

Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajnagar- 431001



B.Sc. Degree Programme

(Three Year / Four Years (Hons) / Four Years (Hons with Research))

Syllabus

BSc. III & IV Semester

NEP 2020

Subject (Major): CHEMISTRY
(with Minor Chemistry)

Effective from 2025-26

BSc Second Year: 3rd Semester

Students will have to select / declare choice of **one major subject** and **one minor subject** from three major options M1, M2 and M3 (which were opted in the first year)

Course Type	Course Code	Examination Code (To be given by respective BoS)	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	CHE/DSC/T/200	SAC0002200 3T	Theory Course Organic Chemistry	2		2		2+2+2+2 = 08
	CHE/DSC/T/201	SAC0002201 3T	Theory Course Physical Chemistry	2		2		
	CHE/DSC/P/226	SAC0002226 3P	Practical based on SUB/DSC/T/200 Organic Chemistry		4		2	
	CHE/DSC/P/227	SAC0002227 3P	Practical based on SUB/DSC/T/201		4		2	
Minor (Choose any two from pool of courses) It is from different discipline of the same faculty	CHE/Mn/T/200	SCC0002200 3T	To be chosen from other discipline of same faculty	2		2		2+2 = 04
	CHE/Mn/T/201	SCC0002201 3T	To be chosen from other discipline of same faculty	2		2		
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	CHE/GE/OE/ T/200	SDC0002200 3T	To be chosen from other faculty	2		2		02
VSC (Vocational Skill Courses) (Choose any one from SUB/VSC/T/ 200 and SUB/VSC/T/ 201) and corresponding Practicals	CHE/VSC/T/200	SEC00022003 T	Theory Course	1		1		1+1 =02
	CHE/VSC/T/201	SEC00022013 T	Theory Course	1		1		
	CHE/VSC/P/226	SEC00022263 P	Practicals based on SUB/VSC/T/ 200		2		1	
	CHE/VSC/P/227	SEC00022273 P	Practicals based on SUB/VSC/T/ 201		2		1	
AEC, VEC, IKS	CHE/AEC/T/200		English (Common for all the faculty)	2		2		2 + 2 = 04
	CHE/VEC/T/201		Environmental Studies	2		2		
OJT/ FP/CEP/CC/RP	CHE/CC/P/226		Cultural Activity / NSS,NCC (Common for all the faculty)		4		2	02
				15	14	15	07	22

Minor Courses for other Discipline

SUB/Mn/T/ 200 : This is a 2 credit theory course to be designed for other discipline **Concepts of Chemistry I**

SUB/Mn/T/ 201 : This is a 2 credit theory course to be designed for other discipline **Concepts of Chemistry II**

Generic /Open Elective Courses for other faculty

SUB/GE/OE/T/200 : This is a 2 credit theory course to be designed for other faculty **General Chemistry**

BSc Second Year: 4th Semester

Course Type	Course Code	Examination Code (To be given by respective BoS)	Course Name	Teaching Scheme (Hrs / Week)		Credits Assigned		Total Credits
				Theory	Practical	Theory	Practical	
Major (Core) Mandatory DSC	CHE/DSC/T/250	SAC0002250 4T	Theory Course Inorganic Chemistry	2		2		2+2+2+2 = 08
	CHE/DSC/T/251	SAC0002251 4T	Theory Course Applied Chemistry	2		2		
	CHE/DSC/P/276	SAC0002276 4P	Practical based on SUB/DSC/T/250		4		2	
	CHE/DSC/P/277	SAC0002277 4P	Practical based on SUB/DSC/T/ 251		4		2	
Minor (Choose any two from pool of courses) It is from different discipline of the same faculty	CHE/Mn/T/250	SCC0002250 4T	To be chosen from other discipline of same faculty	2		2		2+2 = 04
	CHE/Mn/T/251	SCC0002251 4T	To be chosen from other discipline of same faculty	2		2		
Generic / Open Elective (GE/OE) (Choose any one from pool of courses) It should be chosen compulsorily from the faculty other than that of Major	CHE/GE/OE/T/250	SDC0002250 4T	To be chosen from other faculty	2		2		02
SEC (Skill Enhancement Courses) (Choose any one from SUB/SEC/T/250 and SUB/SEC/T/ 251) and corresponding Practicals	CHE/SEC/T/250	SEC0002250 T	Theory Course	1		1		1+1 =02
	CHEM/SEC/T/251	SEC0002251 T	Theory Course	1		1		
	CHEM/SEC/P/276	SEC0002276 P	Practicals based on SUB/SEC/T/250		2		1	
	CHEM/SEC/P/277	SEC0002277 P	Practicals based on SUB/SEC/T/ 251		2		1	
AEC, VEC, IKS	CHE/AEC/T/250		Modern Indian Language (MIL-2) (Choose any one from pool of language courses)	2		2		02
OJT/ FP/CEP/CC/RP	CHE/FP/P/276		Field Project		4		2	2+2= 04
	CHE/CC/P/277		(Fine/ Applied/ Visual/ Performing Arts) (Common for all the faculty)		4		2	
				13	18	13	09	22
Exit Option : Award of UG Diploma in major and minor with 88 credits and an additional 4 credits NSQF course (related to major / minor) / Internship during summer vacation OR Continue with Major and Minor								

Minor Courses for other Discipline

SUB/Mn/T/ 250 :This is a 2 credit theory course to be designed for other discipline **Concepts of Chemistry III**

SUB/Mn/T/ 251: This is a 2 credit theory course to be designed for other discipline **Concepts of Chemistry IV**

Generic /Open Elective Courses for other faculty

SUB/GE/OE/T/250 : This is a 2 credit theory course to be designed for other faculty **Chemistry in Daily Life**

SAC00022003T

CHE/DSC/T/ 200

Title of Paper: Organic Chemistry

Total Credits: 02

Total Contact Hours: 30 Hrs

University Assessment 30 Marks

Internal Assessment 20

Maximum Marks: 30 (UA) + 20 (IA) =50

Learning Objectives of the Course:

1. To develop critical thinking about the Structure of Benzene and its derivatives.
2. To understand Huckel's rule and Aromaticity.
3. To understand electrophilic substitution reactions of benzene.
4. To understand the basic concept of organic reaction mechanism.
5. To understand preparations and reactions of alcohols carboxylic acids, aldehyde and ketones.
6. To understand the nomenclature of organic compounds.
7. To understand Various name reactions with mechanism.

Course Outcomes (COs):

After completion of the course, students will be able to:

1. Understand the structure of benzene and its derivatives.
2. Understand the aromatic and antiaromatic compounds.
3. Understand that different name reactions are involved in organic chemistry.
4. Apply the mechanism of organic reaction mechanisms.
5. Understand preparations and reactions of alcohols, carboxylic acids, aldehydes and ketones.
6. Understand the nomenclature of organic compounds.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Benzene: Nomenclature of benzene derivatives, sigma and pi molecular orbital picture of benzene, resonance in benzene, Aromaticity, Hückel's rule, antiaromaticity. Reactions of benzene: sulphonation, nitration, halogenation, Friedel-Crafts reactions. Aryl Halides: Preparation of Aryl Halides: Sandmeyer & Gattermann reactions. Reactions of Chlorobenzene: Aromatic nucleophilic substitution (replacement by -OH group) and effect of nitro substituents. Benzyne Mechanism: KNH_2/NH_3 (or $\text{NaNH}_2 / \text{NH}_3$). Reactivity and Relative strength of C-Halogen bond in the alkyl, allyl, benzyl, vinyl, and aryl halides.	10 Hrs
II	Alcohols: Nomenclature of alcohols, Preparation of alcohols: Preparation of 1°, 2°, and 3° alcohols using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid, and esters. The acidic nature of alcohol. Reactions of alcohol: HX (Lucas test), esterification, PCC, alkaline KMnO_4 , acidic dichromate, and Oppenauer oxidation. Pinacol-Pinacolone rearrangement with mechanism.	10 Hrs

	Phenols: Acidic nature of phenol. Preparation of phenol from Cumene and diazonium salts. Reactions of phenol: Nitration, halogenation, sulphonation, Reimer-Tiemann Reaction, Gattermann-Koch Reaction.	
III	Aldehydes and Ketones: IUPAC nomenclature of aldehyde and ketones, Preparation: from acid chlorides and nitriles. Reactions of aldehydes and ketones with HCN, ROH, NaHSO ₃ , NH ₂ -G derivatives. Iodoform test, Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation, Clemenson reduction, and Wolff-Kishner reduction. Carboxylic acid: IUPAC nomenclature of carboxylic acids, factors affecting acidity of carboxylic acids. Preparation: from esters, nitriles and alcohol. Reactions: PCl ₃ , SOCl ₂ esterification, Hell-Vohlard-Zelinsky Reaction, synthesis amides and acid anhydrides.	10 Hrs
Text / Reference books:		
<ol style="list-style-type: none"> Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014). McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988). Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010. Stanley Pine, Organic Chemistry, 5th edition. Mukherjee, Singh and Kapoor, Organic Chemistry Vol. I, II and III -Wiley Eastern. S.K. Ghosh, Organic Chemistry. S.M. Mukherjee and S.P. Singh, Reaction Mechanism in Organic Chemistry. P S Kalsi, Organic reactions and their mechanism. Grossman, Robert B, The Art of Writing Reasonable Organic Reaction Mechanism Raj K Bansal Organic chemistry P.S. Kalsi, Text book of Organic Chemistry, Macmillan India Ltd., 1999, Delhi. 		

SAC00022263P

CHE/DSC/P/226:

Title of Paper: Organic Chemistry

Lab Course:

Total Credits: 02

Total Contact Hours: 60 Hrs

University Assessment 30 Marks

Internal Assessment 20 Marks

Maximum Marks: 30 (UA) + 20 (IA) =50

Learning Objectives of the Course:

1. To understand the stoichiometry.
2. To understand the isolation of organic compound
3. To develop basic skills in organic synthesis.
4. To develop the skill of purification of compounds by using Thin Layer Chromatography and crystallization.
5. To develop the skill of separation technique of organic compounds.
6. To develop the skill for element detection and functional group detection in organic compounds.

