



VIRUDHUNAGAR HINDU NADARS' SENTHIKUMARA NADAR COLLEGE
(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Virudhunagar – 626 001.

Course Name: Bachelor of Science

Discipline : Chemistry

(For those who joined in June 2024 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



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COURSE SCHEME:

I year B.Sc. CHEMISTRY

Semester	Part	Subject Name	Hours	Credit	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 1	Tamil	6	3	25+75 = 100												U24PT11	New
	Part 2	English	6	3	25+75 = 100												U23PE11	No Change
	Core I	Introduction to Chemistry	5	4	25+75 = 100			✓						✓			U24CHC11	New
	Core I Lab	LAB: Semi-micro Inorganic Qualitative Analysis	3	-	---			✓								✓	---	---
	Allied I	Ancillary - Algebra and Trigonometry / Oils and Fats I	6 / 4	4/3	25+75 = 100	✓								✓			U24MAAX11/ U24CHA11	New/ Revised 40 %
	Allied I Lab	LAB: Oil analysis	2	-	---	✓										✓	---	---
	SBE I	Principles of Chemical Analysis -I	2	2	25+75 = 100			✓								✓	U24CHS11	New
	SBE II	Bonding Skills in Chemistry-I	2	2	25+75 = 100			✓								✓	U24CHS12	New
	Total			30	18/17													
	Part 1	Tamil	6	3	25+75 = 100												U24PT21	New
	Part 2	English	6	3	25+75 = 100												U23PE21	No Change
	Core	General Chemistry	5	4	25+75 =			✓						✓			U24CHC21	Title Change



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II	II				100												
	Core I Lab	LAB: Semi-micro Inorganic Qualitative Analysis	3	4	40+60 = 100			✓							✓	U24CHCP21	New
	Allied II	Ancillary - Calculus and Matrices / Oils and Fats II	6 / 4	4/3	25+75 = 100	✓							✓		U24MAAX21/ U24CHA21	New/ Revised 20 %	
	Allied I Lab	LAB: Oil Analysis	2	2	40 + 60 = 100	✓								✓	U24CHAP21	Revised 40 %	
	SBE III	Principles of Chemical Analysis -II	2	2	25+75 = 100			✓						✓	U24CHS21	New	
	SBE IV	Bonding Skills in Chemistry- II	2	2	25+75 = 100			✓						✓	U24CHS22	New	
Total			30	22/23													

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



Core subject I -INTRODUCTION TO CHEMISTRY

Hours per week: 5

Subject Code: U24CHC11

Credits: 4

Course Outcome:

CO1: To understand the basics of atomic structure, and to apply quantum numbers and other principles to write the electronic configuration of elements and predict the shape of atomic orbital

CO2: To analyse periodic table the trend of periodic properties

CO3: To study the functional groups in organic chemistry

CO4: To apply various electron displacement effects to organic molecules and to predict the stability and reactivity

CO5: To interpret gas laws and PV isotherm

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 (hydrocarbons only)- 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 –



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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](https://www.youtube.com/watch?v=jcu0cyrVHp8&ab_channel=SADHANA_CHEMISTRY)
5. Classification of Organic Compounds – <https://www.vedantu.com/chemistry/classificationoforganiccompounds>
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=8jppu59edI&ab_channel=OpenYourMindWithMurugaMP

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

Hours per week: 4

Subject Code:U24CHA11

Credits: 3

Course Outcome:

CO1: To know the basic aspects of oils and fats.

CO2: To learn the physical properties of oils and fats.

CO3: To understand the chemical properties of oils and fats.

CO4: To get knowledge on various essential oils and their sources

CO5: To identify the composition and properties of mineral oils



Unit I: Introduction to Oils and Fats

12 Hours

Definition – Nature of oils and fats – Glycerides – Fatty acid – nomenclature of fatty acids – Fatty acids of oils and fats – Raw materials of fatty acids – Animal fats – Tall oil – Vegetable oils - Structure and classification of oils and fats- Common utilization of oils and fats.

