Course Name: Bachelor of Science
Discipline : Chemistry
(For those who joined in June 2022 and after)

Course Objectives

1. To provide a basic knowledge of various chemical phenomena including the recent developments in Chemistry.
2. To instill the confidence among students to do laboratory work independently.
3. To ensure a fair knowledge of applications in Chemistry.
4. To enable the students to get employment in the emerging fields.
5. To prepare the students for higher studies.

Programme Outcome

1. To provide a broad foundation in chemistry that stresses scientific reasoning and analytical problem solving with a molecular perspective.
2. To provide students with the skills required to succeed in graduate school, competitive exams, the chemical industry, or professional school.
3. To expose the students to a breadth of experimental lab techniques using modern instrumentation.
4. To get advanced knowledge in chemistry.
5. To expose the multidisciplinary research aspect in chemistry.

ELIGIBILITY FOR ADMISSION:

A pass in the Higher Secondary Course with Chemistry, Physics, Mathematics/ Biology as subjects

DURATION OF THE COURSE: Three years

COURSE SCHEME:

VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
[Re-accredited with 'A' Grade by NAAC]
Virudhunagar – 626 001.

Sem	Subject	Hrs.	Credits	Int+Ext= Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	Revised / New / No Change / Interchanged & Percentage of revision
I	Part I	6	3	25+75 = 100		✔					✔					**U22PT11**	
	Part II	6	3	25+75 = 100				✔	✓		✓					**U22PE11**	
	Core subject I – Introduction to Chemistry	5	4	25+75 = 100				✔	✓				✓			**U22CHC11**/ U3CHC1	No Change
	Core I– LAB: Semi-micro Inorganic Qualitative Analysis	3	-	---				✔	✓							----	---
	Allied (Ancillary - Algebra and Trigonometry / Ancillary - Oils and Fats I)	6 / 4	4/4	25+75 = 100	✔	✔	✔	✔	✓				✓			**U22MAAX11/ U22CHA11** U2CHA11	40% Change
	Allied I-LAB: Oil analysis	2	-	---			✔		✓						✓	-	No Change
	Skill Based Subject I – Principles of Chemical Analysis -I	2	2	25+75 = 100				✔	✓						✓	**U22CHS11**/ U3CHS11	No Change
	Skill Based Subject II – Bonding Skills in Chemistry-I	2	2	25+75 = 100				✔	✓						✓	**U22CHS12**	**Title Change**
	Part IV SLC - Value Education	-	3	25+75 = 100												**U22VE11**	
	Part II - அற இலக்கியமும் காப்பிய இலக்கியமும்	6	3	25+75 = 100		✔					✔					**U22PT21**	-
	Part II - English - Paper II	6	3	25+75 = 100				✔	✓		✓					**U22PE21**	-

II	Core subject II – General Chemistry	5	4	25+75 = 100				✔	✓				✓			**U22CHC21**/ U3CHC2	No Change
	Core I-LAB: Semi-micro Inorganic Qualitative Analysis	3	4	40+60 = 100				✔	✓						✓	**U22CHCP21**	**New**
	Allied I (Ancillary - Calculus and Matrices / Ancillary - Oils and Fats II)	6 / 4	4/3	25+75 = 100	✔	✔	✔	✔	✓				✓			**U22MAAX21/ U22CHA21** U2MAA2X2/ U2CHA21	-
	Allied I-LAB: Oil Analysis	2	2	40 + 60 = 100			✔		✓						✓	**U22CHAP21** /U2CHA2P	No Change
	Skill Based Subject III- Principles of Chemical Analysis -II	2	2	25+75 = 100				✔	✓						✓	**U22CHS21**/ U3CHS21	No Change
	Skill Based Subject IV – Bonding Skills in Chemistry-II	2	2	25+75 = 100				✔	✓						✓	**U22CHS22**	**Title Change**
	Part IV SLC - Environmental Studies	-	2	25+75 = 100												**U22ES21**	-

Year	Part	Subject	Credit	Int=Total	Code
I & II	Part V	NSS/ NCC/ Physical Education - Sports/YRC/RRC	3	100=100	U2NS4/ U2NC4/ U2PS4/ U1YR4/ **U22RR4**

SEMESTER – I
Core subject I -INTRODUCTION TO CHEMISTRY

Hours per week: 5 **Subject Code: U22CHC11**/ U3CHC1 **Credits: 4**

Course Outcome:

- **To understand**
  - the basics of atomic structure and periodic table
  - functional groups in organic chemistry
  - various electron displacement effects
  - PV isotherm
- **To study**
  - the experimental techniques used in the determination of atomic structure
  - preparation of hydrocarbons
  - various type of reactions in organic chemistry
  - postulates of kinetic theory of gases
  - determination of critical constants
- **To apply**
  - quantum numbers and other principles to write the electronic configuration of elements and predict the shape of atomic orbital
  - IUPAC method to name the organic molecules
  - electron displacement effects to organic molecules and to predict the stability and reactivity
- **To derive**
  - Gas laws
  - van der Waals equation
  - Boyle and inversion temperatures
- To **analyse**
  - the trend of periodic properties
  - the relation between van der Waals constants and critical constants
- To **interpret**
  - the spectrum of hydrogen atom
  - particle and wave character of electron
  - diagonal relationship of elements
  - anomalous behaviour of elements

Unit I: Atomic structure and introduction to wave mechanics **15 Hours**

Rutherford's atomic model – The Bohr theory of hydrogen atom – the spectrum of hydrogen atom – The Sommerfeld extension of the Bohr theory. Quantum theory of radiation – Einstein photoelectric equation – particle and wave character of electron – de Broglie equation – Davisson-Germer experiment – Heisenberg's uncertainty principle – quantum numbers– Pauli exclusion

principle – Hund's rule of maximum spin multiplicity – Aufbau principle – Electronic configuration – Shapes of orbitals (s, p & d orbitals).

Unit II: Periodic table and periodic properties **15 Hours**

Long form of the Periodic Table – classification of elements – periodic properties – atomic volume – atomic radius – ionic radius – electron affinity – ionization energy – electronegativity (Pauling and Mulliken scale) – trends along the group and across the period – inert pair effect, diagonal relationship with illustrations. Anomalous behavior of II period elements.

Unit III: Fundamental aspects of organic chemistry I **15 Hours**

Introduction – Importance of organic compounds in daily life – sources and classification of organic compounds. Functional groups – definition – various functional groups – IUPAC nomenclature - homologous series. General preparation and properties of alkanes, alkenes and alkynes.

Unit IV: Fundamental aspects of organic chemistry II **15 Hours**

Electron displacement effects - inductive effect – electromeric effect – resonance effect – hyperconjugation – explanation with examples. Cleavage of bonds – homolytic and heterolytic cleavage of carbon bond. Types of reactions – Substitution (S_N1 and S_N2) – Addition (Markovnikov rule) – Elimination (E1 & E2) (Saytzeff rule) – Rearrangement and polymerization – Illustration with examples.

Unit V: Gaseous state **15 Hours**

Postulates of kinetic theory of gas- Ideal gas laws – deviations – van der Waals equation. Equation of state – Clausius, Berthelot and Dieterici – reduced equation of state and the law of corresponding states – compressibility factor for gases – Boyle and inversion temperature of gases and their calculations – determination of van der Waals constants. Critical phenomena of gases: PV isotherm of real and van der Waals gases. Critical state of gases – definitions and determination of the critical constants – relation between van der Waals constants and critical constants.

Text Books

Units I and II

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S.Chand & Co. Ltd., New Delhi, 2008.
2. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, 2005.
3. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, 33rd Edition, Vishal Publishing Co., New Delhi, 2019.

Units III and IV

1. P.L.Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2007.
2. B.S.Bahl and Arun Bahl, A Textbook of Organic Chemistry, S.Chand & Co. Ltd., New Delhi, 2018.

Unit V

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2005.

e – Resources

1. Atomic structure – https://byjus.com/jee/atomicstructure
2. Davisson – Germer experiment – https://youtu.be/RkK70bmq2mg
3. Quantum Numbers – https://byjus.com/chemistry/quantumnumbers
4. Periodic table – https://www.youtube.com/watch?v=jcu0cyrVHp8&ab_channel=SADHANA CHEMISTRY
5. Classification of Organic Compounds – https://www.vedantu.com/chemistry/classificationof organiccompounds
6. IUPAC Nomenclature - https://www.youtube.com/watch?v=18b5UHCX5nw&ab_channel= KalabharathiAcademy

7. Electron displacement effects – https://www.youtube.com/watch?v=jSP3JbG5RCg&abchannel=PebblesTNSamacheer%26CompetitiveExams
8. Mechanism of organic reactions – https://www.youtube.com/watch?v=k-fejkgwGw&ab_channel=SREEHARIRAJ
9. Gas laws – https://www.youtube.com/watch?v=8jpqPu59edI&ab channel=OpenYourMindWithMurugaMP

Allied 1 [Ancillary - Mathematics]

Course Title: ALGEBRA AND TRIGONOMETRY	**Total Hours: 90** **Contact Hours per Week : 6**
Course Code: U22MAAX11	**Total Credits: 4**

Objectives:

- To enable the students to sum the series
- To develop the skills of solving equations

Course Outcomes
On completing this course, students can/are

Cos	CO Statement
CO1:	Gain knowledge on various series like binomial series, logarithmic series, trigonometric series.
CO2:	Develop the ability to solve equations and understand the nature of roots of higher order equations.
CO3:	Acquire knowledge on hyperbolic functions.

Unit I Binomial Theorem [18 Hours]

Binomial theorem for rational index – Some important particular cases of the Binomial expansion – Sign of terms in the Binomial expansion – Numerically greatest term – Application of the binomial theorem to the summation of series.
(Text Book 1: Chapter 3: Sections 5, 6, 7, 8, 10) (Solved problems only)

Unit II Exponential and Logarithmic Series [18 Hours]

The exponential theorem – Summation – Problems of the form $\sum_{n=0}^{\infty} f(n) \cdot \frac{x^n}{n!} = (a_0 + a_1 x + a_2 x^2 + \cdots + a_r x^r) e^x$ where $f(n)$ is a polynomial – Logarithmic series – Using the different forms of the logarithmic series finding the sums of the certain series – Series which can be summed up by the logarithmic series.
(Text Book 1: Chapter 4: Sections 2, 3, 3.1, 5, 7, 9) (Solved problems only)

Unit III Theory of Equations [18 Hours]

Formation of Equations - Relation between roots and coefficients **(Text Book 2 - Chapter 2: Sections:** 2.1 and 2.2, Solved problems only (pages 57 – 61 and 64-78)**).**

Unit IV Theory of Equations [18 Hours]

Transformation of equations - Newton's method – Horner's method **(Text Book 2 - Chapter 2: Sections:** 2.4 and 2.5 (pages 92 – 108)**).**

Unit V Trigonometry [18 Hours]

Expressions for Hyperbolic functions.

(Text Book 2 - Chapter 4: pages 195 -204, Sections 4.4 (pages 214 -228). Solved problems only**)**

Text Book (s):

1. T.K.Manicavachagom pillai, T.Natarajan and K.S.Ganapathy, Algebra, Volume I, S.Viswanathan (Printers & Publishers), Pvt., Ltd, 2008.
2. Arumugam, Isaac, Ancillary Mathematics, Paper 1 Revised, New Gamma Publishing House, 2002.

Reference Book (s):

1. Arumugam, Isaac, Classical Algebra, New Gamma Publishing House.
2. Arumugam, Isaac, Summation of Series and Trigonometry, New Gamma Publishing House.

Semester I- Part-III–Allied Subject– OILS AND FATS I

Hours per week: 4 **Subject Code: U22CHA11/**U2CHA11 **Credits: 4**

Course outcome:

CO1: Students learnt about the introduction of oils and fats.
CO2: Also, learnt the physical and chemical properties of oils and fats.
CO3: They learnt how to characterize the oils and fats.
CO4: Study the metabolical aspects
CO5: Can get knowledge about various tests.

Unit I: Introduction to oils and fats 12 Hours

Fats, Oil and Waxes – Definition – Natural source – Glyceride – Fatty acid – nomenclature of fatty acids – Saturated fatty acids – Unsaturated fatty acids – Occurrence of fatty acids – Structure, composition and classification of Oils and Fats- Difference between Oils and Fats. Classification of Oils – Lipids – Role of Oils and fats – Economic importance of Oils and fats.

Unit II: Physical properties of oils and fats 12 Hours

Physical properties of fats and oils – Oil ness and viscosity – surface tension – density – refractive index – specific heat and heat of fusion – smoke, fire and flash points – solubility and miscibility – determination of refractive index, specific gravity, viscosity and surface tension.

Unit III: Chemical properties of oils and fats 12 Hours

Hydrolysis – saponification – Saponification number – Interesterfication- rancidity – oxidative rancidity – hydrolytic rancidity- reactions involved in the carboxyl group – reaction with fatty acid chain – Hydrogenation - halogenation – Iodine number – epoxidation – polymerization – Introduction of hydroxyl group in the fatty acid chain- Acetyl number – hardening of oil – preparation of ketone, aldehyde and hydrocarbon from unsaturated fatty acids.

Unit IV: Metabolical aspects 12 Hours

Metabolism– fat metabolism – Enzymes- Classification of enzyme - ketosis – Bio synthesis of fat and fatty acids - Kreb's cycle – carbohydrate metabolism.

Unit V: Characteristic tests **12 Hours**

Determination of % free fatty acids, acetyl value, saponification value, Iodine Value, Reichert-Meissl value and Polenske value. Detection of adulteration – Baudouin test for sesame oil – Halphen test and Bechi test for cotton seed oil – Ammonium molybdate test for castor oil, valenta test – Bellier turbidity temperature test – Letting test for soyabean oil.

Text & Reference books

1. K.S.Tewari, N.K.Vishnoi and S.N.Mehrota, A Text book of Organic Chemistry, 2nd revised edition, Vikas publishing house PVT LTD, New Delhi, 2005.
2. Arun Bahl and B.S.Bahl, Advanced Organic Chemistry, S.Chand & Company LTD, New Delhi, 2005.
3. P.L.Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons, 2007
4. C.Paquot, Standard Methods for the Analysis of Oils, Fats and Derivatives, 6th edition, Pergamon Press, 1979.
5. F.D.Gunstone, An Introduction to the Chemistry and Biochemistry of Fatty Acids and their Glycerides, Chapman and Hall Ltd., 1967
6. SBP Board of Consultants and Engineers, Fatty Acids and Products, Small Business Publications, 1970.
7. E.A.Weiss, Oilseed Crops, Longman Group Limited, London, 1983.

e – Resources

1. https://www.ifst.org/resources/information-statements/oils-and-fats
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5147699/
3. https://old.amu.ac.in/emp/studym/99999863.pdf.pdf
4. https://old.fssai.gov.in/Portals/0/Pdf/Draft_Manuals/OILS_AND_FAT.pdf

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Skill Based Subject I – PRINCIPLES OF CHEMICAL ANALYSIS-I

Hours per week: **2** **Subject Code: U22CHS11**/ U3CHS11 **Credits: 2**

Course Outcome

CO1: Acquired the basic knowledge on electron transfer reactions
CO2: Understood the theories behind the inorganic salt analysis
CO3: Got the basic concept of volumetric analysis
CO4: Gained the ability to detect elements carbon, hydrogen, oxygen, nitrogen, halogens Sulphur and phosphorus
CO5: Obtained the basic knowledge on estimation of the above elements

Unit I: Concept of electron transfer **6 Hours**

Oxidation and reduction – electronic concept – oxidation number – calculation of oxidation number of elements in compounds and ions – redox reaction – oxidizing agent and reducing agent. Important oxidants and their reduction half reactions – Fe(III) and $KMnO_4$. Important reductants and their oxidation reactions – Fe(II) and oxalic acid. Methods of balancing redox reactions – ion electron method and oxidation number method.