Course Outcomes (COs):

After completion of the course, students will be able to:

1. Understand the stoichiometry.
2. Understand the isolation of organic compound.
3. Develop basic skills in organic synthesis.
4. Develop the skill of purification of compounds by using Thin Layer chromatography and crystallization.
5. Develop the separation technique skills of organic compounds.
6. Develop the skill for element detection and functional group detection in organic compounds.

Module No	Topics / actual contents of the syllabus	Contact Hours
I	<ol style="list-style-type: none">1. Synthesis of 4-nitroacetanilide from acetanilide.2. Synthesis of Chalcones from benzaldehyde & acetophenones.3. Preparation of Quinone from hydroquinone by Green Protocol.4. Synthesis of 4-hydroxy coumarin by Pechmann reaction.5. Synthesis of dibenzalacetone from benzaldehyde.6. Synthesis of phthalimide from phthalic anhydride.7. Synthesis of methyl orange from sulphanilic acid.8. Synthesis of benzil from benzoin.	30
II	Organic Qualitative Analysis Separation of Two Components from a given binary mixture of organic compounds and systematic identification of one component qualitatively. (Seven mixtures: water-insoluble solid-solid type) <ol style="list-style-type: none">1. Acid + Phenol2. Acid + Phenol3. Acid + Base4. Acid + Neutral5. Phenol + Base	30

	6. Base + Neutral 7. Phenol + Neutral	
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Text / Reference Books:

- 1) F.G. Mann, B.C. Saunders, Practical Organic Chemistry, Orient Longman.
- 2) Prof Satish Agarwal and Dr R C Agarwal Advanced Organic Analysis Pragati Prakashan
- 3) V.K. Ahluwalia and Sunita Dhingra, Comparative Practical Organic Chemistry (Qualitative Analysis), Orient Longman.
- 4) V.K. Ahluwalia and Renu Agrawal, Comprehensive Practical Organic Chemistry (Preparation and Qualitative Analysis) by, Orient Longman.
- 5) 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.
- 6) Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960.
- 7) O P Pandey, D. N, Practical Chemistry (for B.Sc. I, II- and III-year students) – Bajpaiand

SAC00022013T

CHE/DSC/T/ 201

Title of Paper: Physical Chemistry

Total Credits: 02

Total Contact Hours: 30 Hrs

University Assessment 30 Marks

Internal Assessment 20

Maximum Marks: 30 (UA) + 20 (IA) =50

Learning Objectives of the Course:

1. To develop critical thinking about the phase equilibrium .
2. To understand conductance and conductometry.
3. To understand laws of quantum theory.
4. To understand the basic concept of photochemistry.
5. To understand laws of photochemistry
6. To understand the fluorescence, phosphoresce and chemiluminescence .

Course Outcomes (COs):

After completion of the course, students will be able to:

1. Understand the phase equilibrium.
2. Understand and apply concept of conductance and conductometry.
3. Understand and apply laws of quantum theory.
4. Apply the mathematical equation for quantum chemistry.
5. Understand and apply photochemical concept and laws
6. Understand use the fluorescence, phosphoresce and chemiluminescence .

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Unit I A) Phase equilibrium 5 Hr Introduction, definitions of phase, component and degree of freedom of a system, phase diagram of one component water system, phase diagrams of two component silver-lead system, Pattinson's process of desilverisation of lead. Partially miscible liquids: phenol-water system. B) Conductometry 5 Hr Introduction, conductance, resistance, electrolytic conductance, Ohm's law, cell constant, specific and equivalent conductance, molar conductance, Kohlrausch's law and its applications, conductivity cell, determination of cell constant, conductometric titrations, Numericals.	10 Hrs
II	Unit II. Quantum Chemistry	10 Hrs

	Introduction, Black body radiation, Planck's radiation law, photoelectric effect, Compton effect, Bohr's model of hydrogen atom (no derivation) and its defects, de Broglie hypothesis. Heisenberg's uncertainty principle, Schrodinger wave equation for hydrogen atom, Physical interpretation of the wave function ψ and ψ^2 , Numericals.	
III	Unit III. Photochemistry Introduction, Lambert's law, Beer's law, Lambert - Beer's law, Difference between thermal and photochemical processes, Laws of photochemistry: Grothus - Draper law, Stark-Einstein law, Quantum yield, Reasons for high and low quantum yield, Factors affecting Quantum yield, experimental method for the determination of quantum yield, Jablonski diagram depicting various processes occurring in the excited state, Qualitative description of fluorescence and phosphorescence, photosensitization, Chemiluminescence, Numericals	10 Hrs

Text / Reference books:

1. Atkins' Physical Chemistry by Peter Atkins, Julio de Paula, James Keeler -11th edition
2. Principles of Physical chemistry by B.R. Puri, L.R. Sharma, M.S. Pathania
3. Essentials of Physical chemistry by Bahl and Tuli-Revised, S. Chand and Company Ltd.
4. Principles of Physical Chemistry, Fourth Edition by S.H. Marron and C. F. Pruton
5. Physical Chemistry- 4th Edition, Gilbert W. Castellan (Narosa Publication)
6. Vogel's Textbook of Quantitative Chemical Analysis. 5th Ed. G. H. Jeffry, J. Basset, J. Mendham, R. C. Denney, Longman Scientific and Technical.
7. Basic Concept of Analytical Chemistry, S. M. Khopkar, New Age International (UK) Ltd, United Kingdom
8. Analytical Chemistry by G.R. Chatwal, Sham Anand.
9. Instrumental Methods of Chemical Analysis by Chatwal and Anand.
10. Elements of Physical Chemistry by Samuel Glasstone, McMillan & Co. Ltd

SAC00022273P

CHE/DSC/P/227:

Title of Paper: Physical Chemistry

Lab Course:

Total Credits: 02

Total Contact Hours: 60 Hrs

University Assessment 30 Marks

Internal Assessment 20 Marks

Maximum Marks: 30 (UA) + 20 (IA) =50

Learning Objectives of the Course:

1. To understand the procedure for determining order of reaction .
2. To understand the experiment for determining viscosity and surface tension
3. To develop basic skills in pH metry.
4. To develop the skill of conductometry and colorimetry.
5. To develop the skill of potentiometry.
6. To understand the method for heterogeneous equilibria

Course Outcomes (COs):

After completion of the course, students will be able to:

1. Understand the chemical kinetics of reaction.
2. Select and apply method for determining viscosity and surface tension.
3. Calibrate and Use Ph meter.
4. Use conductometer and colorimeter.
5. Develop the skill in handling potentiometer.
6. Develop the skill for determination of heterogenous equilibria.

Module No	Topics / actual contents of the syllabus	Contact Hours
I	<p>Chemical Kinetics:</p> <ol style="list-style-type: none">1. Study the acid catalysed hydrolysis of an ester (methyl Acetate) and determine the rate constant (K) (First order reaction)2. Study the kinetics of saponification reaction between sodium hydroxide and ethyl acetate.3. Determine energy of activation of the reaction between $K_2S_2O_8$ and KI with unequal initial concentration. <p>Viscosity:</p> <ol style="list-style-type: none">4. Determine the viscosities of two pure liquids A and B (Benzene and nitrobenzene) and hence find the composition of two liquids.5. Determine the molecular weight of a high polymer by viscosity measurement. <p>Surface Tension:</p> <ol style="list-style-type: none">6. Determine the percentage composition of a given mixture of two liquids by stalagmometer.	60

	<p>Heterogeneous Equilibria:</p> <p>7. Study the mutual solubility of phenol and water at various temperature. Determine the critical solution temperature.</p> <p>pH metry:</p> <p>8. Determine equivalence point of neutralization of CH₃COOH by pH-metric titration with NaOH</p> <p>9. Determine equivalence point of neutralization of HCl by pH-metric titration with NaOH</p> <p>Conductometry:</p> <p>10. To investigate the conductometric titration of strong acid against strong base</p> <p>11. To investigate the conductometric titration of weak acid against strong base</p> <p>Colorimetry:</p> <p>12. Prepare standard solutions of KMnO₄ / CuSO₄, record their absorbance and verify Beer's law and determine unknown concentration.</p> <p>13. Determine the empirical formula of ferric salicylate complex by Job's method.</p> <p>Potentiometry:</p> <p>14. Potentiometric titrations of strong acid / weak acid versus strong base.</p> <p>15. Determine redox potential of Fe²⁺ / Fe³⁺ system by titrating it with standard potassium dichromate solution.</p>	
<p>Text / Reference Books:</p> <ol style="list-style-type: none"> 1. Vogel's Text book of Quantitative Chemical Analysis, 3rd, 6th Ed. A. I. Vogel J. Mendham, et al, Addison Wesley Publishing Co. 2. Experiments in Chemistry by D. V. Jahagirdar, Himalaya publication 2014 3. Systematic experimental physical chemistry by S. W. Rajbhoj, T. K. Chondekar, Anjali publication. 4. Practical Physical Chemistry, Vishwanathan and Raghwan Viva book 5. Practical Chemistry by O.P. Pandey, D.N. Bajpai & S. Giri, S. Chand & Company Ltd. 6. Senior Practical Physical Chemistry by B. D. Khosla, V. C. Garg and A. Gulati, S. Chand & Co. New Delhi (2011) 7. Experiments in Physical Chemistry by C. W. Garland, J.W. Nibler & D.P. Shoemaker, 8th Ed: McGraw-Hill New York (2003) 		

8. Experimental Physical Chemistry by A.M. Halpern & G.C. McBane. 3rd Ed: W.H. Freeman & Co.. New York (2003)
9. Advanced Physical Chemistry Experiment by Gurtu and Gurtu, Pragati Publication

SCC00022003T

CHE/MN/T/200

Title of Paper: Concepts of Chemistry I

Credits: 02

Total Contact Hours: 30

Internal Assessment 20 Marks
Marks

University Assessment 30

Learning Objectives of the Course:

