

Syllabus B.Sc. (Botany) (Sem.- I)

Course Objectives (CO): To enable the students

- CO 1.: Recognize different plant types
- CO 2.: Understand the concept of plant communication, plant defense mechanism, and Aesthetic Botany.
- CO 3.: Comprehend the role of plants in providing food, significance of microgreens, plant-derived beverages like tea, coffee, and squash.
- CO 4.: Explore the diverse applications of plants in everyday products, traditional uses of plants in cultural practices.
- CO 5.: Acquire the knowledge of hydroponics and aeroponics, vertical gardening, *Spirulina* farming

Course Outcomes (OC): The learner will be able to

- OC 1.: Differentiate plant types.
- OC 2.: Describe the concept of plant communication, plant defense mechanism, and Aesthetic Botany.
- OC 3.: Explain the role of plants in providing food, the significance of microgreens, and plant-derived beverages like tea, coffee, and squash.
- OC 4.: Utilize plants in everyday products, and traditional cultural practices.
- OC 5.: Illustrate the techniques of hydroponics and aeroponics, vertical gardening, and *Spirulina* farming.



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Vocational Skill Courses

Name of the Course: Entrepreneurial Botany 60 Hours Credits:02

Course Objectives (CO):

- CO 1. To enable the students, learn the different algal and fungal cultivation practices.
- CO 2. To enable the students, develop the skills of designing and carving of natural material.
- CO 3. To enable the students, understand the making of aroma candles and incense sticks.
- CO 4. To enable the students, comprehend the process of preparing herbal teas, natural dyes, organic pesticides, and composting.
- CO 5. To enable the students, prepare business plan, marketing strategies and branding products.

Course Outcomes (OC): Learner will be able to

- OC 1. Practice the different algal and fungal cultivation practices.
- OC 2. Develop the skills of designing and carving of natural material.
- OC 3. Understand the making of aroma candles and incense sticks.
- OC4. Comprehend the process of preparing herbal teas, natural dyes, organic pesticides, and composting.
- OC 5. Prepare business plan, marketing strategies and branding products.



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Vocational Skill Courses

Name of the Course: Indoor Gardening **60 Hours** **Credits:02**

Course Objectives (CO):

- CO 1. To enable students, identify indoor plants, suitable containers, soils and growth media to grow them.
- CO 2. To enable students, learn different methods and techniques of potting, repotting of indoor plants.
- CO 3. To train students, in care and maintenance of indoor plants.
- CO 4. To enable students, control and manage the insect pests affecting indoor plants.
- CO 5. To enable students, prepare different types of indoor gardens.

Course Outcomes (OC): Learner will be able to

- OC 1. Identify indoor plants, suitable containers, soils and growth media to grow them.
- OC 2. Perform different methods and techniques of potting, repotting of indoor plants.
- OC 3. Take care and maintain the indoor plants.
- OC 4. Control and manage the insect pests affecting indoor plants.
- OC 5. Prepare different types of indoor gardens.

List of Practicals:

1. To Study of different Indoor plants: Foliage and flowering plants.
2. To Study of different types of containers and equipments used in indoor gardening.
3. Selection of soil and media for indoor plants.
4. To Study different methods of application of plant growth regulators.
5. Types of accessories used in indoor gardening.
6. Methods of growing indoor plants: Potting.
7. Technique of Repotting of indoor plants.
8. Care and Maintenance of Indoor plants.
9. Insect pest and their control.
10. Preparation of Terrarium/ Bottle Garden.
11. Preparation of Dish Garden.
12. Preparation of kokidama.
13. Techniques of Growing indoor plants in Different Medias. (Soil, Sand, Sphagnum moss etc.)




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Vocational Skill Courses

Name of the Course: Ayurvedic Aahar

60 Hours Credits:02

Course Objectives (CO):

- CO 1. To enable students, understand the concept of Tridosha and aahar.
- CO2. To enable students, identify the foods with relation to rutuchakra, taste and composition.
- CO 3. To enable students, prepare immunity boosting, iron rich nutritious food.
- CO 4. To enable students, estimate proteins and vitamins in foods.
- CO 5. To enable students, gain knowledge of managing diseases with ayurvedic aahar.

Course Outcomes (OC): Learner will be able to

- OC 1. Understand the concept of Tridosha and aahar.
- OC 2. Identify the foods with relation to rutuchakra, taste and composition.
- OC 3. Prepare immunity boosting, iron rich nutritious food.
- OC 4. Estimate proteins and vitamins in foods.
- OC 5. Manage diseases with ayurvedic aahar.

List of Practicals:

1. Study of Tridosha concept (Prakriti nidaan)
2. Study of Ahar According to Different Prakriti.
3. Study of sattvic, tamasic and Rajasic foods (any two examples of each)
4. Identification of foods as per rutuchakra
5. Study of food based on six taste (Rasa) (two examples of each).
6. Preparation of Iron rich ayurvedic aahar (Nachani satva, aliv laddu)
7. Preparation of immunity boosting dish (amala palak, amala candy)
8. Making a diet plan to manage diseases (diabetes, constipation) with ayurvedic aahar.
9. Study of Examples of incompatibility/antagonistic (*Viruddha-Aahara*)
10. Estimation of Proteins from plant resources used in ayurvedic aahar (Lowry's method)
11. Estimation of vitamin C from fruits. (Amla, Citrus)
12. Study (identification) of Fiber rich vegetables (carrot, sweet potato), leafy vegetables (spinach, fenugreek) and dalia.