Unit II: Semimicro inorganic qualitative analysis **6 Hours**

Common ion effect, Solubility product – application of common ion effect and solubility product in group analysis of cations – interfering radicals – elimination of interfering radicals (arsenate, arsenite, phosphate, borate, chromate, fluoride, oxalate and tartrate).

Unit III: Volumetric analysis **6 Hours**

Principle – standard solution – modes of expressing concentration of solutions (normality, molarity and molality) – mole concept and mole fraction. Equivalent weights of oxidizing agent and

reducing agent. Types and theory of titrations – acid-base, redox, permanganimetry, dichrometry, iodometry and iodimetry – indicators used in the above titrations.

Unit IV: Detection of elements **6 Hours**

Detection of carbon, hydrogen, oxygen, nitrogen (Lassaigne's test, sodalime test), sulphur (Lassaigne's test and oxidation test), halogens (Lassaigne's test and Beilstein test) and phosphorous.

Unit V: Estimation of elements **6 Hours**

Estimation of carbon and hydrogen (Leibig's method), oxygen, nitrogen (Duma's and Kjeldahl methods), halogens, sulphur and phosphorous (Carius method) – recent method of estimation of Carbon, Hydrogen and Nitrogen – CHN analyser.

Text Books

1. P.L.Soni and Mohan Katiyal Textbook of Inorganic Chemistry, S.Chand& Sons , 2008.
2. B.S. Bahl and Arun Bahl, A Textbook of Organic Chemistry, S.Chand & Co. Ltd., New Delhi, 2005.

Reference Books:

1. P.L.Soni and Mohan Katiyal Textbook of Inorganic Chemistry, S.Chand & Sons, 2008.
2. B.S. Bahl and Arun Bahl, A Textbook of Organic Chemistry, S.Chand & Co. Ltd., New Delhi, 2005.
3. M.K.Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.
4. Vogel's Text Book of Practical Organic Chemistry, 5th Edition, 1989, page 1204-1210.
5. A.I.Vogel, Textbook of Practical Inorganic Chemistry, J.Chem.Edn, 1940.

e-Resources

1. *https://byjus.com/jee/oxidation-number/*
2. *http://www.rbmcollege.ac.in/sites/default/files/files/reading%20material/inorganic-qualitative- analysis.pdf*
3. *https://soe.unipune.ac.in › ashwini Wadegaonkar Self*
4. https://*byjus.com › JEE › IIT JEE Study Material Lassaigne's Test - Test for Nitrogen, Sulphur, Halogens - Byjus*
5. *https://www.toppr.com › ... › Quantitative Analysis*

Skill Based Subject II– BONDING SKILLS IN CHEMISTRY – I

Hours per week: 2 **Subject Code: U22CHS12/** U3CHS12 **Credits: 2**

Course outcomes:

CO1: Students can draw Lewis structure for various molecules.
CO2: Student can explain the formation of covalent molecule by using valence bond theory.
CO3: To know the theoretical calculation of lattice energy for ionic compounds.
CO4: Students can differentiate chemical bonding and hydrogen bonding
CO5: Student can predict the condition required for the formation of ionic bond.

Unit I: Classification of elements **6 Hours**

Classification of elements: electronegative – electropositive - inert. Type of bonds - ionic bond – factors influencing the formation of ionic bonds – ionization energy – electron affinity – lattice energy – tendency of elements to form ionic bonds in relation to their position in periodic table – tendency to form cations – tendency to form anions.

Unit II: Properties of ionic compounds **6 Hours**

Properties of ionic compounds: Derivation of Born-Lande equation. Energetic of formation of ionic bond – Born-Haber cycle. Formation of ions of higher charges - Variable valency of cations – covalent character of ionic bond – Fajan's rule

Unit III: Theory of covalency **6 Hours**

Kossel -Lewis approach to chemical bonding – Lewis structure of HCl, H_2O, $BeCl_2$, CO_2, CO, NO_2^-, NO_3^-, CO_3^{2-} and SO_4^{2-} - Exceptions of octet rule $BeCl_2$ and BCl_3 - Atomic orbital overlapping concept of covalency – sigma and pi bonds – formation of H_2, F_2, HF, O_2 and N_2 – relative strength of sigma and pi bonds – variable covalency exhibited by sulphur and halogens –Properties of covalent compounds.

Unit IV: Polar nature of covalent bonds **6 Hours**

Polarity in covalent bond – dipole moment and percentage ionic character of a polar covalent bond – electronegativity difference and percentage ionic character – Pauling′s equation – Hannay-Smith equation – Some important characteristics of covalent compounds – bond length, bond order and bond energy.

Unit V: Coordinate covalent, Metallic and Hydrogen bonding **6 Hours**

Coordinate covalent bond – formation of bond between NH_3 and BF_3 – properties of coordinate covalent compounds. Metallic bond – Free electron theory – explanation of metallic properties – limitations of the model. Hydrogen bonding – definition – type – examples – properties of compounds containing hydrogen bonds.

Text & Reference Books:

Unit I to V

1. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Milestone Publishers, (2010).
2. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand & Co., (2011).
3. P.L.Soni, Text Book of Inorganic Chemistry (A Modern Approach), Sultan Chand & Sons, Revised Edition, (1991).
4. Satya Prakash, G.D. Tuli, S.K. Basu & R.D. Madan, Advanced Inorganic Chemistry, Vol. 1, S. Chand & Company Pvt. Ltd., New Delhi (2014)

e-resources:

1. https://www.nios.ac.in
2. https://www./udel.edu
3. https://universe.bits.pilani.ac.in
4. https://mysite.science.uottawa.ca
5. https://kea.kar.nic.in
6. https://www.lamar.edu
7. https://www.youtube.com/watch?v=QMjKeLKTSYw
8. https://www.youtube.com/watch?v=jR-W02bAuhU
9. https://www.youtube.com/watch?v=Y7a5nzwTWx4

SEMESTER - II

Core Subject II – GENERAL CHEMISTRY

Hours per week: 5 **Subject Code: U22CHC21**/ U3CHC2 **Credits: 4**

- **To understand**

various isomerism
optical activity in organic molecules
racemic mixture and racemisation
characteristics of p-block elements
adsorption isotherms

classification of colloids

- **To study**
  - the determination of configuration of geometrical isomers
  - properties of elements, their oxides, hydrides and halides of p-block elements
  - the structure of diborane, silicones and carbides
  - preparation and structure of Xe compounds
  - preparation of sols
  - purification of colloidal solutions
  - optical, kinetic and electric properties of colloids
  - preparation of emulsions
- **To apply**
  - E, Z nomenclature to geometrical isomers
  - R and S notations to organic molecules
  - the concepts of colloids for human welfare
- **To differentiate**
  - aldoximes and ketoximes
  - adsorption and absorption
  - physisorption and chemisorption
  - true solution, colloidal dispersion and suspension
  - sol, gel and emulsion
- To **define**
  - various terms in surface chemistry
  - Hardy – Schulze law
  - Hofmeiser series
  - Flocculation value
  - Gold number

Unit I: Fundamental concepts of organic chemistry-III **15 Hours**

Reaction intermediates: Free radicals, carbocations and carbanions and their stability – explanation with suitable examples. Nucleophilic and electrophilic reagents – explanation with suitable examples. Structural isomerism – chain isomerism – position isomerism – functional isomerism – metamerism.

Unit II: Stereoisomerism **15 Hours**

Stereoisomerism: Geometrical isomerism - definition – geometrical isomerism of maleic and fumaric acids – aldoximes and ketoximes – determination of configuration of geometrical isomers – E, Z notations – stereochemistry of addition of bromine to double bond compounds. Optical isomerism: Optical activity – specific rotation and its polarimetric determination – definition of optical isomerism – elements of symmetry. Optical isomerism of compounds containing asymmetric carbon atom – racemisation and resolution of racemic mixtures – Walden inversion – asymmetric synthesis. Chirality – specifications of absolute configuration by R and S notations.

Unit III: p-Block Elements **15 Hours**

General characteristic of p-block elements - Electronegativity, electron affinity, oxidizing, & reducing properties of elements, oxides, hydrides, halides, relative strength of halogen acids- Carbides- Classification and uses- Calcium Carbide – Silicon Carbide.

Diborane - Preparation and structure only - silicate –classification: ortho, pyro, chain and sheet silicates. Silicones & Borazine preparation and structure. Preparation and structure XeF_2, XeF_4, XeF_6, $XeOF_4$, XeO_3.

Unit IV: Adsorption **15 Hours**

Introduction to surface chemistry - Definition of various terms – difference between adsorption and absorption – characteristics of adsorption of gases on solids – physisorption and chemisorption – factors influencing adsorption – adsorption isotherm – Freundlich and Langmuir adsorption isotherm, types of adsorption isotherms – application of adsorption.

Unit V: Colloidal state **15 Hours**

Colloidal state: Distinction between true solution, colloidal dispersion and suspension – classification of colloids. Sols – types of sols – preparation of sols – purification of colloidal solution – properties of colloids – optical, kinetic and electrical properties – coagulation – methods for coagulation – coagulating power and Hardy – Schulze law – Hofmeister series – Flocculation value – protection of colloids – Gold Number. Gels – preparation – classification of gels – properties of gels – syneresis, thixotropy, imbibitions. Emulsion – preparation. Role of emulsifier – application of colloids.

Text & Reference books

Units I and II:

1. P.L. Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons,2010.
2. B.S. Bahl and Arun Bahl, A Textbook of Organic Chemistry , S.Chand & Co., New Delhi, 2018.

Unit III:

1. R.D.Madan, Satya Prakash's Modern Inorganic Chemistry, S. Chand & Co., 2008.
2. P.L. Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, Sultan Chand &Sons, 2005.
3. B.R. Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Vishal PublishingCo., New Delhi, 2019.

Unit IV and V:

1. B.R.Puri, L.R.Sharma and S.Pathania, Principles of Physical Chemistry, Vishal Publishing Co., 2005.
2. Arun Bahl, B.S. Bahl and G.D. Tuli, Essentials of Physical Chemistry, S.Chand & Co., 2004.

e – Resources:

1. Isomersim in Organic Compounds - https://www.youtube.com/watch?v=aQ_VaOlPKG4&ab_channel=SREEHARIRAJ
2. https://www.youtube.com/watch?v=Hy9EVaO37H0&ab_channel=Dr.Bala%27sChemistryBALANAGAKARTHIK
3. https://www.youtube.com/watch?v=D-ZegXI5Cp4&ab_channel=KomaliMam
4. https://www.youtube.com/watch?v=BYtMDcBUx84&ab_channel=SREEHARIRAJ
5. R, S configuration - https://www.youtube.com/watch?v=5WCqnBDa_2s&ab_channel=KomaliMam
6. Properties of p-block elements - https://www.youtube.com/watch?v=L_KP7rQkQZw&list=RDCMUC25Q0X1sRyNmqDL0VL8FtgQ&index=2&ab_channel=ChemLoaded
7. Boranes and carboranes - https://www.youtube.com/watch?v=24VQ7X6fDS8& ab_channel =AJChemAcademy
8. Adsorption isotherm - https://www.youtube.com/watch?v=w_wFAQUPEqc&ab_channel =ChemistryTrending
9. Colloids – Classification - https://www.youtube.com/watch?v=YGoGEfbpMSY&ab_channel =SREEHARIRAJ
10. Applications of colloids - https://byjus.com/chemistry/applications-colloid/

Part III – Core I – LAB: SEMI-MICRO INORGANIC QUALITATIVE ANALYSIS

Hours per week: 3 **Credits: 4** **Subject Code: U22CHCP21**

Course Outcome:

- To practice the identification of various anions and cations present in minerals in the presence of eliminating anions.

Semi-micro inorganic qualitative analysis

Analysis of a mixture containing two anions (of which one is an interfering anion) and two cations.

Anions: Carbonate, sulphate, nitrate, fluoride, chloride, bromide, iodide, oxalate, borate, phosphate and chromate.

Cations: Lead, bismuth, copper, cadmium, iron (II and III), aluminium, chromium, zinc, manganese, cobalt, nickel, barium, strontium, magnesium and ammonium.

*Field/Industrial visit (Report submission only)

Allied 2 [Ancillary - Mathematics]

Course Title: CALCULUS AND MATRICES	**Total Hours: 90** **Contact Hours per Week : 6**
Course Code: U22MAAX21/ U2MAA2X2	**Total Credits: 4**

Objectives:

- To know the applications of differential and integral calculus
- To develop the skills of solving simultaneous equations

Course Outcomes

On completing this course, students can/are

Cos	CO Statement
CO1:	Apply the reduction formula to solve problems in integral calculus.
CO2:	Utilize the concept of vector differentiation to find the curl, divergence of a given vector.
CO3:	Construct the evolutes of any curve using differential calculus.
CO4:	Develop the skills of solving simultaneous equations by making use of the rank of matrices.
CO5:	Find the eigen values, eigen vectors of a given matrix.

Unit I **Curvature** **[18 Hours]**

Radius of curvature – center of curvature – Evolutes for ellipse, parabola and hyperbola only (p-r equations excluded).

(Text Book 1: Chapter 3: Sections: 3.2 (Pages 125 -134)**)**

Unit II **Evaluation of definite integrals** **[18 Hours]**

Reduction formulae 1 to 8.

(Text Book 1: Chapter 3: Sections: 3.3 and 3.5 (pages 147-156 and 166-170). Solved problems only**)**

Unit III **Vector Calculus** **[18 Hours]**

Vector differentiation – Gradient – Velocity – Acceleration – Divergence – Curl.

(Text Book 3: Chapter 1: Sections: 1.4, 1.5. Solved problems only (pages 6 – 32)**)**

Matrices **[18 Hours]**

Unit IV

Inverse of a matrix – Rank of a matrix – simultaneous equations.
(Text Book 2: Chapter 7: Problems only. Pages 179-209**)**

Unit V Matrices **[18 Hours]**

Cayley Hamilton Theorem (Statement only) **–** Eigen values – Eigen vectors**.**
(Text Book 2: Chapter 7: pages 210-232. Solved problems only**)**

Text Book :

1. Arumugam, Isaac, Ancillary Mathematics, Paper 1 Revised, New Gamma Publishing House, 2002.
2. Arumugam, Isaac, Ancillary Mathematics, Paper III, New Gamma Publishing House, 2006.
3. Arumugam, Isaac, Ancillary Mathematics, Paper II (Revised), New Gamma Publishing House, 2004

Reference Book :

1. T. K. Manickavasagam Pillay and others, Vector Calculus, S. Viswanathan Printers pvt. Ltd.
2. Arumugam, Isaac, Calculus Revised, New Gamma Publishing House.
3. Arumugam, Isaac, Modern Algebra, New Gamma Publishing House

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Semester II – Part III – Allied Subject – OILS AND FATS II

Hours per week: 4 **Subject Code: U22CHA21/**U2CHA21 **Credits: 3**

Course Outcome

CO1: Students learnt about the composition of milk and milk products.

CO2: Also, they learnt how to analyze the milk products.

CO3: In the last two units (IV & V) they learnt, composition of mineral oils and synthesis of petrochemicals.

Unit I: Milk **12 Hours**

Milk- Definition – Composition of milk – Milk fat – Milk proteins – Milk sugar – Ash and salt enzymes – Vitamins – properties of milk – Effect of heat on milk.

Unit II: Milk and milk product as food **12 Hours**

Nutritional importance of milk – Health benefit of milk - Milk processing – Effect on nutritive value – difference between raw milk and pasteurized milk. Milk product – Vitamin D Milk – Skim milk – concentration milk – cream – butter – cheese – Ghee – ice – cream.

Unit III: Analysis of milk **12 Hours**

Analysis of milk – organoleptic test – determination of pH of milk – ash content in milk – estimation of fat by gravimetric method – determination of specific gravity of milk using lactometer – detection of preservatives in milk .