1. To understand the structure and functions of carbohydrates
2. To understand the concept, reaction and significance of amino acids.
3. To understand structure, function and significance of proteins.
4. To understand the basic concept of organic reaction mechanism.
5. To understand preparations and reactions of alcohols carboxylic acids, aldehyde and ketones.
6. To understand the nomenclature of organic compounds.
7. To understand Various name reactions with mechanism

Course Outcomes (COs):

After completion of the course, students will be able to:

1. Apply knowledge of carbohydrates, amino acids and proteins for dietary analysis
2. Understand that different name reactions are involved in organic chemistry.
3. Apply the mechanism of organic reaction mechanisms.
4. Understand preparations and reactions of alcohols, carboxylic acids, aldehydes and ketones.
5. Understand the nomenclature of organic compounds

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Alcohols: Nomenclature of alcohols, Preparation of alcohols: Preparation of 1°, 2°, and 3° alcohols using Grignard reagent, Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid, and esters. The acidic nature of alcohol. Reactions of alcohol: HX (Lucas test), esterification, PCC, alkaline KMnO ₄ , acidic dichromate, and Oppenauer oxidation. Pinacol-Pinacolone rearrangement with mechanism. Phenols: Acidic nature of phenol. Preparation of phenol from Cumene and diazonium salts. Reactions of phenol: Nitration, halogenation, sulphonation, Reimer-Tiemann Reaction, Gattermann-Koch Reaction.	10
II	Aldehydes and Ketones: IUPAC nomenclature of aldehyde and ketones, Preparation: from acid chlorides and nitriles. Reactions of aldehydes and	10

	ketones with HCN, ROH, NaHSO ₃ , NH ₂ -G derivatives. Iodoform test, Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation, Clemenson reduction, and Wolff-Kishner reduction. Carboxylic acid: IUPAC nomenclature of carboxylic acids, factors affecting acidity of carboxylic acids. Preparation: from esters, nitriles and alcohol. Reactions: PCl ₃ , SOCl ₂ esterification, Hell-Volhard-Zelinsky Reaction, synthesis amides and acid anhydrides.	
III	AMINOACIDS Amino acids: classification of amino acids. Concept of ampholytes, isoelectric pH, zwitterions, titration curve of glycine. Reactions of amino acid with Ninhydrin, Sanger's, Dansyl chloride, and Edmann's reagents and their significance. Peptide bond and its features. PROTEINS Classification based on function, nutrition and composition. Structural organization of proteins-primary, secondary, tertiary and quaternary structures	10
Text / Reference books:		
<ol style="list-style-type: none"> Graham Solomon, T.W., Fryhle, C.B. & Snyder, S.A. Organic Chemistry, John Wiley & Sons (2014). McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Edition, 2013. Sykes, P. A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988). Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010. Stanley Pine, Organic Chemistry, 5th edition. Mukherjee, Singh and Kapoor, Organic Chemistry Vol. I, II and III -Wiley Eastern. S.K. Ghosh, Organic Chemistry. S.M. Mukherjee and S.P. Singh, Reaction Mechanism in Organic Chemistry. P S Kalsi, Organic reactions and their mechanism. Grossman, Robert B, The Art of Writing Reasonable Organic Reaction Mechanism Raj K Bansal Organic chemistry <p>P.S. Kalsi, Text book of Organic Chemistry, Macmillan India Ltd., 1999, Delhi.</p>		

SCC00022013T

CHE/MN/T/201

Total Credits: 02

University Assessment 30 Marks

Title of Paper: Concepts of Chemistry II

Total Contact Hours: 30 Hrs.

Internal Assessment 20 Marks

Learning Objectives of the Course:

1. To understand principles of electrolytic conduction and its applications.
2. To study various theories and phenomenon related to atomic structure.
3. To understand various laws of photochemistry and photochemical processes.

Course Outcomes (COs):

After completion of the course, students will be able to:

1. Understand the principles of electrolytic conduction.
2. Apply the principles of electrolytic conduction.
3. Analyse the phenomenon related to atomic structure.
4. Remember the various laws of photochemistry.
5. Evaluate the photochemical processes.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Conductometry: Introduction, conductance, resistance, electrolytic conductance, Ohm's law, cell constant, specific and equivalent conductance, molar conductance, conductivity cell. determination of cell constant, conductometric titrations, Numerical	10
II	Quantum Chemistry: Introduction, Black body radiation, Planck's radiation law, photoelectric effect, Compton effect, Bohr's model of hydrogen atom (no derivation) and its defects, de Broglie hypothesis. Heisenberg's uncertainty principle.	10
III	Photochemistry: Introduction, Lambert's law, Beer's law, Lambert - Beer's law, Difference between thermal and photochemical processes, Laws of photochemistry: Grothus - Draper law, Stark-Einstein law, Jablonski diagram depicting various processes occurring in the excited state, Qualitative description of fluorescence and phosphorescence, photosensitization, Chemiluminescence.	10

SDC00022003T**CHE/GE/T /200****GE : General Chemistry**

Total Credits : 02

Total Contact Hours : 30 Hrs

University Assessment 30 Marks Internal Assessment 20 Marks

Maximum Marks : 50

Learning Objectives of the Course:**Course Outcomes (COs) :**

After completion of the course, students will be able to -

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Importance of Chemistry Introduction, the need for Chemical literacy, Periodic table, Elements in the human body, Essential, Non-essential elements in human body, Criteria of essentiality. Classification and sources of nutrients: Understanding the role of carbohydrates, proteins, and lipids in food systems, Chemical structures and functions of macromolecules. Carbohydrate-rich foods: Wheat, rice, potato, sugar, etc. Protein-rich foods: Egg, milk, meat, fish, pulses, etc. Fat-rich foods: Oil, ghee, butter, groundnut, etc. Vitamins: Classification and Nomenclature. Sources, deficiency diseases and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1, Vitamin rich foods: Fruits, green leafy vegetables, minerals.	10 Hrs
II	Chemistry of Water Different sources of potable water: Surface water (a lake, river streams, or reservoir, springs), Groundwater (for example, an aquifer), Soft water, Hard water, Softening of water. Properties of Water: pH, Density, TDS, Colour, Odour, Turbidity, Biological Contaminants. Water Treatment methods: Heat (including boiling), filtration, activated charcoal adsorption, chemical disinfection (e.g. chlorination, iodine, ozonation, etc.), ultraviolet purification, distillation (including solar distillation) and flocculation. Coagulation, Flocculation, Sedimentation, and desalination.	10 Hrs
III	Chemistry of surface cleansers Soaps and Detergents: Synthetic surfactants and their mode of action. Basic chemical compositions of soaps, Surface active agents, builders, additives, fillers and fragrance, toilet soap, bathing bars, washing soaps. Biodegradability. Detergents– Introduction, Detergent action, Significance of acidity and alkalinity. Common detergent chemicals. Dry cleaning and its effect on the environment.	10 Hrs

SEC00022003T**CHE/VSC/T/200****: (Title of Paper) FOOD ADULTERATION**

Total Credits : 01

Total Contact Hours : 15 Hrs

Summative SEE: 30 Marks

Formative CIA : 20 Marks

Learning Objectives of the Course:

- i) To educate about common food adulterants and their detection.
- ii) To impart knowledge in the legislator aspects of adulteration.
- iii) To be able to extend their knowledge to other kinds adulteration, detection and consumer protection.
- iv) To introduce students to food safety and standardization act and quality control of foods.

Course Outcomes (COs) : After completion of the course, students will be able to -

- i) Get basic knowledge of various food adulterations.
- ii) Understand the adulteration of common foods and their adverse impact on health.
- iii) Comprehend certain skills of detecting adulteration of common foods.
- iv) Know the basic laws and procedures regarding food adulteration and consumer protection.
- v) Apply the knowledge of food adulteration to other kinds of adulteration.

Module No.	Topics / actual contents of the syllabus	Contact Hours
Unit I	Food Adulteration: Definition, incidental and intentional adulteration, common adulterants in food, health hazards and risks. Methods of detection of adulteration in food (theoretical aspects): Milk, oil, coffee, tea, grain, sugar, food color, spices, fruits and vegetables.	5 Hrs
Unit II	Food Additives: Antioxidants, preservatives, Nutrient supplements, emulsifiers, thickening agents, sweeteners, coloring and flavoring agents.(at least two methods of detection for each food item)	5 Hrs
Unit III	Food laws and Standards: Good manufacturing practices (GMP), Food standards: PFA, FPO, AGMARK, ISI, BIS. Role of food and drug administration and food inspector, Role of quality control laboratory. Highlights of food safety and	5 Hrs

standard act 2006 (FSSA), Consumer education, consumers rights and responsibilities, COPRA-2019-Offenses and penalties.	
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Text / Reference Books:

- 1) A first course in food analysis- A.Y.Sathe, New Age International (P) Ltd., 1999.
- 2) Food safety: case Studies-Ramesh V.Bhat, NIN, 1992.
- 3) DART-Detect adulteration with rapid test. FSSAI, imprinting trust, assuring safe and nutritious food, Ministry of health and family welfare, Govt. of India.
- 4) Rapid detection of food adulterants and contaminants, Theory and Practice, S.N.Jha, 2016, Kindle edition.
- 5) Domestic Tests for food adulterations, H.C. Christian.
- 6) Food Safety and Standards Act, 2006. Edited by Virag Gupta, November 2020, Commercial Law Publishers.
- 7) Chemical Methods in food analysis-Jacob, CBS Publications and Distributors, Delhi, 1999.
- 8) Pearson's Chemical Analysis of foods-Egan, Kiv, Sawyer, Addison Wesley England, 1991.
- 9) <https://www.fssai.gov.in/>
- 10) <https://indianlegalsolutionn.com/laws-on-food-asulteration/>
- 11) <https://fssai.gov.in/dart/>
- 12) Wikipedia.
- 13) <https://byjus.com/biollogy/food-adulteratiion/>

SEC00022263P

CHE/VSC/P/226 : (Title of Paper) Lab Course – FOOD ADULTERATION

Total Credits : 01

Total Contact Hours : 30 Hrs

Summative SEE: 30 Marks

Formative CIA : 20 Marks

Learning Objectives of the Course:

- i) To educate about common food adulterants and their detection.
- ii) To impart practical knowledge in aspects of food adulteration.
- iii) To be able to extend their practical knowledge to other kinds adulteration, detection and consumer protection.
- iv) To make students skilled in food adulteration testing and analytical instrumentation.

