

DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY



CIRCULAR NO.SU/B.Sc./08/2022

It is hereby inform to all concerned that, the syllabi prepared by the Board of Studies and Ad-hoc Boards with recommendation of the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following syllabi of Bachelor of Science with Regulation under the scheme of Choice Based Credit & Grading System** in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Courses	Semester
1.	B.Sc.Electronics(Optional)	Ist and IInd semester (First Year)
2.	B.A./B.Sc.Mathematics(Optional)	Ist and IInd semester (First Year)
3.	B.Sc.Chemistry(Optional)	Ist and IInd semester (First Year)
4.	B.Sc.Physics(Optional)	Ist and IInd semester (First Year)
5.	B.Sc.Analytical Chemistry	Ist and IInd semester (First Year)
6.	B.Sc.Geology (Optional)	Ist to VIth semester (First to Third)

This is effective from the Academic Year 2022-23 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Aurangabad-431 004.

REF.NO.SU/2022/ 6852-62

Date:- 10.08.2022.

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*Deputy Registrar,
Academic Section*

Copy forwarded with compliments to :-

- 1] **The Principal of all concerned Colleges,**
Dr. Babasaheb Ambedkar Marathwada University,
- 2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

- 1] **The Director, Board of Examinations & Evaluation, Dr.BAMU,A'bad.**
- 2] The Section Officer,[B.Sc.Unit] Examination Branch,Dr.BAMU,A'bad.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.BAMU,A'bad.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.BAMU,A'bad.
- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.BAMU,A'bad.
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**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
AURANGABAD.**



SYLLABUS

B. Sc. Chemistry
(Semester I to II)

Choice Based Credit System

Effective from : June 2022

Anil G. Shankarwar
29/07/22

(Dr. Anil G. Shankarwar)
Chairman BOS Chemistry
Dr. Babasaheb Ambedkar Marathwada University
Aurangabad.

[Signature]
24/07/22

Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad

Dr. Babasaheb Ambedkar Marathwada University, Aurangabad

Choice Based Credit System (CBCS) Curriculum
For

Faculty of Science and Technology

Course Structure and Scheme of Examination

B.Sc. Three Year Undergraduate Degree Program for Chemistry with effect from June 2022

Semester I

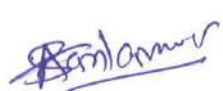
	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSC-1A) Core Courses	CHE-111	Core Course (Theory Paper-I)	2 hours	2	50	10	40	20
	CHE -112	Core Course (Theory Paper-II)	2 hours	2	50	10	40	20
	CHE -121	Lab course 1 (based on CHE -111 and CHE -112)	3 hours	1.5	50	10	40	20

Total Credits for Semester I : 5.5 (Theory : 04 ; Laboratory : 1.5)

Semester II

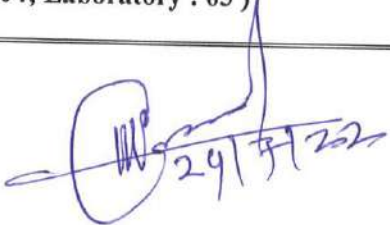
	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSC-1B) Core Courses	CHE -211	Core Course (Theory Paper-III)	2 hours	2	50	10	40	20
	CHE -212	Core Course (Theory Paper-IV)	2 hours	2	50	10	40	20
	CHE -221	Lab course 2 (based on CHE -211 and CHE -212)	3 hours	1.5	50	10	40	20

Total Credits for Semester II : 5.5 (Theory : 04 ; Laboratory : 1.5)


(Dr. Anil G. Shankarwar)
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Aurangabad.


29/7/22

Semester III								
	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSC-1C) Core Courses	CHE 311	Core Course (Theory Paper-V)	2 hours	2	50	10	40	20
	CHE-312	Core Course (Theory Paper-VI)	2 hours	2	50	10	40	20
	CHE -321	Lab course 3 (based on CHE -311)	3 hours	1.5	50	10	40	20
	CHE -322	Lab course 4 (based on CHE -312)	3 hours	1.5	50	10	40	20
Total Credits for Semester III : 07 (Theory : 04 ; Laboratory : 03)								

Semester IV								
	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSC-1D) Core Courses	CHE -411	Core Course (Theory Paper-VII)	2 hours	2	50	10	40	20
	CHE -412	Core Course (Theory Paper-VIII)	2 hours	2	50	10	40	20
	CHE -421	Lab course 4 (based on CHE -411)	3 hours	1.5	50	10	40	20
	CHE -422	Lab course 5 (based on CHE -412)	3 hours	1.5	50	10	40	20
Total Credits for Semester IV : 07 (Theory : 04; Laboratory : 03)								
								