Unit IV: Mineral oil – I **12 Hours**

Occurrence – composition of petroleum – origin of petroleum – Carbide, Engler's and modern theory – Mining of petroleum – Fractional distillation- Purification- treatment with con. H_2SO_4, treatment with Sodium plumbite, treatment with liquid SO_2 and treatment with adsorbent – Increasing the yield of petrol – cracking – types of cracking – Application of cracking. Synthetic petrol – Bergius process – Fischer Tropsch synthesis.

Unit V: Mineral oils – II **12 Hours**

Properties of petrol and diesel – Knocking and antiknocking properties – octane number – reforming – aviation petrol – cetane number – flash point – determination of flash point. Petrochemicals – synthesis of pure chemicals – polymer as petrochemicals – synthetic detergents – synthetic gas – petrochemical industry in India

Text/Reference books

1. Gurdeep Chatwal, Organic chemistry of natural products, Vol–I, Himalaya publishing house, New Delhi 2015.
2. N.Shankuntala Manay and M.Shadaksharaswamy, Foods Facts and Principles, 3rd Edition. New Age International Publishers, New Delhi, 2015.
3. B.Srilakshmi, Food Science, New Age International Publishers, New Delhi , 2013.

e - Resources

1. http://ndvsu.org/images/StudyMaterials/LPT/Milk-Composition-and-its-constituents.pdf
2. https://www.fao.org/dairy-production-products/products/milk-composition/en/
3. https://www.slideshare.net/jadavchandni/milk-processing-45129224
4. https://www.slideshare.net/YNarayudu/analysis-of-milk
5. https://www.scribd.com/document/566326837/Analysis-of-Milk
6. https://www.youtube.com/watch?v=6LutbLtR8FM
7. https://nijabestblog.wordpress.com/petroleum-and-its-origin/

Part III – Allied I – LAB: OIL ANALYSIS

(To be conducted at the end Semester II)

Hours per week: 2 **Subject Code: U22CHAP21** /U2CHA2P **Credits: 2**

Course Outcomes:

CO1: To know the determination of specific gravity and viscosity.
CO2: To learn theparameters of surface tension and Iodine value.
CO3: To study the knowledge about saponification value, acetyl value.
CO4: To analyze the adulteration of oils by using Halphen test, Baudouin test, Bellier turbity temperature test.

Determination of Specific gravity, Surface tension, Viscosity, Refractive index, % Free Fatty acid, Iodine value, Saponification value, Acetyl value, Soxhlet extraction.

Adulteration tests: Baudouin test, Halphen test, Bellier turbidity temperature test.

Skill Based Subject III – PRINCIPLES OF CHEMICAL ANALYSIS – II

Hours per week: 2 **Subject Code: U22CHS21**/ U3CHS21 **Credits: 2**

Course Outcome:

CO1: Understood the concept of purification of solid organic compounds
CO2: Gained the concept of purification of Liquid organic compounds
CO3: Got the knowledge to purify the compounds using Chromatography techniques
CO4: Obtained the ability to find out the empirical and molecular formulae
CO5: Acquired the basic ideas on error analysis

Unit I: Purification Techniques - Solids **6 Hours**

Crystallization – selection of solvent, preparing the solution, filtering, crystallizing, separation and drying of crystals, charcoaling. Fractional crystallization – sublimation. Extraction with a solvent – continuous extraction, Soxhletting.

Unit II: Purification Techniques – Liquids **6 Hours**

Distillation at atmospheric pressure, distillation under reduced pressure, steam distillation and fractional distillation.

Unit III: Chromatography **6 Hours**

General principle. Column chromatography – packing of column, elution. Basic principles of thin layer chromatography, paper chromatography – Rf value. Gas-liquid chromatography.

Unit IV: Empirical formula and molecular formula **6 Hours**

Empirical formula – determination of empirical formula. Determination of molecular weight – Principles of Victor-Meyer's method, for non-volatile compounds, chemical methods, Silver salt method, Chloroplatinic salt method, spectroscopic method. Calculation of molecular formula.

Unit V: Error analysis **6 hours**

Evaluation of analytical data. Idea of significant figures and its importance. Accuracy & precision – methods of expressing accuracy. Error analysis – types of errors, minimizing errors. Finding mean, median, mean deviation and standard deviation.

Text Books

1. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, S.Chand & Sons, 2008.
2. B.S. Bahl and Arun Bahl, A Textbook of Organic Chemistry, S.Chand & Co. Ltd., New Delhi, 2005.
3. A.I.Vogel , Textbook of Practical Inorganic Chemistry, J.Chem.Educ, 1940.

Reference Books:

1. P.L.Soni and Mohan Katiyal, Textbook of Inorganic Chemistry, S.Chand & Sons, 2008.
2. B.S. Bahl and Arun Bahl, A Textbook of Organic Chemistry, S.Chand & Co. Ltd., New Delhi, 2005.
3. M.K.Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., 2011.
4. A.I.Vogel , Textbook of Practical Inorganic Chemistry, J.Chem.Educ, 1940.

e –Resources

1. https://byjus.com *› JEE › IIT JEE Study Material Purification of Organic Compounds*
2. *https://en.wikipedia.org › wiki › Chromatography*
3. *https://byjus.com/jee/victor-meyers-method-to-determine-molecular-masses/*https*://byjus.com› JEE › IIT JEE Study Material*
4. *http://web.iyte.edu.tr › lectures › chem201: Chapter 5: Errors in Chemical Analyses*

Skill Based Subject IV- BONDING SKILLS IN CHEMISTRY - II

Hours per week: 2 **Subject Code: U22CHS22** **Credits:2**

Course outcomes:

CO1: Students can recognize the rules for writing the resonating structure for different molecules.
CO2: Students can understand the modification given to the Valence Bond Theory.
CO3: Find out the structure of the molecules by applying the concept of Hybridization
CO4: Students can test whether the molecule is formed or not by applying Molecular Orbital Theory
CO5: Student can assign the geometry of molecule which is having irregular geometry by using VSEPR Theory.

Unit I: VB theory & Resonance **6 Hours**

Valence Bond theory – postulates of VB theory – formation of hydrogen molecule (Qualitative explanation only) – Merits and demerits of VB theory. Resonance – rules for writing resonance structures – resonance structure of carbonate ion, Ozone and carbon monoxide molecules – Identification of bond order.

Unit II: Molecular orbital theory I **6 Hours**

Molecular Orbital theory – postulates of MO theory – pictorial representation of combination of atomic orbitals to form molecular orbitals – bonding and antibonding molecular orbitals – energy level diagram for H_2, He_2, Li_2, Be_2, B_2, C_2, N_2, O_2 and F_2 molecules - bond order and magnetic properties.

Unit III: Molecular orbital theory – II **6 Hours**

Explanation of stability of molecules on the basis of MO Theory- H_2, H_2^+ and H_2^-; He_2 and He^{2+}; O_2, O^{2+}, O^{2-} and O_2^{2-}. MO diagram of hetero nuclear diatomic molecules – CO, HCl and HF molecules. Comparative study of VB and MO theories – similarities and differences.

Unit IV: Concept of hybridization **6 Hours**

Hybridization and number of hybrid orbitals – geometry of molecules having sp, sp^2, sp^3, sp^3d, dsp^2 and d^2sp^3 hybridization with simple examples such as $BeCl_2$, BF_3, CH_4, $[Ni(CN)_4]^{2-}$, PCl_5, SF_6 and IF_7.

Unit V: VSEPR theory **6 Hours**

VSEPR theory – postulates – shapes of molecules with regular and irregular geometry – SnX_2, $[BF_4]^-$, $[NH_4]^+$, CO_2, C_2H_4, C_2H_2, NH_3, H_2O, Cl_2O, SF_4, ClF_3, $[ICl_2]$, XeF_2, XeF_4, ICl_5 and XeF_6 – Geometry of carbonates, nitrates and sulphates.

Text/Reference Books

Units I to V

1. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.
2. B.R.Puri, L.R.Sharma and K.C.Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand & Co., 2011.
3. P.L.Soni, Text Book of Inorganic Chemistry (A Modern Approach), Sultan Chand & Sons, Revised Edition, 1991.
4. Satya Prakash, G.D. Tuli, S.K. Basu & R.D. Madan, Advanced Inorganic Chemistry, Vol. 1., S. Chand & Company Pvt. Ltd., New Delhi 2014.

e-Resources :

1. https://www.youtube.com/watch?v=1DWZFkipYtE
2. https://www.youtube.com/watch?v=jSqBdC7z2x0
3. https://www.youtube.com/watch?v=hKVZADDl2qo
4. https://www.youtube.com/watch?v=nQUmxtVXnAo
5. https://www.youtube.com/watch?v=mlItgiRdyEU
6. https://www.youtube.com/watch?v=6IpUQaS397o
7. https://www.youtube.com/watch?v=cv_iaxn9fyM
8. https://www.youtube.com/watch?v=4ykSzYl_4vI
9. https://www.youtube.com/watch?v=80zzPvJ7T9Y
10. https://www.youtube.com/watch?v=ywwQQazl8Yk

Course Name: Bachelor of Science
Discipline : Chemistry
CHOICE BASED CREDIT SYSTEM
(For those who joined in June 2018 and after)
Course scheme

Semester	Subject	Hours	Credit	Int+Ext =Total	Local	Regional	National	Global	Professional Ethics	Gender	Human Values	Environment & Sustainability	Employability	Entrepreneurship	Skill Development	Subject Code	**R**evised / **N**ew / No **C**hange / **I**nterchanged & Percentage of revision
III	Tamil / Hindi	6	3	25+75 = 100		✔					✔					U3PT3/ U1PH3	Revised / 60 %
	English III	6	3	25+75 = 100				✔	✓		✓					U3PE3	Revised / 90 %
	Core Subject III– Inorganic and Physical Chemistry	4	4	25+75 = 100				✔	✓							U3CHC3	Revised / 10 %
	Core II - LAB: Semi-micro Inorganic Qualitative Analysis	2	-	---				✔	✓							---	No Change
	Allied I (Differential Equations and Laplace Transform / Oils and Fats-III)	6/4	4/3	25+75 = 100	✔	✔	✔	✔	✓							U3MAA3X3/ U2CHA31	Revised / 10% No Change
	Allied II – LAB: Food Analysis	2	-	---			✔		✓							---	No Change
	Allied II - Physics: Mechanics, Properties of Matter and Sound	4	4	25+75 = 100												U1PHA3X1	No Change
	Allied II – LAB: Physics Practical - I	2	-	---												---	No Change
	Tamil/Hindi	6	3	25+75 = 100		✔					✔					U2PT4/ U1PH4	Revised / 60 %
	English IV	6	3	25+75 = 100				✔	✓		✓					U3PE4	Revised / 65 %

IV	Core Subject IV– Organic and Physical Chemistry	4	4	25+75 = 100				✔	✓							U3CHC4	Revised / 10 %
	Core II – LAB: Semi-micro Inorganic Qualitative Analysis	2	2	40+60 = 100				✔	✓							U1CHC4P	No Change
	Allied I - Statistics, Groups and Fourier Series / Oils and Fats- IV	6/4	4/3	25+75 = 100	✔	✔	✔	✔	✓							U3MAA4X4 / U2CHA41	Revised / 10% No Change
	Allied II - LAB: Food Analysis	2	2	40+60 = 100			✔		✓							U1CHA4P	No Change
	Allied II-Physics: Thermal Physics	4	4	25+75 = 100												U1PHA4X2	No Change
	Allied II – LAB: Physics Practical - I	2	2	40+60 = 100												U1PHA4PX	No Change

Self-Learning Course:

Subject	Semester	Credit	Ext =Tot	Subject Code
Human Rights	IV	5	100 = 100	U1CSL41

YEAR	PART	SUBJECT	CREDIT	INT. MARK = TOTAL	SUBJECT CODE
I & II	V	NSS/ NCC/ PHYSICAL EDUCATION- SPORTS/ YRC/ RRC	1	100 = 100	U2NS4/ U2NC4/ U2PS4/ U1YR4/ U1RR4

Semester III – Part III – Core Subject – Inorganic and Physical Chemistry

Hours per week: 4 **Credits: 4** **Subject Code:** U3CHC3

Objectives:

- To acquire knowledge about metallurgy of a few metals and also to study the preparation,
- To learn the properties and uses of a few important inorganic compounds.
- To study the importance of nuclear reactions.
- To understand the fundamentals of Phase rule and liquid crystals.
- To study the application of distribution law to solvent extraction and purification of solvents.

Unit I: General principles of metallurgy (12 hours)

Ores - Types of ores – Flux – types, ore dressing - gravity separation - froth flotation - magnetic separation -Roasting – calcination – smelting - autoreduction, Electrolytic reduction, pyrometallurgy- reduction by carbon – Aluminothermite process –Kroll's process. Refining of metals: cupellation, zone refining, electrolytic refining, van-Arkel De boer method. Different furnaces used for the metallurgical processes: Reverberatory, Blast, Electric and muffle furnace.

Unit II: Nuclear chemistry (12hours)

Mass defect and binding energy, packing fraction, stability of nucleus – law of radioactivity – Soddy's group displacement law. Artificial radioactivity, nuclear fission – atom bomb- principle and working of nuclear reactor – nuclear fusion – Stellar energy and hydrogen bomb. Detection and measurement of radioactivity – GM and scintillation counters. Applications of radioisotopes in agriculture, medicine, study of reaction mechanism and industry – Radiocarbon dating.

Unit III: Halogens and their compounds (12 hours)

Comparative study of halogens – Preparation, properties and structure of OF_2, O_2F_2, Cl_2O, Cl_2O_6 , Cl_2O_7 , BrO_2 , BrO_3 and I_2O_5 – Oxyacids of halogens: oxidation state of halogens in acids – preparation, uses and structure of hypochlorous acid , chloric acid, perchloric acid and periodic acid. Bleaching powder – preparation, properties and uses. Relative strength of oxyacids of halogens - Interhalogen compounds: Types and general methods of preparation – Structure of XY, XY_3, XY_5 and XY_7

Unit IV Phase rule (12 hours)

Mathematical statement of phase rule – phase – component- degree of freedom, phase rule study of one component system- water - sulphur, carbon dioxide-polymorphism- phase rule study of two component systems- reduced phase rule-simple eutectic system-Pb-Ag system- KI water system-compound formation systems with congruent and incongruent melting points, Ferric chloride-water system, sulphur-water system.

Solubility of partially miscible liquids – Types - Upper CST - Phenol-water system,- Lower CST - Trimethylaniline - water system and Nicotine-water system

Unit V Distribution law and liquid crystals (12 hours)

Nernst distribution law – association – dissociation - chemical combination of solute - application of distribution law: study of association of solute and dissociation of solute, distribution indicators, study of complex ions and solvent extraction.

Liquid crystals:

Mesomorphic state - vapour pressure - temperature diagrams –thermography - thermographic liquid crystals – smectic, nematic, chloesteric, disc shaped and polymer liquid crystals.

Reference Books

Units I–III

1. Satyaprakash's Modern Inorganic Chemistry, R.D.Madan, S.Chand& Co., New Delhi, 2005.
2. Principles of Inorganic Chemistry, B.R.Puri, L.R.Sharma and K.C.Kalia, Milestone Publishers, New Delhi, 2011.
3. Concise Inorganic Chemistry, Fifth edition, J.D.Lee, Blackwell Science Ltd., Oxford Universities Press, 2000.
4. Textbook of Inorganic Chemistry, R.Gopalan. Universities Press. Ltd., 2012.

Units IV and V

1. Principles of Physical Chemistry ,B.R.Puri, L.R.Sharma and S.Pathania, Vishal Publishing Co., New Delhi, 2005.
2. Textbook of Physical Chemistry, P.L.Soni, Sultan Chand & Sons, New Delhi, 2008.

