hrs./Week:5**	**Hrs/ Sem: 75**	**Credits:5**

Objectives:

- To know the importance of effect of substituent in phenol.
- To study the importance of carboxylic acid and their derivatives.
- To understand the different applications of Photochemistry in Organic compounds.
- To know the importance of Heterocyclic compounds.
- To study importance of Synthetic reagents and Specific name reactions.

Course Outcome:

CONo.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO- 1	recall the alcohol series, illustrate the effect of substituent on the acidity of phenols and explain the mechanism of Claisen, Benzoin, Perkin, Knovenegal reaction- Wittig reaction- iodoform reaction	1,2,3,6	Re, Un
CO - 2	rewrite the properties of carbonyl and carboxyl compounds and explain the factors influencing strength of acid -effect of substituent in benzene ring	1, 2, 6	Cr, Un
CO -3	identify the type of the photochemical and thermal reactions and interpret the important applications of photochemistry in organic compounds.	1,7	Re, Un
CO – 4	recall the importance of heterocyclic compounds, alkaloids and terpenes	1, 4	Re
CO-5	predict the nature of compounds in heterocyclic compounds compare quinoline and isoquinoline	5	Ap
CO - 6	recall the preparation of NBS and wilkinsons catalyst and produce reagents in organic synthesis like Lithium Aluminium hydride, Periodic acid and illustrate the mechanisms of Reformatsky reaction- Cope elimination- Bayer-villiger oxidation	1,3,4	Re Cr Un

SEMESTER- V			
Core VII	**Organic Chemistry II**		
Course Code :21UCHC52	**Hrs./Week:5**	**Hrs/ Sem: 75**	**Credits:5**

Unit I: Hydroxy Compounds and Carbonyl compounds

Alcohols – distinction between primary, secondary and tertiary alcohols – (Lucas test, catalytic dehydrogenation, oxidation, Victor - Meyer's test)-Interconversion of primary, secondary and tertiary alcohols. Ascent and descent in the series of alcohols-trihydric alcohol-Glycerol-Preparation, properties – derivatives of glycerol- nitroglycerine-blasting gelatin- Cordite and dynamite-Phenols – classification with example – effect of substitutent on the acidity of phenols

Aliphatic aldehyde& ketones-Reactivity of carbonyl groups-general reactions of aldehydes and ketones-mechanism of addition and condensation reaction- Cannizzaro reaction-Aldol condensation-Reduction reaction- MPV reduction-Wolf-kishner- Clemmenson reduction

Aromatic aldehydes and ketones- Mechanism of Claisen, Benzoin, Perkin, Knovenegal reaction- Wittig reaction-iodoform reaction

Unit II: Carboxylic Acid and their derivative

Aliphatic monocarboxylic acid- general methods of preparation and reactions- acidic nature-factors influencing strength- dicarboxylic acid- Blanc's rule-Aromatic monocarboxylic acid-effect of substituent in benzene ring- Aromatic dicarboxylic acid- Reactions of phthalic acid – Test for Carboxylic acid – Aliphatic hydroxy acids – Preparation reactions of maleic acid and citric acid – Action of heat on hydroxy acid – aliphatic acid derivative- reaction of ester, acid halide and acidamide

Unit III: Photochemistry

Introduction – Photochemical vs thermal reactions – singlet and triplet states – allowed and forbidden transitions – Jablonski diagram – photosensitization – photochemical reaction – elimination reaction – Norrish type I and Type II – photolysis of cyclic ketone – photolysis of aldehyde – photolysis of compounds containing Nitrogen – Barton reaction – photocycloaddition– Paterno-Buchi reaction – photo induced reaction of α,β-unsaturated ketone.

Unit IV: Heterocyclic compounds

Introduction **–** preparation and reactions of furan, pyrrole and thiophene. Aromatic character and basic nature – comparative reactivity. Preparation and reactions of pyridine – preparation and reactions of quinoline, isoquinoline and indole. Structural elucidation of pyridine, quinoline and isoquinoline

Unit V: Reagents of Synthetic Importance and Name Reactions

Preparation and synthetic applications of the following reagents in organic synthesis – Aluminium isopropoxide, N-Bromo succinimide (NBS), Lithium Aluminium hydride, Periodic acid,Osmiumtetraoxide- Wilkinson's catalyst.

Reformatsky reaction- Cope elimination- Bayer-villiger oxidation-Ritter reaction-Hell-Volhard –Zelinsky reaction and Dakin reaction.

Text Books:

1. Tewari K.S, Vishnoi N.K. *A Text Book of Organic Chemistry*.Vishal Publishing.2nd Revised Editions 2017.
2. Arun Bahl and B. S. Bahl. *Advanced Organic chemistry*. S. Chand and Company Ltd., Reprint, 2017.

Books for Reference:

1. Bhupinder Mehta, Manju Mehta. *Organic chemistry*. PHI Learning pvt. Ltd, 2006.
2. Finar I.L .*Organic chemistr, The Fundamental Principles.* Volume I, 6th edition 2014.
3. Tewari N. *Advance Organic Reaction mechanism*. Kolkatta:Books and allied (P) Ltd.Second revised edition, 2017.
4. Jain M.K and Sharma S.C . *Modern organic chemistry*. Vishal publishing co, 4th edition 2012.

Level of Correlation between PO's, PSO's and CO's

	PO									**PSO**								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	3	2	2	3	2	3	**2.6**	3	3	2	2	3	2	3	3	**2.6**
CO-2	3	3	3	2	2	3	2	3	**2.6**	3	3	3	2	3	2	3	3	**2.8**
CO-3	3	3	3	2	2	3	3	3	**2.8**	3	3	2	2	3	2	3	3	**2.8**
CO-4	3	3	3	2	2	3	2	3	**2.6**	3	2	3	2	3	3	2	3	**2.6**
CO-5	3	2	3	2	2	3	2	3	**2.6**	3	3	3	2	3	2	3	3	**2.8**
CO-6	3	2	3	3	2	3	3	3	**2.6**	3	3	2	3	3	2	3	3	**2.8**
Average	3	2.7	3	2.2	2	3	2.3	3		3	2.8	2.5	2.2	3	2.2	2.8	3	
PO Mean									**2.6**	PSO Mean								**2.7**
Strength of PO Correlation				Strong						Strength of PSO Correlation				Strong				

SEMESTER- V			
Core VIII	**Physical Chemistry-II**		
Course Code : 21UCHC53	**Hrs/Week : 5**	**Hrs/ Sem : 75**	**Credits : 5**

Objectives:

- To study the various thermodynamic parameters and its applications in different physical states of the systems.
- To sustain a deep knowledge about the importance of electrochemistry and its applications.