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Skill Enhancement Courses

Name of the Course: Tools and Techniques in Plant Science
60 Hours

Credits:02

Course Objectives (CO):

- CO 1. To enable students, understand the essential laboratory techniques used in plant science.
- CO 2. To enable students, identify the foods with relation to rutuchakra, taste and composition.
- CO 3. To enable students, prepare immunity boosting, iron rich nutritious food.
- CO 4. To enable students, estimate proteins and vitamins in foods.
- CO 5. To enable students, gain knowledge of managing diseases with ayurvedic aahar.

Course Outcomes (OC): Learner will be able to

- OC 1. Understand the concept of Tridosha and aahar.
- OC 2. Identify the foods with relation to rutuchakra, taste and composition.
- OC 3. Prepare immunity boosting, iron rich nutritious food.
- OC 4. Estimate proteins and vitamins in foods.
- OC 5. Manage diseases with ayurvedic aahar.

List of Practicals:

Module 1: Introduction to Laboratory Tools and Instruments

- 1.1 Study of Basic Laboratory Instruments (Microscope, Colorimeter, Autoclave, Oven, Incubator, Laminar Air Chamber, Tilak Air Sampler)
- 1.2 Study of stains and staining techniques

Module 2: Microscopy and staining Techniques

- 2.1 Microslide Preparation—Whole Mounts, Smears, Squashes
- 2.2 Plant Microtechnique (T.S., L.S., R.L.S., T.L.S.)

Module 3: Separation techniques

- 3.1 Separation of Amino Acids by Paper Chromatography
- 3.2 Separation of Sugars by Thin-Layer Chromatography

Module 4: Biochemical analysis



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Course I (Mandatory)

Name of the Course: Cytogenetics, Ecology and Environment Conservation (2 credits)

Course Objectives (CO):

CO 1. To enable the students, to identify the structure and functions of the Cell and cell organelles in plants.

CO 2. To enable the students to understand the Cell cycle and cell division in plants.

CO 3. To enable the students to apply the biostatistical concepts.

CO 4. To enable the students, to comprehend ecology and environment conservation.

CO 5. To enable the students, to carry out a thorough study of the active constituents of medicinal plants

Course Outcomes (OC): The Learner will be able to

OC 1. Identify the structure and functions of the Cell and cell organelles in plants.

OC 2. Understand the Cell cycle and cell division in plants.

OC 3. Comprehend the biostatistical application.

OC 4. Apply the biostatistical concepts.

OC 5. Carry out a thorough study of the active constituents of medicinal plants with an emphasis on the use of plant-based food as medicine.

Module 1: Cytogenetics

15 Lectures

1. Ultrastructure and functions of Cell wall, Plasma membrane (2 Lectures)
2. Ultrastructure and functions of the cell organelles – Chloroplast, Endoplasmic reticulum, Mitochondrion (2 Lectures)
3. Cell cycle, Mitosis in Plant Cells and its significance (2 Lectures)
4. History, Concept and Definition, Genetic Terminologies- Gene, Genome, Allele, Locus, Traits, Genotype, Phenotype, Dominant, Recessive, Co-dominance, Heredity, Inheritance, Variation, Homozygous, Heterozygous, Back Cross and Test Cross. (1 Lecture)
5. Mendelian Genetics - Law of Dominance, Law of Segregation, Law of Independent Assortment, Monohybrid Cross, Dihybrid Cross, Incomplete Dominance and Co-Dominance. (3 Lectures)



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Vocational Skill Courses

Name of the Course: Flower Arrangement 60 Hours Credits:02

Course Objectives (CO):

- CO 1. To enable students, identify the foliage and cut flowers used in different occasions.
- CO 2. To enable students, learn the basic styles and shapes in flower arrangement.
- CO 3. To enable students, prepare different flower arrangements.
- CO 4. To enable students, study methods of Drying and preservation of flowers.
- CO 5. To enable students, select the suitable types of containers and accessories for flower arrangement.

Course Outcomes (OC): Learner will be able to

- OC 1. Identify the foliage and cut flowers used in different occasions.
- OC 2. Understand the basic styles and shapes in flower arrangement.
- OC 3. Prepare different flower arrangements.
- OC 4. Perform Drying and preservation of flowers.
- OC 5. Select the suitable types of containers and accessories for flower arrangement.

List of Practicals:

1. Identification of cut flowers: flowers on special occasions.
2. Study of different foliage used in flower arrangement.
3. Different types of containers and accessories for flower arrangement.
4. To study basic styles and shapes in flower arrangement.
5. Preparation of various type of garlands, Gajra, Venni etc.
6. Preparation of Rangoli by using various types of flowers.
7. Preparation of various types of bouquets.
8. Japanese style of flower arrangement: Ikebana, Moribana.
9. To study methods of Drying and preservation of flowers.
10. Dry flower arrangement.
11. Preparation of pot pourrie.
12. Preparation of Greeting card /Book mark using dry flower arrangement.
13. Arrangement of flower for different areas and occasions.
14. Visit to nearby florist / Flower market.
15. Visit / Organise exhibition of cut flowers and floral arrangement.



Vocational Skill Courses

Name of the Course: Bonsai Art

60 Hours Credits:02

Course Objectives (CO):

- CO 1. To enable the students, know different types of containers, tools and accessories used in bonsai.
- CO 2. To enable the students, identify suitable plants, soil and media for Bonsai.
- CO 3. To enable the students, learn Bonsai management practices and their care techniques.
- CO 4. To enable the students, prepare different styles of Bonsai.
- CO 5. To enable the students, gain knowledge about Insect pest and diseases and their control.

Course Outcomes (OC): Learner will be able to

- OC 1. Select different types of containers, tools and accessories used in bonsai.
- OC 2. Identify suitable plants, soil and media for Bonsai.
- OC 3. Perform bonsai management practices and their care techniques.
- OC 4. Prepare different styles of Bonsai.
- OC 5. Deal with Insect pest and diseases and their control.