Ancillary Mathematics III – Differential Equations and Laplace Transforms

Contact Hours per Semester: 90 Hrs Subject Code:U3MAA3X3

Contact Hours per Week: 6 Hrs Credit: 4

Objectives:

- To enable the students to know the methods of solving differential equations and Partial differential equations
- To understand the Laplace transform, inverse Laplace transform and its applications.

Unit I: Differential Equations: Equations of the first order and of the first degree (Type A, Type B, Type C) – Linear Equation (Type D) – Bernouilli's equation (Type E).

Chapter II: Sections: 1 - 5

Unit II: Linear equations with constants coefficients – Definitions – The operator D – Complementary function of a linear equations with constants coefficients – Particular integral: General method of finding particular integral – Special methods for finding P.I.

Chapter V: Sections: 1, 2, 3, 4, 4.1, 4.2.

Unit III: The Laplace Transforms – Definition – Properties and basic results – Laplace transform of periodic functions - Some general theorems – Evaluation of certain integrals using the Laplace transform.

Chapter V: Sections: 1, 1.1, 1.2, 2, 3, 4 and 5.

Unit IV: The Inverse Laplace Transforms – Definition – Basic results on Inverse Laplace transforms of functions – Solution of ordinary differential equations with constant coefficients using Laplace transformation technique

Chapter V: Sections: 6, 7 and 8.

Unit V: Partial Differential Equations of the First Order – Definition – Classification of integrals – Singular integral – General integral – Derivation of partial differential equations – Lagrange's method of solving the linear equation – Special methods and standard forms (Standards I to IV)

Chapter XII: Sections: 1, 2, 3, 3.1, 3.2, 4, 5, 5.1 to 5.4

Text Book:

1. S. Narayanan and T.K. Manicavachagom Pillay, Differential Equations and its Applications, Reprint October 2014, S. Viswanathan (Printers & Publishers) Pvt Ltd.,

Reference Books:

1. Arumugam, Issac, Ancillary Mathematics, Paper I, Revised 2002, New Gamma Publishing House, Palayamkottai.
2. Arumugam, Issac, Ancillary Mathematics, Paper II, Revised 2004, New Gamma Publishing House, Palayamkottai.

Part III – Allied I : Oils and Fats – III

Hours per week: 4 **Credits: 3** **Subject Code: U2CHA31**

Objectives:

- To gain knowledge about the extraction of oil and also the chemical composition of oils.
- To learn the fundamentals of hydrolytic and oxidative rancidity.
- To get mastery over refining and bleaching processes.

Unit I Composition of Oil Seeds (12 hours)

Chemical composition of seeds and oils of groundnut, sesame, coconut, cotton seed, mustard, sunflower, linseed and soya bean crops.

Unit II Oil Extraction Methods - I (12 hours)

Methods of extraction of oils from seeds - Process of extraction of oils – cleaning – dehulling -heat treatment – rendering - cooking types of rendering - mechanical extraction of oil - solvent extraction - various solvents used for Soxhlet extraction.

Unit III Oil Extraction Methods - II (12 hours)

Characteristics and method of extraction of the following: Castor oil, sesame oil, cotton seed oil, sunflower oil, linseed oil, soya bean oil.

Unit IV Oil processing methods (12 hours)

Refining – bleaching - effect of refining - types of refining – bleaching - adsorption method -chemical methods of bleaching - deodourisation.

Unit V Spoilage of oils (12 hours)

Methods of spoilage – hydrogenation - spoilage during storage method and prevention of spoilage - improving keeping quality - uses of oils and fats.

Reference books

Unit I -II

1. C.Paquot, Standard Methods for the Analysis of Oils, Fats and Derivatives, 6th edn.,Pergamon Press, 1979.

2. F.D.Gunstone, An Introduction to the Chemistry and Biochemistry of Fatty Acids and their Glycerides, Chapman and Hall Ltd., 1967.

Unit III -V

1. B.Srilakshmi, Food science, New age international publishers, New Delhi fifth edition (2010).
2. SBP Board of Consultants and Engineers, Fatty Acids and Products, Small Business Publications, 1970.
3. E.A.Weiss, Oilseed Crops, Longman Group Limited,1983.

COURSE : ALLIED PHYSICS SEMESTER : III	**MECHANICS, PROPERTIES OF MATTER AND SOUND** PAPER -II	Hours : 4 Credit : 4

Contact hours per Week – 4 hours
Contact hours per Semester –60 hours **Subject Code: U1PHA3X1**

UNIT-I: 12 Hours

Forces in nature - central forces – Gravitational, electromagnetic, conservative and Non-conservative forces – Examples - Nuclear force - Friction - Angle of friction - Motion of bodies along an inclined plane - Work done by a force - Work done by a varying force - Expression for kinetic energy - Expression for potential energy - power.

UNIT-II: 12 Hours

Angular velocity - Normal acceleration (no derivation) - centrifugal and centripetal forces - Torque and angular acceleration - Work and power in rotational motion - Angular momentum - K.E. of rotation - Moment of inertia - Laws of parallel and perpendicular axes theorems - M.I. of ring, circular disc, solid sphere, hollow sphere and cylinder.

UNIT-III: 12 Hours

Kepler's laws of planetary motion - Laws of gravitation - Boy's method for 'G' - Compound pendulum - Expression for period - Expression to find 'g' - Variation of 'g' with latitude, altitude and depth - Artificial satellites.

UNIT-IV: 12 Hours

Elastic moduli - Poisson's ratio - beams - Expression for bending moment - Determination of Young's modulus by uniform and non-uniform bending - I section girders - Torsion - Expression for couple per unit twist - work done in twisting, Torsion pendulum - Derivation of Poiseuille's formula (analytical methods) - Bernoulli's theorem - Proof - Applications - Venturimeter - Pitot tube.

UNIT-V: 12 Hours

Simple harmonic motion - Progressive wave properties - composition of two S.H.M. and beats - Stationary waves - Properties - Melde's experiments for the frequency of electrically maintained tuning fork - Transverse and longitudinal modes - Acoustics - Ultrasonics - Properties and application.

Book for study:

1. Mechanics, Properties of matter and Sound - R. Murugesan

Books For Reference:

1. Mechanics by D.S. Mathur - S. Chand & Co. 2008.
2. Properties of matter by Brijlal & N. Subrahmanyam. S. Chand & Co. 2004.
3. A text Book of Sound by Brijlal & N. Subrahmanyam. S. Chand & Co. 2004.

Semester IV – Part III – Core Subject – Organic and Physical Chemistry

Hours per week: 4 **Credits: 4** **Subject Code:** U3CHC4

Objectives:

- To get expertise knowledge in the preparation of substituted benzene and heterocycles.
- To enable the students to gain structural knowledge of different carbohydrates and crystal structures.
- To the basics of colligative property.

Unit I: Structure of benzene, aromaticity and orientation (12 hours)

Structure of benzene, resonance energy of benzene. Aromaticity – Huckel rule. Mechanism of aromatic electrophilic substitution reactions – halogenation, nitration and sulphonation of benzene – Friedel-Crafts alkylation and acylation. Directive influence of substituents – ortho-para and meta directing groups – effect of substituents on reactivity – theory of directing effects – theory of activating and deactivating effects.

Unit II: Heterocyclic compounds (12 hours)

Classification of heterocyclic compounds – Preparation, properties, uses and structure of 5-membered heterocycles – pyrrole, furan, thiophene. 6-Membered heterocycles – pyridine – preparation, properties and structure of pyridine. Condensed ring heterocycles – preparation, properties and uses of indole, quinoline and isoquinoline.

Unit III: Carbohydrates (12 hours)

Definition – classification – monosaccharides – properties and uses of glucose and fructose – configuration of glucose – Haworth structure – Kiliani synthesis - conversion of glucose to fructose and vice versa. **Disaccharides:** preparation and structure of sucrose – Distinction among sucrose, glucose and fructose.

Polysaccharides: preparation, uses and structure of starch and cellulose (No structural elucidation).

Unit IV: Solid state (12 hours)

Isotropy and anisotropy – symmetry in crystal systems – space lattice – unit cell – Bravais lattice – seven crystal systems – laws of crystallography – law of constancy of interfacial angle, law of symmetry, law of rational indices – Miller indices – symmetry elements in a crystal. X-Ray diffraction – Bragg's equation – experimental method of determination of inter-planar spacing (problems).

Types of crystals: Ionic (NaCl and CsCl), molecular (water), covalent (diamond and graphite) and metallic crystals.

Band theory of solids - Conductors, insulators and semiconductors – Defects of solids: Frenkel, Schottky, metal excess and metal deficiency defects.

Unit V:

Dilute solution and colligative properties

Colligative properties – Vapour pressure lowering (Raoult's law)– Determination of molecular weights from relative lowering of vapour pressure – Depression of freezing point – cryoscopic - Determination of molecular weight from depression of freezing point – Elevation of boiling point ebullioscopic – Determination of molecular weight from elevation of boiling point – Osmosis and osmotic pressure – Determination of molecular weight by osmotic pressure measurement – Abnormal colligative properties – van't Hoff factor -Dissociation of solute molecule – Association of solute molecules.

Reference Books

Units I – III

1. P.L.Soni and H.M.Chawla, Textbook of Organic Chemistry, Sultan Chand & Sons, New Delhi, 2007.
2. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Co. Ltd., New Delhi, 2003.
3. M.K.Jain and S.C.Sharma, Modern Organic Chemistry, Vishal Publishing Co., New Delhi, 2014.

Units IV and V

1. Principles of Physical Chemistry, B.R.Puri, L.R.Sharma and S.Pathania, Vishal Publishing Co., New Delhi, 2005.
2. Textbook of Physical Chemistry, P.L.Soni, Sultan Chand & Sons, New Delhi, 2008.
3. Essentials of Physical Chemistry, ArunBahl, B.S.Bahl and G.D.Tuli, S.Chand& Co., New Delhi, 2004.
4. V. Sangaranarayanan and V. Mahadevan Textbook of Physical Chemistry, Universities Press Pvt. Ltd., 2011

Part III – Core II – LAB: Semi-micro Inorganic Qualitative Analysis

Hours per week: 2 **Credits: 2** **Subject Code: U1CHC4P**

Objectives:

- To practice the identification of various anions and cations present in minerals in the presence of eliminating anions.

Semi-micro inorganic qualitative analysis

Analysis of a mixture containing two anions (of which one is an interfering anion) and two cations.

Anions: Carbonate, sulphate, nitrate, fluoride, chloride, bromide, iodide, oxalate, borate, phosphate and chromate.

Cations: Lead, bismuth, copper, cadmium, iron (II and III), aluminium, chromium, zinc, manganese, cobalt, nickel, barium, strontium, magnesium and ammonium.

Ancillary Mathematics IV – Statistics, Groups and Fourier Series

Contact Hours per Semester: 90 Hrs Subject Code:U3MAA4X4
Contact Hours per Week: 6 Hrs Credit: 4

Objectives:

To know the statistical methods
To introduce the abstract systems and Fourier series

Unit I: Correlation and Regression: Definition of Correlation, Usefulness, Types of correlation – Coefficient of correlation: Karl Pearson's coefficient of correlation (excluding grouped bi-variate data) – Rank correlation coefficient: Spearman's rank correlation coefficient, merits and demerits of Rank correlation. Regression: Definition – Use of Regression analysis - Significance of regression study - difference between correlation and regression - Regression equations: Regression equation of X on Y and Regression equation of Y on X(excluding regression equation in a bi-variate grouped distribution) .

Text Book 1 - Chapter 12: Pages: 363, 364, 365, 366, 369-380,389-393, 431-434, 437-440, 445-449..

Unit II: Index Numbers: Definition – Characteristics of index numbers – Uses – Types of index numbers – Weighted Index number – Weighted average of Price relative – Quantity Index number – Consumer Price Index number.

Text Book 1 - Chapter 14: Pages: 487-491, 498-505, 519-528 and appropriate miscellaneous illustrative problems.

Unit III: Interpolation and Extrapolation: Meaning – Uses – Assumptions - Method of Interpolation: Algebraic method **(**1. Binomial Expansion method, Interpolating two or more missing values, 2. Newton's method of advancing Differences, 3. Newton-Gauss forward method, 4. Newton-Gauss backward method and 7. Lagrange's method**).**

Text Book 1 - Chapter: 16 - Pages: 611 – 627, 630 – 633 and appropriate miscellaneous illustrative problems.

Unit IV: Groups: Elementary properties of a group – Permutation groups - Subgroups - Cyclic groups – Order of an element.

Text Book 2 - Chapter 3: Sections: 3.2, 3.4, 3.5, 3.6 and 3.7.

Unit V: Fourier Series: Fourier series – Cosine and Sine series – Half range Fourier Sine series – Half range Fourier Cosine series.

Text Book 3 - Chapter 6: Full

Text Books:

1. R.S.N. Pillai and V. Bagavathi, Statistics, Seventh Edition (Reprint 2007), S. Chand & Company Ltd, India.
2. S. Arumugam and A. Thangapandi Isaac, Modern Algebra, Reprint July 2008, Scitech Publications (India) Pvt Ltd, Chennai.
3. S. Arumugam and A. Thangapandi Isaac, Sequences and Series and Fourier Series, August 2006, New Gamma Publishing House, Palayamkottai.

References:

1. Arumugam, Isaac, Statistics, New Gamma Publishing House, Palayamkottai.
2. Arumugam, Issac, Ancillary Mathematics, Paper III, August 2006, New Gamma Publishing House, Palayamkottai.

Part III – Allied Oils and Fats - IV

Hours per week: 4 **Credits:3** **Subject Code: U2CHA41**

Objectives:

- To understand the role of constituents of food
- To learn the role of lipids
- To study about balanced diet
- To get mastery over food preservation

Unit- I- Introduction to food science (12 hours)

Food: Source, functions of food – food groups – food guide – basic five food groups, usage of the food guide – food in relation to health – objectives of cooking.

Constituents of foods: Major and minor nutrients of natural food- Role of Major and minor nutrients of natural food and their functions.

Unit – II- Food Chemistry (12 hours)

Carbohydrate: Classification of carbohydrates – functions of sugars in foods – Caramelization and Maillard reactions.

Lipids: Classification – role of lipids – fatty acids – Reaction of fat – lipids in food.

Amino acids: Essential and non-essential amino acids

Proteins: Classification – Peptides – Protein structure – Properties of protein – Food protein – Nutritional importance.

Vitamins: Classification – Source – Function – deficiency diseases.

Minerals: Macronutrients - Micronutrients

Unit- III – Food additives (12 hours)

Definition – Need for food additives – antioxidants – chelating agents – colouring agents – curing agents – Emulsions – Flavours and flavour enhancers – Nutrient supplements – non-nutritive sweeteners

Unit-IV Food preservation and Food preservatives (12 hours)

Food Preservatives: Sodium chloride, Sugar, Sulphur dioxide, Nitrate, Nitrite, Sorbic acid, Acetic acid, Propionic acid, Benzoic acid, Parabens, Epoxides and Antibiotics.

Food Preservation: Food spoilage – Methods of food preservation – Preservation by low temperature – Effect of freezing on nutritive value – Preservation by high temperature – Preserve by preservatives – Preservation by dehydration.

Unit – V Food adulteration (12 hours)

Adulteration – adulterant – Types of adulterant – Intentional adulterant – Methods of detection – Incidental adulterant – Food laws – Mandatory measures – Prevention of food adulteration (PFA) – Essential commodities act – Bureau of Indian standard – AGMARK standard.

References Books

Unit-I

1. Norman N. Potter, Food Science, CBS Publishers and Distributors, New Delhi, 1994.
2. Lillian Hoagoland Meyer, Food Chemistry, CBS Publishers and Distributors, New Delhi. 1994.
3. B.Srilakshmi, Dietecics, New Age International Publishers, New Delhi, Seventh edition (2014).

Unit-II

1. N.ShakuntalaManay and M.Shadaksharaswamy, Foods, facts and principles, New age international publisher, New Delhi, Third edition (1997).
2. Owen R Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.