Unit II: Physical properties of Oils and Fats

12 Hours

Oiliness and Viscosity – Surface and Interfacial tension – Density and Expansibility – Thermal Properties – Heat of combustion – Specific heats and heats of fusion – Vapour pressure, Boiling point and Heat of vaporization – Solubility and Miscibility – Refractive Index - Electrical Properties Resistance and Dielectric constant.

Unit III: Chemical properties of Oils and Fats

12 Hours

Hydrolysis – Saponification – Saponification number – Interesterification- 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.

Unit IV: Essential and Mineral Oil - I

12 Hours

Sources and Uses of essential oils – Agar oil – Chinnamon leaf oil – Citrus oil – Eucalyptus oil-Lemon Grass oil – Turpentine oil.

Mineral oil - 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.

Unit V: Essential and Mineral Oil - II

12 Hours

Sources and Uses of essential oils – Ginger Grass oil – Jasmine oil – Khus oil – Mint oil. Mineral oil - Increasing the yield of petrol - Cracking – Types of cracking – Application of cracking - Properties of petrol and diesel – Knocking and Antiknocking properties – Octane number – reforming – aviation petrol – Cetane number - Synthetic petrol – Bergius process – Fischer Tropsch synthesis.

Text & Reference Books:

Units I, II and III

1. SBP Board of Consultants and Engineers, Fatty Acids and Products, Small Business Publications, Delhi.
2. M.M.Chakrabarty, Chemistry and Technology of Oils and Fats, Allied Publishers Pvt .Ltd, 2003.
3. F.D. Gunstone, The Chemistry of Oils and Fats, Blackwell Publishing Ltd., 2004.



Units IV and V

1. S.B.Shrivastva, Perfume, Flavour and Essential oil Industry, Small Industry Research Institute, Delhi.
2. Gurdeep Chatwal, Organic chemistry of natural products, Vol-I, Himalaya publishing house, New Delhi 2015.

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

Ancillary Mathematics

Allied 1 [For B.Sc., Physics / Chemistry]

Course Title: Algebra and Trigonometry	Total Hours: 90
	Contact Hours per Week : 6
Course Code: U24MAAX11	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**)

Unit II Exponential and Logarithmic Series

[18 Hours]

The exponential theorem – Summation – Problems of the form $\sum_{n=0}^{\infty} f(n) \cdot \frac{x^n}{n!} = (a_0 + a_1x + a_2x^2 + \dots + a_r x^r) e^x$ 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**)



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 (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]
Expression for $\sin n\theta$, $\cos n\theta$ and $\tan n\theta$ – Expression for $-\sin^n \theta$ and $\cos^n \theta$ - Hyperbolic functions – Inverse Hyperbolic functions.
(Text Book 2 - Chapter 4: Sections 4.1, 4.2 (pages 195 -204), Sections 4.4, 4.5 (pages 214 - 228))

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.
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Skill Based Subject I – PRINCIPLES OF CHEMICAL ANALYSIS-I

Hours per week: 2

Subject Code: U24CHS11

Credits: 2

Course Outcome:

CO1: To acquire the basic knowledge on electron transfer reactions

CO2: To understand the theories behind the inorganic salt analysis

CO3: To get the basic concept of volumetric analysis

CO4: To gain the ability to detect elements carbon, hydrogen, oxygen, nitrogen, halogens sulphur and phosphorus

CO5: To obtain 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: Semi micro 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, permanganometry, 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) – CHN analyser: principle and Instrumentation.

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: U24CHS12

Credits: 2

Course Outcome:

CO1: To understand and draw the Lewis structure for various molecules.

CO2: To explain the formation of covalent molecule by using valence bond theory.

CO3: To know the theoretical calculation of lattice energy for ionic compounds.