List of Practicals:

1. Study of Different types of containers used in bonsai.
2. Study of tools and accessories used in Bonsai making.
3. Study of best suitable plants for Bonsai.
4. Selection of soil and media for bonsai
5. Bonsai management practices: Media Potting, Re-Potting and watering.
6. Bonsai care techniques: Pruning, pinching and defoliation.
7. Study of upright (formal styles) in Bonsai.
8. Study of Upright (Informal style) in Bonsai.
9. Preparation of Bonsai: Cascade, Semi-cascade.
10. Preparation of Bonsai: Forest style.
11. Insect pest and diseases and their control.
12. Visit to Bonsai exhibition/Nursery.

Reference Books

1. Dr. N. Mangadevi, Bonsai-Emesco Books publisher

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Vocational Skill Courses

Name of the Course: Plant Propagation Practices

60 Hours Credits:02

Course Objectives (CO):

- CO 1. To enable the students, identify garden implements and suitable potting mixture.
- CO 2. To train the students, in potting, repotting techniques, and preparation of nursery beds.
- CO3. To enable the students, learn methods of seed treatment and application of growth hormones.
- CO 4. To enable the students, in the skills of plant propagation.

Course Outcomes (OC): Learner will be able to

- OC 1. Identify garden implements and suitable potting mixture.
- OC 2. Perform potting, repotting and preparation of nursery beds.
- OC 3. Apply methods of seed treatment and application of growth hormones for Plant Propagation.
- OC 4. Perform plant propagation practices.

List of Practicals:

1. Study of Garden implements.
2. Preparation of Potting Mixture.
3. Potting & Repotting techniques.
4. Preparation of nursery beds.
5. Methods of Seed Treatment.
6. Application & methods of plant growth regulators.
7. Perform various methods of cutting.
8. Perform various methods of layering.
9. Perform various methods of grafting.
10. Perform various methods of budding.
11. Perform propagation by specialized structure- rhizome, suckers, runners, offset, bulb, corm, tuber, etc.
12. Visit to Plant nursery.



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Vocational Skill Courses

Name of the Course: Marine Botany

60 Hours Credits:02

Course Objectives (CO):

- CO1. To enable students, understand the characteristics features of the marine phytoplanktons and marine fungi.
- CO 2. To enable students, study the value-added products and medicinal uses of marine algae.
- CO 3. To enable students, identify mangrove plants.
- CO4.To enable students, comprehend the characteristic features of Mangroves, mangrove associates and sea grasses.
- CO 5. To enable students, realise the ecological importance and medicinal uses of mangroves.

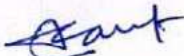
Course Outcomes (OC): Learner will be able to

- OC 1. Understand the characteristics features of the marine phytoplanktons and marine fungi.
- OC 2. Study the value-added products and medicinal uses of marine algae.
- OC 3. Identify mangrove plants.
- OC 4. Comprehend the characteristic features of Mangroves, mangrove associates and sea grasses.
- OC 5. Realise the ecological importance and medicinal uses of mangroves.

List of Practicals:

1. Study of marine phytoplanktons.
2. Study of characteristic features (Morphological, Photosynthetic pigments, reserve food material) of Chlorophyta (*Enteromorpha, Chaetomorpha, Ulva, Caulerpa*- any two).
3. Study of characteristic features (Morphological, Photosynthetic pigments, reserve food material) of Phaeophyta (*Padina, Dictyota, Sargassum*- any two)
4. Study of characteristic features (Morphological, Photosynthetic pigments, reserve food material) of Rhodophyta (*Gracilaria, Gelidium, Hypnea* - any two).
5. Study of marine fungi.




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Skill Enhancement Courses

Name of the Course: Field Study Techniques

60 Hours

Credits:02

Course Objectives (CO):

- CO 1. To develop skill among the first-year botany students, focusing on essential field study techniques in botany.
- CO 2. To enable students, to Understand basics of biodiversity analysis and measurement
- CO 3. To inculcate skills that can pave the way for a promising career in field and environmental botany.
- CO 4. To provide hand on training and experiential learning of various aspects of field survey techniques.

Course Outcomes (OC): Learner will be able to

- OC 1. Understand vegetation type and analyze vegetation.
- OC2. Develop skill useful for forest Mensuration for programs like tree census etc.
- OC 3. Understand basic parameters of soil profiling
- OC 4. Calculate diversity using Simpson's index and comment on biodiversity status of the studied area.
- OC 5. Analyse water samples for hydrobiological assessments

List of Practicals:

Module 1: Field visit and Vegetation Analysis

- Vegetation study by field visit for habit and habitat study
- Study of quadrat Method (List quadrat and Chart quadrat)
- Line and Belt Transect Studies (demonstration)
- Data collection using questionnaires
- Photography technique (Geo tag photographs) and Use of GPS for Field Survey and Plant location

Module 2: Forest Mensuration

- Keys for Identification of trees
- Measurement of Diameter of trees in field
- Measurement of height of trees in field
- Volume measurement of trees

Module 3: Soil analysis

- Soil profiling using pH meter and thermometer

Module 4: Biodiversity Indexing

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Skill Enhancement Courses

Name of the Course: Organic Farming

60 Hours

Credits:02

Course Objectives (CO):

- CO 1. To spread knowledge about organic agriculture.
- CO 2. To provide information and abilities needed to engage in organic food production and sustainable agriculture.
- CO 3. To create awareness about certification process, packaging, and marketing of organic products.
- CO 4. To spread idea of an organic ecosystem and educate oneself on biological magnification and its relevance in the modern world.

Course Outcomes (OC): Learner will be able to

- OC 1. Get comprehensive knowledge and practical skills in organic farming practices
- OC 2. To Understand various methods of organic compost preparation,
- OC 3. Acquire skills to control pest and disease using botanicals, natural pesticides.
- OC 4. Get hands on training and experiential learning on vermiculture techniques, bio-pesticide application, and sustainable post-harvest management.