Unit-III

1. N.ShakuntalaManay and M.Shadaksharaswamy, Foods, Facts and Principles, New age international publisher, New Delhi, Third edition (1997).
2. Lillian Hoagoland Meyer, Food Chemistry, CBS Publishers and Distributors, New Delhi, 1994.
3. Owen R Fennema, Food Chemistry, Marcel Decker Inc., New York. 1996.

Unit-IV

1. B.Srilakshmi, Food Science, New Age International Publishers, New Delhi, fifth edition (2010).
2. N.ShakuntalaManay and M.Shadaksharaswamy, Foods, Facts and Principles, New Age International Publisher, New Delhi, Third edition (1997).

Unit-V

4. B.Srilakshmi, Food science, New Age International publishers, New Delhi, fifth edition (2010).
5. Swaminathan M, Advanced Text Book on Food and Nutrition, Volume I and II Printing and Publishing CO., Ltd., Bangalore. 1993.

Allied Oils and Fats Practical II – LAB: Food Analysis

(to be conducted at the end of Semester IV)

Hours per week: 2 **Credits: 2**

Subject Code: U1CHA4P

Objectives:

- To study the role of food Adulterants.
- To impart basic knowledge about nutrients.

1. (a) Qualitative Analysis of some Bio-organic compounds

(i) Carbohydrate, Fat, Protein and Vitamins

(b) Food Analysis

(i) Milk analysis
(ii) Analysis of Wheat flour
(iii) Analysis of Potatoes
(iv) Analysis of Bread

(v) Analysis of Egg
(vi) Analysis of Cheese

2. (a) Estimation of reducing sugar by using Benedict's reagent.
(b) Estimation of creatine by Folin method.
(c) Estimation of Inorganic phosphate by Fiske and Subbarow method.

3. Analysis of various Food Adulterants

COURSE : ALLIED PHYSICS SEMESTER : IV	**THERMAL PHYSICS** PAPER -II	Hours : 4 Credit : 4

Contact hours per Week – 4 hours
Contact hours per Semester –60 hours **Subject Code: U1PHA4X2**

UNIT-I: 12 Hours

Expansion of crystals - Determination of α by air wedge method - Expansion of anisotropic solids - solids of low expansivity and their uses - anomalous expansion of water - thermostats. Isothermal and adiabatic changes - Derivation of equation for both C_v, and C_p of a gas - relation between them - experimental determination of C_v, by Joly's method - Determination of C_p by Regnault's method.

UNIT-II: 12 Hours

Lee's disc method for conductivity of bad conductor - air and cardboard/ ebonite - analogy between heat flow and electric current - Wiedmann-Franz law - Convection in atmosphere - lapse rate - stability of atmosphere - green house effect - atmospheric pollution.

UNIT-III: 12 Hours

Radiation - Stefan's law - Determination of Stefan's constant by filament heating method - Solar constant measurement (water flow Pyroheliometer) - temperature of the Sun - Solar spectrum - energy distribution in black body spectrum - Planck's law (no derivation) - Derivation of Wien's and Rayleigh Jeans law from Planck's law.

UNIT-IV: 12 Hours

Kinetic theory of gases - Mean free path - transport phenomena - diffusion, viscosity and thermal conductivity - Maxwell's law of distribution of molecular speed - experimental verification - degree of freedom - Boltzman's law of equipartition of energy - calculation of C_p for monoatomic and diatomic gases.

UNIT-V: 12 Hours

Thermodynamics - Carnot's theorem - Derivation of efficiency - second law of thermodynamics - entropy - change of entropy in Carnot's cycle - Change of entropy in conversion of ice into steam - Joule-Kelvin effect - simple theory of Porous-plug experiment - adiabatic demagnetism - Curie's law - Giauque's method - Superconductivity.

Book for study :

1. Thermal Physics - R. Murugesan

Books for Reference :

1. Heat and Thermodynamics. Brijlal & N. Subrahmanyam. S. Chand & Co. 2004
2. Ancillary Physics (Thermal Physics). R. Murugesan.

COURSE : ALLIED PHYSICS	**LAB: PHYSICS PRACTICAL –I**	Hours : 2 Credit : 2

INTERNAL: 40 **SUBJECT CODE: U1PHA4PX**

EXTERNAL: 60

1. Young's Modulus - Uniform bending (Pin & Microscope).
2. Young's Modulus - Non-Uniform bending - Optic lever.
3. Young's Modulus - Cantilever depression.
4. Determination of 'g' - Compound pendulum.
5. Rigidity Modulus and Moment of inertia - Torsion pendulum with loads.
6. Verification of laws - Sonometer.
7. Frequency of Tuning fork - Melde's String.
8. Thermal conductivity of bad conductor- Lee's disc.
9. Convex lens - f, R and μ
10. Refractive index of glass prism - Spectrometer.
11. Comparison of capacitances - Spot Galvanometer method.
12. Resistance & Specific Resistance - Carey Foster Bridge.
13. Calibration of low range voltmeter - Potentiometer.
14. Calibration of Ammeter - Potentiometer.

Program Name: Bachelor of Science
Discipline : Chemistry
(For those who Join in 2018 and after)

Semester	Part	Subject	Hour	Credit	Int+Ext= Total	Subject Code	Focus on Employability/ Entrepreneurship / Skill Development	Revised/ New/ No Change/ Interchanged If Revised % of Change
V	Core	Core Subject V – Organic Chemistry I	4	4	25+75= 100	U3CHC51	Employability	30% Revised
	Core	Core Subject VI – Physical Chemistry I	4	4	25+75= 100	U3CHC52	Employability	15% Revised
	Core	Core Subject VII – Inorganic Chemistry I	4	4	25+75= 100	U3CHC53	Employability	10% Revised
	Core Lab	Core III – LAB: Organic Preparations and Gravimetric Estimations	3	-	---	---	Skill Development	No Change
	Core Lab	Core IV – LAB: Organic Analysis and Organic Estimations	3	-	---	---	Skill Development	No Change
	Core Lab	Core lab V – Physical Chemistry experiments	2	-	---	---	Skill Development	No Change
	Allied	Allied II (Physics)Electricity and Electronics	4	4	25+75= 100	U1PHA5X3		
	Allied	Allied II - LAB (Physics)	2	-	---	---		
	SBS	Skill Based Subject V – Employability Skills	2	2	25+75= 100	U1PS51	Skill Development	No Change
	NME	Non Major Elective I –Chemistry in day-to-day life	2	2	25+75= 100	U3CHN51	Employability	20% Change

Semester	Part	Subject	Hour	Credit	Int+Ext= Total	Subject Code	Focus on Employability/ Entrepreneurship/ Skill Development	Revised/ New/ No Change/ Interchanged If Revised % of Change
VI	Core	Core Subject VIII – Organic Chemistry II	4	4	25+75= 100	U2CHC61	Employability	25% Revised
	Core	Core Subject IX – Physical Chemistry II	4	4	25+75= 100	U3CHC62	Employability	10% Revised
	Core	Core Subject X – Inorganic Chemistry-II	4	4	25+75= 100	U3CHC63	Employability	20% Revised
	Core Lab	Core III – LAB: Organic Preparations and Gravimetric Estimations	3	4	40+60= 100	U1CHC6P1	Skill Development	No Change
	Core Lab	Core IV – LAB: Organic Analysis and Organic Estimations	3	4	40+60= 100	U1CHC6P2	Skill Development	No Change
	Core Lab	Core V – LAB: Physical Chemistry experiments	2	4	40+60= 100	U2CHC6P3	Skill Development	No Change
	Allied	Allied II (Physics) Optics, Spectroscopy and Modern Physics	4	4	25+75= 100	U1PHA6X4		
	Allied	Allied II- LAB: Physics Practical II	2	2	40+60= 100	U2PHA6PX		
	SBS	Project	2	2	50+50= 100	U1CH6PR	Employability and Skill Development	New
	NME	Non Major Elective II – Industrial Chemistry	2	2	25+75= 100	U2CHN61	Employability	No Change

Self-Learning Course:

Year	Semester	SELF LEARNING COURSE Subject	Credit	Ext= TOT	Subject Code	Focus on Employability/ Entrepreneurship/ Skill Development	Revised/ New/ No Change/ Interchanged If Revised % of Change
III	V	COSMETICS	5	100=100	U1CHSL51	Entrepreneurship	No Change
III	V	CHEMISTRY COMPETITIVE SKILL DEVELOPMENT COURSE	5	100=100	U1CHSL52	Skill Development	New

SEMESTER-V
ORGANIC CHEMISTRY I

Hours per week: 4 **Credits: 4** **Subject Code: U3CHC51**

Course Outcomes :

Students after Successful completion of the course will be able to

- Gain knowledge on polynuclear hydrocarbons and green chemistry.
- Learn the synthesis of new compounds and their uses.
- Understand the concept of aromaticity and aromatic substitution.
- Impart the knowledge of reaction mechanism and substituent effect to the compound.

Unit-I: Polynuclear aromatic hydrocarbons and Green chemistry: (12 hours)

Isolated system- preparation, properties and uses of biphenyl, triphenylmethane and stilbene. Condensed ring system: synthesis, properties and the structure of naphthalene, anthracene and phenanthrene - preparation, properties and uses of naphthylamines, naphthols, naphthaquinones and alizarin- structural elucidation of alizarin.

Green Chemistry- Twelve principles of Green Chemistry- Green solvents.

Unit-II: Derivatives of benzene: (12 hours)

Halobenzenes: Theory of orientation and reactivity - general preparation – properties - uses. Electrophilic and nucleophilic aromatic substitution reactions (Benzyne mechanism) - mechanisms.

Hydroxybenzene: Acidic character of phenols - effect of substituents on acidity of phenols - mechanism of Reimer -Tiemann reaction, Kolbe reaction- preparation of cresols, catechol, resorcinol, quinol and eugenol.

Aromatic nitro compounds: Preparation and properties of nitrotoluenes - reduction in different medium.

Aromatic amino compounds: - preparations - effect of substituents on the basic character of aromatic amines - comparison between aliphatic and aromatic amines.

Unit-III: Aromatic carbonyl compounds (12 hours)

Aldehydes and ketones: Nomenclature - structure of carbonyl compounds - General method of preparation and properties of aldehydes and ketones. Preparation, properties and uses of cinnamaldehyde – coumarin - vanillin, Michler's ketone, benzoquinones, Quinone's - nitroso oxime tautomerism. Phenolic ketones- phloroacetophenone - Houben-Hoesch synthesis.

Mechanism of Perkin's reaction, Claisen reaction, Cannizzaro reaction, Knoevenagel reaction, Benzoin condensation and Gattermann aldehyde synthesis.

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Unit-IV: Aromatic carboxylic acids (12 hours)

Aromatic carboxylic acids - Nomenclature - structure of carboxylic acid - General methods of preparation and properties of carboxylic acids - effect of substituents on acidic character. Preparation, properties and uses of phenylacetic acid, mandelic acid, cinnamic acid, phthalic acid, isophthalic acid and terephthalic acid.

Substituted acids - preparation, properties and uses of salicylic acid, aspirin, anthranilic acid. Aromatic sulphonic acids: preparation and uses of benzene sulphonic acid, saccharin, chloramine-T and dichloramine-T.

Unit-V: Organic synthesis (12 hours)

Active methylene compounds: Introduction - Preparation, properties and synthetic applications of active methylene compounds such as acetoacetic ester and dimethylmalonate.

Organometallic compounds: Introduction. Preparation, properties and synthetic applications of - Grignard reagent.

Preparation and synthetic applications of benzene diazonium chloride.

References:

Unit I to V

1. I.L. Finar, Organic Chemistry Vol.I ELBS, 6th edition, 1973.
2. R.T. Morrison and R.W.Boyd, Organic Chemistry, Prantice Hall of India private Ltd, 6 th edition, 2001.
3. P.L.Soni, Organic Chemistry, Sultan Chand & Sons, New Delhi, 29th edition,2007.
4 B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Company Ltd., Ram Nagar, New Delhi, 14th edition,1996.
5. M.K. Jain and S.C. Sharma, Modern Organic Chemistry, Vishal Publishing Co, Jalandhar-Delhi,4th edition,2013.
6. V. Kumar An Introduction to Green Chemistry, Vishal Publishing Company, Delhi.
7. K. S. Tewari and N. K. Vishoni, A textbook of organic chemistry, III Edition, 2006, Vikas Publishing House, New Delhi.

Physical Chemistry I

Hours per week: 4 **Credits: 4** **Subject Code: U3CHC52**

Course Outcomes:

Students after successful completion of the course will be able to

- Know basic concepts of thermodynamics and its applications to simple systems
- Understand the basic concepts of electrochemistry and their applications
- Acquire the basic knowledge on chemical kinetics and able to apply the principles for the study of simple reactions.
- Impart the skill of applying the principles of chemical and ionic equilibria to solve simple problems.

Unit I: Thermodynamics I (12 hours)

Terms used in thermodynamics - thermodynamic processes- work, energy and heat- First Law – statement – mathematical formulation – internal energy – enthalpy or heat content – heat capacity at constant volume (C_v) and at constant pressure (C_P) – relationship between C_p

and C_v – work done, heat change and enthalpy change for reversible isothermal expansion and compression of an ideal gas – calculation of q, w, ΔE and ΔH for reversible adiabatic expansion of an ideal gas – relation between T, V and P of an ideal gas undergoing adiabatic reversible expansion – application of first law to non ideal gas undergoing reversible isothermal and adiabatic expansion – Joule Thomson effect – Joule Thomson coefficient in the case of ideal and real gases – inversion temperature and its physical significance.

Unit II: Thermodynamics II (12 hours)

Limitations of first law of thermodynamics – spontaneous process – various statements of second law – conversion of heat into work – thermodynamic efficiency – Carnot cycle – refrigeration cycle – Carnot theorem – Kelvin scale of temperature.

Concept of entropy – physical significance of entropy – derivation of the concept of entropy – Helmholtz work function — Gibbs free energy – variation of free energy with temperature and pressure - Maxwell's relations- Thermodynamic equation of states- Criteria for reversible and irreversible processes in terms of ΔS, ΔG, ΔH and ΔA – limitations of these criteria- Gibbs-Helmholtz equation and its applications.

Unit III: Basics of Electrochemistry I (12 hours)

Electrolytic conduction- Faraday's law of electrolysis- conductivities of ions- specific, equivalent and molar conductance- measurement of conductance of electrolytes- variation of conductance with dilution- equivalent conductance at infinite dilution- Ionic mobility- Transport number- determination of transport number- Hittorf's method- moving boundary method- Kohlrausch's law of independent migration of ions and its applications - Debye – Huckel-Onsager equation (Derivation not required)- Applications of conductance measurements - determination of degree of dissociation of weak electrolytes- determination of pH - determination of solubility products of sparingly soluble salts - conductometric titrations.

Unit IV: Chemical kinetics (12 hours)

Terms in chemical kinetics- rate equation- rate constant – order of a reaction and examples for zero, first, second and third order reactions - unit of rate constants- molecularity of reactions- differences between order and molecularity. Derivation of rate constants for zero, first and second order (2A → Product) reactions – characteristics of these reactions and examples - pseudo-unimolecular reactions – Experimental determination of order of a chemical reaction – use of differential and intergral rate expressions - half life period method- isolation method. Kinetic study of some specific reactions- Catalytic decomposition of hydrogen peroxide – decomposition of dinitrogen pentoxide. Inversion of cane sugar and acid catalysed hydrolysis of ester.

Unit V: Chemical and ionic equilibria (12 hours)

The law of mass action- Thermodynamic treatment of law of mass action- K_P, K_c and K_x and the relationship among them - van't Hoff reaction isotherm – Temperature dependence of the equilibrium constant : the van't Hoff equation and its integrated form (Derivation and problems)- Le Chatelier's principle.