Course Outcomes (COs) :

After completion of the course, students will be able to -

- i) Know the basic and procedures regarding food adulteration.
- ii) Comprehend certain skills of detecting adulteration of common foods.
- iii) Analyse the quality and adulteration of various food materials.
- iv) Perform practical's skilfully related to food adulteration.
- v) Detects skilfully adulterants in given sample by using chemical test.
- vi) Understand the exact chemical reaction involved in food adulteration chemical tests.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	<ol style="list-style-type: none">1. To detect the adulterants like paraffin wax/hydrocarbons, dyes and Argemone in the fats, oils and ghee.2. To detect the presence of adulterants like water, proteins, urea Formalin, detergents, synthetic milk, sugar and starch in the milk.3. To detect the adulteration of insoluble substance, chalk powder and washing soda in sugar.4. To detect the adulteration of Red lead salts /brick powder in chilli powder, yellow lead salt/colored saw dust in turmeric and dried papaya seeds in pepper.5. To detect Sugar as an adulterants in honey.6. To detect adulterants in spices.7. To detect clay, chicory powder and iron fillings in coffee and tea.	30 Hrs

	8. To detect washing soda, chalk powder, metanil yellow color in jiggery.	
<p>Text / Reference Books:</p> <p>8) Some Forms of Food Adulteration and Simple Methods for Their Detection; Volume No.100, Burton James Howard and Willard Dell Bigelow</p> <p>9) Frontiers in Drug Safety, Adulteration Analysis of Some Foods and Drugs, Vol.1, Alankar Shrivastava.</p> <p>10) Chemical Methods in food analysis-Jacob, CBS Publications and Distributors, Delhi, 1999.</p> <p>11) Domestic Tests for food adulterations, H.C. Christian.</p> <p>12) A Laboratory manual of Food Analysis- S. Sehgal, Wiley Publishers.</p> <p>13) Rapid detection of food adulterants and contaminants, Theory and Practice, S.N.Jha, 2016, Kindle edition.</p> <p>14) DART-Detect adulteration with rapid test. FSSAI, imprinting trust, assuring safe and nutritious food, Ministry of health and family welfare, Govt. of India.</p>		
<p>Web resources:</p> <p>1) Chrome extension://efaidnbmnnnibpcajpcglclefindmkaj/https://foodsafety.delhi.gov.in/sites/default/files/generic_multiple_files/quick_test_final_2014.pdf</p> <p>2) chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://dfda.goa.gov.in/images/PDF-DOCUMENTS/quciktestforsomeadullterantsinfood-fssaiinitiative.pdf</p> <p>3) chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ifuwa.org/pdf/Food%20Adulteration%20Testing%20Manual%20(14%20Edition).pdf</p> <p>4) chrome-extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.aau.in/sites/default/files/qualitative_tests_for_detection_of_common_adulterants_in_milk_oct2021.pdf</p>		

SEC00022013T

CHEM/VSC/T/201: (Title of Paper)

Sauces and Ketchups

Total Credits : 01

Total Contact Hours : 15 Hrs

Summative SEE: 30 Marks

Formative CIA : 20 Marks

Learning Objectives of the Course:

- i) To impart knowledge about preparation and analysis of sauces and ketchups
- ii) To impart knowledge in the legislator aspects of adulteration.
- iii) To be able to extend their knowledge to other kinds adulteration, detection and consumer protection.
- iv) To introduce students to food safety and standardization act and quality control of foods.

Course Outcomes (COs) : After completion of the course, students will be able to -

- vi) Get basic knowledge of various Sauce and ketchups.
- vii) Understand the adulteration of common foods and their adverse impact on health.
- viii) Comprehend certain skills of detecting adulteration of common foods.
- ix) Know the basic laws and procedures regarding food adulteration and consumer protection.
- x) Apply the knowledge of food adulteration to other kinds of adulteration.

Module No.	Topics / actual contents of the syllabus	Contact Hours
Unit -I	SAUCES- I Introduction, Basic Types of sauces(Mother Sauces), Basic steps of Marinara, Ingredients of Basic Sauces, pH and preservation of Sauces, five qualities of a good sauce. Sauce flour, Roux and its types, Manufacturing of Tomato sauce, Reduction, Emulsification, thickening processes sauce making. Preservatives used in tomato sauce manufacturing.	5 Hrs
Unit II	SAUCES- II Role of apocarotenoids, Potash, Potassium nitrate, and Calcium Chloride in tomato sauce manufacturing process. NPK ratio for tomatoes required for sauce making, Steps involved in industrial manufacturing of tomato sauce. Ketchup I Introduction, History of Tomato ketchup and Mushroom Ketchup, Composition, Nutritional value as per USDA,	5 Hrs
Unit III	Ketchup II Food Nutrient Database, Viscosity, Pseudoplastic, pH of ketchup, Characteristics, Difference between tomato sauce and tomato ketchup, Raw materials and Key ingredients if Ketchup, Chemicals used in Ketchup manufacturing.	5 Hrs

	Manufacturing Process of tomato ketchup with flow chart. Pasteurization of tomato Ketchup	
<p><i>Text / Reference Books:</i></p> <p>14) A first course in food analysis- A.Y.Sathe, New Age International (P) Ltd., 1999.</p> <p>15) Food safety: case Studies-Ramesh V.Bhat, NIN, 1992.</p> <p>16) DART-Detect adulteration with rapid test. FSSAI, imprinting trust, assuring safe and nutritious food, Ministry of health and family welfare, Govt. of India.</p> <p>17) Rapid detection of food adulterants and contaminants, Theory and Practice, S.N.Jha, 2016, Kindle edition.</p> <p>18) Domestic Tests for food adulterations, H.C. Christian.</p> <p>19) Food Safety and Standards Act, 2006. Edited by Virag Gupta, November 2020, Commercial Law Publishers.</p> <p>20) Chemical Methods in food analysis-Jacob, CBS Publications and Distributors, Delhi, 1999.</p> <p>21) Pearson's Chemical Analysis of foods-Egan, Kiv, Sawyer, Addison Wesley England, 1991.</p> <p>22) https://www.fssai.gov.in/</p> <p>23) https://indianlegalsolutionn.com/laws-on-food-asulteration/</p> <p>24) https://fssai.gov.in/dart/</p> <p>25) Wikipedia.</p> <p>26) https://byjus.com/biollogy/food-adulteratiion/</p>		

SEC00022273P

CHE/VSC/P/227: (Title of Paper) Lab Course – SAUCE AND KETCHUPS

Total Credits : 01

Total Contact Hours : 30 Hrs

Summative SEE: 30 Marks

Formative CIA : 20 Marks

Learning Objectives of the Course:

- i) To educate about common food adulterants and their detection.
- ii) To impart practical knowledge in aspects of food adulteration.
- iii) To be able to extend their practical knowledge to other kinds adulteration, detection and consumer protection.
- iv) To make students skilled in food adulteration testing and analytical instrumentation.

Course Outcomes (COs) :

After completion of the course, students will be able to -

- i) Know the basic and procedures regarding food adulteration.
- ii) Comprehend certain skills of detecting adulteration of common foods.
- iii) Analyse the quality and adulteration of various food materials.
- iv) Perform practical's skilfully related to sauce and ketchups.
- v) Detects skilfully adulterants in given sample by using chemical test.
- vi) Understand the exact chemical reaction involved in food adulteration chemical tests.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	<ol style="list-style-type: none">1. To determine pH of sauce and ketchup2. To measure viscosity of sauce3. To measure viscosity of ketchup4. Assess the color of the sauce using spectrophotometer5. Quantitative determination of total acid content of ketchup6. Quantitative determination of total acid content in sauce7. To determine amount of total soluble solids in sauces using refractometer8. To determine amount of total soluble solids in ketchup using refractometer9. To prepare tomato sauce in laboratory10. To prepare tomato ketchup in laboratory	30 Hrs

Text / Reference Books:

- 1) Some Forms of Food Adulteration and Simple Methods for Their Detection; Volume No.100, Burton James Howard and Willard Dell Bigelow
- 2) Frontiers in Drug Safety, Adulteration Analysis of Some Foods and Drugs, Vol.1, Alankar Shrivastava.
- 3) Chemical Methods in food analysis-Jacob, CBS Publications and Distributors, Delhi, 1999.
- 4) Domestic Tests for food adulterations, H.C. Christian.
- 5) A Laboratory manual of Food Analysis- S. Sehgal, Wiley Publishers.
- 6) Rapid detection of food adulterants and contaminants, Theory and Practice, S.N.Jha, 2016, Kindle edition.
- 7) DART-Detect adulteration with rapid test. FSSAI, imprinting trust, assuring safe and nutritious food, Ministry of health and family welfare, Govt. of India.

Web resources:

- 1) Chrome

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://foodsafety.delhi.gov.in/sites/default/files/generic_multiple_files/quick_test_final_2014.pdf

- 2) chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://dfda.goa.gov.in/images/PDF-DOCUMENTS/quciktestforsomeadullterantsinfood-fssaiinitiative.pdf

- 3) chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.ifuwa.org/pdf/Food%20Adulteration%20Testing%20Manual%20(14%20Edition).pdf

- 4) chrome-

extension://efaidnbmnnnibpcajpcglclefindmkaj/https://www.aau.in/sites/default/files/qualitative_tests_for_detection_of_common_adulterants_in_milk_oct2021.pdf

Fourth Semester

SAC00022504T

CHE/DSC/T/250 :

(Inorganic Chemistry) : Theory Course

Total Credits : 02

Total Contact Hours : 30 Hrs

University Assessment 30 Marks

Internal Assessment 20 Marks

Maximum Marks : 50

Learning Objectives of the Course:

- i) Student will learn electronic configuration of first transition element.
- ii) To understand the properties of first transition element.
- iii) To understand coordination compound and different isomerism.
- iv) To understand the formation of coordination compound on basis of VBT.
- v) To understand assumptions and application of CFT towards different geometry.
- vi) Students will learn volumetric analysis.