List of Practicals:

Module 1: Organic Compost Making and analysis

- 1.1 Aerobic Composting Methods
- 1.2 Anaerobic Composting Techniques
- 1.3 Physicochemical properties of compost

Module 2: Green Manures and its application

- 2.1 Different plants used as green manures and their applications

Module 3: Biofertilizers and bio inoculants

- 3.1 Different types of biofertilizers and Methods of Biofertilizer Applications
- 3.2. Types of bioinoculants and their applications

Module 4: Pest and Disease Control using biological methods



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B.Sc (H) CHEMISTRY**Course Outcomes**

Paper No.	Paper Name
CC - I	Inorganic Chemistry I: Atomic Structure & Chemical Bonding (Theory)
CO-1	<ul style="list-style-type: none"> Introduction of quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves and shapes of various orbitals
CO-2	<ul style="list-style-type: none"> Learn to draw the plausible structures and geometries of molecules using Radius Ratio Rules, VSEPR theory and molecular orbital diagrams
CO-3	<ul style="list-style-type: none"> Understand the importance and application of chemical bonds, intermolecular and intramolecular weak chemical forces and their effect on melting points, boiling points, solubility and energetics of dissolution
CO-4	<ul style="list-style-type: none"> Learn the concept and periodic trends in atomic radii, ionic radii, ionization energy and electron affinity of elements
CO-5	<ul style="list-style-type: none"> Understand the concept of lattice energy
CO-6	<ul style="list-style-type: none"> Learn Band theory and its application in rationalizing the conductivity of metals, semiconductors and insulators
CC - I	Inorganic Chemistry I: Atomic Structure & Chemical Bonding (Practical)
CO-1	<ul style="list-style-type: none"> Learn the calibration and use of apparatus
CO-2	<ul style="list-style-type: none"> Learn to prepare solutions of titrants of different Molarity/Normality
CO-3	<ul style="list-style-type: none"> Learn the principles of acid-base titrations and redox titrations
CO-4	<ul style="list-style-type: none"> Learn to determine strength of solutions
CO-5	<ul style="list-style-type: none"> Basic understanding of various common indicators and their selection criterion
CC-II	Physical Chemistry I: States of Matter & Ionic Equilibrium (Theory)
CO-1	<ul style="list-style-type: none"> To understand the basics and advanced concepts related to state of matter i.e. Gaseous State, Liquid State and Solid State
CO-2	<ul style="list-style-type: none"> To understand the basics of Acids and Bases and calculate the pH of various acidic and Basic solutions
CO-3	<ul style="list-style-type: none"> To understand the concept of Buffer Solutions and can prepare the Buffer solutions as per the requirement
CO-4	<ul style="list-style-type: none"> To derive the various mathematical expressions to define the physical properties of Solids, Liquids and Gases
CO-5	<ul style="list-style-type: none"> To derive the various equations dealing with the calculation of pH of Acids and Bases, Buffer Solutions
CC-II	Physical Chemistry I: States of Matter & Ionic Equilibrium (Practical)
CO-1	<ul style="list-style-type: none"> To determine the Surface tension of Unknown Liquids using Stalagmometer
CO-2	<ul style="list-style-type: none"> To determine the Viscosity of Unknown Liquids using Viscometer
CO-3	<ul style="list-style-type: none"> To determine the pH of different unknown solution using pH-meter
CO-4	<ul style="list-style-type: none"> To determine the concentration of unknown Acid using pH-meter
CO-5	<ul style="list-style-type: none"> To prepare different Buffer Solutions



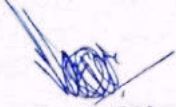
CO-6	<ul style="list-style-type: none"> To determine the Surface tension of Unknown Liquids using Stalagmometer
CC-III	Organic Chemistry I: Basics & Hydrocarbons (Theory)
CO-1	<ul style="list-style-type: none"> Understand the basic concepts in Organic Chemistry to be used in the subsequent semesters.
CO-2	<ul style="list-style-type: none"> Learn the details of hybridization, electronic displacement and their applications.
CO-3	<ul style="list-style-type: none"> Detailed study of the chemistry of hydrocarbons aliphatic and aromatic.
CO-4	<ul style="list-style-type: none"> Enhance the knowledge on various reaction mechanisms through correlation with the fundamental properties of the reactants.
CO-5	<ul style="list-style-type: none"> Learn about free radical substitution, electrophilic addition and electrophilic aromatic substitution.
CO-6	<ul style="list-style-type: none"> Familiarize with the stereochemical aspects which will help in understanding the actual course of reaction.
CC-III	Organic Chemistry I: Basics & Hydrocarbons (Practical)
CO-1	<ul style="list-style-type: none"> Hands on experience on organic preparations namely nitration, bromination.
CO-2	<ul style="list-style-type: none"> Develop an understanding on techniques like crystallization, melting point determination, boiling point determination along with the hands on experience.
CO-3	<ul style="list-style-type: none"> Development of the ability to do separation of mixtures of amino acids, sugars by various chromatographic techniques.
CO-4	<ul style="list-style-type: none"> Develop the skills on the detection of extra elements in the unknown organic compounds which has application in the subsequent semesters.
CO-5	<ul style="list-style-type: none"> Learn the separation technique, thin layer chromatography (TLC) for the separation of a mixture of o-and p-nitrophenol and o-and p-aminophenol.
CO-6	<ul style="list-style-type: none"> Aware of the effect of impurities on the melting point – mixed melting point of two unknown organic compounds.
CC-IV	Physical Chemistry II: Chemical Thermodynamics & its Applications (Theory)
CO-1	<ul style="list-style-type: none"> Understand the Laws of Thermodynamics, State Functions, Path Functions, Intensive & Extensive variables
CO-2	<ul style="list-style-type: none"> To derive the various mathematical expressions of First Law, Second Law, Third Law, ΔU, ΔH, ΔS, ΔG, ΔA for ideal and real gases under different conditions
CO-3	<ul style="list-style-type: none"> Explain and derive the mathematical relations for partial molar properties
CO-4	<ul style="list-style-type: none"> Understand and derive the thermodynamic relations explaining colligative properties and their applications
CO-5	<ul style="list-style-type: none"> Explain various Enthalpies of reactions and derive the mathematical relations for these enthalpies of reaction.
CC-IV	Physical Chemistry II: Chemical Thermodynamics & its Applications (Practical)
CO-1	<ul style="list-style-type: none"> To determine the heat capacity of beaker for different volume of water using calorimeter