Semester V

	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSE-1 A) Discipline Specific Elective	CHE -511	DSE-1A(1) (Theory Paper-IX) (Select any one paper from A1/B1/C1/D1)	2 hours	2	50	10	40	20
	CHE -512	DSE-1A(2) (Theory Paper-X) (Select any one paper from A2/B2/C2/D2)	2 hours	2	50	10	40	20
	CHE -521	Lab course 6 (based on CHE -511)	3 hours	1.5	50	10	40	20
	CHE -522	Lab course 7 (based on CHE -512)	3 hours	1.5	50	10	40	20

Total Credits for Semester V : 07 (Theory : 04 ; Laboratory : 03)

Semester VI

	Course Code	Course Title	Teaching time/week	Credits	Scheme of Examination			
					Max Marks	CIA	UA	Min Marks
Optional I (DSE-1 B) Discipline Specific Elective	CHE -611	DSE-1B(1) (Theory Paper-XI) (Select any one paper from A1/B1/C1/D1)	2 hours	2	50	10	40	20
	CHE -612	DSE-1B(2) (Theory Paper-XII) (Select any one paper from A2/B2/C2/D2)	2 hours	2	50	10	40	20
	CHE -621	Lab course 8 (based on CHE -611)	3 hours	1.5	50	10	40	20
	CHE -622	Lab course 9 (based on CHE -612)	3 hours	1.5	50	10	40	20

Total Credits for Semester VI : 07 (Theory : 04 ; Laboratory : 03)

Total Credits for three years: Sem. I (05.5) + Sem. II (05.5) + Sem. III (07) + Sem. IV (07) + Sem. V (07) + Sem. VI (07) = 39 Credits

(Dr. Anil G. Shankarwar)
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Important Notes:

- i) **Nomenclature:** DSC- Discipline Specific Core course, SEC – Skill Enhancement Course, AECC- Ability Enhancement compulsory course, DSE- Discipline Specific Elective, UA- University Assessment (Semester End), CIA- Continuous Internal Assessment
- ii) **Assessment:** 80% for University Assessment (Semester End Examination) and 20 % for Continuous Internal Assessment (CIA)
- iii) Continuous Internal Assessment (CIA): **Theory** (10 Marks): Internal Test 05 Marks (Two Internal Tests of 05 marks each and average of the two test will be considered) and 05 Marks for Assignment/tutorials.
- iv) Continuous Internal Assessment (CIA): **Practical** (10 Marks): 07 Marks for Internal Practical Examination and 03 Marks for record book/submission of collection and field survey report and excursion report
- v) Practical examination : Annual examination

CHE – 111
(Inorganic Chemistry)
(Theory Credits: 02, Lectures-45)

Unit I: Atomic Structure and Periodicity of Elements (13 Lecturers)

Bohr's theory and its limitations. Idea of de-Broglie matter waves.

Heisenberg uncertainty principle. Quantum numbers and its types.

Significance of quantum numbers. Shapes of s, p and d atomic orbitals, nodal planes.

Rules for filling electrons rules in various orbitals: i) Aufbau's principle

ii) Hund's rule of maximum multiplicity iii) Pauli's exclusion principle

Electronic configuration of elements from Hydrogen to Zinc.

Stability of empty, half-filled and completely filled orbitals

Definition and trends in Periodic table of the following properties:

- i) Atomic radii and ionic radii ii) Ionization energy iii) Electron affinity
- iv) Electronegativity

Factors affecting ionization energy.

Pauling's and Mulliken's scale of electronegativity.

Unit II: Chemical Bonding and Molecular structure (I) Ionic Bonding (10 Lectures)

Definition and general characteristics of ionic bonding. Factors affecting on an Ionic bond formation. Lattice energy, solvation energy and their importance. Born Lande equation (no derivation) to calculate lattice energy. Born-Haber cycle for NaCl and its applications

Fajan's Rule, Applications of Fajan's rule for,

- Polarizing power and polarizability
- Ionic character in covalent compounds
- Dipole moment and percentage ionic character

Unit III: Chemical Bonding and Molecular structure (II) covalent Bonding (12 Lectures)

Concept of hybridization, different types of hybridization and geometry of following molecules on the basis of Valence bond theory.

- Linear geometry- BeCl_2 (sp hybridization)
 - Planer trigonal geometry- BF_3 (sp^2 hybridization)
 - Tetrahedral geometry- SiCl_4 (sp^3 hybridization)
 - Trigonal bipyramidal geometry- PCl_5 (sp^3d hybridization)
 - Octahedral geometry- SF_6 (sp^3d^2 hybridization)
 - Pentagonal bipyramidal geometry - IF_7 (sp^3d^3 hybridization)
- VSEPR theory: Assumptions of theory. Explain the geometry of following irregular molecules on the basis of VSEPR theory.