Course Outcomes (COs) :

After completion of the course, students will be able to –

- i. To understand transition elements and its characteristic properties.
- ii. Understand the assumptions and Werner's coordination theory.
- iii. Understand the different types of isomerism.
- iv. Differentiate between VBT and CFT.
- v. Understand the formation of outer and inner orbital complexes.
- vi. Understand the basic concepts of volumetric analysis.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Chemistry of First Transition Series Elements General characteristic feature of d-block elements Properties of the elements of the first transition series: Atomic Size, Ionic Size, Metallic properties, Ionization potential, Magnetic properties, Oxidation State. Co-ordination Compounds Double salt, Coordination compound, Coordinate bond, Types of ligand, Chelate, Central metal ion, Charge on complex ion, Calculation of oxidation state of central metal ion. IUPAC nomenclature, Werner's Theory, Effective atomic number rule, Types of isomerism, Geometric isomerism and Optical isomerism in octahedral complexes.	10 Hrs

<p style="text-align: center;">II</p>	<p style="text-align: center;">Valence Bond Theory of Coordination Compound</p> <p>Aspects and assumptions of VBT, Applications of VBT. Hybridisation, structure and bonding in Inner orbital complexes $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Fe}(\text{CN})_6]^{2-}$, and Outer orbital $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Co}(\text{NH}_3)_6]^{2+}$, $[\text{FeF}_6]^{3-}$, $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$, Limitation of VBT</p> <p style="text-align: center;">Crystal Field Theory</p> <p>Assumptions of Crystal Field Theory, Spectrochemical Series, Crystal Field Splitting in Octahedral, Tetrahedral and Square Planar Complexes, , Crystal field stabilization energy (CFSE) and factor affecting crystal field parameter.</p>	<p style="text-align: center;">10 Hrs</p>
<p style="text-align: center;">III</p>	<p style="text-align: center;">Volumetric Analysis</p> <p>Introduction Acid-base titration ,Theory of indicators, Neutralization curves and choice of indicators for Strong acid-strong base and Weak base -strong acid., Complexometric titrations - Introduction , Types of EDTA titrations Metallochromic indicator- Eriochrome black- T , Indicator Action of Eriochrome black- T , Redox Titrations- Introduction , KMnO_4 Vs Oxalic acid titration, Theory of KMnO_4 as self indicator. Precipitation Titrations - Introduction , Silver nitrate Vs Sodium chloride solution using Potassium chromate indicator</p>	<p style="text-align: center;">10 Hrs</p>
<p><i>Text / Reference Books:</i></p> <ol style="list-style-type: none"> 1. Concise Inorganic Chemistry by J.D. Lee. 2. Advanced inorganic chemistry by Gurudeep Raj and Chatwal Anand. 3. Advanced inorganic chemistry vol. II by Satyaprakash, Tuli, Basu and Madan. 4. Inorganic chemistry by Huheey, keiter and Keiter. 5. Basic Inorganic Chemistry by Cotton,F.A.,Wilkinson.. 6. Principles of Inorganic Chemistry by Puri,Sharma, Kaliya. 7. Vogels Qualitative Inorganic Analysis (Seventh Edition). 		

SAC00022764P

CHE/DSC/P/ 276

: (Inorganic Chemistry) Lab Course 7

Total Credits : 02

Total Contact Hours : 60 Hrs

University Assessment 30 Marks

Internal Assessment 20 Marks

Maximum Marks : 50

Learning Objectives of the Course:

- i) The principles of gravimetric analysis and apply the same for coordination complexes.
- ii) To train how to prepare coordination complexes.
- iii) To characterization the coordination compounds.
- iv) Follow established SOPs for various chemical experiments

Course Outcomes (COs) :

After completion of the course, students will be able to –

- i) Understand synthesis of coordination compounds and metal and ligand bonding.
- ii) Understand the principle of gravimetric analysis and able to estimate Ni, Cu, Fe, Al, Ba, Ca, Mn and Zn
- iii) Know how to prepare coordination complexes
- iv) Know how to calculation of Experiments.

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Synthesis of Coordination compounds 1. Synthesis of sodium cobalt(II) nitrite from Co(II) salt and NaNO ₂ salts. 2. Synthesis of potassium Tris(oxalate)aluminium(III) K ₃ [Al(C ₂ O ₄) ₃] using Al Metal powder (Scrap Aluminium). 3. Synthesis of Tris(acetyl acetone)iron(III) [Fe(C ₅ H ₇ O ₂) ₃] by reaction between Fe(OH) ₃ and acac. by green chemistry method 4. Synthesis of Tris(ethylenediamine)nickel(II) from Ni(II) salt, ethylenediamine and Sodium thiosulfate. 5. Synthesis of K[Cr(C ₂ O ₄) ₂ .(H ₂ O) ₂] Potassium dioxalatodiaquachromate (III) 6. Synthesis of Tetra ammine copper(II)sulphate, [Cu(NH ₃) ₄]SO ₄ .H ₂ O 7. Synthesis of Hexaaminecobalt (III) chloride. [Co(NH ₃) ₆]Cl ₃	30 Hrs

II	<p>Gravimetric estimation</p> <p>8. Estimation of nickel (II) gravimetrically as using Nickel Dimethylglyoxime (Ni-DMG) in the given solution.</p> <p>9. Estimation of copper as CuSCN Cuprous thiocynate in the given solution of copper sulphate.</p> <p>10. Estimation of iron as Fe₂O₃ by precipitating iron as Fe (OH)₃.</p> <p>11. Estimation of Al(III) by precipitating with oxine and weighing as Al(oxine)₃(aluminiumoxinate)</p> <p>12. Estimation of Zn as Zinc ammonium phosphate.</p> <p>13. Estimation of Mn as Manganese ammonium phosphate.</p> <p>14. Estimation of Ba as Barium Chromate (BaCrO₄).</p> <p>15. Estimation of calcium as calcium oxide.</p>	30 Hrs
<p>Text / Reference Books:</p> <ol style="list-style-type: none"> 1) Vogel, A.I. (2002). A text book of Quantitative Analysis. ELBS. 2) Marr, G. & Rockett, B.W. (1972). Practical Inorganic Chemistry. Van Nostrand Reinhold. 3) Svehla, G. Vogel's Qualitative Inorganic Analysis, Pearson Education, 2012 4) Advanced Practical Inorganic Chemistry by Gurdeep Raj, Goel Publishing House, Meerut UP. 5) Vogel-A Text Book of Qualitative Inorganic Analysis. 6) O P Pandey, D.N, Practical Chemistry (for B.Sc. I,II and III year students) -.Bajpai and 7) Kolthoff and Sandell-Text book of qualitative Inorganic Analysis 		

SAC00022514T

CHE/DSC /T/251 : (Title of Paper) **APPLIED CHEMISTRY**
Total Credits : 02 Total Contact Hours : 30 Hrs
Summative SEE: 30 Marks Formative CIA : 20 Marks

Learning Objectives of the Course:

- vii) To understand the basic concept of spectroscopy.
- viii) To understand the nature and regions of electromagnetic radiations.
- ix) To understand the absorption of UV radiation by organic molecules leading to different excitations
- x) To understand principle and instrumentation of IR spectroscopy
- xi) To understand the difference between IR and Raman spectroscopy.

Course Outcomes (COs) :

- After completion of the course, students will be able to -
- xi) Know the different analytical spectroscopic techniques.
 - xii) Understand the phenomenon used in the UV-Visible Spectroscopy
 - xiii) Understand the interaction of radiation with matter.
 - xiv) Able to interpreting UV-Visible, IR spectra.
 - xv) Understand the methods of formation, structure and properties of the intermediate.
 - xvi) Understand the principle used in IR and Raman Spectroscopy

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Introduction to Spectroscopy Meaning of spectroscopy, Nature of electromagnetic radiation: wavelength, frequency, energy, amplitude, wave number and their relationship, Different units of measurement of wavelength and frequency, Different regions of electromagnetic radiations, Interaction of radiation with matter: absorption, emission, fluorescence and scattering, Types of spectroscopy and advantages of spectroscopic methods, Energy types and energy levels of atoms and molecules.	10 Hrs
II	UV-Visible Spectroscopy Introduction, Beer-Lambert's law, absorption of UV radiation by organic molecules leading to different excitations, Instrumentation, Terms used in UV Spectroscopy: Chromophore, Auxochrome, Bathochromic shift,	10 Hrs

