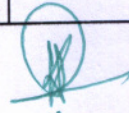


**BA/BSc/BCom/BBA/BCA**

**BSc Semester 1 – Chemistry (Hons) with specialization in Analytical Chemistry**

**Title of the Course: DSC-1: Analytical and Organic Chemistry – I**

Number of Theory Credits	Number of lecture hours/ semester	Number of practical Credits	Number of practical hours/ semesters
4	56	2	56
<b>Content of Theory Course 1</b>			<b>56Hrs</b>
<b>Unit – 1</b>			<b>14</b>
<p>Language of analytical chemistry: Definitions of analysis, determination, measurement, techniques and methods. Classification of analytical techniques. Choice of an analytical method - accuracy, precision, sensitivity, selectivity, method validation. Figures of merit of analytical methods and limit of detection (LOD), Limit of quantification (LOQ), linear dynamic range (working range).</p> <p>Errors and treatment of analytical data: Limitations of analytical methods – Errors: Determinate and indeterminate errors, absolute error, relative error, minimization of errors. Statistical treatment of finite samples -mean, median, range, standard deviation and variance. External standard calibration - regression equation (least squares method), correlation coefficient (<math>R^2</math>).</p> <p>Numerical problems</p> <p>Basic laboratory practices, calibration of glassware (pipette, burette and volumetric flask), Sampling (solids and liquids), weighing, drying, dissolving, Acid treatment, Rules of work in analytical laboratory, General rule for performing quantitative determinations (volumetric and gravimetric), Safety in Chemical laboratory, Rules of fire prevention and accidents, First aid. Precautions to be taken while handling toxic chemicals, concentrated/fuming acids and organic solvents.</p>			
<b>Unit - 2</b>			<b>14</b>
<p>Titrimetric analysis: Basic principle of titrimetric analysis. Classification. Preparation and dilution of reagents/solutions. Normality, Molarity and Mole fraction. Use of <math>N_1V_1 = N_2V_2</math> formula, Preparation of ppm level solutions from source materials (salts), conversion factors.</p> <p>Acid-base titrimetry: Titration curves for strong acid vs strong base, weak acid vs strong base and weak base vs strong acid titrations. Titration curves, Quantitative applications – selecting and standardizing a titrant, inorganic analysis - alkalinity, acidity.</p> <p>Complexometric titrimetry: Indicators for EDTA titrations - theory of metal ion indicators, titration methods employing EDTA - direct, back, displacement and indirect determinations, Application-determination of hardness of water.</p> <p>Redox titrimetry: Balancing redox equations, calculation of the equilibrium constant of redox reactions, titration curves, Theory of redox indicators, calculation of standard potentials using Nernst equation. Applications.</p> <p>Precipitation titrimetry: Titration curves, titrants and standards, indicators for precipitation titrations involving silver nitrate- Volhard's and Mohr's methods and their differences.</p> <p>Gravimetric Analysis: Requisites of precipitation, mechanism of precipitation, Factors influencing precipitation, Co-precipitation, post-precipitation, Advantages of organic reagents over inorganic reagents, reagents used in gravimetry (8-hydroxy quinoline (oxine) and dimethyl glyoxime (DMG)).</p> <p>Numerical problems on all the above aspects.</p>			
<b>Unit - 3</b>			<b>14</b>
<p>Classification and nomenclature of organic compounds, Hybridization, Shapes of organic molecules, Influence of hybridization on bond properties.</p> <p><b>Nature of bonding in Organic molecules</b></p> <p>Formation of Covalent bond, Types of chemical bonding, localized and delocalized, conjugation and cross conjugation, concept of resonance, electronic displacements: Inductive effect, Electromeric effect, Resonance and Hyper conjugation, cross conjugation explanation with examples. Concept of resonance, aromaticity, Huckel rule, anti-aromaticity explanation with examples. Strengths of Organic acid and bases: Comparative study with emphasis on factors effecting pK values. Relative strength of aliphatic and aromatic carboxylic acids-Acetic acid and chloroacetic acid, acetic acid and propionic</p>			