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CO-2	<ul style="list-style-type: none"> To determine the enthalpy of Neutralization and Ionization for Acids and Bases.
CO-3	<ul style="list-style-type: none"> To determine the basicity of diprotic acids
CO-4	<ul style="list-style-type: none"> To determine the enthalpy of hydration
CO-5	<ul style="list-style-type: none"> To determine the effect of concentration on elevation in boiling point, variation in elevation in boiling point by adding electrolytes and non-electrolytes
CC-V	Inorganic Chemistry II: s- and p-Block elements (Theory)
CO-1	<ul style="list-style-type: none"> Understanding the principles of different metallurgical procedures with respect to different metals.
CO-2	<ul style="list-style-type: none"> Comparison of different properties of s and p block elements. Intergroup and intragroup comparison.
CO-3	<ul style="list-style-type: none"> Comparative study of listed compounds of s and p block elements.
CO-4	<ul style="list-style-type: none"> Detailed study of specific compounds of p block elements mentioned in the syllabus w.r.t. their synthesis, structure, properties, bonding and uses
CC-V	Inorganic Chemistry II: s- and p-Block elements (Practical)
CO-1	<ul style="list-style-type: none"> To understand the principle of Iodometry and Iodimetry
CO-2	<ul style="list-style-type: none"> Estimation of different oxidizing and reducing agents by the above methods
CO-3	<ul style="list-style-type: none"> Introduction of complexometric titrations using EDTA solutions
CO-4	<ul style="list-style-type: none"> Estimation of different metals like Zinc, Calcium, Magnesium by complexometry
CO-5	<ul style="list-style-type: none"> Preparing inorganic compounds
CO-6	<ul style="list-style-type: none"> Chromatographic separation of cations
CC-VI	Organic Chemistry II: Halogenated Hydrocarbons and Oxygen Containing Functional Groups (Theory)
CO-1	<ul style="list-style-type: none"> Provides better understanding of the organic functional groups and their reactivity.
CO-2	<ul style="list-style-type: none"> Helps in designing the synthesis of molecules of synthetic utility by functional group transformation.
CO-3	<ul style="list-style-type: none"> Learn about halogenated hydrocarbon, alcohol, phenol, ether, epoxides, carbonyl compounds, carboxylic acids and their derivatives.
CO-4	<ul style="list-style-type: none"> Detailed study of important name reactions.
CO-5	<ul style="list-style-type: none"> Description of tautomerism and synthetic application of diethyl malonate and ethyl acetoacetate.
CC-VI	Organic Chemistry II: Halogenated Hydrocarbons and Oxygen Containing Functional Groups (Practical)
CO-1	<ul style="list-style-type: none"> Hands-on practice on organic synthesis discussed theoretically in theory course.
CO-2	<ul style="list-style-type: none"> Understanding the problem faced during the said procedure and precautions needs to be adopted.
CO-3	<ul style="list-style-type: none"> Learning tests of various functional groups such as alcohols, phenols carbonyl compounds carboxylic acids which has further applications.




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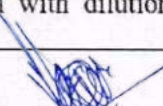
CO-4	<ul style="list-style-type: none"> Learn organic synthesis such as acetylation, benzoylation, oxidation, selective reduction of m- dinitro benzene etc.
CO-5	<ul style="list-style-type: none"> Preparation of semicarbazone, s-benzyl isothiuronium salt.
CO-6	<ul style="list-style-type: none"> Learn about carrying out Aldol condensation.
CC-VII	Physical Chemistry III: Phase Equilibrium and Electrochemical Cells (Theory)
CO-1	<ul style="list-style-type: none"> To impart the students the knowledge on phase rule, its applications and alloys, their importance, composition and applications.
CO-2	<ul style="list-style-type: none"> To demonstrate the application of spectroscopic and electrochemical methods in mechanistic studies of photochemical reactions
CO-3	<ul style="list-style-type: none"> To make students familiar with a broad variety of photochemical systems and their applications
CC - VII	Physical Chemistry III: Phase Equilibrium and Electrochemical Cells (Practical)
CO-1	<ul style="list-style-type: none"> Basic learning of the laboratory procedure for the determination of critical solution temperature and composition at CST of the phenol water system
CO-2	<ul style="list-style-type: none"> To study the effect of impurities of sodium chloride and succinic acid on CST of the phenol water system
CO-3	<ul style="list-style-type: none"> Learning of the procedure to construct the phase diagram using cooling curves
CO-4	<ul style="list-style-type: none"> Perform experiment for distribution of acetic/ benzoic acid between water and chloroform or cyclohexane
CO-5	<ul style="list-style-type: none"> Experiments of Potentiometric titrations of various types
CC-VIII	Inorganic Chemistry III: Coordination Chemistry (Theory)
CO-1	<ul style="list-style-type: none"> Understanding the general chemistry of transition elements with reference to electronic configuration, oxidation state, electrode potential, colour, electronic spectra. Complex formation tendency etc.
CO-2	<ul style="list-style-type: none"> Study the chemistry of some transition elements like Cr, Fe and Mn in reference to its compound for ex. Peroxo compounds, potassium permanganate, potassium ferrocyanide, potassium ferricyanide, sodium nitroprusside and sodium cobaltinitrite.
CO-3	<ul style="list-style-type: none"> Understanding the concept of bonding in transition elements
CO-4	<ul style="list-style-type: none"> Study various theories of bonding like valence bond theory, crystal field theory, ligand field theory and molecular field theory.
CO-5	<ul style="list-style-type: none"> Understanding the application of crystal field theory.
CO-6	<ul style="list-style-type: none"> To study the chemistry of lanthanides and actinides.
CO-7	<ul style="list-style-type: none"> Understanding the inorganic reaction mechanisms like substitution reactions in square planar complexes, trans- effect, theories of trans effect. thermodynamic and kinetic stability of complexes
CC -VIII	Inorganic Chemistry III: Coordination Chemistry (Practical)
CO-1	<ul style="list-style-type: none"> Understanding the basic principles of gravimetry, chemistry involved in gravimetry analysis, terms applied in gravimetric analysis like co-precipitation, post precipitation, digestion etc.
CO-2	<ul style="list-style-type: none"> Understanding the application of gravimetric analysis in estimation of