SEMESTER- V			
Core VIII	**Physical Chemistry-II**		
Course Code : 21UCHC53	**Hrs/Week : 5**	**Hrs/ Sem : 75**	**Credits : 5**

Unit I: Thermodynamics I

Scope of thermodynamics-Thermodynamic terms and basic concepts-thermodynamic equilibrium – types of thermodynamic system –Intensive and extensive properties-State function-Path function-Thermodynamic processes – (Isothermal, adiabatic, isobaric, isochoric)– Reversible and irreversible process-sign conventions of work and heat – Pressure-Volume Work-Internal Energy-First law of thermodynamics – Various statements- enthalpy of a system – relationbetween ΔH and ΔE – molar heat capacities – definition – molar heat capacity at constantvolume – molar heat capacity at constant pressure – relation between Cp and C_v- JouleThomson effect – Joule Thomson coefficient – inversion temperature.

Unit II: Thermodynamics II

Limitations of first law of thermodynamics-Spontaneous process-Examples and criteria of spontaneity-Entropy-Second law of thermodynamics –Different statements — Entropy changes in isothermal expansion of anideal gas – Entropy changes in reversible and irreversible processes –-Work function and freeenergy function – Variation of free energy with temperature and pressure – Gibbs Helmholtzequation – Derivation and significance – Partial molar properties – Chemical potential –Gibb's Duhem equation – Derivation and significance .

Unit III: Thermodynamics III

Claussius-Claypeyron equation – derivation (integral anddifferential forms) - significances - application in ice skating — derivation of Van't Hoff isotherm and isochore-Concept of fugacity– fugacity of a gas in a gaseous mixture –physical significance offugacity-Nernst heat theorem – third law of thermodynamics – statement -determination ofabsolute entropy of solids, liquids and gases– entropy change in chemical reactions – derivation of the Boltzmannentropy equation – residual entropy – Thermodynamic equilibrium-Zeroth law of thermodynamics.

Unit IV: Electrochemistry I

Strong and weak electrolyte-Effect of equivalent conductance on dilution- Elementary treatment of Debye-Huckel theory of strong electrolytes – Significance of Debye-Huckel Onsagar equation (Derivation not required) – Transport Number – Determination by Hittorff's and moving boundary methods – Abnormal transport numbers – Absolute velocity of an ion and its determination – Kohlrausch's law and its applications — Conductometric titrations – Different types – Advantages.

Electrochemical cells-Types-Chemical cell and concentration cell-Reversible and irreversible cell – Cell representation-Cell reaction-Single electrode potential -Standard electrode potential- Types of electrodes- Primary and secondary reference electrode-metal – metal ion-gas electrode- metal insoluble metal salt electrode (calomel), membrane and redox electrodes.

Unit V: Electrochemistry II

EMF –Definition- Electrochemical series and significance- – Nernst equation (Relation between EMF and equilibrium constant)–Derivation-Application of Nernst equation to calomel electrode- glass electrode -quinhydrone electrode.

Concentration cells – Types-Electrode concentration cells –Electrolyte concentration cells with and without transference- liquid junction potential –Elimination of Liquid Junction Potential-Applications of EMF-Potentiometric titration (acid-base, redox and precipitation).

Industrial applications of electrolysis-Electroplating-Principle-Process-Electroplating of Cu, Ni and Cd-Power sources-Primary cells-selection of anode and cathode-Alkaline-MnO_2 cell-Secondary cells-Characteristics- Lithium battery and Ni-Cd battery-Fuel cells-Principle-Hydrogen-Oxygen fuel cells-alkaline fuel cells.

Corrosion-Principle-Stability ofmetals-active and noble metals-Anode and cathode process-Protective coating-Types of coating-Protection of structures and pipe lines-Protection of ships in sea.

Text Books:

1. Puri B.R, Sharma L.R, Madan S. Pathania. *Principles of Physical Chemistry*. VishalPublishing Co., 2008.

2. Arun Bahl, Bahl B.S, Tuli G.D. *Essentials of Physical Chemistry*.New Delhi:S. Chand & Company Ltd , 2008.

Books for Reference:

1. Samuel Glasstone.*Thermodynamics for chemists*.New Delhi: Affiliated East-West Press (Pvt.) Ltd., III printing, 2010.
2. Samuel Glasstone. *An introduction to electrochemistry*.New Delhi: Affiliated East-West Press (P) Ltd., 2006.

Course Outcome

CONo.	Upon completion of this course, students should be able to	PSO addressed	CL
CO- 1	list various thermodynamic parameters and its applications in different physical states of the systems and have a study about the first law of thermodynamics.	1 ,2 , 3	Re
CO- 2	interpret the concept of entropy and Second law of thermodynamics.	1,3	Un
CO- 3	relate the significance and application of Claussius-Claypeyron equation.	1,2,5	Ap
CO-4	analyse the concept of fugacity, Nernst heat theorem and third law of thermodynamics.	1, 3,4	An
CO- 5	appraise the concept of EMF, electrochemical series and its significance, concentration cells and applications of e.m.f.	2,3	An
CO-6	outline the importance of electrochemistry and its industrial application.	1,3	An

21UCHC53 Physical Chemistry-II

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	2	2	2	3	3	3	**2.6**	3	3	2	2	3	2	3	3	**2.6**
CO-2	2	3	2	3	2	3	3	3	**2.6**	3	2	3	2	2	2	3	3	**2.5**
CO-3	3	3	2	2	2	3	3	3	**2.6**	3	3	3	2	3	3	2	3	**2.8**
CO-4	3	3	2	3	2	2	3	3	**2.6**	3	3	3	2	3	3	2	3	**2.8**
CO-5	3	2	2	3	3	2	3	3	**2.8**	3	3	3	2	3	2	3	3	**2.8**
CO-6	3	3	3	3	3	3	3	3	**2.6**	3	3	3	3	3	2	3	3	**2.9**
Average	2.8	2.8	2.2	2.7	2.3	2.8	3	3		3	3	3	2.2	2.8	2.3	2.7	3	
PO Mean									2.6	PSO Mean								2.8
Strength of PO Correlation				Strong						Strength of PSO Correlation						Strong		

Semester - V			
Common Skill Based Core	**Computer for Digital Era and Soft Skills**		
Code : 21UCSB51	**Hrs / Week : 2**	**Hrs / Sem : 30**	**Credits : 2**

Unit I: Fundamentals of Computers:

Introduction to computers- Components of computers-Working principle-Types of computers-Tablet-Notebook-Smart phone-PDA-Impact of computers on society-Types of software.

Unit II: Recent Trends in Computer Science and e-Governance:

IoT - applications- Mobile applications - E-Learning- E-Commerce - digital payments

Unit III: Social Media:

Face book-Twitter-Linked In-Instagram-Advantages of Social Networking-Issues/Risks of Social Networking-Protecting ourselves from social Networking problems-Cybercrimes-Hacking-Phishing- Cyber Security

Unit IV: Introduction to Soft Skills:

Learning objectives – What are soft skills?-Categories of Soft Skills-Integral Parts of Soft Skills.