	<p>hypsochromic shift, hyperchromic and hypochromic effect, Modes of electromagnetic transitions, Effect of conjugation on position of UV band, Calculation of λ_{max} by Woodward and Fischer rules for dienes and enones, Colour and visible spectrum, Applications of UV Spectroscopy. Numerical problems based on UV-Visible spectroscopy.</p>	
III	<p>A. IR Spectroscopy Introduction, Principle of IR Spectroscopy, Instrumentation - Schematic diagram, Theory of Molecular Vibrations, Fundamental modes of vibrations, Regions of IR spectrum, fundamental group region, finger print region, Selection Rules (Active and Forbidden Vibrations), Factors affecting IR absorption frequency, Interpreting IR spectra: functional group and fingerprint region. Infrared spectroscopy in organic molecules, IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on $>\text{C}=\text{O}$) stretching absorptions, Numerical problems based on IR spectroscopy.</p> <p>B. Raman Spectroscopy: Introduction, Classical and Quantum theory of Raman Effect, Rayleigh, Stokes and anti-Stokes lines, pure rotational Raman spectra of linear diatomic molecules</p>	10 Hrs
<p>Text / Reference Books:</p> <ol style="list-style-type: none"> 1. Absorption Spectroscopy of Organic Molecules by V. M. Parikh. 2. Spectroscopy of Organic compounds by P. S. Kalsi. 3. Elementary Organic Absorption Spectroscopy by Y. R. Sharma. 4. Instrumental Methods of Analysis (7th edition) by Willard, Merritt, Dean, Settle. 5. Spectroscopy by G. R. Chatwal and S. K. Anand 6. Spectroscopy by Pavia, Lampman, Kriz, Vyvyan 7. Organic Spectroscopy (2nd edition) by Jag Mohan 8. Organic Spectroscopy (3rd edition) by William Kemp 9. Instrumental Methods of Chemical Analysis by H. Kaur 10. Spectrometric Identification of Organic Compounds by R.M. Silverstein, G.C. Bassler, and T.C. Morrill (Wiley Publication, New York) 		

SAC00022774P
(Title of Paper) Lab Course -Applied chemistry

CHE/DSC/P/277:

Total Credits : 02

Total Contact Hours : 60 Hrs

Summative SEE: 30 Marks

Formative CIA : 20 Marks

Learning Objectives of the Course:

- v) To introduce applied chemistry practicals for skill development.
- vi) To understand how to estimate the content of drug molecule.
- vii) To understand the various determination methods for analysis of commercial products.
- viii) Develop proficiency in applied chemical laboratory techniques.
- ix) To understand the handling of sophisticated analytical instruments.
- x) To follow established SOPs for analysis of various products.

Course Outcomes (COs) :

After completion of the course, students will be able to -

- vii) To consistently follow established SOPs for various chemical analysis.
- viii) To know the handling of various sophisticated analytical instruments.
- ix) To maintain accurate and thorough records of experimental data, and analyze results to draw meaningful conclusions.
- x) To apply critical thinking skills to identify and address challenges that may arise during experiments, showcasing the ability to troubleshoot and optimize procedures.
- xi) To gain insights into how chemical lab practices are applied in professional research or industrial settings, preparing them for future careers in diverse scientific and industrial fields.
- xii) Students will exhibit ethical conduct in all features of laboratory work, highlighting integrity, accountability, and professionalism

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	1. Estimation of Aniline from a given tablet. 2. Determination of acetic acid in Commercial vinegar by titrating with standard NaOH solution. 3. Estimation of Paracetamol content in tablet. 4. Estimation of the vitamin-c content in tablet. 5. Estimation of Casein from milk sample. 6. Estimation of Rhodamine B from Chilli powder spectrophotometrically 7. Estimation of lead chromate in turmeric powder	60 Hrs

	<p>8. Estimation of Tannic acid from Tea sample by spectrophotometer/Colorimeter</p> <p>9. Interpretation of UV-Visible spectrum and calculation of λ_{\max} of Benzene, 1,3,5-Hexatriene, 4-Aminobenzoic Acid, Naphthalene, Anthracene, 4-Bromobenzoic acid, 4-Hydroxybenzoic acid, 3,4-Dihydroxybenzoic acid.(Any Four)</p> <p>10. Interpretation of IR spectrum of Ethyl alcohol, Cis-2-butene, Trans-2-butene, Benzoic acid, Propanaldehyde, Ethyl methyl ether, Ethyl acetate, Salicylic acid, Nitrophenols (Any Four)</p>	
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Text / Reference Books:

- 1) Food Analysis by Pearson
- 2) Food Analysis by A.G. Woodman. McGraw Hill.
- 3) Food Analysis by S.S.Neilson.
- 4) Standard methods of biochemical analysis by S.R.Thimmaiah.
- 5) Biophysical chemistry (Principles and techniques), Upadhyay, Upadhyay and Nath.

SCC00022504T	
CHEM/MN/T/250 :	Title of the Paper (Concepts of Chemistry III) : Theory Course
Total Credits : 02	Total Contact Hours : 30 Hrs
University Assessment 30 Marks	Internal Assessment 20 Marks
Maximum Marks : 50	
Learning Objectives of the Course:	
<ol style="list-style-type: none"> i) Student will learn electronic configuration of first transition element. ii) To understand the properties of first transition element. iii) To understand coordination compound and different isomerism. iv) To understand the formation of coordination compound on basis of VBT. v) To understand assumptions and application of CFT towards different geometry. vi) Students will learn Lanthanides and Actinides. 	
Course Outcomes (COs) :	
After completion of the course, students will be able to –	
<ol style="list-style-type: none"> i. To understand transition elements and its characteristic properties. 	

	<ul style="list-style-type: none"> ii. Understand the assumptions and Werner's coordination theory. iii. Understand the different types of isomerism. iv. Differentiate between VBT and CFT. v. Understand the formation of outer and inner orbital complexes. vi. Understand the basic concepts of Lanthanides and Actinides. 	
Module No.	Topics / actual contents of the syllabus	Contact Hours
I	<p>Chemistry of First Transition Series Elements</p> <p>General characteristic feature of d-block elements Properties of the elements of the first transition series: Atomic Size, Ionic Size, Metallic properties, Ionization potential, Magnetic properties, Oxidation State.</p> <p>Co-ordination Compounds</p> <p>Double salt, Coordination compound, Coordinate bond, Types of ligand, Chelate, Central metal ion, Charge on complex ion, Calculation of oxidation state of central metal ion. IUPAC nomenclature, Werner's Theory, Effective atomic number rule, Types of isomerism, Geometric isomerism and Optical isomerism in octahedral complexes.</p>	10 Hrs
II	<p>Valence Bond Theory of Coordination Compound</p> <p>Aspects and assumptions of VBT, Applications of VBT. Hybridisation, structure and bonding in Inner orbital complexes $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Fe}(\text{CN})_6]^{2-}$, and Outer orbital $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Co}(\text{NH}_3)_6]^{2+}$, $[\text{FeF}_6]^{3-}$, $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$, Limitation of VBT</p> <p>Crystal Field Theory</p> <p>Assumptions of Crystal Field Theory, Spectrochemical Series, Crystal Field Splitting in Octahedral, Tetrahedral and Square Planar Complexes, , Crystal field stabilization energy (CFSE) and factor affecting crystal field parameter.</p>	10 Hrs
III	<p>Chemistry of F-Block Elements</p> <p>Lanthanides</p> <p>Introduction, Occurrence, Position in the periodic table,</p>	10 Hrs

	<p>Electronic Configuration, Atomic Radii, Ionic Radii, Lanthanide Contraction, Consequences of Lanthanide Contraction and cause of Lanthanide Contraction, Oxidation state, Magnetic Properties of Lanthanides.</p> <p>Extraction of Lanthanides by ion exchange method, Applications of Lanthanides.</p> <p>Actinides</p> <p>Occurrence, Position in the periodic table, Electronic Configuration, Atomic Radii, Ionic Radii, Oxidation state of Actinides , Chemistry of separation of Np, Pu and Am from U Comparison of Lanthanides and Actinides.</p>	
<p><i>Text / Reference Books:</i></p> <ol style="list-style-type: none"> 1. Concise Inorganic Chemistry by J.D. Lee. 2. Advanced Inorganic Chemistry Volume I by Gurudeep Raj 3. Advanced Inorganic Chemistry Vol. II by Satyaprakash, Tuli, Basu and Madan. 4. Inorganic Chemistry by Huheey, Keiter and Keiter. 5. Basic Inorganic Chemistry by Cotton, F.A., Wilkinson.. 6. Principles of Inorganic Chemistry by Puri, Sharma, Kaliya. 7. Modern Inorganic Chemistry by R.D. Madan 		

SCC00022514T

CHE/MN/T/251

Title of the Paper: Concepts of Chemistry IV

Total Credits : 02

Total Contact Hours : 30 Hrs

University Assessment 30 Marks

Internal Assessment 20 Marks

Maximum Marks : 50

Learning Objectives of the Course:

- 1) To part knowledge of Electromagnetic Radiation (EMR)
- 2) To understand the energy bands of EMR.
- 3) Acquaint the interaction of EMR with matter
- 4) Understand the basics of colour compounds
- 5) To develop skill for the interpretation of IR and UV-Vis graphs.

Course Outcomes:

After completion of the course, students will be able to

- 1) Understand the interaction of EMR and matter.
- 2) Get idea about relationship between Energy, wavelength, frequency and wavenumbers.
- 3) Understand energy transitions, absorption and emission spectral phenomenon.