Dissociation of weak acids and bases- Ostwald's dilution law - Dissociation constant of polybasic acids – Ionic product of water – the pH scale – Common ion effect - Buffer solutions – buffer action – pH of buffer mixtures : Henderson-Hasselbatch equation.

Recommended Books

Unit I, II & V

1. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry, (2003) Vishal Publishing Co., Jalandhar.
2. P.L. Soni, Principles of Physical Chemistry, S. Chand & Co., New Delhi, 1980.
3. B.S. Bahl, G.D. Tuli and Arun Bahl, Essentials of Physical Chemistry, S.Chand & Co., New Delhi, 2000.
4. S. Glasston, Thermodynamics for Chemists, East-West Press Private Ltd., New Delhi, 1969.
5. J. Rajaram and J.C. Kuriakose, Thermodynamics for students of chemistry, Shoban Lal Nagin Chand & Co., (1986).

Unit III

1 B.Viswanathan, S. Sundaram, R. Venkataraman, K. Rengarajan and P.S. Raghavan, "Electrochemistry-Principles and Applications" S. Viswanathan Printers and Publishers Pvt., Ltd., (2007)
2. D.R. Crow, "Principles and Application of Electrochemistry", Chapmann Hall, London (1988).
3. L.Antropov, "Theoretical Electrochemistry" Mir Publications, Moscow (1972)
4. S.Glasstone, An Introduction to Electrochemistry, East west Press private limited, New Delhi, 2000.

Unit IV

1. K.J. Laidler, Chemical Kinetics, 3rd Edn., Harper International Edn., London (1987).
2. K.J. Laidler, Theories of Chemical Reaction Rates, McGraw Hill Book Co., London (1969).
3. C. Kalidas, Chemical Kinetic Methods, New Age International, 1996.

Part III Core subject VII – Inorganic Chemistry I

Hours per week: 4 **Credits: 4** **Subject Code: U3CHC53**

Course Outcomes :

Students after successful completion of the course will be able to

- Learn the students to understand the d-block elements.
- Understand the basics of co-ordination chemistry.
- Acquire knowledge on acid – base concepts.
- Understand the basics of error analysis for analytical chemistry.

Unit I: d-Block elements I (12 hours)

General characteristics of d-block elements: Metallic character and related properties, variable oxidation states, colour of transition metal complexes and magnetic properties.

Comparative studies of Group IV(B) elements Ti, Zr and Hf - Extraction, properties and uses of titanium - Preparation and uses of TiO_2 and $TiCl_4$.

Comparative studies of Group V(B) elements V, Nb and Ta - Extraction, properties and uses of vanadium - compounds of vanadium.

Unit II: d-Block elements II (12 hours)

Comparative studies of Group VI(B) elements Cr, Mo and W – Extraction and uses of chromium, compounds of chromium - Lead chromate, basic lead chromate and basic zinc chromate.

Comparative studies of Group VIII elements Fe, Co and Ni. Extraction, preparation and uses Cobalt. Preparation and uses of sodium cobaltnitrite. Platinum - Extraction, properties and uses – Preparation and uses of platinised asbestos, spongy platinum, platinum black. Colloidal platinum and potassium choloroplatinate.

Comparative study of Cu, Ag and Au. Comparative study of Zn, Cd and Hg.

Unit III: Coordination Chemistry (12 hours)

Introduction – double salts – coordination compounds – coordination number – ligands – Types of ligands. Nomenclature of coordination compounds. Isomerism in coordination compounds – structural isomerism and stereoisomerism. Werner's theory- Sidgwick theory, EAN rule. Valence Bond Theory (VBT) in inner and outer d-orbital of octahedral complexes, tetrahedral and square planar complexes - limitations of VB theory. Crystal Field Theory (CFT): low spin and high spin octahedral and tetrahedral complexes - magnetic properties.

Unit IV: Acids, bases and non-aqueous solvents (12 hours)

Arrhenius concept – Bronsted-Lowry concept - conjugate acid-base pair - Amphiprotic substances - levelling effect - Lux-Flood concept – Lewis concept- Relative strength of acids and bases: substituent effect- steric effect - F-strain - Usanovich concept- HSAB concept.
Classification of solvents – non- aqueous solvents - chemical reactions in liquid ammonia: precipitation reactions- Acid- base reactions - complex formation reactions - Ammonolysis reactions - protolysis reaction - solvation reaction - metal-ammonia solution and their reactions.

Unit V: Error analysis and curve fitting (12 hours)

Accuracy – precision – errors- absolute error - relative error - classification of errors - minimisation of errors - significant figures - rules for identifying significant figures – statistical treatment of data: Range, average, median, deviation, mean deviation, relative mean deviation, standard deviation, variance, linear regression and correlation co-efficient. Rejection of experimental data - Q-test - Student's t-test - Analysis of experimental results – graphical method – linear curve fitting - least square method (straight line equation).

Reference Books

Unit-I

1. Sathya Prakash's Modern Inorganic Chemistry, R.D.Madan, S.Chand & Co., New Delhi, 2005.
2. Advanced Inorganic Chemistry, Sathya Prakash, Volume I and II,S.Chand & Co., New Delhi, Revised reprint 2013.
3. P. L. Soni and M. Katyal, Textbook of Inorganic Chemsitry, Sultan Chand and Sons, New Delhi.

Unit-II

1. Sathya Prakash's Modern Inorganic Chemistry, R.D.Madan, S.Chand & Co., New Delhi, 2005.
2. Advanced Inorganic Chemistry, Sathya Prakash, Volume I and II,S.Chand & Co., New Delhi, Revised reprint 2013.

Unit-III

1. Sathya Prakash's Modern Inorganic Chemistry, R.D.Madan, S.Chand & Co., New Delhi, 2005.

2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.
3. R. Gopalan and V. Ramalingam, Concise Coordination Chemistry, Vikas Publishing House Private Limited, New Delhi, 2010.

Unit-IV

1. Sathya Prakash's Modern Inorganic Chemistry, R.D.Madan, S.Chand & Co., New Delhi, 2005.
2. Advanced Inorganic Chemistry, Sathya Prakash, Volume I and II,S.Chand & Co., New Delhi, Revised reprint 2013.

Unit-V

1. Vogel's Text Book of Quantitative Chemical Analysis, V Edition, ELBS, 1989.
2. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.

COURSE : ALLIED PHYSICS SEMESTER : V	**ELECTRICITY & ELECTRONICS**	Hours : 4 Credit : 4

Subject Code: U1PHA5X3

UNIT - I:

Gauss's law – Proof – Applications – Field due to a charged sphere and an infinite plane sheet – Field near a charged conducting cylinder – Coulomb's theorem – Electric potential – Relation between potential and field – Capacitors – Expression for capacity of parallel plate, spherical (outer sphere earthed) and cylindrical capacitors – Energy of charged capacitor – Loss of energy due to sharing of charges.

UNIT - II:

Kirchoff's laws – Application of Wheatstone's network – Sensitveness of bridge – Carey Foster's bridge – measurement of resistance and temperature coefficient of resistance – Principle of potentiometer – Calibration of ammeter and voltmeter (low range and high range) – measurement of resistance using potentiometer.

UNIT - III:

Torque on a current loop – Mirror galvanometer – dead beat and ballistic – current sensitiveness – B.G theory – damping correction – expression for charge sensitiveness – comparison of e.m.f's and comparison of capacitors.

Electromotive force generated in a coil rotating in a uniform magnetic field – R.M.S and mean value of alternating current – LCR circuit – impedances – Series and Parallel resonant circuits – power factor – wattles current – choke.

UNIT - IV:

Junction diodes – Forward and reverse bias – Diode characteristics – Types of diodes (LED and Zener) – Bridge rectifier using junction diodes – π filter – Transistor – its characteristics (CE mode only) – biasing and action of a single stage transistor (CE) amplifier – frequency response of Hartley oscillator – Modulation (qualitative study) – Op-amp and its characteristics – Virtual earth – Voltage amplifier in inverting mode – Op-amp as adder and subtractor.

UNIT - V:

Binary number system – reason for using binary numbers – binary to decimal and decimal to binary conversions – addition and subtraction of binary numbers – Logic circuits –

Boolean algebra – De Morgan's theorem – OR, AND, NOT, NOR & NAND gates – NOR & NAND gates as universal building blocks – Ex-OR gate.

Book for study

Electricity and Electronics by R.Murugeshan.

Reference Books

1. Solid State Electronics – B.L.Theraja, S. Chand, (2003).
2. Electricity and Magnetism – Brijlal and Subramanyam. S Chand, (2007).

SBE- EMPLOYABILITY SKILLS

Contact Hours per week: 2 **Subject Code: U1PS51**
Contact Hours per Semester: 30 **Credits: 2**

Objectives:

To enrich the Employability Skills by imparting Reasoning skills, Aptitude skills and General Knowledge.

Unit I : Quantitative Aptitude – Averages, Percentage, Profit & Loss, Ratio & Proportion, Time & Work, Time & Distance, Clock. **(6-hours)**

Unit II : Quantitative Aptitude –Problems on Ages, Boat & Stream, Simple Interest, Compound Interest, Area, Partnerships. **(6-hours)**

Unit III: Reasoning **(6-hours)**

Verbal Reasoning - Analogy, Classification, Series, Coding & Decoding, Blood Relations, Direction Sense Test.

Unit IV: Reasoning **(6-hours)**

Verbal Reasoning - Number Test, Ranking & Time sequence Test, Alphabet Test, Logical Venn Diagrams.

Unit V: **(6-hours)**

General Knowledge: Abbreviations, Acronyms, Famous Personalities, Important Days, Capital Cities, Currencies, Books and Authors, Inventions.

Reference Books:

1. Verbal & Non Verbal Reasoning - R.S.Aggarwal
2. Quantitative Aptitude - R.S.Aggarwal
3. Subjective & Objective Quantitative Aptitude - R.S.Aggarwal
4. Malayala Manorama Year Book, 2014

Non Major Elective-I
Chemistry in day-to-day life

Hours per week: 2 **Credits: 2** **Subject Code:** U3CHN51

Course Outcomes :

Students after successful completion of the course will be able to

- Learn about cosmetics
- Know about polymers and their role
- Learn the chemical aspects of Milk and milk products
- Understand the role of chemistry in food science
- Know the details of drugs.

Unit I: Cosmetics **(6 hours)**

Tooth powder, tooth paste, soaps and Detergents - cleansing action - Differences between soaps and detergents- talcum powder, lipstick, nail polish, eyetex, shampoo, hair dye, perfumes-vanishing creams.

Unit II: Polymers in our life **(6 hours)**

Polymers and their classification with examples; Thermo and thermosetting polymers
Commercial polymers: Polyethylene, PVC & Polyesters (Elementary idea only-Definition, examples & uses); Plastic identification code & Recycle
Biomedical applications of polymers: Polymers used in surgery, Polymers used in medicine, contact lens, dental polymers, artificial heart & kidney.

Unit III: Milk and Milk products **(6 hours)**

Composition of milk – flavor and aroma – physical properties – pasteurisation – methods of pasteurisation – effects of pasteurisation. Ice cream – stabilizers – emulsifier. Dry milk – types, properties and uses.

Unit IV: Food Chemistry **(6 hours)**

Food - Nutrients - Classification, sources and functions of Carbohydrate, Proteins, Vitamins and Fat- Adulteration of food - Food preservatives - Qualities of food preservatives , examples, Bad effects – Iodized salt- Colouring agents and Flavouring agents.

Unit V: Chemistry for health **(6 hours)**

Importance of chemistry in pharmacy, Drugs-definition and example for antibiotics, anesthetics, antiseptics, antacids, antipyretics, hypnotics, sedatives, laxatives, dental cement, and antimalarial drugs, cancer-cobalt therapy, AIDS - causes and prevention.

Reference Books

Unit I - II

1. B.K. Sharma, "Industrial Chemistry" Goel publishing House, 1994.

Unit III

1. Fundamental Concepts of Applied Chemistry, Jeyashree Ghosh, S. Chand & Company Ltd., 2008.

Unit IV

1. N.Shakuntala Manay and M.Shadaksharaswamy, "Food, Facts and Principles", New age international publisher, New Delhi, Third edition, 1997.
2. Lillian Hoagoland Meyer, Food Chemistry, CBS Publishers and Distributors, New Delhi 1994.
3. B.Srilakshmi, Food Science, New Age International Publishers, New Delhi, fifth edition 2010.

Unit V

1. A Text book of pharmaceutical Chemistry, Jeyashree Ghosh, 2003,S. Chand and Company Ltd., Ram Nagar, New Delhi

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SEMESTER-VI
ORGANIC CHEMISTRY II

Hours per week: 4 **Credits: 4** **Subject Code: U2CHC61**

Course Outcomes :

Students after successful completion of the course will be able to

- Offer sufficient basic knowledge in elucidating the structure of natural products.
- Inculcate the curiosity in learning conformational analysis.
- Provide basic knowledge in the spectroscopy.
- Create awareness in learning re-arrangement reactions.
- Impart the knowledge of dyes and its application.

Unit-I: Molecular rearrangements (12 hours)

Molecular rearrangements - definition- Intra & Inter molecular rearrangement reactions-methods used to identify the inter and intra molecular rearrangement - Detailed mechanism of the following rearrangements - Carbon to carbon migration (rearrangement to electron deficient carbon) - Pinacol-pinacolone, Benzil- benzilic acid, Carbon to nitrogen migration (rearrangement to electron deficient nitrogen) - Hofmann, Beckmann rearrangement – Aromatic rearrangement - Claisen, Benzidine, Fries rearrangement.

Chemotherapy: Drug - classification of drugs – drug action – sulpha drugs (sulphonamide)-mode of action of sulpha drugs – antibiotics - penicillin and its derivatives – mode of action – chloramphenicol, tetracycline and streptomycin and their uses - antimalarial drugs-antipyretics and analgesics (narcotic and non-narcotics)-tranquillizer-antiseptics and disinfectants.

Unit-II: Spectroscopy of organic molecules (12 hours)

UV Spectroscopy-absorption laws- types of electronic transition- bathochromic, hypsochromic, hyperchromic and hypochromic effects - applications of UV spectroscopy to organic compounds- Woodward- Fieser rule applied to conjugated dienes and α,β-unsaturated ketones.

IR Spectroscopy- Introduction-mode of vibration-selection rule-group frequency concept-application of IR to organic compounds-Finger print region - effect of hydrogen bond.

NMR Spectroscopy: Introduction- chemical shift- shielding and deshielding effects-factors influencing chemical shift value- use of TMS as reference - splitting of signals- coupling constants- ^{1}H NMR spectra of simple organic compounds like bromoethane, ethanol, propanal, benzene and benzaldehyde.

Unit-III: Alicyclic compounds and Conformational analysis (12 hours)

Alicyclic compounds: General methods of preparation and properties of cycloalkanes-Bayer's strain theory and its modification. Synthesis of Civetone and muscone (any one method) - structure only (elucidation not necessary)

Conformational analysis: Difference between configuration and conformation. Fischer, Sawhorse and Newmann projection formula- conformational analysis of ethane, n-butane, 1,2- dichloroethane, cyclohexane and monosubstituted cyclohexane.

Unit-IV: Alkaloids and Terpenes (12 hours)

Alkaloids: General methods of isolation and determination of structure of alkaloids - classification of alkaloids- structural elucidation of the following alkaloids – Coniine, piperine (piperidine alkaloids) and nicotine (pyrrolidine-pyridine alkaloids).

Terpenes: Introduction, classification, occurrence and isolation-general properties- isoprene rule- general methods for determining structure – structural elucidation of citral, geranial (acyclic terpene) and terpineol (monocyclic terpene).

Unit – V: Proteins, nucleic acids and Dyes (12 hours)

Proteins and nucleic acid: definition - classification of proteins - colour reactions of proteins- primary, secondary, tertiary and quaternary structure of proteins (an elementary idea only)- Nucleic acids-Nucleosides and Nucleotides- RNA and DNA - structure and differences.