Unit V: Understanding Self and Team Building:

Transactional Analysis (TA) - Structural analysis of Ego states- The functional model of Ego states - Egogram-Storkes - Life Position - Egogram and Life Positions Questionnaire-Team and Team Building- Features of effective creative teams

Books for Reference:

1. Peter Norton, Introduction to Computers 6th Edition
2. Charles P Pfleeger, Shari Lawrence Pfleeger, Security in Computing, I Edition, Pearson Education, 2003.
3. E.Balagurusamy, Fundamentals of Computers, McGraw Hill
4. Henry Chan, Raymond Lee, Tharam Dillon, Elizabeth Chang ,

E-Commerce fundamentals and applications, Wiley Student edition

5. Benita Bhatia Dua, DeepaJeyaraman, Profit with Social Media, CNBC
6. Dr.K.Alex, Soft Skills, S.Chand & Co
7. http://www.digitalindia.gov.in/content/social-media-analytics
8. https://www.researchgate.net/publication/307878962_Introduction to_ E- Governance
9. http://www.ijqr.net/journal/v10
10. https://www.researchgate.net/publication/258339295_FUNDAMENTALS_OF_ COMPUTER _STUDIES

Course Outcomes

CONo.	Upon completion of this course, students will be able to	PSOaddressed	CL
CO- 1	Identify different types of computer systems.	2,3	Re
CO - 2	Classify various types of software being used.	2	Un
CO - 3	Compare various digital payments and use them in day to day life.	1, 2	An
CO -4	Recognise the innovative technologies IoT and integrate it in various fields.	1,7	Re
CO – 5	Analyze various social networking platforms and use them efficiently.	1	Un
CO – 6	Distinguish various cyber attacks and apply preventive measures.	1, 4	Re

21UCSB51 Computer for digital era and soft skills

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	2	3	3	2	3	3	3	3	2.8	2	3	3	3	3	3	3	3	2.9
CO-2	3	3	3	2	3	3	2	3	2.8	2	3	3	3	2	3	3	3	2.8
CO-3	3	2	3	3	2	3	3	3	2.8	3	3	3	3	2	3	3	3	2.9
CO-4	3	3	3	2	3	3	3	3	2.9	3	3	3	3	2	3	3	3	2.9
CO-5	3	3	3	2	3	2	3	3	2.8	2	3	3	3	2	3	3	3	2.8
CO-6	3	2	3	3	3	2	3	3	2.8	3	3	3	3	2	2	3	3	2.8
Average	2.8	2.7	3	2.3	2.8	2.7	3	3		2.5	3	3	3	2	2.8	3	3	
PO Mean									**2.8**	PSO Mean								**2.9**
Strength of PO Correlation				Strong						Strength of PSO Correlation						Strong		

Name of the Course: Inorganic Chemistry - II

Blueprint of the question paper	Section	Unit I	Unit II	Unit III	Unit IV	Unit V
	Section A	2	2	2	2	2
	Section B Any FIVE	2	2	1	1	1
	Section C Either OR	2	2	2	2	2
	Section D Any THREE	1	1	1	1	1

SEMESTER- VI			
Core IX	**Inorganic Chemistry - II**		
Course Code :21UCHC61	**Hrs./Week:4**	**Hrs/ Sem: 60**	**Credits:4**

Objectives:

- To study the formation and bonding in coordination compounds
- To know the theories behind the formation of coordination complexes.
- To study the reaction mechanism in complexes
- To know the importance of metals in biological systems and the application of metal chelates in various fields.
- To understand the nature of metal carbonyls and their applications

SEMESTER- VI			
Core IX	**Inorganic Chemistry - II**		
Course Code :21UCHC61	**Hrs./Week:4**	**Hrs/ Sem: 60**	**Credits:4**

Unit I: Co-ordination Compounds I

Limitations of VB theory,Co-ordination compounds –definition –addition (or) molecular compounds double salts-complex salts. Terminology – complex ions (central metal ion) coordination number- ligands - types of ligands (monodentate– bidentate – polydentate - bridging ligands) –Chelating ligands – Oxidation number, co-ordination sphere, effective atomic number (EAN). Nomenclature of coordination compounds – isomerism in co-ordination compound – structural and stereo isomerism. Hydrate isomerism – ligand isomerism – linkage isomerism – coordination isomerism – coordination position isomerism – polymerisation isomerism. Stability of complex ions – Irving William series.

Unit II: Co-ordination Compounds II

Crystal field theory –postulates of Crystal field theory- CF splitting in tetrahedral, Relation between Δ_t, Δ_0 and 10 Dq. Distribution of d^x (x=0 to 10) electrons in t_{2g} and $e_g$orbitals in tetrahedral complexes - and CF splitting in octahedral complexes - Distribution of d^x (x=0 to 10) electrons in t_{2g} and $e_g$orbitals in octahedral complexes-. Spiltting of d orbitals in square planar complexes – calculating the value of crystal field splitting parameter in square planar complexes - Strong and weak field ligands, Crystal field stabilization energy (CFSE) – factors influencing the magnitude of CF splitting — applications of crystal field theory - magnetic properties, colour of transition metal complexes – Ligand field theory- Jahn Teller theorem Consequences of Jahn- Teller distortion.

Unit III: Reaction Mechanism in Co-ordination Compounds

Substitution reaction in octahedral complexes – dissociative (S_N1), associative(S_N2) mechanism. Lability and inertness of transition metal complexes- Interpretation - Lability of non-transition metal complexes- Substitution reactions in octahedral complexes (acid and base hydrolysis) and substitution reactions in square planar complexes S_N1 and S_N2. Trans effect- pi bonding theory of trans effect – uses of trans effect. Electron transfer reactions – Outer sphere and inner sphere mechanism, MO diagram for sigma system$[Co(NH_3)_6]^{3+}$, $[Ti(H_2O)_6]^{3+}$.

Unit IV: Organometallic compounds and Metal clusters

Eighteen electron rule – Nomenclature of organometallic compounds- classification of carbonyls- based on the number of metal atoms present in carbonyl- based on the structure of carbonyls. General methods of preparation, properties of transition metal carbonyls.

Nature of M-CO bonding in metal carbonyls - Structure and bonding in metal carbonyls of mono, bi nuclear and poly nuclear carbonyls of Ni, V, Cr, Fe, Co and Mn. [$(Ni(CO)_4$.) $V(CO)_6$, $Fe(CO)_5$, $Cr(CO)_6$, $Co_2(CO)_8$, $Fe_2(CO)_9$, $Mn_2(CO)_{10}$, and $Fe_3(CO)_{12}$]. Carbonyl clusters – Wade's rules. Bonding in ferrocene – Aromatic character of ferrocene.

Unit V: Bio-Inorganic Chemistry

Role of metal ion in living systems (excess and deficiency of trace metals) – metalloproteins, metallo-enzymes – characteristics of metallo-enzymes – characteristics of metal activated enzymes – functions of metal in enzymes – elementary idea of metallo-porphyrins. Structure and function of haemoglobin, myoglobin and chlorophyll .Function of Na/K pump. Biological

functions and toxicity of some elements. Applications of co-ordination compounds in medicine, industry, biological systems and analytical chemistry.