Module No.	Topics/Actual contents of the syllabus	Contact Hours
I	Basics of Spectroscopy Degree of freedom, Classification of Instrumental methods, Spectroscopy, Properties of Electromagnetic Radiation, Spectrum, Types of Molecular Energies, Interaction of EMR with matter, Origin of Spectrum, The Joblonski Diagram	10
II	UV-Visible Spectroscopy Introduction, Lambert' Law, Beer's Law, Deviations from Beer's Law, Instrumentation, Types of transitions in Inorganic and Organic molecules, Auxochromes, Chromophores, Bathochromic shift, Hypsochromic shift, Hyperchromic and Hypochromic shift, Applications	10
III	Infrared spectroscopy Introduction, Range of Infrared Radiation, Nomenclature of Infrared Spectra, Theory of Infrared Absorption Spectroscopy, Instrumentation, Comparison of Fourier Transform and Dispersive IR, Modes of vibrations in polyatomic molecules, Factors affecting on vibrational frequencies, Selection rules, Applications	10

Text / Reference Books:

1. Absorption Spectroscopy of Organic Molecules by V. M. Parikh.
2. Spectroscopy of Organic compounds by P. S. Kalsi.
3. Elementary Organic Absorption Spectroscopy by Y. R. Sharma.
4. Instrumental Methods of Analysis (7th edition) by Willard, Merritt, Dean, Settle.
5. Spectroscopy by G. R. Chatwal and S. K. Anand
6. Spectroscopy by Pavia, Lampman, Kriz, Vyvyan
7. Organic Spectroscopy (2nd edition) by Jag Mohan
8. Organic Spectroscopy (3rd edition) by William Kemp
9. Instrumental Methods of Chemical Analysis by H. Kaur
10. Spectrometric Identification of Organic Compounds by R.M. Silverstein, G.C. Bassler, and T.C. Morrill (Wiley Publication, New York)

SDC00022504T**CHE/GE/T/250****GE : Chemistry in Daily Life (IV SEM)**

Total Credits : 02

Total Contact Hours : 30 Hrs

University Assessment 30 Marks Internal Assessment 20 Marks

Maximum Marks : 50

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	Macromolecules in Food Understanding the role of carbohydrates, proteins, and lipids in food systems, Chemical structures and functions of macromolecules in cooking and nutrition, Impact of macromolecules on the taste, texture, and nutritional value of food Classification and sources of nutrients a) Carbohydrate-rich foods: Wheat, rice, potato, sugar, etc. b) Protein-rich foods: Egg, milk, meat, fish, pulses, etc. c) Fat-rich foods: Oil, ghee, butter, groundnut, etc. d) Vitamins rich foods: Fruits, green leafy vegetables e) vitamins and minerals	10 Hrs
II	Kitchen chemistry (Chemistry of Cooking) Physical and Chemical changes, Stability of nutrients during cooking. Microwave cooking, Food sterilization, Chemistry of spices and herbs, Safety protocols and best practices in kitchen chemistry.	10 Hrs
III	Food additives Adulterants and contaminants- Food preservatives like benzoates, propionates, sorbates, disulphites. Artificial sweeteners: Aspartame, saccharin, dulcin, sucralose, and sodium cyclamate. Flavors: Vanillin, alkyl esters (fruit flavors), and monosodium glutamate. Artificial food colorants: Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food. Safety considerations and regulatory aspects of food additives in food production.	10 Hrs

SEC00022504T**CHE/SEC//T/250****Lab Safety and Laboratory Practices**

Total Credits : 01

(Theory)

Total Contact Hours : 15 Hrs

Max. Marks : 50

Learning objective of Course: -

1. To understand safety protocols.
2. To understand the procedures of handling hazardous chemicals and its storage.
3. Develop proficiency in fundamental chemical lab safety and emergency response.
4. To develop skill in fire prevention burns, fire drills and risk control.
5. To access and utilize MSDS information.

Learning Course Outcomes: -

By the end of this course, student will be able to:

1. To consistently follow the established safety protocols.
2. To recognize hazards and implement safety measures.
3. To apply thinking skills to administer first aid for fire and chemical exposure.
4. To enhance workplace safety.
5. Able to disposed off hazardous chemicals/waste.

Module No.	Topics/ actual contents of the syllabus	Contact Hours
Unit I.	Laboratory Safety & Behavior : Introduction, Personal Practices, Lab dress and foot ware Food and drink in the lab Good Housekeeping, chemical spill Handling of acids and bases and it's arrangement in a lab shell, Chemical Waste disposal	5 hrs
Unit II	Laboratory Safety Glassware safety, Electrical safety, Gas safety, Materials Safety Data Sheets Personal protective equipment, PPE, Various safety goggles and masks Safety shoes, Acid room, Chemical Fume Hood safety and ventilation, Alcohol room, its location and approach path	5 hrs
Unit III	Emergency and fire management: Emergency response: Fire accident reporting, Emergency Contact information, Chemical Safety Committee : First aid box, safety rules, Eye washers, Fire extinguisher, it's handling	5 hrs

1. Safety in laboratory and good laboratory practices: Dr. N.D. Phatangare and P.H. Naikwadi
2. Prudent Practices in the Laboratory : Handling and Management of Chemical Hazards: Updated Version. National Research Council (US) Committee on Prudent Practices in the Laboratory. Washington(DC) : National Academies Press (US);
3. Laboratory Safety for Chemical Student; Robert H, Finster David C, John Willey
4. Laboratory Safety Handbook Fevzi Cakmak Cebeci; Fens Laboratory Safety Team
5. Laboratory Safety Theory and Practice; Anthony Fuscaldo Academic Press

SEC00022764P**CHE/SEC/P//276****Lab Safety and Laboratory Practices**Total Credits : 01
Max. Marks : 50

(Practical Paper)

Total Contact Hours : 30 Hrs

Learning objectives of the Course: -

1. To enhance the ability to recognize and interpret various safety symbols.
2. To provide practical knowledge on precautionary measures.
3. To facilitate individuals on first aid measures to overcome chemical accidents.
4. To develop awareness and competence in the safe disposal of hazardous chemicals.
5. To provide in-depth knowledge on the treatment and safety measures required in the case of chemical accidents,

Learning Course Outcomes: -

By the end of this course, student will be able to:

1. Understand various safety symbols, chemical packaging information.
2. Understand the precautionary measures required when handling hazardous substances.
3. To perform first aid effectively for chemical accidents.
5. Understand best practices for the disposal of hazardous chemicals

Module No.	Topics/ actual contents of the syllabus	Contact Hours
1.	<ol style="list-style-type: none"> 1. Recognition of Safety Symbols. 2. Recognition of Chemical Packings and Instrumentation with the conception of MSDS. 3. Material Safety data sheet with reference to POCl_3, $\text{K}_2\text{Cr}_2\text{O}_7$. 4. Demonstration of Pictograms of Chemicals used to study Precautionary measures in handling Hazardous substances. 5. Demonstration of Preventive measures for Chemical Accidents 6. Demonstration of First Aid measures to be taken for Mouth, Skin and Eye accidents 7. First aid treatment in case of acid Swallowed by student. 8. Disposal of Hazardous Chemicals. 9. First aid treatment in case of Bromine inhalation. 	30 hrs

1. Safety in laboratory and good laboratory practices Dr. N.D. Phatangare and P.H. Naikwade
2. Prudent Practices in the Laboratory : Handling and Management of Chemical Hazards: Updated Version. National Research Council (US) Committee on Prudent Practices in the Laboratory. Washington(DC) : National Academies Press (US);
3. Laboratory Safety for Chemical Student; Robert H, Finster David C, John Willey
4. Laboratory Safety Handbook Fevzi Cakmak Cebeci; Fens Laboratory Safety Team
5. Laboratory Safety Theory and Practice; Anthony Fuscaldo Academic Press

SEC00022514T (Title of Paper) INDUSTRIAL FERMENTATION & ALCOHOL TECHNOLOGY		
CHE/SEC/T/251: Total Credits : 01 Summative SEE: 30 Marks		Total Contact Hours : 15 Hrs Formative CIA : 20 Marks
Learning Objectives of the Course: <ul style="list-style-type: none"> i) Understand the basics of Industrial fermentation. ii) Study of Raw Materials used for fermentative production of alcohol. iii) Understand the composition, storage and properties of Molasses. iv) Understand Isolation and purification of cultures. v) Understand various forms of alcohols and its grades. vi) Study the various sources of Saccharine. 		
Course Outcomes (COs) : After completion of the course, students will be able to - <ul style="list-style-type: none"> i) Know the process of fermentation and role of microorganisms. ii) Get knowledge about row materials used for production of alcohol. iii) Able to understand the production statistics of ethyl alcohol. iv) Evaluate various forms of ethyl alcohol v) Understand the fermented and Pre-Conditioned Alcoholic beverages 		
Module No.	Topics / actual contents of the syllabus	Contact Hours
Unit I	A. Industrial Fermentation Introduction: Fermentation, types of fermentations and role of microorganism and other condition on fermentation., Raw Materials for fermentative production of alcohol, Molasses: Composition, storage, spontaneous combustion, grades and classification of molasses,	5 Hrs
Unit II	Other Saccharine Materials: cane juice, beet juice, sweet sorghum, mahua flowers, fruits' juices, etc., Starchy and Cellulosic Materials, Isolation and purification of cultures.	5 Hrs

Unit II	<p>Alcohol statistics and forms Production statistics of ethyl alcohol. Various forms of ethyl alcohol as an industrial, commercial commodity and its grades etc.</p> <p>Alcohol Technology</p> <p>Primary Rectified spirit, Potable Grade Alcohol, Pharmaceutical Grade Alcohol, Fuel Grade ethanol, Fermented and Pre-Conditioned Alcoholic beverages like Beer, Wine, Fruit Wine etc, Indian made foreign liquors (Blended and matured).</p>	5 Hrs
<p>Text / Reference Books:</p> <p>27) Industrial fermentation By. L.A. Under Koeffler, Chemica Pu.Co., New york</p> <p>28) Comprehensive Biotechnology Vol.3 By M.M.Young Pergamon Press LTD., Oxford</p>		

SEC00022774P	
CHE/SEC/P/277 :	(Title of Paper) Lab Course - Alcohol Fermentation
Total Credits : 01	Total Contact Hours : 30 Hrs
Summative SEE: 30 Marks	Formative CIA : 20 Marks
<p>Learning Objectives of the Course:</p> <ol style="list-style-type: none"> i) Understand the basics of fermentation and ethanol production. ii) Study the effect of sugar type, pH, and temperature on fermentation. iii) Learn distillation and alcohol measurement techniques. iv) Identify different alcohol grades and their uses. v) Quality testing of fermentation water and alcohol is performed. vi) Conduct chemical tests for aldehydes, esters, and acidity. vii) Develop skills in yeast isolation and viability testing. <p>Course Outcomes (COs) :</p> <p>After completion of the course, students will be able to -</p> <ol style="list-style-type: none"> i) Conduct experiments on alcohol fermentation using basic lab equipment. ii) Apply distillation techniques to purify ethanol. iii) Analyze the quality and composition of alcoholic beverages. iv) Identify and classify various types of alcohol based on standards. v) Evaluate the impact of fermentation conditions on ethanol yield. vi) Perform basic chemical analyses for quality control in spirits and wine. vii) Demonstrate practical skills in yeast handling and fermentation processes. 	