Dyes: Definition- theories of colour and constitution - classification of dyes according to their structure and application. Azo dyes- preparation of methyl orange & Congo red- triphenyl methane dyes - preparation of malachite green, rosaniline and crystal violet- Phthalein dyes- preparation of phenolphthalein, fluorescein and eosin- Vat dyes- preparation of indigo.

References:

Unit I, III,IV and V:

1. I.L. Finar, Organic Chemistry Vol.I, ELBS, 6th edition, 1973.
2. I.L. Finar, Organic Chemistry Vol.II, ELBS, 6th edition, 1973.
3. R.T. Morrison and R.W.Boyd, Organic Chemistry, Printice Hall of India private Ltd, 6 th edition, 2001.
4. P.L.Soni, Organic Chemistry, Sultan Chand & Sons,New Delhi, 29th edition, 2007.
5. B.S.Bahl and Arun Bahl, Advanced Organic Chemistry, S.Chand & Company Ltd, Ram Nagar, New Delhi,14th edition,1996.
6. M.K. Jain and S.C. Sharma, Modern Organic Chemistry, Vishal Publishing Co, Jalandhar-Delhi, 4th edition, 2013

Unit – II

1. P.S Kalsi, Spectroscopy of organic compounds, New Age International (P) Ltd, 6th edition, 2004.
2. B.M.Silverstein, G.C.Bassler and T.C.Morrill, Spectroscopic Identification of Organic Compounds. John wiley & Sons Inc, 6th edition, 2005.
3. William Kemp, Organic Spectroscopy, Mac Millan Press Ltd, 1st edition, 1975.
4. Y.R. Sharma Elementary Organic spectroscopy, S.Chand & Co, New Delhi, Fourth Edition, 2007

Physical Chemistry II

Hours per week: 4 **Credits: 4** **Subject Code: U3CHC62**

Course Outcomes :

Students after successful completion of the course will be able to

- Solve thermo-chemical equations and to get basic ideas on thermodynamics of open system
- Understand the basic concepts of group theory in Chemistry
- Get basic ideas and applications of molecular spectroscopy such as microwave, IR, Raman, Electronic, NMR and EPR.
- Acquire basic knowledge behind various photophysical and photochemical processes

Unit I: Thermodynamics III (12 hours)

Thermochemistry- Hess's law of constant heat summation – Kirchoff's equation – Bond enthalpies and its applications in the determination of enthalpies of reactions, enthalpies of formation of compounds and resonance energy.

Thermodynamics of open systems- Partial molar quantities – definition and significance of chemical potential –Gibbs-Duhem equation – variation of chemical potential with temperature and pressure– Clausius-Clapeyron equation – derivation and applications – Concept of fugacity- determination- physical significance-concept of activity- activity coefficient- reference or standard states of gas, liquid and solid.

Nernst heat theorem- formulation of third law of thermodynamics- concept of residual entropy.

Unit II: Group theory (12 hours)

Molecular symmetry elements and symmetry operations – classification of group- definitions, theorems and grammar of group theory- subgroups- product of symmetry operations – classes and similarity transformation –Inverse and cyclic rules for writing group multiplication table - Classification of molecules into point groups – rotational (C & S), Dihedral (D) and T- type (T_d& O_h) point groups with examples. Transformation matrices of symmetry operations.

Unit III: Molecular Spectroscopy I (12 hours)

Introduction – electromagnetic radiation – different regions – absorption spectroscopy – molecular spectra – types of molecular spectra.

Rotational spectra of diatomic molecules – rigid rotator (no derivation) – selection rule – determination of moment of inertia and bond length.

Vibrational spectra – IR spectra of diatomic molecules – Hooke's law – simple harmonic oscillator (no derivation) - force constant – selection rule – vibrational energy level diagram – applications – force constant determination. Modes of vibration in polyatomic molecules – vibrational spectra of H_2O and CO_2- Rotational vibrational spectra of diatomic molecules.

Unit IV: Molecular Spectroscopy II (12 hours)

Raman spectra – Raman effect – Stokes and anti-Stokes lines – quantum theory of Raman effect – experimental study – comparison between IR and Raman spectroscopy – applications of Raman spectra- Electronic Spectroscopy – Franck-Condon principle-Types of electronic transition- Nuclear magnetic resonance spectroscopy – theory of NMR spectroscopy- types of NMR spectroscopy- Position of NMR signals- chemical shift- number and position of NMR signals – ^{1}H NMR spectra of ethanol - Electron paramagnetic resonance spectroscopy – principle – difference between NMR and EPR –EPR spectrum of hydrogen and methyl radicals.

Unit V: Photochemistry (12 hours)

Definition of photochemical reactions – comparative study of thermal and photochemical reactions – laws of photochemistry – Lambert and Beer's law – Grotthus-Draper's law – Stark-Einstein law – quantum efficiency and its determination – reasons for high and low quantum efficiency - consequence of light absorption by atoms and molecules – Jablonski diagram - photophysical processes – fluorescence, phosphorescence and other deactivating processes – Photochemical processes – kinetics of photochemical reactions. Gaseous reactions: Hydrogen-halogen reactions (formation of HCl and HBr and decomposition of HI) - Photosensitization, chemiluminescence – bioluminescence.

Recommended Books

UNIT I

1. B.R. Puri, L.R. Sharma and M.S. Pathania, "Principles of Physical Chemistry, (2010) Vishal Publishing Co., Jalandhar.
2. P.L. Soni, Principles of Physical Chemistry, S. Chand & Co., New Delhi, (1980).
3. B.S. Bahl, G.D. Tuli and Arun Bahl, Essentials of Physical Chemistry, S.Chand & Co., New Delhi (2000).

UNIT II

1. F.A.Cotton, Chemical Applications of Group Theory, 3rd, Edn., John Wiley & Sons, New York (1999).
2. V.Ramakrishnan and M.S. Gopinath, Group theory in chemistry, 2nd Edn., Vishal Publications (1991).
3. K.V. Raman, Group theory and its application to chemistry, Tata McGraw-Hill Pub. Co., (1990)

UNIT III & IV

1. C.N.Banwell and E.M.McCash, Molecular Spectroscopy, Tata McGraw Hill, 4th Edn., (1995).
2. G. Aruldhas, "Molecular Structure and Spectroscopy", Prentice-Hall of India Pvt., Ltd., New Delhi (2001)

UNIT V

1. K.K. Rohatgi Mukherjee, Fundamentals of Photochemistry,New age international private limited, (2000).
2. N.J. Turro, Modern Molecular Photochemistry, Benjamin Cummings (1965)

Part III Core subject X – Inorganic Chemistry - II

Hours per week: 4 **Credits: 4** **Subject Code: U3CHC63**

Course Outcomes:

Students after successful completion of the course will be able to

- Know the basics of thermo analytical methods.
- Understand the basics of metal carbonyls and f-block elements.
- Acquire fundamental knowledge on Chromatographic techniques
- Learn the basics of Bio-inorganic Chemistry

Unit I: Bio-inorganic chemistry (12 hours)

Porphyrin ring system – metalloporphyrin - Iron porphyrins - structure and functions of hemoglobin and myoglobin - Bohr effect - explanation for cooperativity effect. Structure and functions of chlorophyll – ionophores - sodium-potassium ion pump. Metal ion toxicity and chelate therapy.

Unit II: Chromatography (12 hours)

Definition – Types of chromatography – Theories of chromatography – retardation factor – retention volume – Column capacity. Thin layer chromatography: choice of adsorbent and solvent preparation - R_f value. Ion exchange chromatography: principle – resins - action of resins, experiment techniques, applications**.** High performance chromatography (HPLC) : Principle - Instrumentation – apparatus and materials – applications. Gas chromatography:

principle of gas chromatography – Gas-liquid chromatography – instrumentation – applications.

Unit III: Metal Carbonyls (12 hours)

π - Acid complexes - low oxidation state of metal in metal carbonyls. Classifications of metal carbonyls - EAN rule applied to metal carbonyls. Bonding of metal carbonyls – Identification of metal carbonyls by IR spectroscopy. General methods of preparation and properties. Structure of $Cr(CO)_6$, $Ni(CO)_4$, $Fe(CO)_5$, $V(CO)_6$, $Mn_2(CO)_{10}$, $Fe_2(CO)_9$, $Co_2(CO)_8$ and $Fe_3(CO)_{12}$.

Unit IV: f-Block elements (12 hours)

Lanthanide series - electronic configuration - oxidation states - atomic and ionic radii of M^{3+} ions - Lanthanide contraction - colour of M^{3+} cations - occurrence, extraction of lanthanides from monazite sand.

Actinide series –occurrence - electronic configuration - oxidation states - atomic and ionic radii of M^{3+} ions - Actinide contraction - colour of M^{3+} cations. Comparison between lanthanides and actinides. Trans-uranic elements.

Unit V: Gravimetric and Thermo analytical methods (12 hours)

Gravimetric analysis: Principle – mechanism of precipitation – factors affecting solubility of precipitates - Coprecipitation - Post precipitation. Digestion, Washing and Drying/Ignition of the precipitate.

Thermo analytical method – Principle of thermogravimetry, differential thermal analysis- Instrumentation for TGA and DTA – factors affecting TGA and DTA curves – TGA and DTA of calcium oxalate monohydrate and copper sulphate pentahydrate.

Reference Books

Unit-I

1.B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.
2.Bertini, H.B.Gray, S.J. Lippard and J.S. Valantine, Bioinorganic Chemistry, Viva Books Private Limited., 1998.
3.R.Gopalan and V. Ramalingam, Concise Coordination Chemistry, Vikas Publishing House Private Limited, New Delhi, 2010.

Unit-II

1. B.K. Sharma, Instrumental methods of Chemical Analysis, Goel Publishing House 23rd Edition, 2004.
2.V.K. Srivastava, and K.K. Srivastava, Introduction to Chromatography- Theory and Practice, S. Chand & Co., 1987.
3. Gurdeep R.Chatwal and Sham K.Anand, Instrumental methods of chemical analysis, Himalaya publishing house, 2013.

UNIT-III

1. Sathya Prakash's Modern Inorganic Chemistry, R.D.Madan, S.Chand & Co., New Delhi, 2005.
2. Advanced Inorganic Chemistry, Sathya Prakash, Volume I and II, S.Chand & Co., New Delhi, Revised reprint 2013.
3. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.

4. R. Gopalan and V. Ramalingam, Concise Coordination Chemistry, Vikas Publishing House Private Limited, New Delhi, 2010.

UNIT-IV

1.Sathya Prakash's Modern Inorganic Chemistry, R.D.Madan, S.Chand & Co., New Delhi, 2005.
2.Advanced Inorganic Chemistry, Sathya Prakash, Volume I and II, S.Chand & Co., New Delhi, Revised reprint 2013.
3.B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.
4.P. L. Soni and M. Katyal, Textbook of Inorganic Chemsitry, Sultan Chand and Sons, New Delhi**.**

UNIT-V

1.Vogel's Text Book of Quantitative Chemical Analysis, V Edition, ELBS, 1989.
2.B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers, 2010.
3.B.K. Sharma, Instrumental methods of Chemical Analysis, Goel Publishing House 23rd Edition, 2004.

Part III – Core III – LAB: Organic preparation and Gravimetric Estimation

Hours per week: 3 Credits: 4 Subject Code: U1CHC6P1

Course Outcomes :

- To study the basics of organic preparation.
- To acquire knowledge on gravimetric estimation.

Organic preparation:

1. Oxidation : Preparation of benzoic acid from benzaldehyde
2. Hydrolysis: (i) Preparation of benzoic acid from benzamide
(ii) Preparation of benzoic acid from ethyl benzoate.
3. Acetylation: Preparation of acetanilide from aniline
4. Bromination: Preparation of p-bromoacetanilide from acetanilide
5. Nitration: (i) Preparation of m-dinitrobenzene from nitrobenzene
(ii) Preparation of picric acid from phenol.
6. Benzoylation: Preparation of β-naphthyl benzoate from β-naphthol
7. Addition: Preparation of osazone from glucose.

Gravimetric Estimation:

1. Estimation of lead as lead chromate.
2. Estimation of barium as barium chromate.
3. Estimation of calcium as calcium oxalate
4. Estimation of copper as cuprous thiocyanate.
5. Estimation of nickel as Ni-Dimethylglyoxime.

Part III – Core IV – LAB: Organic Analysis and Organic Estimation

Hours per week: 3 Credits: 4 Subject Code: U1CHC6P2

Course Outcomes :

1. To acquire knowledge about the analysis of simple organic compounds.
2. To know the fundamental strategies of organic estimation.

Organic Analysis

Analysis of organic compound containing one or two functional groups and confirmation by preparing of a solid derivative – acids, phenols, aldehydes, ketones, esters, nitro compounds, amines, amides, anilides, aliphatic diamide, and sulphur analogue of diamide, carbohydrate.

Organic Estimation

1. Estimation of phenol
2. Estimation of aniline

Part III Core V - LAB – Physical Chemistry experiments

Hours per week: 2 **Credits: 4** **Subject Code: U2CHC6P3**

Objective:

The theoretical concepts dealt in the physical chemistry theory papers are given as experiments for the better understanding of the concepts.

I. **Determination of molecular weight by**

1. Transition temperature method – Sodium thiosulphate pentahydrate, sodium acetate trihydrate
2. Cryoscopic method –Rast method

II **Phase diagram**

1. Simple eutectic phase diagram

III **Critical Solution Temperature**

1. Determination of CST of phenol – water system
2. Effect of impurity on CST of phenol water system

IV **Heat of Solution**

1. Determination of heat of solution of oxalic acid in water
2. Determination of heat of solution of $K_2Cr_2O_7$ in water
3. Determination of heat of solution of $(NH_4)_2C_2O_4$ in water

V **Kinetic experiments**

1. Kinetics of acid catalysed hydrolysis of ester

a) Determination of rate constant of the reaction

b) Determination of relative strength of acids.

VI **Conductometric methods**

1. Acid base titration: NH_4Cl→ NaOH → HCl
2. Determination of cell constant of the given cell and determination of dissociation constant of weak acid.

VII **Potentiometric methods**

1. Acid base titration: HCl vs NaOH
2. Redox titration: $KMnO_4$ vs FAS

COURSE : ALLIED PHYSICS SEMESTER : IV	**OPTICS, SPECTROSCOPY AND MODERN PHYSICS**	Hours : 4 Credit : 4

Subject Code: U1PHA6X4

UNIT - I:

Deviation produced by thin lens – Focal length of two thin lenses in and out of contact – Cardinal points – Refraction through a thin prism – Dispersion – Dispersive power – Combination of thin prisms to produce (a) deviation without dispersion and (b) dispersion without deviation – Direct vision spectroscope – Chromatic aberrationin lenses and its removal – Spherical aberration in lenses and its removal – Aplanatic lenses – Oil immersion objective – Theory of primary and secondary rainbows.

UNIT - II:

Interference in thin films – Airwedge – Newton's rings (Refected beam only) – Determination of wavelength – Jamin's interferometer – Principle and use.

Diffraction – Theory of plane transmission grating (Normal incidence only) – Experiment to determine wavelength.

UNIT - III:

Double refraction – Nicol prism, constructions, action and uses – QWP and HWP – Optic activity (no theory) – Biot's laws – Specific rotatory power – Half shade polarimeter – Determination of specific rotatory power – Fibre optics – Light propagation in fibres – Fibre optic communication systems.

UNIT - IV:

Infrared radiation – production, properties and uses – Ultraviolet radiation sources, properties and uses – Quantum theory – Planck's quantum thory – Raman effect – simple theory experimental study (Wood's apparatus) – Applications – Photoelectricity – Laws of photoelectricity – Einstein equations – Photo cells and their uses – Photo emissive, photo conductive and photo voltaic cells.