Text book:

1. Puri B.R. Sharma L.R. Kalia. *Principles of Inorganic Chemistry*.Delhi:K.K. Milestone Publishers & Distributors, 2019 – 2020.

Books for Reference:

1. Lee J.D. *Concise Inorganic Chemistry*. Blackwell ScienceWiley.fifth edition, 2008.
2. Gopalan R, Ramalingam V.*Concise co-ordination Chemistry*. Vikas Publishing House Pvt Ltd, 2008.
3. Wahid U Malik, Tuli G.D, Madan R.D. *Selected Topics in Inorganic Chemistry.* S. Chand & Co. Ltd, 2018.
4. Albert Cotton F, Geoffrey Wilkinson, Carlos A. Murillo, Manfred Bochmann. *Advanced Inorganic Chemistry*, John Wiley & Sons.sixth edition 2016.

5. Course Outcome:

CO No.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	develop methods to synthesize the coordination compounds and explain the definition of coordination compounds, naming them and decide isomerism.	1, 6	Cr
CO - 2	examine the formation and bonding in coordination compounds.	1, 2	An
CO - 3	Apply the knowledge of bonding and identify the structure and bonding in metal carbonyls of mono, bi nuclear and poly nuclear carbonyls.	1, 5	Ap
CO - 4	Outline the reaction mechanism of coordination compounds.	1	An
CO – 5	describe the formation of metal clusters.	1	Re
CO-6	make independent research ideas in the field of bioinorganic chemistry.	1	Cr

2	PO									PSO								
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Avg	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	Avg
CO-1	2	3	3	2	2	3	2	3	**2.5**	3	3	3	2	3	2	3	3	**2.8**
CO-2	3	3	2	2	2	3	3	3	**2.6**	3	3	3	2	3	3	3	3	**2.9**
CO-3	3	3	3	2	2	3	3	3	**2.8**	3	3	3	2	3	3	3	3	**2.9**
CO-4	3	3	2	2	2	2	2	3	**2.3**	2	2	3	2	2	3	2	2	**2.2**
CO-5	3	3	3	2	2	3	2	3	**2.6**	3	3	3	2	3	3	3	3	**2.9**
CO-6	3	3	2	3	3	3	3	2	**2.8**	3	3	3	3	2	3	3	3	**2.9**
Average	3	3	2.5	2.2	2.2	2.8	2.5	2.8		2.8	2.8	2.2	2.2	2.3	2.8	2.2	2.2	
PO Mean									**2.6**	PSO Mean								**2.8**
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

21UCHC61 Inorganic Chemistry II

SEMESTER- VI			
Core X	**Organic Chemistry-III**		
Course Code :21UCHC62	**Hrs./Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Objectives:

- To have an idea on GreenChemistry and crown ethers
- To Know the classification of dyes and importance of poly nuclear hydrocarbons
- To understand retrosynthesis and its relay approach tosynthesis
- To know the extraction of oil using Clevenger apparatus
- To interpret the chemical structure of molecules using spectroscopy

SEMESTER- VI			
CoreX	**Organic Chemistry-III**		
Course Code :21UCHC62	**Hrs./Week: 4**	**Hrs/ Sem: 60**	**Credits: 4**

Unit I: Green Chemistry

Introduction – need for green chemistry – twelve principles of green chemistry – greenchemistryinday-to-daylife–drycleaning,versatilebleachingagent–atomeconomy-green solvents – supercritical fluid CO_2, ionic liquids andwater

Microwave assisted organic synthesis – introduction – microwave assisted reactions in water – Hofmann elimination and hydrolysis of benzyl chloride – microwave assisted reactions in organic solvents – esterification and Fries rearrangement – microwave assisted reactions in solid state – deacylation, oxidation of alcohols usingclayfen.

Unit II: Dyes and Polynuclear hydrocarbons

Dyes-Witt's theory of colour and constitution – chromophore – Auxochrome –classification of dyes according to chemical structure – preparation and uses of Nitrodyes – Martius yellow. Azo dyes – Aniline yellow, Methyl orange, Congo red, Bismarkbrown, Diphenylmethane dyes- Auramine O. Xanthene dyes – Fluorescein, Eosin and Rhodamine B. Phthalein dyes – Phenolphthalein. Indigo and Thioindigoid dyes – Indigo and Thioindigo. Anthraquinoid dyes – Alizarin. Classification of dyes according to method of application-Direct dyes, Mordant dyes, Vat dyes, Ingrain dyes and Disperse dyes.

Polynuclear hydrocarbons -Synthesis, reactions and structure of naphthalene and anthracene.

Unit III: Retrosynthetic Analysisand Crown ethers

Synthons and synthetic equivalent (electrophilic and nucleophilic). Carbon-carbon bond forming reactions involving Michael and Dieckmann reaction-Protection of functional groups and removal of protecting groups-disconnection approach-Application of Protection and deprotection to alcohols, aldehydes, ketones, acids, phenols and amines. Retrosynthetic analysis of 5- hexanoicacid.

Crown ethers- Synthesis and applications.

Unit IV: Alkaloid and Terpenoids

Alkaloids – definition – classification – occurrence – extraction using soxhelet apparatus pigment analysis using flame photometer-extraction of oil from plants using Clevenger-general characteristics. General methods of identification –functional nature of oxygen, nitrogen. Oxidation, Hofmann's exhaustive methylation – structure and synthesis of coniine, piperineandnicotine.Methods of extraction –Qualitative analysis of phytochemicals – Quantitative estimation of tannin, phenoliccompounds.

Terpenoids – introduction – classification – isolation of terpenoids – isoprene rule – general properties of terpenoids. General procedure for determining structure of terpenoids – synthesis and structure of geraniol, Citral, dipentene and menthol.

Unit V: Organic Spectroscopy

UV Spectroscopy – Chromophore, auxochrome, bathochromic shift, hypsochromic shift, hyperchromic and hypochromic effect – instrumentation- types of electronic transitions – forbidden and allowed transitions. Woodward-Fieser rule for calculation of absorption maxima of dienes and α, β unsaturated ketones .

IR Spectroscopy – number of fundamental vibrations. Finger print region, characteristics of IR absorption frequencies, intermolecular and intramolecular hydrogen bonding.

NMR Spectroscopy – introduction – number of signals – internal standard(TMS) – chemical shift – factors influencing chemical shift – splitting of the signals, spin-spin coupling, coupling constant. NMR spectrum of ethanol, benzyl alcohol, propionic acid, anisole, benzaldehyde, 2,3-dibromopropene, ethyl methyl ketone and mesitylene. C^{13} NMR.

Text Books:

1. Tewari K.S, Vishnoi N.K. *.A Text Book of Organic Chemistry*. Vishal Publishing 2nd Revised Editions, 2017.
2. Arun Bahl and Bahl B. S. *Advanced Organic chemistry*. S. Chand and Company Ltd, Reprint, 2017.