- Linear geometry- XeF_2 (sp^3d hybridization)
- T-shaped geometry- ClF_3 (sp^3d hybridization)
- Irregular tetrahedral geometry- SF_4 (sp^3d^2 hybridization)
- Square pyramidal geometry- IF_5 (sp^3d^2 hybridization)

Unit IV: Chemical Bonding and Molecular structure (III) Molecular orbital theory (MOT) (10 Lectures)

Rules for the LCAO method. Formation of bonding, antibonding and nonbonding molecular orbitals. Types of overlaps – s-s, s-p and p-p combinations of atomic orbitals. Energy level sequence for molecular orbital when $n=1 \& 2$. MO diagrams for homonuclear diatomic molecule of I & II periods. i.e. (He_2 , Li_2 , B_2 , N_2 , O_2). Molecular orbital diagrams for heteroatomic diatomic molecules. (CO , NO)

Bond order and its significance.

Reference Books:

- 1) Lee, J.D. Concise Inorganic Chemistry ELBS, 1991.
- 2) Cotton, F.A., Wilkinson, G. & Gaus, P.L. Basic Inorganic Chemistry, 3rd ed., Wiley.
- 3) Douglas, B.E., McDaniel, D.H. & Alexander, J.J. Concepts and Models in Inorganic Chemistry, John Wiley Sons.
- 4) Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K. Inorganic Chemistry:
5) Principles of Structure and Reactivity, Pearson Education India, 2006.
- 6) Puri, Sharma, Kalia. Principles of Inorganic Chemistry
- 7) Madan R. L. Chemistry for Degree Students (B . Sc. First year), S. Chand Publications

CHE – 112
(Organic Chemistry)
(Theory Credits: 02, Lectures-45)

Unit-I : Fundamentals of Organic Reaction mechanism (7 Lectures)

Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: formation, structure, reactivity and stability of Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values.

Unit-II : Isomerism and Stereochemistry (10 Lectures)

Concept of isomerism, type, (Structural chain, position, functional group) Representation of organic Molecules – zig- zag structures, projection formulae – (Saw horse (Andiron), Newman, Fisher & Dotted – wedge). Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Elements of symmetry, Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis – trans nomenclature; CIP Rules: R/ S and E / Z Nomenclature.

Unit-III : Benzene & its Reactions (6 Lectures)

Aromaticity: Benzenoids and Hückel's rule, Structure of benzene, Kekule structure, stability of benzene, Reactions of benzene, aromatic character, Huckel rule, Nomenclature of benzene derivatives, sulphonation, halogenation, Friedel – Crafts reactions of benzene.

Unit-IV : Alkyl and Aryl Halides (10 Lectures)

Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN^1 , SN^2 and SN^i) reactions. Preparation: from alkenes and alcohols.

Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination v/s substitution.

Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by $-OH$ group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$). Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Unit-V : Alcohols, Phenols

(12 Lectures)

Alcohols: Preparation: Preparation of 1° , 2° and 3° alcohols: using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters.

Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk. $KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: Preparation: Cumene hydroperoxide method, from diazonium salts.

Reactions with mechanism: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben-Hoesch Condensation, Schotten-Baumann Reaction.

Reference Books

1. Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014).
2. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013.
3. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
4. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.
5. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.
6. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
7. Organic Chemistry by Pine, 5th edition.

8. Organic Chemistry Vol. I, II and III by Mukharjee, Singh and Kapoor-Wiley Eastern.
9. Organic Chemistry by S.K. Ghosh.
10. Reaction Mechanism in Organic Chemistry by S.M. Mukharjee and S.P. Singh.
11. Stereochemistry and mechanism through solved problems by P.S. Kalsi.
12. Organic reactions and their mechanism by P S Kalsi –New age.
13. The Art of Writing Reasonable Organic Reaction Mechanisms by Grossman, Robert B
14. Organic chemistry, By Raj K Bansal
15. Eliel, E.L. Stereochemistry of Carbon Compounds, Tata McGraw Hill education, 2000
16. Text book of Organic Chemistry by P.S. Kalsi published by Macmillan India Ltd., 1999, Delhi.

CHE – 121
Laboratory Course – 1
(Credits 1.5: 3 hours per week)
(Lectures- 04 per week)

Inorganic chemistry

Semi micro qualitative analysis of inorganic salt mixture containing two acidic radicals and two basic radicals of same or different groups.

