Vitthalbhai Patel & Rajratna P. T. Patel Science College
(Autonomous)
(Reaccredited with 'A' Grade by NAAC (CGPA 3.13)
Affiliated to SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
Syllabus effective from the Academic Year 2024-2025

(Bachelor of Science) (Undergraduate) (NEP-2020)
B. Sc. (UG) Semester-I

Course Code	**US01MACHE01**	Title of the Course	**GENERAL CHEMISTRY- I**
Total Credits of the Course	4	Hours per Week	4

Course Objectives:	To make students familiar with: 1. Chemistry as a subject. 2. Historic development and scope of chemistry 3. Basic concepts related to Organic, Inorganic, physical and analytical chemistry.

Course Content

Unit	**Description**	**Weightage* (%)**
1.	**ALKANE, ALKENE AND ALKYNE** **Hydrocarbons** : Physical properties of alkanes, alkene and alkynes, Common and IUPAC nomenclature of alkanes, alkenes and alkynes. **Alkanes**: Preparation from alkene by hydrogenation, reduction of alkyl halide, The Grignard reagent, Corey-House reaction, Wurtz reaction, Wurtz-Fittig reaction, Mechanism of halogenations, Orientation of halogenations : n-propane, n-butane, iso-butane, 2,3-dimethylbutane**,** n-pentane and isopentane, Ease of formation and stability of free radical. **Alkenes** : Geometrical isomerism (Cis-Trans and E-Z isomerism), Preparation of alkene from dehydrohalogenation of alkyl halide with Mechanism, dehydration of alcohol. The E^2 mechanism, Evidence : Absence of hydrogen exchange, element effect, Heat of hydrogenation and stability of alkene, The E^1 mechanism, Evidence accompanished by rearrangement, Electrophilic addition Mechanism, Electrophilic addition rearrangement, Mechanism of addition of halogen, Halohydrin formation, Free-radical addition, Hydroxylation, addition of alkene and alkane to alkene, Oxymercuration-Demercuration and Hydroboration-oxidation, Ozonolysis.	**25**

	Alkynes: Preparation from dehydrohalogenation of alkyl halide, Reaction of metal acetylide with primary alkyl halides, Hydration of alkynes, Acidity of alkynes, Analysis of alkynes.	
2.	**PERIODIC PROPERTIES** **Periodic Table:** Definition of periodic table, Periodic Law, Modern periodic table (Long form of periodic table), Merits of long form of periodic table, Brief introduction and types of elements, Atomic, ionic and covalent radii and its related numericals, Shielding effect and effective nuclear charge, Factor affecting the magnitude of σ and Z_{eff} and their variation in the periodic table, Slater's rule for calculation σ and Z_{eff}. **Ionization Energy**: Successive ionization energy, Factor affecting magnitude of Ionization Energy, Variation of IE values in main group element, Variation of IE values in different element groups, Ionization energies of isoelectronic species, Find out the order of second IE values of the element of second period, Difference between Ionization potential and Electrode potential of a metal. **Electron Affinity:** Relation between EA of X(g) atom and IE of X-(g) ion, EA2 represents energy required, Factor affecting the magnitude of electron affinity, Variation of electron affinity in main group elements of the periodic table, Variation of electron affinity values of different groups. **Electronegativity:** Different methods used for calculating electronegativity (like Pauling, Mulliken, Allred-Rachow),Factor affecting the magnitude of electronegativity, Role of electronegativity in chemical behaviour, Variation of electronegativity of the elements of different group, Variation of electronegativity in a period of s and p Block elements, Application of electronegativity. Numerical based on above topics.	**25**
3.	**IONIC EQUILIBRIA IN AQUEOUS SOLUTIONS** Sparingly Soluble Salts, Selective Precipitation, Acids & Bases; Arrhenius theory of Acids and Bases, The Lowry – Bronsted Concept, Strength of Acids and Bases, The Lewis concept, Numerical problems; Self Ionization of water, Weak acids and bases, Hydrolysis, Buffer Solutions; Indicator, Numerical based on above topics.	**25**
4.	**ANALYTICAL CHEMISTRY** Introduction, Qualitative and Quantitative analysis, Instrumental and	