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	Nickel as bis(dimethyl glyoximato)nickel(II)
CO-3	<ul style="list-style-type: none"> Understanding the application of gravimetric analysis in estimation of Cu as CuSCN
CO-4	<ul style="list-style-type: none"> Understanding the application of gravimetric analysis in estimation of iron as Fe₂O₃ by precipitating iron as Fe(OH)₃
CO-5	<ul style="list-style-type: none"> Understanding the basic principles of UV-vis spectrophotometer.
CO-6	<ul style="list-style-type: none"> Understanding the application of spectrophotometer in calculation of 10Dq and verification of spectrochemical series.
CO-7	<ul style="list-style-type: none"> Study the application of reaction mechanism with reference to reaction of ammine complexes of Ni(II)
CO-8	<ul style="list-style-type: none"> Understanding the synthesis of some co-ordination compounds like Tetraamminecopper (II) sulphate, [Cu(NH₃)₄]SO₄ .H₂O, Acetylacetonate complexes of Cu²⁺/Fe³⁺, Tetraamminecarbonatocobalt (III) nitrate and Potassium tri(oxalato)ferrate(III)
CC-IX	Organic Chemistry III: Nitrogen Containing functional groups, Polynuclear Hydrocarbons, Heterocyclic Chemistry, Alkaloids and Terpenes (Theory)
CO-1	<ul style="list-style-type: none"> Understanding chemistry of nitrogen containing functional groups, polynuclear hydrocarbons, heterocyclic compounds and natural compounds.
CO-2	<ul style="list-style-type: none"> Learn about chemistry of amines, diazonium salt, nitro compounds, nitriles and isonitriles.
CO-3	<ul style="list-style-type: none"> Detailed study of polynuclear hydrocarbon such as naphthalene, anthracene and phenanthrene.
CO-4	<ul style="list-style-type: none"> General method of synthesis of furan, pyrrole, thiophene, pyridine, indole, quinoline & isoquinoline & their reactions.
CO-5	<ul style="list-style-type: none"> Study of Hoffmann's exhaustive methylation & Emde's method.
CO-6	<ul style="list-style-type: none"> Illustration of structural elucidation of organic compound which are very helpful in future studies in chemistry.
CO-7	<ul style="list-style-type: none"> Structure elucidation of nicotine.
CC-IX	Organic Chemistry III: Nitrogen Containing functional groups, Polynuclear Hydrocarbons, Heterocyclic Chemistry, Alkaloids and Terpenes (Practical)
CO-1	<ul style="list-style-type: none"> Qualitative analysis of unknown organic compounds such as alcohols, carboxylic acids etc. Students get an idea how to identify an unknown organic compound, which is very useful in subsequent semesters.
CO-2	<ul style="list-style-type: none"> Systematic analysis involves alcohols, carboxylic acid, phenols, carbonyl compounds and esters.
CO-3	<ul style="list-style-type: none"> Isolation of natural compound, which is useful in further studies.
CO-4	<ul style="list-style-type: none"> Learn about extraction of caffeine from tea leaves.
CO-5	<ul style="list-style-type: none"> Understand quantitative organic chemistry experiments.
CO-6	<ul style="list-style-type: none"> Learn about aniline estimation by acetylation & bromate-bromide method.
CC - X	Physical Chemistry IV: Conductance & Chemical Kinetics (Theory)
CO-1	<ul style="list-style-type: none"> To explain the conductance and its variation with dilution, molar and equivalent conductance