CO4: To differentiate chemical bonding and hydrogen bonding

CO5: To get the ability to 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-Landé equation. Energy 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, H₂O, BeCl₂, CO₂, CO, NO₂⁻, NO₃⁻, CO₃²⁻ and SO₄²⁻ Exceptions of octet rule BeCl₂ and BCl₃-Atomic orbital overlapping concept of covalency – sigma and pi bonds–formation of H₂, F₂, HF, O₂ and N₂ – 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 NH₃ and BF₃– 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:

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.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>
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SEMESTER - II

Core Subject II – GENERAL CHEMISTRY

Hours per week: 5

Subject Code: U24CHC21

Credits: 4

Course Outcome:

CO1: To study a few organic reaction intermediates and the concept of structural isomerism

CO2 : To understand the concept of types of isomerism and to apply E, Z nomenclature and R and S notations to organic molecules

CO3: To know the properties of elements, their oxides, hydrides and halides of p-block elements and have an idea about the preparation and structure of diborane, xenon compounds and various types of silicates

CO4: To differentiate adsorption, absorption and various adsorption isotherms

CO5: To get the concept of colloids, their types and various applications

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 – Silicates: classification- ortho, pyro, chain and sheet silicates. Silicones & Borazine preparation and structure. Preparation and structure of Xenon compounds (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 – Adsorption of gases on solids – physisorption and chemisorption – factors influencing adsorption – Freundlich adsorption isotherm - Langmuir adsorption isotherm (derivation) – BET adsorption isotherm (elementary idea only) - Applications 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, imbibition. Emulsions – preparation. Role of emulsifier – Applications 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 Publishing Co., New Delhi, 2019.

Units 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. Isomers in Organic Compounds - https://www.youtube.com/watch?v=aQ_VaOIPKG4&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: U24CHCP21

Course Outcome:

CO1: To acquire the knowledge of semimicro analysis

CO2: To practice the identification of various anions present in minerals in the presence of eliminating anions.

CO3: To analyse the various cations present in minerals in the presence of eliminating anions.

CO4 : To understand the concept of interfering anions

CO5: To acquire the knowledge of how to present the Report of an analysis.

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)**

Part III – Allied Subject – OILS AND FATS II

Hours per week: 4

Subject Code: U24CHA21

Credits: 3

Course Outcome:

CO1: To learn the composition of milk and milk properties.

CO2: To know the importance of milk and various milk products.

CO3: To analyze the milk

CO4: To ensure a fair knowledge of Nutritional and health aspects of vegetable oils

CO5: To acquire knowledge on various characteristic tests

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 –



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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: Nutritional and health aspects of vegetable oils

12 Hours

Sources and Properties of edible oil – primary and secondary source – Essential fatty acids- Major functions of essential fatty acids – Fat and fatty acid requirement for adults – Nutraceuticals in oils and their uses in human health – Oryzanol – Lecithin – Tocopherols and Tocotrienols – Phytosterols – Sterols – Phenolic compounds – Omega – 3 and Omega- 6 fatty acids.

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:

Units I, II and III

1. N.Shankuntala Manay and M.Shadaksharaswamy, Foods Facts and Principles, 3rd Edition, New Age International Publishers, New Delhi, 2015.
2. B.Srilakshmi, Food Science, New Age International Publishers, New Delhi , 2013.
3. <http://ndvsu.org/images/StudyMaterials/LPT/Milk-Composition-and-its-constituents.pdf>
4. <https://www.fao.org/dairy-production-products/products/milk-composition/en/>
5. <https://www.slideshare.net/jadavchandni/milk-processing-45129224>
6. <https://www.slideshare.net/YNarayudu/analysis-of-milk>
7. <https://www.scribd.com/document/566326837/Analysis-of-Milk>