	Chemical Methods of analysis, Applications of Chemical Analytical Chemistry, Sampling of Solid, Liquid and Gas, Stages of Analysis, Selection of Methods, Classification of quantitative analysis on the basis of : Quantitative execution of chemical reaction, Electrical measurements, Spectroscopic properties and Movement of substance in a medium under controlled condition, limitations of Analytical Methods, Classification of Errors, Accuracy and Precision, Absolute and Relative Error, Minimization of Error, Significant Figure, Rounding off, Mean, Median, Standard Deviation, , Distribution of Random Error, Reliability of Results (Q-test), Comparison of Results: Student's t-test and F-test, confidence limit (interval), Numericals based on above topics.	**25**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Class test/Internal written test 15 Marks (30%), Quiz 15 Marks (30%), Active learning 05 Marks (10%), Home Assignments 05 Marks (10%), Class Assignments 05 Marks (10%), Attendance 05 Marks (10%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 50 Marks (100%)].	50
2.	Semester End Examination [Total 50 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain the knowledge of Chemistry using various fundamental aspects of all four major branches of chemical sciences.

2.	Explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the several chemical reactions.
3.	To have knowledge of basic aspects of inorganic chemistry comprising of various aspects of periodic table.
4	Gain knowledge about various acid-base theory and their applications.
5	Know about use of various theoretical analytical methods and their applications.

Suggested References:

Sr. No.	References
1.	Morrison, R. T. & Boyd, R. N., *Organic chemistry* (6^{th} edition). (unit- 1)
2.	Clayden, J., Greeves, N., Warren, S., *Organic Chemistry* 2^{nd} Edition, Oxford University Press. (unit- 1)
3	Prakash S., Tuli, G. D., Basu, S. K., Madan R. D., *Advance inorganic chemistry* (Vol. - I). (unit- 2)
4	Lee J. D., *Concise Inorganic Chemistry* (4^{th} Edition). (unit- 2)
5	Cotton, F.A. & Wilkinson, G. *Basic Inorganic Chemistry*, Wiley. (unit- 2)
6	Mahan, B.H. *University Chemistry*, 3^{rd} Edition Narosa. (unit- 3)
7	Day, R. A. and Underwood A. L., *Quantitative Analysis* 6^{th} Edition. (unit- 4)
8	Vogel, A. I., *Textbook Quantitative Chemical Analysis*, Prentice-Hall, 5^{th} Ed. (unit- 4)

On-line resources to be used if available as reference material

On-line Resources : Google books, INFLIBNET, Google Web

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(Bachelor of Science) (Undergraduate) (NEP-2020)

B. Sc. (UG) Semester-I

Course Code	**US01MACHE02**	Title of the Course	**PRACTICAL IN CHEMISTRY- I**
Total Credits of the Course	4	Hours per Week	8

Course Objectives:	To make students familiar about: 1. Chemistry as a subject 2. Practical aspects of chemistry 3. Basic concepts related to volumetric analysis and qualitative analysis of inorganic substances. 4. Hands on training of laboratory practices.