Analysis of basic radicals to be done by using spot test reagents.

Following radicals to be given carbonate, nitrite, sulphite, sulphide, chloride, bromide, iodide, nitrate and sulphate, silver(I), copper(II), bismuth(III), cadmium(II), tin(II), arsenic(III), antimony(III), iron(III), chromium(III), aluminium(III), nickel(II), cobalt(II), manganese(II), zinc(II), calcium(II), strontium(II), barium(II), magnesium(II).

Volumetric Analysis

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Estimation of oxalic acid by titrating it with KMnO_4 .
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.

Organic Chemistry

1. Organic Qualitative Analysis: Detection of physical constant, type, functional group, elements, and Confirmatory test.
 - a) Acids: Oxalic acid, Benzoic acid, cinnamic acid
 - b) Phenols: Beta-Naphthol, Resorcinol
 - c) Base: Aniline, p-Nitroaniline
 - d) Neutral: Acetone, Acetanilide, Chloroform, m-Dinitrobenzene, Thiourea, Bromobenzene

Organic Preparations

1. Preparation of acetanilide (Acetylation).
2. Preparation of Benzanilide (Benzoylation).
3. Preparation of m-di-Nitrobenzene (Nitration).
4. Preparation of tri-Bromoaniline from Aniline (Bromination).
5. Preparation of Benzoic acid from Benzamide (Hydrolysis).
6. Preparation of phenylazo – β – naphthol dye (Diazotisation).

Reference Books for Practical's

1. Practical Organic Chemistry by F.G. Mann, B.C. Saunders, Orient Longman.
2. Comparative Practical Organic Chemistry (Qualitative Analysis) by V.K. Ahluwalia and Sunita Dhingra, Orient Longman.
3. Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by V.K. Ahluwalia and Renu Agrawal, Orient Longman.
4. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996.
5. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
6. Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012
7. Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut.

CHE – 211
(Physical Chemistry)
(Theory Credits: 02, Lectures-45)

Unit-I : Chemical Energetics:

(12 Lectures)

A) Thermodynamics

Basic concepts of thermodynamics: system, surrounding, boundary. Types of systems. State & path functions. Thermodynamic processes. Intensive & Extensive properties. First law of thermodynamics. Spontaneous & nonspontaneous processes. Statements of second law of thermodynamics. Carnot's cycle and its efficiency. Entropy, physical significance of entropy. Third law of thermodynamics. Calculation of absolute entropies of substances.

B) Thermochemistry

Concept of standard state, standard enthalpy of formation. Hess's law of constant heat summation and its applications. Bond dissociation energy and its calculations from thermochemical data. Temperature dependence of enthalpy- Kirchoff's equation.

Unit-II: Chemical Equilibrium:

(08 Lectures)

Free energy change in chemical reactions. Thermodynamic derivation of the law of chemical equilibrium. Relation between K_p , K_c and K_x for reactions involving ideal gases. Le Chatelier's principle.

Unit-III: Gaseous State:

(10 Lectures)

Postulates of kinetic theory of gases and derivation of the kinetic gas equation. Deduction of gas laws; Boyle's law, Charles's law, Graham's law of diffusion, Avogadro's hypothesis, deviation of real gases from ideal behavior, Vanderwall's equation of state for real gases. Critical phenomenon; PV isotherms of real gases.

Unit –IV: Chemical Kinetics

(15 Lectures)

Rate of reaction, Definition and units of rate constant, Factors affecting rate of reaction. (Nature of reactant, Concentration, pressure, temperature and catalyst.) Order and Molecularity of reaction, Zero-order reaction, First order reaction, Characteristics of first-order reaction, examples. Pseudo-unimolecular reactions, examples. Second order reaction: Derivation of rate constant for equal and unequal concentration of the reactants. Characteristics of Second order reaction, Numerical on First order and second order reactions. Arrhenius equation, Concept of energy of activation.

Reference Books:

1. Principles of Physical Chemistry Puri, Sharma and Pathania, Vishal Publishing House, 44th Edition
2. Advanced Physical Chemistry Gurdeep Raj GOEL Publishing House, 6th Edition
3. Essentials of Physical Chemistry, Bahl, Tuli and Bahl
4. Text Book of Physical Chemistry, Soni and Dharmarha
5. Essentials of Nuclear Chemistry by H J Arnikar, New Age, 4th edition.
6. Mathematical preparation of Physical Chemistry : F. Daniel ,Mc-Graw Hill Book Company Ltd.
7. Elements of Physical Chemistry : S. Glasstone and D. Lewis (D. Van Nostrand Co. Inc)
8. Physical Chemistry : W. J. Moore (Orient Longman)
9. Principles of Physical Chemistry : Maron Prutton
10. University Chemistry : B. H. Mahan (Addison - Wesley Publ. Co.)
11. Chemistry for Degree students (B. Sc. First Year): R L Madan (S. Chand and Company)

CHE – 212
(Applied Chemistry)
(Theory Credits: 02, Lectures-45)

Unit-I : Basic principles of Chromatography (10 Lectures)

Introduction, Basic Principle of Chromatography, Basic terms, Classification of Chromatography.