acid, acetic acid and Benzoic acid. Steric effect- Relative stability of trans and cis-2-butene. <b>Mechanisms of Organic Reactions</b> Notations used to represent electron movements and directions of reactions- curly arrows, formal charges. Types of bonds breaking- homolytic and heterolytic. Types of reagents-Electrophiles, nucleophiles, nucleophilicity and basicity. Types of organic reactions- substitution, addition, elimination, rearrangement and pericyclic reactions, explanation with examples. Chemistry of Aliphatic hydrocarbons, Carbon-Carbon Sigma bonds Chemistry of alkanes: Formation of alkanes, Wurtz reaction, Wurtz-Fittig reaction, Free radical substitution, Halogenation- relative reactivity and selectivity <b>Carbon-carbon pi bonds</b> Formation of alkenes and alkynes by elimination reaction. Mechanism of E1, E2, E1cb reaction. Saytzeff and Hofmann eliminations. Addition of HBr to propene, Free radical addition of HBr to propene. Addition of halogens to alkenes-carbocation and halonium ion mechanism. Stereospecificity of halogen addition. Ozonolysis mechanism - ozonolysis of propene. Addition of hydrogen halides to alkenes, mechanism, regioselectivity and relative rates of addition. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes, explanation with examples, 1,2 and 1,4- addition reactions in conjugated dienes. Diels-Alder reaction, Allylic and benzylic bromination and mechanism in propene, 1-butene, 1-toluene and ethylbenzene.	
<b>Unit - 4</b>	14
Nucleophilic substitution at saturated carbon. Mechanism of $S_N^1$ and $S_N^2$ reactions with suitable examples. Energy profile diagrams, Stereochemistry and factors effecting $S_N^1$ and $S_N^2$ reactions. Aromatic Electrophilic substitution reactions, Mechanisms, $\sigma$ and $\pi$ complexes, Halogenation, Nitration, Sulphonation, Friedel Crafts alkylation and acylation with their mechanism. Activating and deactivating groups. Orientation influence, Ortho-para ratio. Aromatic nucleophilic substitution reaction: $S_N^{Ar}$ and Benzyne mechanism with suitable examples	

#### Text Books

1. Vogel's Textbook of Quantitative Chemical Analysis, J. Mendham, R.C. Denney, J.D Barnes and M.J.K. Thomas, 6<sup>th</sup> edition, Third Indian Reprint, Pearson Education Pvt.Ltd.(2007).
2. Fundamentals of Analytical Chemistry, D.A. Skoog, D.M. West, Holler and Crouch, 8<sup>th</sup> edition, Saunders College Publishing, New York (2005).
3. Analytical Chemistry, G.D. Christian, 6<sup>th</sup> edition, Wiley-India (2007).
4. Practical Volumetric Analysis, Peter A C McPherson, Royal Society of Chemistry, Cambridge, UK (2015).
5. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
6. Finar, I. L. *Organic Chemistry (Volume I)*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education)
7. McMurry, J. E. *Fundamentals of Organic Chemistry*, 7<sup>th</sup> Ed. Cengage Learning India Edition, 2013
8. Organic Reaction mechanism by V. K. Ahluwalia and K. Parashar (Narosa Publishers).
9. Organic Chemistry by S. M. Mukherji, S. P. Singh and R. K. Kapoor. (Narosa Publishers)
10. A Guide book to mechanism in Organic Chemistry by Peter sykes. Pearson.

#### References

#### Pedagogy

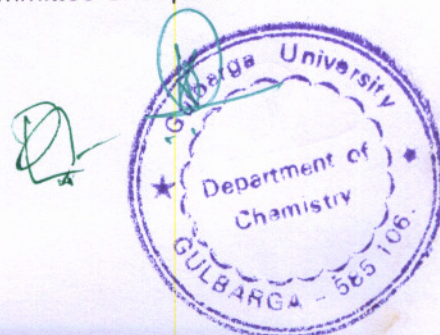
Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Internal Test	30
Sem End Exam	70
<b>Total</b>	<b>100</b>

Date

Course Co-ordinator

Subject Committee Chairperson

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## Content of Practical Course 1: List of Experiments to be conducted

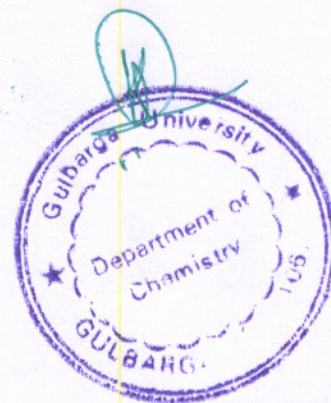
### PART-A Analytical Chemistry

1. Calibration of glassware, pipette, burette and volumetric flask.
2. Determination of sodium carbonate and sodium bicarbonate in a mixture.
3. Determination of alkali present in soaps/detergents
4. Determination of iron(II) using potassium dichromate
5. Determination of oxalic acid using potassium permanganate solution
6. Standardization of EDTA solution and determination of hardness of water
7. Determination of  $\text{Fe}^{2+}$  as  $\text{Fe}_2\text{O}_3$
8. Determination of  $\text{Ni}^{2+}$  as  $\text{Ni}(\text{DMG})_2$  complex.