Course Content	
Practical	**Description**
	Introduction to chemical laboratory, use of glassware, chemical and reagents, organic and inorganic solvents, bench reagents, side reagents, safety practices in the chemistry laboratory, knowledge about toxic chemicals and safety precautions in their handling.
1.	**Analysis of Inorganic substances (water soluble and water insoluble)** Identification of inorganic substance [at least 12 substances] as a positive and negative radicals like : Pb^{+2}, Cu^{+2}, Fe^{+2}, Zn^{+2}, Al^{+3}, Ni^{+2}, Mn^{+2}, Ba^{+2}, Sr^{+2}, Ca^{+2}, Mg^{+2}, NH_4^+, K^+, Cl^-, Br^-, I^-, NO_3^-, CO_3^{-2} , S^{-2}, PO_4^{-3}(soluble and insoluble), SO_4^{-2}, CrO_4^{-2}, $Cr_2O_7^{-2}$.
2.	**Volumetric analysis**: For the following exercise student has to prepare solution of titrant, where ever required. (i) Standardization of NaOH using Succinic acid. (ii) Standardization of HCl using NaOH solution. (iii) To determine the amount and gm/lit, gm/500 mL, gm/250 mL of carbonate and bicarbonates mixture using phenolphthalein and methyl orange indicator. (iv) To determine the amount and gm/lit, gm/500 mL, gm/250 mL of NaOH and Na_2CO_3 mixture using phenolphthalein and methyl orange indicator. (v) To determine the amount of Fe^{+2} by titration of $KMnO_4$ against

	$FeSO_4(NH_4)_2.SO_4 .6H_2O$. (vi) To determine the amount of Fe^{+2} by titration of $K_2Cr_2O_7$ against $FeSO_4(NH_4)_2.SO_4 .6H_2O$. (vii) To determine the amount of Fe^{+2} by $K_2Cr_2O_7$ using diphenyl amine as an internal indicator. (viii) To determine the amount and gm/lit, gm/750 mL of Oxalic acid using $KMnO_4$. (ix) To determine the molarity of mixture and gm/lit of Oxalic acid and sodium oxalate solution mixture by using 0.1M $KMnO_4$ and 0.02M NaOH. (x) To determine the molarity of mixture and gm/lit of Oxalic acid and H_2SO_4 solution mixture by using 0.1M $KMnO_4$ and 0.1M NaOH.

Teaching-Learning Methodology	Hands on training, Practical Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Laboratory work Assessment 20 (40%), Viva Voce/Lab Quiz 20 (40%), Attendance 10 (20%). [Total 50 Marks (100%)].	50
2.	Semester End Examination : Laboratory work Assessment 40 (80%), Viva Voce/Lab Quiz 10 (20%). (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 50 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to learn	
1.	About hands on training of Volumetric analysis and Analysis of Inorganic substances.

2.	About improvement in practical skills of students.

Suggested References:	
Sr. No.	References
1.	Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M. J. K., *Vogel's textbook of quantitative chemical analysis*, 6th Edition.
2.	Pandey, O. P., Bajpai, D. N., Giri, S., *Practical Chemistry*.
3	Ghoshal, Mahapatra,Nad , *An Advanced course in Practical Chemistry.*

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Course Code (Minor)	**US01MICHE01**	Title of the Course	**BASIC CHEMISTRY- I**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Chemistry as a subject. 2. Historic development and scope of chemistry 3. Basic concepts related to organic and inorganic chemistry.

Course Content		
Unit	Description	Weightage* (%)
1.	**ALKANE, ALKENE AND ALKYNE** **Hydrocarbons** : Physical properties of alkanes, alkene and alkynes, Common and IUPAC nomenclature of alkanes, alkenes and alkynes. **Alkanes**: Preparation from alkene by hydrogenation, reduction of alkyl halide, The Grignard reagent, Corey-House reaction, Wurtz reaction, Wurtz-Fittig reaction, Mechanism of halogenations, Orientation of halogenations : n-propane, n-butane, iso-butane, 2,3-dimethylbutane**,** n-pentane and isopentane, Ease of formation and stability of free radical. **Alkenes** : Geometrical isomerism (Cis-Trans and E-Z isomerism), Preparation of alkene from dehydrohalogenation of alkyl halide with Mechanism, dehydration of alcohol. The E^2 mechanism, Evidence : Absence of hydrogen exchange, element effect, Heat of hydrogenation and stability of alkene, The E^1 mechanism, Evidence accompanished by rearrangement, Electrophilic addition Mechanism, Electrophilic addition rearrangement, Mechanism of addition of halogen, Halohydrin formation, Free-radical addition, Hydroxylation, addition of alkene and alkane to alkene, Oxymercuration-Demercuration and Hydroboration-oxidation, Ozonolysis.	**50**