Books for Reference:

1. Kumar V. *An introduction to green chemistry*. Delhi:Vishal Publishing Company, Jabudhar, May2007.
2. Ahluwalia V. K .*Green Chemistry* . Ane Books Pvt. Ltd. Second edition, 2013.

3. Rashmi Sanghi. *Green Chemistry Environmental Friendly Alternatives* .Editors M.M. SrivatsavaNarosa Publishing House Reprint, 2008.
4. Finar I.L. *Organic chemistry -The Fundamental Principles*, Volume I. 6th edition, 2014.
5. Tewari N. *Advance Organic Reaction mechanism.* Kolkata:*Books* and allied (P) Ltd. Second revised edition, 2017.
6. Jain M.K and Sharma S.C. *Modern organic chemistry*. Vishal publishing co., 4th edition 2012.
7. Kalsi P.S .*Spectroscopy of Organic compounds*. New Delhi: New Age International(P) Ltd. IV Edition., 2007.
8. Sharma B.K. *Spectroscopy*.Goel Publishing House. Fourteenth Edition,2000.
9. Jag Mohan.*Organic Spectroscopy - Principles and Application.*, U.K: Alpha Science International Limited. Second Edition,2004.
10. Robert M. Silverstein, Francis X. Webster, David J. Kiemle. *Spectroscopic Identification of Organic Compounds.*Newyork:JohnWileyandSons, Inc., 2014.
11. Bhupinder Mehta, Manju Mehta.*Organic chemistry*. PHI Learning pvt. Ltd., 2006.

Course Outcome:

CONo.	Upon completion of this course, students will be able to	PSO addressed	CL
CO - 1	apply green chemistry in day-to-day life, dry cleaning, versatile bleaching agent and implement an awareness about green chemistry and the methods of microwave assisted synthesis.	4,7,8	Ap
CO - 2	demonstrate various Theories of colour and constitution, know the applications of dyes and classify the polynuclear hydrocarbons.	1, 6	Re, Ap
CO - 3	state synthons and synthetic equivalent- Protection and deprotection of different groups and explain retrosynthesis of 5-hexanoic acid and applications of crown ethers	1,3,6	Re, Un, Ap
CO-4	apply the methods of extraction of Alkaloids and Terpenoids	6	Ap
CO - 5	apply Woodward-Fieser rule for calculation of absorptionmaxima of dienes and α, β unsaturated ketones and enumerate the applications of UV spectroscopy in	1 ,6	Ap

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	2	2	2	3	3	3	**2.6**	3	3	2	2	3	2	3	3	**2.6**
CO-2	2	3	2	3	2	3	3	3	**2.6**	3	2	3	2	2	3	3	3	**2.6**
CO-3	3	3	2	2	2	3	3	3	**2.6**	3	3	3	2	3	3	2	3	**2.8**
CO-4	3	3	2	3	2	2	3	3	**2.6**	3	3	3	2	3	3	2	3	**2.8**
CO-5	3	2	2	3	3	2	3	3	**2.8**	3	3	3	2	3	2	3	3	**2.8**
CO-6	3	3	3	3	3	3	3	3	**2.6**	3	3	3	3	3	2	3	3	**2.9**
Average	2.8	2.8	2.2	2.7	2.3	2.8	3	3		3	3	3	2.2	2.8	2.5	2.7	3	
PO Mean									2.6	PSO Mean								2.8
Strength of PO Correlation				Strong						Strength of PSO Correlation				Strong				

	coordinationcomplexes.		
CO - 6	Categorize the theoretical principle, selection rules and instrumentation , absorption frequencies and applications of IR spectroscopy	1, 4,6	An

21UCHC62 Organic Chemistry-III

SEMESTER- VI			
Core XI	**Physical Chemistry-III**		
Course Code : 21UCHC63	**Hrs/Week : 5**	**Hrs/ Sem : 75**	**Credits : 5**

Objectives:

- To know the concepts of chemistry behind light and sound
- To study the symmetry elements and apply group theory to various molecules.
- To apply phase rule to different physical states of system.
- Inculcate a wide understanding about reaction kinetics and its applications
- To have a basic knowledge about various types of spectra and their applications.

Course Outcome:

CO No.	Upon completion of this course, studentsshould be able to	PSO addressed	CL
CO - 1	recall the terminologies used in phase diagram and interpret phase rule as applied to one component system and two component system	1,3,4	Re
CO - 2	apply reaction kinetics to determine the rate of chemical reactions; understand the factors that influence rates of reaction.	1,2, 3,5	Ap
CO-3	compute the kinetics of the reactionto determine the reaction mechanism	1,2,4	Ap

CO No.	Upon completion of this course, studentsshould be able to	PSO addressed	CL
CO - 4	summarize the chemical reactions under light and sound	3	Un
CO - 5	apply the concept of group theory to various molecules and outline the different symmetry elements, symmetry operations and point groups	1	Ap
CO-6	understand the theory and applications of rotational spectroscopy, IR, UV and NMR	1,2	Un

SEMESTER- VI			
Core XI	**Physical Chemistry-III**		
Course Code : 21UCHC63	**Hrs/Week : 5**	**Hrs/ Sem : 75**	**Credits : 5**

Unit I: Phase Rule

Statement – definitions of terms used – thermodynamic derivation of phase rule –phase

diagrams- areas- curves- triple point- meta stable equilibrium- polymorphism-enantiotropy-monotropy-experimental determination of transition point –colour change-density change-solubility change, and cooling curve methods.

One component system-water system, Sulphur system -two component system – condensedsystem and reduced phase rule – simple eutectic system – Ag-Pb system –Pattinson's process or the desilverisation of argentoferrous Lead –Zn-Cd system -principles of freezing mixture –KI-H_2O -system forming compounds with congruent and incongruent melting points – (Zn –Mg system, $FeCl_3$ – H_2O system)

Unit II: Chemical Kinetics

Reaction rate –units of rates –order and molecularity of a reaction–Pseudo unimolecular reactions –examples- Differential and integratedforms of rate expressions for first, second and zero reactions – first order reaction –examples- Experimental determination of rate constant of decomposition of N_2O_5 in CCl_4 -second order reaction—examples-experimental determination

of alkaline hydrolysis of ester-Time for half change for first, second order reactions – determination of order of thereactions (integrated rate equation method ,differential method, graphical method ,half lifemethod, Van't Hoff method)- Effect of temperature on reaction rate – Arrhenius equation – Activation energy and itssignificance. Collision theory and derivation of rate constant of a bimolecular reaction –Limitations of collision theory – unimolecular reactions and Lindemann's theory –Transitionstate theory –potential energy diagram for activation energy as applied to endothermicand exothermic reaction.

Unit III: Photochemistry and Sonochemistry

Photochemistry – photochemical reaction – Beer-Lambert law(derivation)— Grotthus-Draper law, Starck-Einsteins law of photochemicalequivalence – quantum yield – validity of Einstein's law – reason for low and high quantumyield – determination of quantum yield using actinometer – flash photolysis. Photolysis ofNH_3 and chlorination of methane. Kinetics of decomposition of HI – combination of H_2 andCl_2 reaction – kinetics of the H_2 and Br_2 reaction. Photophysical processes – Photosensitisation-Jablonski diagrams-explanation offluorescence and phosphorescence and its applications– luminescence– chemiluminescence– bioluminescence-thermoluminescence .