Units IV and V

1. F.D.Gunstone, The Chemistry of Oils and Fats, Blackwell Publishing Ltd., 2004.
2. M.M.Chakrabarty, Chemistry and Technology of Oils and Fats, Allied Publishers Pvt . Ltd, 2003
3. <https://icar-iior.org.in/sites/default/files/iiorcontent/misc/nutrition-oils.pdf>
4. C.Paquot, Standard Methods for the Analysis of Oils, Fats and Derivatives, 6th edn.,Pergamon Press, 1979.

e – Resources:

1. <http://ndvsu.org/images/StudyMaterials/LPT/Milk-Composition-and-its-constituents.pdf>



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- <https://www.fao.org/dairy-production-products/products/milk-composition/en/>
- <https://www.slideshare.net/jadavchandni/milk-processing-45129224>
- <https://www.slideshare.net/YNarayudu/analysis-of-milk>
- <https://www.scribd.com/document/566326837/Analysis-of-Milk>
- <https://www.youtube.com/watch?v=6LutbLtR8FM>
- <https://nijabestblog.wordpress.com/petroleum-and-its-origin/>

Allied 2 [For B.Sc., Physics / Chemistry]

Course Title: Calculus and Matrices	Total Hours: 90
Course Code: U24MAAX21	Contact Hours per Week : 6
	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)).

Unit III Vector Calculus

[18 Hours]

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

(Text Book 3: Chapter 1: Sections: 1.4, 1.5 (pages 6 – 32))

Unit IV Matrices

[18 Hours]

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)

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
-

Part III – Allied I – LAB: OIL ANALYSIS

(To be conducted at the end Semester II)

Hours per week: 2

Subject Code: U24CHAP21

Credits: 2

Course Outcome:

CO1: To know the determination of specific gravity and viscosity.

CO2: To learn the parameters of surface tension

CO3: To determine the Refractive index, % Free Fatty acid and Iodine value.

CO4: To study the knowledge about saponification value and acetyl value

CO5: To acquire the idea of soxhlet extraction.

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

Reference Book:

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

e –Resource:

- [https://fssai.gov.in/upload/uploadfiles/files/Manual_Oil_Fat_25_05_2016\(1\).pdf](https://fssai.gov.in/upload/uploadfiles/files/Manual_Oil_Fat_25_05_2016(1).pdf)
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Skill Based Subject III – PRINCIPLES OF CHEMICAL ANALYSIS – II

Hours per week: 2

Subject Code: U24CHS21

Credits: 2

Course Outcome:

CO1: To understand the concept of purification of solid organic compounds

CO2: To gain the concept of purification of Liquid organic compounds

CO3: To get the knowledge to purify the compounds using Chromatography techniques

CO4: To obtain the ability to findout the empirical and molecular formulae

CO5: To acquire 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 – R_f 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: U24CHS22

Credits:2

Course Outcome:

CO1: To recognize the rules for writing the resonating structure for different molecules.

CO2: To understand the modification given to the Valence Bond Theory.

CO3: To find out the structure of the molecules by applying the concept of Hybridization

CO4: To test whether the molecule is formed or not by applying Molecular Orbital Theory

CO5: To 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 H₂, He₂, Li₂, Be₂, B₂, C₂, N₂, O₂ and F₂ 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- H₂, H₂⁺ and H₂⁻; He₂ and He₂²⁺; O₂, O₂²⁺, O₂²⁻ and O₂²⁻. 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 sp², sp³, sp³, sp², sp², dsp and d sp hybridization with simple examples such as BeCl₂, BF₃, CH₄, [Ni(CN)₄]²⁻, PCl₅, SF₆ and IF₇.

Unit V: VSEPR theory

6 Hours

VSEPR theory–postulates–shapes of molecules with regular and irregular geometry– SnX₂, [BF₄]⁻, [NH₄]⁺, CO₂, C₂H₄, C₂H₂, NH₃, H₂O, Cl₂O, SF₄, ClF₃, [ICl₂]⁻, XeF₂, XeF₄, ICl₅, and XeF₆– 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, ShobanLal 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>
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