	Alkynes: Preparation from dehydrohalogenation of alkyl halide, Reaction of metal acetylide with primary alkyl halides, Hydration of alkynes, Acidity of alkynes, Analysis of alkynes.	
2.	**PERIODIC PROPERTIES** **Periodic Table:** Definition of periodic table, Periodic Law, Modern periodic table (Long form of periodic table), Merits of long form of periodic table, Brief introduction and types of elements, Atomic, ionic and covalent radii and its related numericals, Shielding effect and effective nuclear charge, Factor affecting the magnitude of σ and Z_{eff} and their variation in the periodic table, Slater's rule for calculation σ and Z_{eff}. **Ionization Energy**: Successive ionization energy, Factor affecting magnitude of Ionization Energy, Variation of IE values in main group element, Variation of IE values in different element groups, Ionization energies of isoelectronic species, Find out the order of second IE values of the element of second period, Difference between Ionization potential and Electrode potential of a metal. **Electron Affinity:** Relation between EA of X(g) atom and IE of X-(g) ion, EA2 represents energy required, Factor affecting the magnitude of electron affinity, Variation of electron affinity in main group elements of the periodic table, Variation of electron affinity values of different groups. **Electronegativity:** Different methods used for calculating electronegativity (like Pauling, Mulliken, Allred-Rachow),Factor affecting the magnitude of electronegativity, Role of electronegativity in chemical behaviour, Variation of electronegativity of the elements of different group, Variation of electronegativity in a period of s and p Block elements, Application of electronegativity. Numerical based on above topics.	**50**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (50%)].	50
2.	Semester End Examination [Total 25 Marks (50%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain the knowledge of Chemistry using various fundamental aspects of chemical sciences.
2.	Explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the chemical reactions.
3.	To have knowledge of basic aspects of inorganic chemistry comprising of various aspects of periodic table.

Suggested References:	
Sr. No.	References
1.	Morrison, R. T. & Boyd, R. N., *Organic chemistry* (6^{th} edition).
2.	Clayden, J., Greeves, N., Warren, S., *Organic Chemistry* 2^{nd} Edition, Oxford University Press.
3	Prakash S., Tuli, G. D., Basu, S. K., Madan R. D., *Advance inorganic chemistry* (Vol. - I).
4	Cotton, F.A. & Wilkinson, G. *Basic Inorganic Chemistry,* Wiley.
5	Lee J. D., *Concise Inorganic Chemistry* (4^{th} Edition).

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Course Code (Minor)	**US01MICHE02**	Title of the Course	**CHEMISTRY PRACTICAL-2**
Total Credits of the Course	2	Hours per Week	4

Course Objectives:	To make students familiar about: 1. Chemistry as a subject 2. Practical aspects of chemistry 3. Basic concepts related to qualitative analysis of inorganic substances. 4. Hands on training of laboratory practices.

Course Content	
Practical	Description
	Introduction to chemical laboratory, use of glass wares, chemical and reagents, organic and inorganic solvents, bench reagents, side reagents, safety practices in the chemistry laboratory, knowledge about toxic chemicals and safety precautions in their handling.
1	**Analysis of Inorganic substances (water soluble and water insoluble)** Identification of inorganic substance [at least 12 substances] as a positive and negative radicals like : Pb^{+2}, Cu^{+2}, Fe^{+2}, Zn^{+2}, Al^{+3}, Ni^{+2}, Mn^{+2}, Ba^{+2}, Sr^{+2}, Ca^{+2}, Mg^{+2}, NH_4^{+}, K^{+}, Cl^{-}, Br^{-}, I^{-}, NO_3^{-}, CO_3^{-2} , S^{-2}, PO_4^{-3}(soluble and insoluble), SO_4^{-2}, CrO_4^{-2}, $Cr_2O_7^{-2}$.