Sonochemistry – definition, principle -Cavitation-Sonoluminescence- applications-in the field of industry and medicine.

Unit IV: Group Theory

Symmetry elements and symmetry operations –centre of symmetry –axis ofsymmetry- plane of symmetry -proper axis of rotation- improper axis of rotation– Inversionand identity operations – symmetry elements in water, ammonia, boron trifluoride, benzene,allene and 1,2-dichloro ethylene. Group postulates and types of groups - abelian and non-abeliangroups-order of a group-Point group-Assignment of point group to water and ammonia –Rearrangement theorem-Group multiplication table forC_{2V} – molecular point groups.

Unit V: Spectroscopy

Electromagnetic Spectrum-Regions- interaction of radiation with matter – Differenttypes of energy levels in molecules – rotation, vibration and electronic levels.

Microwave spectroscopy - theory -applications in the determination of bond distances in diatomic molecules –microwaveoven

IR Spectroscopy-Vibrational (IR) spectra – theoretical principle – harmonic oscillator and unharmonicity – modes of vibrations – selection rules – Number of fundamental vibrations — Hook's Law -Force constant – Fermi resonance – Overtones- characteristics of IR absorption frequencies, – Applications in the determination of bond strength.

UV Spectroscopy-Theory – types of electronic transitions - selection rules – forbidden and allowedtransitions - Chromophore, auxochrome, bathochromic shift, hypsochromic shift-hyperchromic and hypochromic effect – Woodward - Fieser rule forcalculation of absorption maxima of dienes and α, β unsaturated ketones (simple problemscan be asked using Woodward-Fieser rule)

NMR-Introduction – spin moment-theory – number of signals –internalstandard (TMS) – chemical shift – factors influencing chemical shift – splitting of the signals,spin-spin coupling, coupling constant. NMR spectrum of ethanol-Magnetic Resonance Imaging.

Text Books:

1. Puri B.R, Sharma L.R, Madan S. Pathania. *Principles of Physical Chemistry*. Vishal Publishing Co., 2008.
2. Arun Bahl, Bahl B.S, Tuli. G.D. *Essentials of Physical Chemistry*.New Delhi: S. Chand & Company Ltd, 2008.
3. Ramakrishnan V and Gopinathan M.S. *Group Theory in Chemistry.* NewDelhi:Vishal Publications,1991.
4. Sharma B.K. *Spectroscopy.*Goel Publishing House. Fourteenth Edition, 2000.

Books for Reference:

1. Samuel Glasstone.*Thermodynamics for chemists*.New Delhi:Affiliated East-West Press (Pvt.) Ltd, III printing, 2010.
2. Soni P.L, Dharmaha O. P. *Text Book of Physical Chemistry* (A Modern Approach). Sultan Chand and Sons Publishers. Revised Edition, 2010.
3. Bhattacharya P.K. *Group Theory and its Chemical Applications*..Mumbai: Himalaya Publishing House,1988.
4. Morris Sylvin. *Photochemistry and Sonochemistry*. NewDelhi: Ivy Publishing House, 2003.
5. Albert Cotton F.*Chemical Applications of Group Theory*. John Wiley and Sons.III Edition, 1999.
6. Banwell C.N. *Fundamentals of Molecular Spectroscopy*. Mc. Graw Hill. Fourth Edition 2003.

21UCHC63-Physical Chemistry III

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	2	2	2	3	3	3	**2.6**	3	3	2	2	3	2	3	3	**2.6**
CO-2	2	3	2	3	2	3	3	3	**2.6**	3	2	3	2	2	2	3	3	**2.5**
CO-3	3	3	2	2	2	3	3	3	**2.6**	3	3	3	2	3	3	2	3	**2.8**
CO-4	3	3	2	3	2	2	3	3	**2.6**	3	3	3	2	3	3	2	3	**2.8**
CO-5	3	2	2	3	3	2	2	3	**2.5**	3	3	3	2	3	2	3	3	**2.8**
CO-6	3	3	3	3	3	3	3	3	**2.6**	3	3	3	3	3	2	3	3	**2.9**
Average	2.8	2.8	2.2	2.7	2.3	2.8	2.8	3		3	3	3	2.2	2.8	2.3	2.7	3	
PO Mean									2.7	PSO Mean								2.8
Strength of PO Correlation				Strong						Strength of PSO Correlation				Strong				

SEMESTER VI			
Elective	**Polymer Chemistry**		
Course Code :21UCHE61	**Hrs/Week : 4**	**Hrs/ Sem : 60**	**Credits : 4**

Objectives:

- To understand the chemistry and technology of different types of polymers.
- To study their applications in various fields.
- To understand the property of polymers.
- To learn different types of polymerisation techniques.

Unit I: Introduction to Polymers

Introduction-Classification based on chemical structure,mode of synthesis and composition – Characteristics of the polymers-nomenclature of polymers – Homopolymers and Hetero polymers — Conducting polymers- Tacticity – isotactic, atactic, syndiotactic polymers – Copolymer-types-statistical, random, alternating,block and graft copolymer.Plastics(thermoplast and thermosets)–elastomers –fibres. Degree of polymerization – functionality – linear, branched and cross linked polymers.

Unit II: Properties of Polymers

Glassy stage – glass transition temperature, factors affecting it crystallinity of polymers. Viscosity, solubility, optical, electrical, thermal and mechanical properties of polymers – Degradation of polymers of thermal, oxidative, mechanical and chemical methods.

Molecular mass – Number average, weight average, viscosity average moleculer mass and their determination– practical significance of moleculer mass distribution.

Unit III: Polymerization Techniques

Classification of polymerization reactions-addition polymerization, condensation polymerization-difference between addition and condensation polymerization-ionic polymerization and coordination polymerization.Polymerization.techniques- bulk, suspension, emulsion and solution polymerization.

Unit IV: Polymer Reactions

Initiators-types – azo, free radical, peroxide and redox initiators. Inhibitors and its applications. Retarders-definition and examples. Mechanism of anionic and cationicpolymerization. Kinetics of free radical,anionic and Ziegler- Natta polymerisation.

Unit V: Some Important Synthetic Resins and Polymers

Outline of synthesis and their usesof the following

Resins-Phenol formaldehyde resin, Melamine – formaldehyde resin, Epoxy resins – grades, and curing process.

Synthetic Polymers:Poly olefins – Polyethylene – HDPE, LDPE,LLDPE – Polypropylene – Polyvinyl chloride – grades of PVC – Teflon, Polymethylmethacrylate (pexiglass) polystyrene, polyamide – Nylon6, Nylon6,6, Nylon6,10 Nylon11, - polyester – polyurethanes – polycarbonates

Synthetic rubber – Styrene rubber, Nitrile rubber, Butyl rubber, Polysulphide rubber and Neoprene.