UNIT - V:

De Broglie's theory - electron diffraction – G.P.Thomson experiment – Michelson Morley experiment – Significance of negative results – Postulates of special theory of relativity – Lorentz transformation equations (no derivation) – Length contaction – Time dilation – Variation of mass with velocity – Mass-energy relation(simple derivation).

Book for study

Optics, Spectroscopy and Modern Physics by R.Murugeshan.

Reference Books

1. A Text Book of Optics by Brijlal and N.Subramanyam S.Chand, (2002).

COURSE : ALLIED PHYSICS	**ALLIED: PHYSICS PRACTICAL –II**	Hours : 2 Credit : 2

Subject Code: U2PHA6PX

INTERNAL: 40 **EXTERNAL: 60**

1. Spectrometer – Grating (Normal incidence).
2. Spectrometer – Dispersive power of the prism.
3. Newton's rings.
4. Air wedge – Thickness of insulation.
5. Series resonance.
6. Parallel resonance.

7. Comparison of Capacitance – Desauty's Bridge (AC method)
8. Logic gates – AND, OR, NOT using discrete components.
9. Logic gates – NAND, NOR using discrete components.
10. Bridge rectifier.
11. Zener diode – Characteristics.
12. Transistor – Static characteristics (CE mode).
13. Hartley oscillator.
14. Verification of De Morgan's laws.

PROJECT

Hours/week-2 **Sub code: U1CH6PR** **Credit: 2**

Course Outcomes :

• To train the students in various research/industry learning skills like critical thinking, creativity, synthesis of knowledge, analyzing capacity, instrument basics and handling and scientific report writing.

• To introduce the frontier areas of research in chemistry and in the interdisciplinary areas among students

• To understand the scope of research programme in chemistry and in the interdisciplinary areas.

• The project work (includes literature review/chemical factory industry visit training /National/University Research Labs visit training / Nuclear Plant/Quality control lab/R&D Lab/field work / theoretical / lab work) is to inculcate students to learn adequate knowledge on research methodology in the subject and prepare them for pursuing research in theoretical / experimental areas of the subject.

Project will be carried out by the final year students in the sixth semester under the guidance of respective guides. The Project work or Field Study is to be undertaken under the guidance of a Teacher of the Department. Projects will be carried out in groups (with maximum of 5 students per group). For projects internal marks (max 50) will be awarded by the respective guide and external marks (max 50) will be awarded by the external examiner during summative practical examination.

INDUSTRIAL CHEMISTRY (UG-NME)

Hours per week: 2 **Credits: 2** **Subject Code: U2CHN61**

Objectives:

- To study the development of chemical industries.
- To learn the toxic effects of metals.
- To know the importance of fuels.

UNIT I: Water Treatment **(6 hours)**

Introduction – Impurities in water – Disadvantages of Hard water – hardness – Estimation of Hardness – EDTA method – Potable water (water for domestic supply) – desalination – electrodialysis – reverse osmosis.

UNIT II: Chemical Toxicology **(6 hours)**

Introduction – Toxic chemicals in the environment. Influence of toxic substances in the body - classification of toxic effects. Toxic effects of various chemicals.

UNIT III: Explosives and Rocket Fuels (6hours)

Introduction – Requirements and characteristics of good explosives – Assessment of explosives – Classification of rocket fuels – Propellants and rocket fuels.

UNIT IV: Corrosion protection (6 hours)

Introduction – preparation of materials for coating – Metallic coatings - hot dipping – spraying – electroplating – Inorganic non-metallic coatings – surface conversion – anodized oxide coating – porcelain enamel coating.

UNIT V: Fuels (6 hours)

Definition and classification of fuels – Characteristics of a good fuel – advantages and disadvantages of solid, liquid and gaseous fuels – Calorific value – bomb calorimeter – calculation of calorific value -coal – Liquid fuels – Gaseous fuels.

Reference book

1. Applied chemistry, N. Krishnamurthy, K. Jeyasubramanian and P. Vallinayagam, Tata Mcgraw-Hill Publishing Company Limited, New Delhi, 1999.

Program Name: Bachelor of Science
Discipline : Chemistry

Self Learning Course

Self-Learning Course (UG Only):

Year	Semester	SELF LEARNING COURSE Subject	Credit	Ext= TOT	Subject Code	Focus on Employability/ Entrepreneurship/ Skill Development	Revised/ New/ No Change/ Interchanged If Revised % of Change
III	V	COSMETICS	5	100=100	U1CHSL51	Entrepreneurship	No Change
III	V	CHEMISTRY COMPETITIVE SKILL DEVELOPMENT COURSE	5	100=100	U1CHSL52	Skill Development	New

SELF LEARNING

COSMETICS

Credit: 5 **CODE: U1CHSL51**
Total Marks: 100

Unit-I Fundamentals of Cosmetics

Introduction - Classification of cosmetics - Lotions – Creams – Lipsticks – Eye make up – Eye shadow – Eye pencils – Eye Liners – Mascara – Eye make up removers – Antiperspirants – shaving foams – Shampoo and their formulation – dipialtory

Unit-II Hair Preparations

Hair lotions and tonics – Hair conditioners – Hair dressings – Hair creams – Hair sprays – Hair bleaching – Hair dyes – Hair waving preparation – Hair straightness

Unit-III Herbal Cosmetics

Introduction – Aloe vera – Cucumber – turmeric – Khus – Henan – Neam – Amla – Reetha – Voaltile Oils

Unit-IV Skin Preparations

Skin creams – Anti wrinkle creams - Skin protective creams - Cleansing creams – moisturizing and foundation creams- cold creams – Night and massage creams –Hand creams and lotions.

Unit-V Face Preparations

Introduction - formulation of face powder – compact face powder – talcum powder – Baby powders – face masks and packs – Evaluation and quality control –Commercially available brands.

Reference:

"Text Book of Cosmetics" by Garud-Sharma-Garud, Pragati Prakashan, 2012.

CHEMISTRY COMPETITIVE SKILL DEVELOPMENT COURSE

Credit: 5 **CODE: U1CHSL52**

Total Marks: 100

Course Outcomes:

Students, after successful completion of the course ,will be able to

- Understand the fundamentals of chemistry concepts
- Apply and solve the chemistry problems
- Prepare for the competitive exam
- Pass the competitive exam successfully

Unit I:

- **Theory of Gases:** Equation of state for ideal and non-ideal (van der Waals) gases; Kinetic theory of gases; Maxwell-Boltzmann distribution law; equipartition of energy.
- **Chemical Thermodynamics:** Reversible and irreversible processes; first law and its application to ideal and nonideal gases; thermochemistry; second law; entropy and free energy; criteria for spontaneity.
- **Chemical and Phase Equilibria:** Law of mass action; K_p, K_c, K_x and K_n; effect of temperature on K; ionic equilibria in solutions; pH and buffer solutions; hydrolysis; solubility product; phase equilibria–phase rule and its application to one-component and two-component systems; colligative properties.
- **Electrochemistry:** Conductance and its applications; transport number; galvanic cells; EMF and free energy; concentration cells with and without transport; polarography; concentration cells with and without transport; Debey-Huckel-Onsagar theory of strong electrolytes.
- **Chemical Kinetics:** Reactions of various order; Arrhenius equation; collision theory; transition state theory; chain reactions – normal and branched; enzyme kinetics; photochemical processes; catalysis.
- **Adsorption:** Gibbs adsorption equation; adsorption isotherm; types of adsorption; surface area of adsorbents; surface films on liquids.

Unit II:

- **Basic Concepts in Organic Chemistry and Stereochemistry:** Electronic effects (resonance, inductive, hyperconjugation) and steric effects and its applications (acid/base property); optical isomerism in compounds with and without any stereocenters (allenes, biphenyls); conformation of acyclic systems (substituted ethane/n-propane/n-butane) and cyclic systems (mono- and di-substituted cyclohexanes).
- **Organic Reaction Mechanism and Synthetic Applications:** Chemistry of reactive intermediates (carbocations, carbanions, free radicals, carbenes, nitrenes, benzynes etc.); Hofmann-Curtius-Lossen rearrangement, Wolff rearrangement, Simmons-Smith reaction, Reimer-Tiemann reaction, Michael reaction, Darzens reaction, Wittig reaction and McMurry reaction; Pinacol-pinacolone, Favorskii, benzilic acid rearrangement, dienone-phenol rearrangement, Baeyer-Villeger reaction; oxidation and reduction reactions in organic chemistry; organometallic reagents in organic synthesis (Grignard, organolithium and organocopper); Diels-Alder, electrocyclic and sigmatropic reactions; functional group inter-conversions and structural problems using chemical reactions.
- **Natural Products Chemistry:** Chemistry of alkaloids, steroids, terpenes, carbohydrates, amino acids, peptides and nucleic acids.

- **Aromatic and Heterocyclic Chemistry:** Monocyclic, bicyclic and tricyclic aromatic hydrocarbons, and monocyclic compounds with one hetero atom: synthesis, reactivity and properties.

Unit III:

- **Periodic Table:** Periodic classification of elements and periodicity in properties; general methods of isolation and purification of elements.
- **Main Group Elements (s and p blocks):** General concepts on group relationships and gradation in properties; structure of electron deficient compounds involving main group elements.
- **Transition Metals (d block):** Characteristics of 3d elements; oxide, hydroxide and salts of first row metals; coordination complexes: structure, isomerism, reaction mechanism and electronic spectra; VB, MO and Crystal Field theoretical approaches for structure, color and magnetic properties of metal complexes; organometallic compounds having ligands with back bonding capabilities such as metal carbonyls, carbenes, nitrosyls and metallocenes; homogenous catalysis.
- **Bioinorganic Chemistry:** Essentials and trace elements of life; basic reactions in the biological systems and the role of metal ions, especially Fe^{2+}, Fe^{3+}, Cu^{2+} and Zn^{2+}; structure and function of hemoglobin and myoglobin and carbonic anhydrase.

Unit IV:

- **Basic Mathematical Concepts:** Functions; maxima and minima; integrals; ordinary differential equations; vectors and matrices; determinants; elementary statistics and probability theory.
- **Atomic and Molecular Structure:** Fundamental particles; Bohr's theory of hydrogen-like atom; wave-particle duality; uncertainty principle; Schrödinger's wave equation; quantum numbers; shapes of orbitals; Hund's rule and Pauli's exclusion principle; electronic configuration of simple homonuclear diatomic molecules.
- **Chemical Bonding and Shapes of Compounds:** Types of bonding; VSEPR theory and shapes of molecules; hybridization; dipole moment; ionic solids; structure of NaCl, CsCl, diamond and graphite; lattice energy.
- **Solid State:** Crystals and crystal systems; X-rays; NaCl and KCl structures; close packing; atomic and ionic radii; radius ratio rules; lattice energy; Born-Haber cycle; isomorphism; heat capacity of solids.

Unit V:

- **Spectroscopy:** Beer-Lambert law; fundamental concepts of rotational, vibrational, electronic and magnetic resonance spectroscopy.
- **Qualitative Organic Analysis:** Identification of functional groups by chemical tests; elementary UV, IR and 1H NMR spectroscopic techniques as tools for structural elucidation.
- **Instrumental Methods of Analysis:** Basic principles; instrumentations and simple applications of conductometry, potentiometry and UV-vis spectrophotometry; analysis of water, air and soil samples.
- **Analytical Chemistry:** Principles of qualitative and quantitative analysis; acid-base, oxidation-reduction and complexometric titrations using EDTA; precipitation reactions; use of indicators; use of organic reagents in inorganic analysis; radioactivity; nuclear reactions; applications of isotopes.

Discipline: Chemistry
CHOICE BASED CREDIT SYSTEM
Course scheme

VALUE ADDED COURSES

Course Name	Internal Mark = Total Mark	Subject Code
Molecular Modeling and Drug Designing	100 = 100	V1CH1

MOLECULAR MODELING AND DRUG DESIGNING
Subject Code: V1CH1

UNIT-I Introduction

Molecular modeling – Introduction – Role of computational chemistry - Different methods – Ab initio, DFT, Semi-empirical – Molecular mechanics – Hybrid methods (QM/MM)- - Potential energy surfaces (PES) - Stationary points - Intrinsic reaction coordinate (IRC)- Born–Oppenheimer Approximation - Geometry Optimization – Energy minimization – Global minimum, saddle point / Transition state, Single point energy - Hessian matrix - applications - softwares for calculations.

UNIT-II Applications of Molecular Modeling

Thermodynamics applications – theoretical calculation of Heat of formation of methane – calculation of pKa of phenol and Redox potential dopamine and comparison with experimental values - Conformational analysis.

Spectroscopic applications –theoretical IR and Raman spectra of formaldehyde - HOMO-LUMO energy gap - UV-visible spectrum of acrolein, Circular Dichroism spectrum - Calculation of NMR (chemical shift and spin-spin splitting constant) and ESR isotropic hyperfine coupling constants.

UNIT-III Molecular Dynamics and Simulations

Molecular Mechanics - The Anatomy of a Molecular Mechanics Force Field - Stretching Energy - Bending Energy - Torsion Energy - Non-Bonded Energy - Molecular Dynamics - Types of Molecular Dynamics Simulation – Newtonian mechanics, semi-empirical, polarizable, Quantum mechanics/molecular mechanics (QM/MM) - Simulation methods – Langevin dynamics, Brownian dynamics, Monte Carlo – List of softwares.

UNIT-IV Molecuar Modeling in Drug Discovery

Drug Discovery - Drug Design - In-silico Drug Design - Structure Based Drug Design - Homology Modeling - Ligand search - Structure based virtual screening - Ligand based virtual screening - molecular docking - docking algorithm - scoring function - ligand based drug design –QSAR - Hansch equation - Comparative molecular field analysis (CoMFA) - Comparative molecular similarity indices analysis (CoMSIA).

UNIT-V Applications of Molecular Docking and Dynamics

Applications of Molecular Docking - Installation of AutoDock - docking of HIV drug with HIV protease.

Applications of MD simulations – Practical demonstrations – Installation of GROMACS – Molecular dynamics simulation of spider toxin peptide – MD trajectory, Analysis, MD simulation of HIV protein with its drug.

References

1] Leach, A.R. Molecular Modelling Principles and Application, Longman, 2001.
2] Haile, J.M. Molecular Dynamics Simulation Elementary Methods, John Wiley and Sons, 1997.
3] Gupta, S.P. QSAR and Molecular Modeling, Springer - Anamaya Publishers, 2008.

Web Resources

UNIT-I

1] https://pdfs.semanticscholar.org/5d29/0d637917cec7c37a93710cbab952161ea2b2.pdf

2] Molecular modeling principles and application second edition Andrew R.Leach 1-744

UNIT-III

1] Meng-Meng Liu et al, Experimental and Theoretical Prediction of The Redox Potential of Dopamine, *Int. J. Electrochem. Sci.*, 10 (2015) 235 – 247
2] Matthew D. et al, Absolute pKa Determinations for Substituted Phenols *J. AM. CHEM. SOC.* 2002, 124, 6421-6427

3] https://m.tau.ac.il/~ephraim/complab.html

4] www.grs-sim.de/cms/upload/Carloni/Tutorials/FMCP/Exercise_acrolein_UV.pdf

5] Computer experiment 8: computational UV/VIS, IR, Raman using ORCA/GABEDIT.

UNIT-IV

1] Vu LA, et al, In silico Drug Design : Prospective for Drug Lead Discovery. Int J Eng Sci Invent. 2015;4: 60–70. doi:10.1080/13607863.2014.997191

2] Chaudhary KK et al, A review on molecular docking: Novel tool for drug discovery. JSM Chem. 2016;4: 1029. Available: https://www.jscimedcentral.com/Chemistry/chemistry-4-1029.pdf

UNIT-V

1] Autodock https://www.slideshare.net/bcmenv/autodock4-procedure
2] Molecular dynamics www.mdtutorials.com/gmx/complex/index.html