Teaching-Learning Methodology	Hands on training, Practical Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Laboratory work Assessment 10 (40%), Viva Voce/Lab Quiz 10 (40%), Attendance 05 (20%). [Total 25 Marks (100%)]	50
2.	Semester End Examination : Laboratory work Assessment 20 (80%), Viva Voce/Lab Quiz 5 (20%). (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to learn	
1.	About hands on training of Analysis of Inorganic substances.
2.	About improvement in practical skills of students.

Suggested References:	
Sr. No.	References
1.	Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M. J. K., *Vogel's textbook of quantitative chemical analysis*, 6th Edition.
2.	Pandey, O. P., Bajpai, D. N., Giri, S., *Practical Chemistry*.
3	Ghoshal, Mahapatra, Nad , *An Advanced course in Practical Chemistry*.

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Course Code (Inter Disciplinary)	**US01IDCHE01**	Title of the Course	**FUNDAMENTALS OF CHEMISTRY- 1**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Chemistry as a subject. 2. Historic development and scope of chemistry 3. Basic concepts related to analytical and physical chemistry.

Course Content		
Unit	Description	Weightage* (%)
1.	**IONIC EQUILIBRIA IN AQUEOUS SOLUTIONS** Sparingly Soluble Salts, Selective Precipitation, Acids & Bases; Arrhenius theory of Acids and Bases, The Lowry – Bronsted Concept, Strength of Acids and Bases, The Lewis concept, Numerical problems; Self Ionization of water, Weak acids and bases, Hydrolysis, Buffer Solutions; Indicator, Numerical based on above topics.	**50**
2.	**ANALYTICAL CHEMISTRY** Introduction, Qualitative and Quantitative analysis, Instrumental and Chemical Methods of analysis, Applications of Chemical Analytical Chemistry, Sampling of Solid, Liquid and Gas, Stages of Analysis, Selection of Methods, Classification of quantitative analysis on the basis of : Quantitative execution of chemical reaction, Electrical measurements, Spectroscopic properties and Movement of substance in a medium under controlled condition, limitations of Analytical Methods, Classification of Errors, Accuracy and Precision, Absolute and Relative Error, Minimization of Error, Significant Figure, Rounding off, Mean, Median,	**50**

	Standard Deviation, , Distribution of Random Error, Reliability of Results (Q-test), Comparison of Results: Student's t-test and F-test, confidence limit (interval), Numericals based on above topics.	

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain the knowledge of Chemistry using various fundamental aspects of all four major branches of chemical sciences.
2.	Gain knowledge about various acid -base theory and their applications.
3.	Know about use of various theoretical analytical methods and their applications.

Suggested References:	
Sr. No.	References

1.	Vogel, A. I., *Textbook Quantitative Chemical Analysis,* Prentice-Hall, 5th edition.
2.	Day, R. A. and Underwood A. L., *Quantitative Analysis* 6^{th} Edition.
3	Mahan, B.H. *University Chemistry*, 3^{rd} Edition Narosa.

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Course Code (Inter Disciplinary)	**US01IDCHE02**	Title of the Course	**CHEMISTRY PRACTICAL-3**
Total Credits of the Course	2	Hours per Week	4

Course Objectives:	To make students familiar about: 1. Chemistry as a subject 2. Practical aspects of chemistry 3. Basic concepts related qualitative analysis of inorganic substances. 4. Hands on training of laboratory practices.