Biomedical Applications of polymers.

Text book:

1. Bagavathi Sundari K. *Applied Chemistry.* Chennai: MJP Publishers, Tamilnadu Book House, 2008.

Books for Reference:

1. Young R.J and Lovell P.A . *Introduction to polymers*. Replika press Pvt.Ltd.India.II Edition, 2011
2. Arora M.G, Singh M. *Polymer chemistry*. New Delhi:Anmol publications Pvt.Ltd. 4374/4B, Ansari Road,Daryaganj,2003.
3. Gowarikar V.R, Viswanathan N. V and Streedhar J. *Polymer science*. 4th edition, 2021.
4. Jain P.C. and Monika Jain. *Engineering chemistry*. Delhi: DhanpatRai & Sons. Eleventh Edition, 2012.

Course Outcome:

CO No.	Upon completion of this course, students should be able to	PSO addressed	CL
CO - 1	express the terminologies used in polymers and interpret the degree of polymerization.	1,3,4	Un
CO - 2	apply mechanism for determining molecular weight.	1,2, 3,5	Ap
CO-3	recall the properties of different polymers.	1,2,4	Re
CO - 4	summarize the polymerization techniques.	3	Un
CO - 5	outline the principle of polymerization reactions.	3	An
CO - 6	apply the concept of inhibitors and retarders and have a thorough knowledge of kinetics of polymerization have a basic knowledge of synthetic polymers and relate the biomedical applications of polymers.	1,2,3	Ap, Un

Level of Correlation between PO's, PSO's and CO's

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	3	2	2	3	3	3	**2.6**	3	3	2	3	2	2	3	3	**2.6**
CO-2	2	3	2	3	2	3	3	3	**2.6**	3	2	3	3	3	3	3	3	**2.9**
CO-3	3	3	2	2	2	3	3	3	**2.6**	3	3	3	2	3	3	3	3	**2.9**
CO-4	3	3	3	3	2	2	3	3	**2.6**	3	3	3	3	3	2	2	3	**2.8**
CO-5	3	2	2	3	3	3	3	3	**2.8**	3	3	3	3	3	3	3	3	**3**
CO-6	3	3	3	3	3	3	3	3	**3**	3	3	3	3	3	3	3	3	**3**
Average	2.8	2.9	2.4	2.8	2.5	2.6	3	3		3	2.8	2.8	2.8	2.8	2.7	2.8	3	
PO Mean									**2.8**	PSO Mean								**2.9**
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

SEMESTER V & VI			
Core Practical IV Organic Analysis and Organic Preparations			
Course Code : 21UCHCR4	**Hrs/Week : 3**	**Hrs/ Sem : 45**	**Credits : 3**

Objective:

Enable the students to develop analytical skill in organic qualitative and quantitative analysis and to develop skill in preparing organic compounds.

1. Organic Analysis:
   Analysis of simple organic compounds
   a. Nature of the compound- Aromatic / Aliphatic
   b. Test for saturation/ unsaturation.
   c. Detection of element present/ absent
   d. Characterization of functional groups (Acids, amide, amines, phenol, aldehyde, ketone, anilide, ester, carbohydrates , nitro compounds), Confirmation by preparation of a solid derivative.
2. Preparation of Organic compounds involving the following chemical conversions
   1.Oxidation 2. Hydrolysis 3. Nitration 4. Bromination
   5. Diazotization 6.Benzoylation 7.Osazone formation
3. Determination of physical constant(melting point/boiling point)
4. Course work

i. Extraction of various phytochemicals using soxhelet apparatus and to analyse plant pigmentsusing flame photometer
ii. Extraction of oil from plants using Clevenger apparatus.

Books for Reference:

1. Raghupati Mukhopadhyay, Pratul Chatterjee. *Advanced Practical Chemistry*. Books andAllied (P) Ltd. Third Edition, 2007.
2. Gurtu J.N. and Kapoor R .*Advanced experimental chemistry*. S.Chand and Co., 1987.
3. Arthur I.Vogel. *A text book of practical organic chemistry* including qualitative analysis. Longman Group Ltd.ELBS edition,1975.
4. Gnanapragasam N.S, Ramamoorthy G.*Organic Chemistry Lab Manual*. S. Viswanathan Printers and Publishers Pvt. Ltd., 2007.

Course Outcomes

CO. No.	**Upon completion of this course, students will be able to**	**PSO addressed**	**CL**
CO-1	observe the physical state, odour, colour and solubility of the given organic compound.	1 , 2 , 3	Re
CO-2	identify the presence of special elements and functional group in an unknown organic compound performing a systematic analysis.	1, 2	Un
CO-3	compare mono and dicarboxylic acids, primary, secondary and tertiary amines, mono and diamides, mono and polyhydric phenols, aldehyde and ketone, reducing and non- reducing sugars and explain the reactions behind it.	1,3	Ap
CO-4	exhibit a solid derivative with respect to the identified functional group.	2, 3,6	Ap
CO-5	assess the yield of organic compounds and separation of compounds by chromatography and electrophoresis.	1, 4	An

CO-6	Know the difference between saturated and unsaturated compounds	1 , 2	An

21UCHCR4 Organic Analysis and Organic Preparations

	PO									PSO								
	PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	Avg	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8	Avg
CO-1	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	2	3	3	2	3	3	2.8	3	3	3	3	3	2	3	3	3
CO-3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
CO-4	3	3	3	3	2	3	2	3	2.8	3	3	3	3	3	3	3	3	3
CO-5	3	3	2	3	3	3	2	3	2.8	3	3	3	3	3	2	3	3	2.9
CO-6	3	3	3	3	3	3	3	3	3	3	3	2	3	3	3	3	3	2.9
Average	3	3	2.7	3	2.8	2.8	2.7	3		3	3	2.8	3	3	2.7	3	3	
PO Mean									**2.9**	PSO Mean								**3**
Strength of PO Correlation				Strong						Strength of PSO Correlation						Strong		

SEMESTER VI			
Core Practical V Gravimetry and Inorganic Preparation			
Course Code : 21UCHCR5	**Hrs./Week:5**	**Hrs/ Sem: 75**	**Credits : 2**

Objective:

Enable the student to get analytical skills and help them to plan and execute experimental projects.

a) Gravimetric Analysis

1. Estimation of Lead as Lead Chromate.
2. Estimation of Barium as Barium Chromate
3. Estimation of Zinc as Zinc Oxinate
4. Estimation of copper as copper (I) thiocyanate
5. Estimation of calcium as calcium oxalate.

b) Inorganic Preparations

1. Preparation of Potash alum
2. Preparation of Hexamminenickel(II)chloride
3. Preparation of Tetramminecopper(II)sulphate
4. Preparation of Prussian blue.
5. Preparation of Potassiumtrioxalatochromate (III) trihydrate
6. Preparation of Potassiumtrisoxalatoferrate(III)
7. Preparation of Tristhioureacopper(I) sulphate