Module No.	Topics / actual contents of the syllabus	Contact Hours
I	<ol style="list-style-type: none"> 1. To study the fermentation process using molasses and other saccharine materials to produce ethanol. 2. Effect of Different Sugars on Fermentation Rate 3. Distillation of Fermented Alcohol Solution. 4. Production of Ethanol from Fruit Juices OR Preparation of wine from grapes. 5. Effect of pH and Temperature on Fermentation Efficiency 6. Identification of Different Alcohol Grades 7. Quality Testing of Fermentation Water 8. Determination of Alcohol By Specific Gravity Method 9. Determination of aldehyde content of spirit. 10. Determination of ester content of spirit. 11. Determination of pH and total acidity of wine. 12. Determination of alcohol content in wine. 	30 Hrs
<p><i>Text / Reference Books:</i></p> <ol style="list-style-type: none"> 8) Hand Book of Fermentation & Distillation-A.C.Chatterjee 9) The Alcohol Text Book – Lyons & Kelsall 10) Handbook of enology volume – I-Pascal Ribereau 11) Alcoholometry -Satyanarayana Rao 12) Handbook of alcohol technology-S.V.Patil 13) Industrial alcohol technology hand book-NPCSB of consultant & engineer 14) Manual of Methods Of Analysis Of Foods Alcoholic Beverages. 		

All theory papers Major, Minor, SEC, VSC and GE of chemistry, analytical chemistry and polymer chemistry

THEORY QUESTION PAPER PATTERN

Total Credits: 02 University Assessment 30 Marks			Total Contact Hours: 01 Hr Internal Assessment 20		
Question No	Title of the questions				Marks
1.	Choose correct option for following multiple choice questions. i. ii. iii. iv v				10
2	Solve Any Four of the following. a. b. c. d. e. f.				20

PRACTICAL QUESTION PAPER PATTERN

QUESTION PAPER PATTERN DSC- CHEM/DSC/P/226: Title of Paper: Organic Chemistry Lab Course:		
Total Credits:02		
University Assessment: 30 Marks		Internal Assessment: 20 Marks
Maximum Marks: 30 (UA) + 20 (IA) =50		
Question No	Title of the questions	Marks
1	Synthesis of from	12
2	Organic Qualitative Analysis Separation of Two Components from given binary mixture of organic compounds and systematic identification of one component qualitatively. (Water insoluble solid-solid type mixture)	15
3	Record Book and Viva	03

<p style="text-align: center;">QUESTION PAPER PATTERN DSC- CHEM/DSC/P/227: Title of Paper: Physical Chemistry Lab Course:</p>		
<p>Total Credits:02 Hours: University Assessment: 30 Marks Internal Assessment: 20 Marks Maximum Marks: 30 (UA) + 20 (IA) =50</p>		
Question No	Title of the questions	Marks
1	<p>a) To determine equivalence point of neutralization of CH₃COOH by pH-metric titration with NaOH</p> <p style="text-align: center;">OR</p> <p>b) To determine equivalence point of neutralization of HCl by pH-metric titration with NaOH</p> <p style="text-align: center;">OR</p> <p>c) To investigate the conductometric titration of strong acid against strong base</p> <p style="text-align: center;">OR</p> <p>d) To investigate the conductometric titration of weak acid against strong base</p> <p style="text-align: center;">OR</p> <p>e) Prepare standard solutions of KMnO₄ / CuSO₄, record their absorbance and verify Beer's law and determine unknown concentration.</p> <p style="text-align: center;">OR</p> <p>f) To determine the empirical formula of ferric salicylate complex by Job's method.</p> <p style="text-align: center;">OR</p> <p>g) Potentiometric titrations of strong acid / weak acid versus strong base.</p> <p style="text-align: center;">OR</p> <p>h) To determine redox potential of Fe²⁺ / Fe³⁺ system by titrating it with standard potassium dichromate solution.</p>	15
2	<p>a) To study the acid catalysed hydrolysis of an ester (methyl Acetate) and determine the rate constant (K) (First order reaction)</p> <p style="text-align: center;">OR</p> <p>b) To study the kinetics of saponification reaction between sodium hydroxide and ethyl acetate.</p> <p style="text-align: center;">OR</p>	12

	<p>c) To determine energy of activation of the reaction between $K_2S_2O_8$ and KI with unequal initial concentration.</p> <p style="text-align: center;">OR</p> <p>d) To determine the viscosities of two pure liquids A and B (Benzene and nitrobenzene) and hence find the composition of two liquids.</p> <p style="text-align: center;">OR</p> <p>e) To determine the molecular weight of a high polymer by viscosity measurement.</p> <p style="text-align: center;">OR</p> <p>f) To determine the percentage composition of a given mixture of two liquids by stalagmometer.</p> <p style="text-align: center;">OR</p> <p>g) To study the mutual solubility of phenol and water at various temperature. Determine the critical solution temperature.</p>	
3	Record Book and Viva	03

QUESTION PAPER PATTERN

DSC- 276 : Title of the paper (Inorganic Chemistry) Lab Course

Total Credits : 02

University Assessment 30 Marks

Internal Assessment 20 Marks

Maximum Marks : 50

Question No	Title of the question paper	Marks
1	1. Synthesis of sodium cobalt nitrite from Co (II) salt and NaNO_2 salts. OR 2. Synthesis of potassium Tris(oxalate)aluminium(III) using Al Metal powder (Scrap Aluminium). OR 3. Synthesis of Tris(acetylaceton)iron(III) by green chemistry method by reaction between $\text{Fe}(\text{OH})_3$ and acac. OR 4. Synthesis of Tris(ethylenediamine)nickel(II) from Ni(II) salt, ethyldiamine and Sodium thiosulfate. OR 5. Synthesis of $\text{K}[\text{Cr}(\text{C}_2\text{O}_4)_2 \cdot (\text{H}_2\text{O})_2]$ Potassium dioxalatodiaquachromate (III) OR 6. Synthesis of Tetra ammine copper(II)sulphate, $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4 \cdot \text{H}_2\text{O}$ OR 7. Synthesis of Hexaaminecobalt (III) chloride. $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$	15 Marks
2	8. Estimation of nickel (II) gravimetrically as using Nickel Dimethylglyoxime (Ni-DMG) in the given solution. OR	10 Marks

	<p>9. Estimation of copper as CuSCN Cuprous thiocyanate in the given solution of copper sulphate.</p> <p style="text-align: center;">OR</p> <p>10. Estimation of iron as Fe_2O_3 by precipitating iron as $\text{Fe}(\text{OH})_3$.</p> <p style="text-align: center;">OR</p> <p>11. Estimation of $\text{Al}(\text{III})$ by precipitating with oxine and weighing as $\text{Al}(\text{oxine})_3$ (aluminiumoxinate)</p> <p>12. Estimation of Zn as Zinc ammonium phosphate.</p> <p style="text-align: center;">OR</p> <p>13. Estimation of Mn as Manganese ammonium phosphate.</p> <p style="text-align: center;">OR</p> <p>14. Estimation of Ba as Barium Chromate (BaCrO_4).</p> <p style="text-align: center;">OR</p> <p>15. Estimation of calcium as calcium oxide.</p>	
3	Record Book & Viva -Voce	05 Marks

QUESTION PAPER PATTERN

CHEM/DSC/P/277: (Title of Paper) Applied chemistry
Lab Course - _____

Total Credits : 02

Hours :

Summative SEE: 30 Marks

Formative CIA : 20 Marks

Question No	Title of the question paper	Marks
1	<ol style="list-style-type: none">1. Estimation of Aniline from a given tablet.2. Determination of acetic acid in Commercial vinegar by titrating with standard NaOH solution.3. Estimation of Paracetamol content in tablet.4. Estimation of the vitamin-c content in tablet.5. Estimation of Casein from milk sample.6. Estimation of Rhodamine B from Chilli powder spectrophotometrically7. Estimation of lead chromate in turmeric powder8. Estimation of Tannic acid from Tea sample by spectrophotometer/Colorimeter	15
2	<ol style="list-style-type: none">1. Interpretation of UV-Visible spectrum and calculation of λ_{max} of Benzene, 1,3,5-Hexatriene, 4-Aminobenzoic Acid, Naphthalene, Anthracene, 4-Bromobenzoic acid, 4-Hydroxybenzoic acid, 3,4-Dihydroxybenzoic acid.(Any one) OR2. Interpretation of IR spectrum of Ethyl alcohol, Cis-2-butene, Trans-2-butene, Benzoic acid, Propanaldehyde, Ethyl methyl ether, Ethyl acetate, Salicylic acid, Nitrophenols (Any one)	10
3	Record Book and Viva-Voce	5

QUESTION PAPER PATTERN (Practical Exam)

CHEM/SEC/P/----- : (Title of Paper) Lab Course -FOOD ADULTERATION

Total Credits : 01

Time in Hours :

Summative SEE: 30 Marks

Formative CIA : 20 Marks

Question No	Title of the question paper	Marks
1	(Perform Any one experiment from the followings) 1. Detect the presence of paraffin wax/hydrocarbons, dyes and Argemone as adulterants in the fats, oils and ghee. 2. Detect the presence of water, proteins, urea Formalin, detergents, synthetic milk, sugar and starch as adulterants in the milk. 3. Detect the presence of Red lead salts /brick powder in chilli powder, yellow lead salt/coloured saw dust as adulterants in turmeric and dried papaya seeds in pepper. 4. Detect the presence of washing soda, chalk powder and metanil yellow colour as adulterants in jiggery.	15
2	(Perform Any one experiment from the followings) 1. Detect the presence of adulterants in given three spices. 2. Detect the presence of clay, chicory powder and iron fillings as adulterants in coffee. 3. Detect the presence of clay, chicory powder and iron fillings as adulterants in tea. 4. Detect the presence of insoluble substance, chalk powder and washing soda as adulterants in sugar. 5. Detect the presence of sugar as adulterants in honey.	10
3	Record Book and Viva-Voce	5