Course Content	
Practical	Description
	Introduction to chemical laboratory, use of glass wares, chemical and reagents, organic and inorganic solvents, bench reagents, side reagents, safety practices in the chemistry laboratory, knowledge about toxic chemicals and safety precautions in their handling.
1	**Analysis of Inorganic substances (water soluble and water insoluble)** Identification of inorganic substance [at least 12 substances] as a positive and negative radicals like : Pb^{+2}, Cu^{+2}, Fe^{+2}, Zn^{+2}, Al^{+3}, Ni^{+2}, Mn^{+2}, Ba^{+2}, Sr^{+2}, Ca^{+2}, Mg^{+2}, NH_4^+, K^+, Cl^-, Br^-, I^-, NO_3^-, CO_3^{-2} , S^{-2}, PO_4^{-3}(soluble and insoluble), SO_4^{-2}, CrO_4^{-2}, $Cr_2O_7^{-2}$.

Teaching-Learning Methodology	Hands on training, Practical Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops,

	models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Laboratory work Assessment 10 (40%), Viva Voce/Lab Quiz 10 (40%), Attendance 05 (20%). [Total 25 Marks (100%)]	50
2.	Semester End Examination : Laboratory work Assessment 20 (80%), Viva Voce/Lab Quiz 5 (20%). (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to learn	
1.	About hands on training of Analysis of Inorganic substances.
2.	About improvement in practical skills of students.

Suggested References:	
Sr. No.	References
1.	Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M. J. K., *Vogel's textbook of quantitative chemical analysis*, 6th Edition.
2.	Pandey, O. P., Bajpai, D. N., Giri, S., *Practical Chemistry*.
3	Ghoshal, Mahapatra, Nad , *An Advanced course in Practical Chemistry*.

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On-line Resources : Google books, INFLIBNET, Google Web

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Course Code (Multidisciplinary)	**US01MDCHE01**	Title of the Course	**ENVIRONMENTAL POLLUTION- I**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Chemistry as a subject. 2. Basic concepts related to pollution and its effect on environment.

Course Content		
Unit	Description	Weightage* (%)
1.	**Air Pollution** Introduction, Environmental Pollution disasters, Mediterranean: A dead sea, Classification of pollutants. Air pollution, Composition of air, Chemical reaction in air due to sun light, Reactions in Troposphere, Stratosphere and mesosphere. Smog formation in air. Major sources of air pollution, Other sources of air pollution, Units of measurement of air pollutant. Classification of air pollutants. Sulphur compounds as pollutants.	**50**
2.	**Water Pollutants And Their Properties** Introduction, Sources of water, Chemistry of water, Definition of water pollution, Types of water pollution including main point, Types of water pollution, Types of water pollution based on sources and storages. Ground water pollution, Factors affecting the ground water pollution, Effect of ground water pollution on man and soil, Surface water pollution, Factors affecting the surface water, Sources of surface water pollution, Lake water pollution, Sources of pollutants in lake water.	**50**

Teaching-Learning	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Chemistry programme are delivered through classroom,

Methodology	laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain the knowledge of pollution chemistry using various fundamental aspects of chemical sciences.
2.	Understand types of pollutions and its effect on surrounding environment.
3.	To have knowledge of basic aspects of pollution chemistry.

Suggested References:	
Sr. No.	References
1.	Environmental studies by S.V.S Rana Second reprint (F. Edi):2007.
2.	Environmental Chemistry by B. K. Sharma, H.KAUR, Third revised and enlarged edition -1996-97.

On-line resources to be used if available as reference material
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Course Code (Multi Disciplinary)	**US01MDCHE02**	Title of the Course	**CHEMISTRY PRACTICAL-4**
Total Credits of the Course	2	Hours per Week	4

Course Objectives:	To make students familiar about: 1. Chemistry as a subject 2. Practical aspects of chemistry 3. Basic concepts related qualitative analysis of inorganic substances. 4. Hands on training of laboratory practices.