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CO-2	<ul style="list-style-type: none"> To explain migration of ions under the influence of external potential
CO-3	<ul style="list-style-type: none"> To explain and derive the mathematical expressions of different rate laws
CO-4	<ul style="list-style-type: none"> Learn the basics and theories of rate of reaction and enzyme catalyzed reactions
CO-5	<ul style="list-style-type: none"> Have an understanding of laws of absorption of light energy and reactions catalyzed by light i.e. photochemical reactions
CC - X	Physical Chemistry IV: Conductance & Chemical Kinetics (Practical)
CO-1	<ul style="list-style-type: none"> To use colorimeter for the determination of conductance of different solutions.
CO-2	<ul style="list-style-type: none"> Demonstrate the application of colorimeter for studying various acid - base titrations
CO-3	<ul style="list-style-type: none"> To carry out different experiments in laboratory to study the kinetics of acid hydrolysis
CO-4	<ul style="list-style-type: none"> Experimentally study the kinetics of Iodine -persulphate reaction
CO-5	<ul style="list-style-type: none"> Experimentally Study the kinetics of saponification
CO-6	<ul style="list-style-type: none"> Carry out experiments to compare the strength of different acids, hydrolysis constants
CO-7	<ul style="list-style-type: none"> To demonstrate the effect of change of concentration of reactants and effect of temperature on rate of reactions
CC - XI	Organic Chemistry IV: Biomolecules (Theory)
CO-1	<ul style="list-style-type: none"> Understand and demonstrate how structure of biomolecules determine their reactivity and biological functions. Learn about Enzymes, cofactors and their actions and functions.
CO-2	<ul style="list-style-type: none"> Understand the structure and functions of DNA and RNA. Learn the concept of heredity through the study of genetic code, replication, transcription and translation.
CO-3	<ul style="list-style-type: none"> Demonstrate understanding the metabolic pathways, their interrelationship, regulation and energy production from biochemical processes
CO-4	<ul style="list-style-type: none"> Learn about the structure, synthesis, properties and functions of proteins and their precursors.
CO-5	<ul style="list-style-type: none"> Learn about the class of molecules which complete our basic needs i.e. food, shelter and clothing.
CO-6	<ul style="list-style-type: none"> Be able to understand the structure and properties of oils and fats and their precursors.
CC - XI	Organic Chemistry-IV: Biomolecules (Practical)
CO-1	<ul style="list-style-type: none"> Learn about the estimation of glucose by Fehling's solution.
CO-2	<ul style="list-style-type: none"> Understand the titration curve of amino acid (glycine).
CO-3	<ul style="list-style-type: none"> Learn how to estimate protein by Lowry's method.
CO-4	<ul style="list-style-type: none"> Understand the action of salivary amylase on starch under optimum conditions.
CO-5	<ul style="list-style-type: none"> Learn how to isolate and estimate DNA from plant source e.g. onion, peas, cauliflower.
CO-6	<ul style="list-style-type: none"> Learn how to determine Saponification value and Iodine value of any oil or fat and their significance also.



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CC - XII	Physical Chemistry V: Quantum Chemistry & Spectroscopy (Theory)
CO-1	<ul style="list-style-type: none"> Developing understanding of matter and energy beyond classical notion to explore at atomic and subatomic level
CO-2	<ul style="list-style-type: none"> Understanding the shortcomings and inadequacies of classical mechanics
CO-3	<ul style="list-style-type: none"> Providing tools and techniques of problem solving in quantum chemistry
CO-4	<ul style="list-style-type: none"> Honing abilities to compare spectroscopy and quantum chemistry
CC - XII	Physical Chemistry V: Quantum Chemistry & Spectroscopy (Practical)
CO-1	<ul style="list-style-type: none"> Basic understanding of the colorimeter and its working
CO-2	<ul style="list-style-type: none"> To perform various experiments based on the Lambert-Beer's Law
CO-3	<ul style="list-style-type: none"> Kinetic studies using spectroscopic method
CO-4	<ul style="list-style-type: none"> Understanding of the Spectrophotometer and various experiments related to it
CO-5	<ul style="list-style-type: none"> To use colorimeter to study rate of reactions
CC - XIII	Inorganic Chemistry IV: Organometallic Chemistry & Bioinorganic Chemistry (Theory)
CO-1	<ul style="list-style-type: none"> Understanding of the basic principles of qualitative inorganic analysis
CO-2	<ul style="list-style-type: none"> Rationalization of the stability of metal carbonyls and related species
CO-3	<ul style="list-style-type: none"> Understand the nature, structure and reactivity of metal carbonyls, Zeise's salt and ferrocene
CO-4	<ul style="list-style-type: none"> Identify important structural features of the metal alkyls tetrameric methyl lithium and dimeric trialkyl aluminium and explain the concept of multi-center bonding in these compounds
CO-5	<ul style="list-style-type: none"> Introduction to important features of catalysis and mechanisms of Wilkinson's catalyst, Zeigler- Natta catalyst and manufacturing of synthetic gasoline by Fischer-Tropsch process
CO-6	<ul style="list-style-type: none"> Basic knowledge of sources, effects of excess and deficiency of trace metals. Understanding the toxicity of certain metal ions, reasons for toxicity and their antidotes.
CO-7	<ul style="list-style-type: none"> Basic understanding of the use of chelating agents in medicine and the role of cisplatin in cancer therapy
CO-8	<ul style="list-style-type: none"> Learn the applications of iron in biological systems with particular reference to haemoglobin, myoglobin, ferritin and transferrin
CO-9	<ul style="list-style-type: none"> Understand the functioning of sodium-potassium pump in organisms
CO-10	<ul style="list-style-type: none"> Understand and describe the active sites and action cycles of the metalloenzymes carbonic anhydrase and carboxypeptidase
CC - XIII	Inorganic Chemistry IV: Organometallic Chemistry & Bioinorganic Chemistry (Practical)
CO-1	<ul style="list-style-type: none"> Understanding the basic principles of qualitative inorganic analysis
CO-2	<ul style="list-style-type: none"> Identification of different anions and cations present in a mixture
CO-3	<ul style="list-style-type: none"> Identification and removal of interfering ions in a mixture
CC - XIV	Organic Chemistry-V: Spectroscopy and Applied Organic Chemistry (Theory)
CO-1	<ul style="list-style-type: none"> Understand the basic principles of UV-Visible, IR and NMR Spectroscopic techniques