Paper Chromatography- Principle, types of paper chromatography. Treatment of sample loading, choice of solvent, development of ascending, descending, circular chromatography, location of spots, determination of R_f value, Applications, advantages and disadvantages.

Thin layer chromatography; Principle, Solvent system, stationary phases, preparation of TLC plate, Detecting reagents, methodology-sample loading, development, detection of spot, R_f value, Applications, advantages and disadvantages. Comparison of paper chromatography and TLC

Unit-II : Study of Drugs (8 Lectures)

Introduction and classification of drugs. Properties of ideal drug. Synthesis and properties of aspirin, paracetamol, ibuprofen and chloramphenicol.

Unit-III: Study of Glass (08 Lectures)

Introduction, physical properties of glass. Chemical properties of glass. Characteristics of glass. Raw materials used in the manufacture of glass. Process of manufacture of glass. Varieties of glass.

Unit-IV: Principle and Applications of Ultraviolet Spectroscopy (12 Lectures)

Introduction, Theory of electronic Spectroscopy, Types of electronic transitions, Transition probability, Concept of Chromophore, Auxochrome, absorption and intensity shifts, Absorption bands, Conjugated dienes, Woodward-Fieser rules for calculating absorption maximum in dienes, $\alpha - \beta$ unsaturated carbonyl compounds (Simple examples), Applications of UV-Spectroscopy

Unit-V: Analysis of Fertilizers:**(07 Lectures)**

Introduction. Types of fertilizers. Necessity and requirements of good fertilizers. Sampling and sample preparation. Analysis of Nitrogen by Kjeldahl's method. Analysis of Phosphorus by phosphomolybdate method. Analysis of Potassium by sodium tetraphenyl borate method

References:

1. Textbook of quantitative Inorganic analysis-A.I. Vogel
2. Instrumental methods of Chemical analysis-H. Kaur
3. Instrumental methods of Chemical analysis-B.K. Sharma
4. Instrumental methods of Chemical analysis-Chatwal Anand
5. Fundamental of analytical Chemistry-Skoog and West
6. Basic Concepts of analytical Chemistry-S.M. Khopkar
7. Analytical Chemistry-Alka Gupta (Pragati Prakashan)
8. Indian Pharmacopoeia
9. Chromatography-H. Kaur

CHE – 221
Laboratory Course – 2
(Credits 1.5: 3 Hour per week)
(Lectures- 04 per week)

Physical Chemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3 , NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH .
7. Determination of Equivalent weight of mg by Eudiometer
8. To Determine Viscosity of given liquid (Water / Ethanol) by viscometer.
9. To determine surface tension of given liquid by Staganometer.
10. Chemical Kinetics: To study the effect of acid strength on the hydrolysis of an ester.

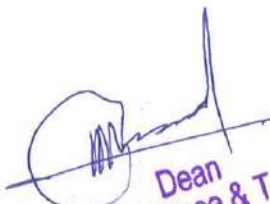
Applied Chemistry

Separation of mixtures by Chromatography:

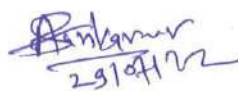
- a) Measure the R_f value in each case (combination of two compounds to be given)
 1. Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography.
 2. Identify and separate the cations by Paper Chromatographic technique from the following mixtures :
 - a) $\text{Ni}^{+2} + \text{Cu}^{+2}$
 - b) $\text{Ni}^{+2} + \text{Co}^{+2}$

Reference Books:

- 1) Practical Physical Chemistry: Palit and De.
- 2) Practical Physical Chemistry: Yadav.
- 3) Practical Physical Chemistry: Khosla.
- 4) Khosla, B. D.; Garg, V. C. & Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).
- 5) Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut.
- 6) Systematic Practical Physical Chemistry by Prof. S. W. Rajbhoj and Dr. T. K. Chondekar, Anjali Publication, Aurangabad.



Dean
Faculty of Science & Technology
Dr. Babasaheb Ambedkar Marathwada
University, Aurangabad



(Dr. Anil G. Shankarwar)
Chairman BOS Chemistry
Dr. Babasaheb Ambedkar Marathwada University
Aurangabad.