Course Content	
Practical	Description
	Introduction to chemical laboratory, use of glass wares, chemical and reagents, organic and inorganic solvents, bench reagents, side reagents, safety practices in the chemistry laboratory, knowledge about toxic chemicals and safety precautions in their handling.
1	**Analysis of Inorganic substances (water soluble and water insoluble)** Identification of inorganic substance [at least 12 substances] as a positive and negative radicals like : Pb^{+2}, Cu^{+2}, Fe^{+2}, Zn^{+2}, Al^{+3}, Ni^{+2}, Mn^{+2}, Ba^{+2}, Sr^{+2}, Ca^{+2}, Mg^{+2}, NH_4^+, K^+, Cl^-, Br^-, I^-, NO_3^-, CO_3^{-2} , S^{-2}, PO_4^{-3}(soluble and insoluble), SO_4^{-2}, CrO_4^{-2}, $Cr_2O_7^{-2}$.

Teaching-Learning Methodology	Hands on training, Practical Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Laboratory work Assessment 10 (40%), Viva Voce/Lab Quiz 10 (40%), Attendance 05 (20%). [Total 25 Marks (100%)]	50
2.	Semester End Examination : Laboratory work Assessment 20 (80%), Viva Voce/Lab Quiz 5 (20%). (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to learn	
1.	About hands on training of analysis of Inorganic substances.
2.	About improvement in practical skills of students.

Suggested References:	
Sr. No.	References
1.	Mendham, J., Denney, R. C., Barnes, J. D., Thomas, M. J. K., *Vogel's textbook of quantitative chemical analysis*, 6th Edition.
2.	Pandey, O. P., Bajpai, D. N., Giri, S., *Practical Chemistry*.
3	Ghoshal, Mahapatra, Nad , *An Advanced course in Practical Chemistry*.

On-line resources to be used if available as reference material
On-line Resources : Google books, INFLIBNET, Google Web

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Vitthalbhai Patel & Rajratna P. T. Patel Science College
(Autonomous)
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Affiliated to SARDAR PATEL UNIVERSITY
Vallabh Vidyanagar, Gujarat
Syllabus effective from the Academic Year 2024-2025

Course Code (Skill Enhancement Courses)	**US01SECHE01**	Title of the Course	**ENVIRONMENTAL CHEMISTRY - I**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Chemistry as a subject. 2. To understand environmental chemistry and its effect on surrounding.

Course Content		
Unit	Description	Weightage* (%)
1.	**Introduction to Environmental Studies:** Definition, Scope & Significance of Environmental Studies, Multidisciplinary Nature, Components of Environment, Atmosphere, Hydrosphere (Hydrological Cycle), Lithosphere (Structure of Earth), Biosphere. Green House Gases. Bio-Geochemical Cycles: Nitrogen & Carbon.	**50**
2.	**Natural Resources:** Classification, Renewable Sources & Types, Non-Renewable Sources & Types. Conservation of Natural Resources, Forest Resource: Forest Wealth of Gujarat (Forest Cover, Types, Species Composition) Causes of Deforestation, Conservation Strategies Significance, Water Resources : Use & Over exploitation & Surface & Ground Water. Conservation Methods, Dams-Benefits & Problems Case Studies. Land Resources Use, Over exploration & Conservation of Soil.	**50**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that

	accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage (%)
1.	Continuous and compression evaluation : Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50
2.	Semester End Examination [Total 25 Marks (100%)].	50

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain the knowledge of Environmental Chemistry and Natural Resources.

Suggested References:	
Sr. No.	References
1.	Environmental Science by Dr Y K Singh.
2.	Environmental Science by S C Santra.
3	Environmental Studies by R Rajagopalan.
4	A Text Book of Environmental Studies by D K Asthana & M Asthana.

On-line resources to be used if available as reference material
On-line Resources : Google books, INFLIBNET, Google Web

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(Bachelor of Science) (Undergraduate) (NEP-2020)
B. Sc. (UG) Semester-I

Course Code	**US01SECHE02**	Title of the Course	**BASIC ORGANIC CHEMISTRY- I**
Total Credits of the Course	2	Hours per Week	2

Course Objectives:	To make students familiar with: 1. Chemistry as a subject. 2. Historic development and scope of chemistry 3. Basic concepts related to basic organic chemistry and related aspects.