### PART-B Organic Chemistry

1. Selection of suitable solvents for Purification/Crystallization of organic compounds.
2. Preparation of acetanilide from aniline using Zn/acetic acid (Green method).
3. Synthesis of p-nitro acetanilide from acetanilide using nitrating mixture.
4. Bromination of acetanilide (i) Conventional method and/or (ii) with ceric ammonium nitrate and potassium bromide (Green method).
5. Hydrolysis of methyl m-nitrobenzoate to m-nitrobenzoic acid (Conventional method)
6. Synthesis of diazoaminobenzene from aniline (conventional method).
7. Preparation of dibenzalacetone (Green method).
8. Diels Alder reaction between furan and maleic acid (Green method).

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## BSc Semester 1 – Chemistry (Hons) with specialization in Analytical Chemistry

### Title of the Course: OE-1: CHEMISTRY IN DAILY LIFE

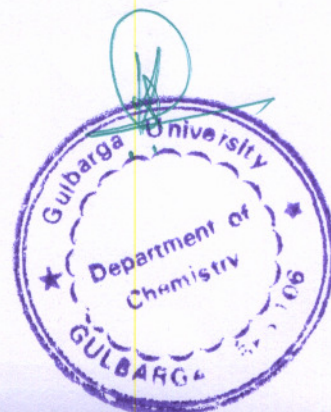
Number of Theory Credits	Number of lecture hours/ semester	Number of practical Credits	Number of practical hours/ semesters
3	42	-	42
Content of Theory Course 1			42 Hrs
Unit – 1			14
<b>Dairy Products:</b> Composition of milk and milk products. Analysis of fat content, minerals in milk and butter. Estimation of added water in milk. Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, determination of methyl alcohol in alcoholic beverages. <b>Food additives, adulterants, and contaminants-</b> 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. <b>Artificial food colorants:</b> Coal tar dyes and non-permitted colors and metallic salts. Analysis of pesticide residues in food.			
Unit - 2			14
<b>Vitamins:</b> Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1. <b>Oils and fats:</b> Composition of edible oils, detection of purity, rancidity of fats and oil. Tests for adulterants like argemone oil and mineral oils. Halphen test. <b>Soaps &amp; Detergents:</b> Definition, classification, manufacturing of soaps and detergents, composition and uses			
Unit - 3			14
<b>Chemical and Renewable Energy Sources:</b> principles and applications of primary & secondary batteries and fuel cells. Basics of solar energy, future energy storer. <b>Polymers:</b> Basic concept of polymers, classification and characteristics of polymers. Applications of polymers as plastics in electronic, automobile components, medical fields, and aerospace materials. Problems of plastic waste management. Strategies for the development of environment-friendly polymers.			

### Text Books

1. B. K. Sharma: Introduction to Industrial Chemistry, Goel Publishing, Meerut (1998)
2. Medicinal Chemistry- Ashtoush Kar.
3. Analysis of Foods – H.E. Cox: 13.
4. Chemical Analysis of Foods – H.E. Cox and Pearson.
5. Foods: Facts and Principles. N. Shakuntala Many and S. Swamy, 4<sup>th</sup> ed. New Age International (1998)
6. Physical Chemistry – P I Atkins and J. de Paula – 7<sup>th</sup> Ed. 2002, Oxford University Press.
7. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6<sup>th</sup> ed. 2001, FAI.
8. Organic Chemistry by I. L. Finar, Vol. 1 & 2. 9. Polymer Science and Technology, J. R. Fried (Prentice Hall).

### References

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## Pedagogy

Formative Assessment	
Assessment Occasion/ type	Weightage in Marks
Internal Test	30
Sem End Exam	70
<b>Total</b>	100

Date

Course Co-ordinator

Subject Committee Chairperson