Course work:

1. Estimation of Nickel as Nickel – DMG complex
2. Estimation of Iron/ Nickel by spectrophotometer.

Course Outcomes

CO. No.	Upon completion of this course, students will be able to	Cognitive Level
CO-1	describe the principles and methodology for the gravimetry.	Un
CO-2	explain the procedure, data and methodology for the gravimetric analysis	Ap

	PO									PSO								
	PO-1	**PO-2**	**PO-3**	**PO-4**	**PO-5**	**PO-6**	**PO-7**	**PO-8**	**Avg**	**PSO-1**	**PSO-2**	**PSO-3**	**PSO-4**	**PSO-5**	**PSO-6**	**PSO-7**	**PSO-8**	**Avg**
CO-1	3	3	3	3	3	3	2	3	3	3	3	3	3	3	3	3	3	3
CO-2	3	3	2	3	3	2	3	3	2.8	3	3	3	3	3	2	3	3	3
CO-3	3	3	3	2	3	3	2	3	2.8	3	3	3	3	3	3	3	3	3
CO-4	2	3	3	3	3	2	3	3	2.8	3	3	3	3	3	3	3	3	3
CO-5	3	3	2	3	2	3	3	3	2.8	3	3	3	3	3	2	3	3	2.9
CO-6	3	3	3	2	3	3	2	3	2.9	3	3	3	3	3	2	3	3	2.9
Average	3	3	2.7	2.7	2.8	2.5	2.5	3		3	3	3	3	3	2.3	3	3	
PO Mean									**2.9**	PSO Mean								**3**
Strength of PO Correlation				Strong						Strength of PSO Correlation					Strong			

CO-3	apply the principles of gravimetry for carrying out the practical work	Ap
CO-4	demonstrate laboratory skills for safe handling of the equipment and chemicals	An
CO-5	Evaluate the structure of inorganic complexes	Ev

Level of Correlation between PSO's and CO's

Attainment of Course Outcomes of the BSc Chemistry

Course Code	Name of the Course	Course Outcomes															
		Programme Outcomes (PO)								Programme Specific Outcomes (PSO)							
		PO-1	PO-2	PO-3	PO-4	PO-5	PO-6	PO-7	PO-8	PSO-1	PSO-2	PSO-3	PSO-4	PSO-5	PSO-6	PSO-7	PSO-8
21ULTA11	Part-I Tamil	2.8	2.5	2.6	3	2.8	2.5	2.3	3	2.6	2.8	2.8	2.8	2.8	3	2.8	2.6
21ULFB11	Part-I French	3	3	2.8	3 3	3	2.3	3	2.6	3	2.8	2.8	2.8	3	3	3	3
21UGEN11	Part-II General English	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.6	2.5	2.6	2.5
21UCHC11	General Chemistry - I	2.8	2.8	2.2	2.7	2.3	2.8	3	3	3	3	3	2.2	2.8	2.3	2.7	3
21UMAA11	Allied Mathematics – I	3	3	3	3	3	3	2	3	3	3	3	3	3	3	2	2
21UCBA11	Allied Biochemistry -I	**2.6**	**2.3**	**2.8**	**2.8**	**2.6**	**2.3**	**2.3**	**2.3**	**3**	**2.8**	**3**	**2.8**	**2.8**	**2**	**2**	**2**
21ULTA21	Part-I Tamil	2.8	2.6	2.6	3	2.8	2.5	2.5	2.8	2.6	2.8	2.6	2.8	2.8	2.6	2.8	2.6
21ULFB21	Part-I French	2.8	3	3	3	3	3	2.3	3	3	3	3	2.8	3	3	2.8	3
21UGEN21	Part-II General English	2.6	2.5	2.6	2.5	2.6	2.5	2.5	2.5	2.6	2.5	2.6	2.5	2.6	2.5	2.6	2.5
21UCHC22	General Chemistry - II	3	2.7	3	2.2	2	3	2.3	3	3	2.8	2.5	2.2	3	2.2	2.8	3
21UMAA21	Allied Mathematics – II	3	3	3	2.8	3	2.7	2	2	3	3	3	3	3	3	2	2

21UCBA21	Allied Biochemistry -I	3	2.6	3	3	2.6	2.3	1.3	1.8	3	2.8	3	2.6	3	2.1	2	2
21ULTA31	Part-I Tamil	2.6	2.8	2.6	3	2.8	2.5	2.5	2.8	2.5	2.8	2.6	2.8	2.8	2.6	2.8	2.6
2 21ULFB31	Part-I French	2.8	3	2.8	3	3	3	2.7	3	3	2.8	3	3	2.8	3	2.8	3
21UGEN31	Part-II General English	2.8	2.6	2.5	3	2.5	2.8	2.6	2.5	2.5	2.8	2.6	2.8	2.8	2.3	2.8	2.5
21UCHC31	Physical Chemistry I	2.8	2.8	2.2	2.7	2.3	2.8	3	3	3	3	3	2.2	2.8	2.3	2.7	3
21ULTA41	Part-I Tamil	2.6	2.5	2.6	2.6	2.8	2.5	2.8	2.8	2.6	2.8	2.8	2.5	2.8	2.6	2.8	2.6
21ULFB41	Part-I French	3	2.8	3	3	3	3	2.3	3	2.8	2.8	3	3	3	3	3	3
21UGEN41	Part-II General English	2.8	3	2.6	3	2.6	2.8	2.8	2.6	2.6	2.8	2.6	2.8	3	2.6	2.8	2.6
21UPCC51	Material Science	2.8	2.9	2.4	2.8	2.5	2.6	3	3	3	2.8	2.8	2.8	2.8	2.7	2.8	3
21UCHC51	Inorganic Chemistry I	3	2.7	3	2.2	2	3	2.3	3	3	2.8	2.5	2.2	3	2.2	2.8	3
21UCHC52	Organic Chemistry II	3	2.7	3	2.2	2	3	2.3	3	3	2.8	2.5	2.2	3	2.2	2.8	3
21UCHC53	Physical Chemistry II	2.8	2.8	2.2	2.7	2.3	2.8	3	3	3	3	3	2.2	2.8	2.3	2.7	3
21UCHC61	Inorganic Chemistry I	3	3	2.5	2.2	2.2	2.8	2.5	2.8	2.8	2.8	2.2	2.2	2.3	2.8	2.2	2.2
21UCHC62	Organic Chemistry-III	2.8	2.8	2.2	2.7	2.3	2.8	3	3	3	3	3	2.2	2.8	2.5	2.7	3
21UCHC63	Physical Chemistry III	2.8	2.8	2.2	2.7	2.3	2.8	2.8	3	3	3	3	2.2	2.8	2.3	2.7	3
21UCHE61	Polymer Chemistry	2.8	2.9	2.4	2.8	2.5	2.6	3	3	3	2.8	2.8	2.8	2.8	2.7	2.8	3

Average Correlation																
Mean Overall Score		**The POs and PSOs are strongly correlated with the COs of the programme**														