Course Content

Unit	**Description**	**Weightage* (%)**
1.	**ALKANE, ALKENE AND ALKYNE** **Hydrocarbons** : Physical properties of alkanes, alkene and alkynes, Common and IUPAC nomenclature of alkanes, alkenes and alkynes. **Alkanes**: Preparation from alkane by hydrogenation, reduction of alkyl halide, The Grignard reagent, Corey-House reaction, Wurtz reaction, Wurtz-Fittig reaction, Mechanism of halogenations, Orientation of halogenations, Ease of formation and stability of free radical. **Alkenes** : Geometrical isomerism (Cis-Trans and E-Z isomerism), Preparation of alkene from dehydrohalogenation of alkyl halide with Mechanism, dehydration of alcohol. The E^2 mechanism, The E^1 mechanism, Electrophilic addition Mechanism, Mechanism of addition of halogen, Halohydrin formation, Free-radical addition, Hydroxylation, addition of alkene and alkane to alkene, Ozonolysis. **Alkynes**: Preparation from dehydrohalogenation of alkyl halide, Reaction of metal acetylide with primary alkyl halides, Hydration of alkynes, Acidity of alkynes, Analysis of alkynes.	**50%**
2.	**ALKYL AND ARYL HALIDES** Homolytic and Heterolytic chemistry, Classification, Preparation, Reaction: Nucleophilic aliphatic substitution, SN^2 Reaction: Mechanism, kinetics, Reactivity and steric hindrance, SN^1 Reaction:	

	Mechanism, kinetics, Carbocation, Structure of carbocation, Relative stability of carbocations, Stability of carbocation: polar effect, Rearrangement of carbocation, Reaction, Low reactivity of aryl and vinyl halides, Structure of aryl and vinyl halides, Nucleophilic aromatic substitution, Bimolecular displacement for nucleophilic aromatic substitution, Reactivity in nucleophilic aromatic substitution, Orientation in nucleophilic aromatic substitution.	**50%**

Teaching-Learning Methodology	Conventional method (classroom blackboard teaching), ICT. Courses for B. Sc. Chemistry programme are delivered through classroom, laboratory work in a challenging, engaging, and inclusive manner that accommodates a variety of learning styles and tools (PowerPoint presentations, audio visual resources, e-resources, seminars, workshops, models).

Evaluation Pattern		
Sr. No.	Details of the Evaluation	Weightage
1.	Continuous and compression evaluation : Class test/Internal written test 10 Marks (40%), Quiz 05 Marks (20%), Home Assignments 05 Marks (20%), Attendance 05 Marks (20%), (As per SPU Letter No. E-3/2748 dated 02/02/2024) [Total 25 Marks (100%)].	50 %
2.	Semester End Examination [Total 25 Marks (100%)].	50 %

Course Outcomes: Having completed this course, the learner will be able to	
1.	Gain the knowledge of Chemistry using various fundamental aspects of all four major branches of chemical sciences.
2.	Explain nomenclature, stereochemistry, structures, reactivity, and mechanism of the several chemical reactions.
3.	To have knowledge of basic aspects of inorganic chemistry comprising of various aspects of periodic table.

4	Gain knowledge about various acid-base theory and their applications.
5	Know about use of various theoretical analytical methods and their applications.

Suggested References:	
Sr. No.	References
1.	Morrison, R. T. & Boyd, R. N., *Organic chemistry* (6^{th} edition). (unit- 1)
2.	Clayden, J., Greeves, N., Warren, S., *Organic Chemistry* 2^{nd} Edition, Oxford University Press. (unit- 1)

On-line resources to be used if available as reference material
On-line Resources : Google books, INFLIBNET, Google Web

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