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CO-2	<ul style="list-style-type: none"> Know how to use spectroscopic techniques to determine structure and stereochemistry of known and unknown compounds
CO-3	<ul style="list-style-type: none"> Develop a sound understanding of the structure of pharmaceutical compounds. They will also understand the importance of different classes of drugs and their applications for treatment of various diseases.
CO-4	<ul style="list-style-type: none"> Learn about the chemistry of natural and synthetic polymers and polymerization including fabrics and rubbers
CO-5	<ul style="list-style-type: none"> Understand the chemistry of biodegradable and conducting polymers and appreciate the need of biodegradable polymers with the emphasis on basic principles.
CO-6	<ul style="list-style-type: none"> Learn about the theory of colour and constitution as well as the chemistry of dyeing.
CO-7	<ul style="list-style-type: none"> Know applications of various types of dyes including those in foods, medicines and textiles.
CC - XIV	Organic Chemistry-V: Spectroscopy and Applied Organic Chemistry (Practical)
CO-1	<ul style="list-style-type: none"> Learn about the systematic qualitative analysis and identification of the monofunctional organic compounds e.g. aromatic hydrocarbons, aryl halides, carbohydrates, nitro compounds, amines, amides etc.
CO-2	<ul style="list-style-type: none"> Understand the identification of some simple bifunctional organic compounds e.g. salicylic acid, cinnamic acid, nitrophenols.
CO-3	<ul style="list-style-type: none"> Learn about the identification of the simple organic compounds by IR and NMR spectra (if spectra is provided).

DISCIPLINE SPECIFIC ELECTIVE COURSES (DSE)


Paper No.	Paper Name
DSE - II	Inorganic Materials of Industrial Importance (Theory)
CO-1	<ul style="list-style-type: none"> Understand the composition and application of different kinds of glass. Also get learning about glazing of ceramics and the factors affecting their porosity. Develop an understanding about the manufacturing of cement and the mechanism of setting of cement.
CO-2	<ul style="list-style-type: none"> Understand the suitability of fertilizers for different kinds of crops and soil.
CO-3	<ul style="list-style-type: none"> Student will learn the process of formulation of paints and the basic principle behind the protection offered by the surface coatings.
CO-4	<ul style="list-style-type: none"> Understand the principle, working and applications of different types of batteries.
CO-5	<ul style="list-style-type: none"> This topic lists and explains the properties of engineering materials for mechanical construction used in day to day life.
CO-6	<ul style="list-style-type: none"> Learn about the synthesis and properties of nano-dimensional materials, various semiconductors, superconducting oxides and their applications in different industries.
DSE - II	Inorganic Materials of Industrial Importance (Practical)
CO-1	<ul style="list-style-type: none"> Enable the students to synthesize pigments and nanoparticles in laboratory.




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CO-2	<ul style="list-style-type: none"> Hands on experiments for the qualitative estimation of ions in fertilizers and alloys.
CO-3	<ul style="list-style-type: none"> Hands on experiments for the extraction of ions from alloys and their quantitative estimation
CO-4	<ul style="list-style-type: none"> Learn about the analysis of one or more ions by different quantitative estimation methods like gravimetry, iodometry, complexometry and potentiometry.
DSE-III	Application of Computers in Chemistry (Theory)
CO-1	<ul style="list-style-type: none"> Get accustomed with computer and programming skills
CO-2	<ul style="list-style-type: none"> Application of algorithm and various mathematical methods to solve problems of chemistry computationally using BASIC languages
CO-3	<ul style="list-style-type: none"> Handling the data and graphical representation in Excel, Q-Basic and other softwares
DSE -III	Application of Computers in Chemistry (Practicals)
CO-1	<ul style="list-style-type: none"> To write computer programs for using Q-Basic for different problems based on solving roots of equation in chemistry
CO-2	<ul style="list-style-type: none"> To write programs using different numerical methods
CO-3	<ul style="list-style-type: none"> To write programs on least square curve fitting method
CO-4	<ul style="list-style-type: none"> To write computer programs for graphical display of various chemistry related problems such as vander waals isotherm, compressibility and pressure curves, pH metric titrations, conductometric titrations, lambert beer law and many more
CO-5	<ul style="list-style-type: none"> To use excel for handling and manipulating data
DSE -IV	Analytical Methods in Chemistry (Theory)
CO-1	<ul style="list-style-type: none"> To enable the students to perform experiments with accuracy and precision
CO-2	<ul style="list-style-type: none"> Basic understanding of method development for analysis of different samples
CO-3	<ul style="list-style-type: none"> Understand basic principle and working of important instruments like Flame Photometer, UV-vis spectrophotometer and thermal analyser
CO-4	<ul style="list-style-type: none"> Estimation of metal ions from aqueous solution using UV-vis spectrophotometer
CO-5	<ul style="list-style-type: none"> Estimation of macronutrients using Flame photometry
CO-6	<ul style="list-style-type: none"> Learn separation of analytes by chromatography
CO-7	<ul style="list-style-type: none"> Learn extraction of different components using solvent extraction
CO-8	<ul style="list-style-type: none"> Learn basic principle of electroanalytical methods and titrations
DSE - IV	Analytical Methods in Chemistry (Practical)
CO-1	<ul style="list-style-type: none"> Learning method development for analysis of different samples
CO-2	<ul style="list-style-type: none"> Learn separation of analytes by chromatography
CO-3	<ul style="list-style-type: none"> Learn to separate amino acids from organic acids by ion exchange chromatography
CO-4	<ul style="list-style-type: none"> Learn to determine exchange capacity of cation and anion exchange resins
CO-5	<ul style="list-style-type: none"> Learn extraction of components using solvent extraction
CO-6	<ul style="list-style-type: none"> Learn to estimate metal ions from aqueous solution using UV-vis spectrophotometer




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CO-7	<ul style="list-style-type: none"> Learn to determine the composition of soil
DSE - V	Molecular Modelling & Drug Design (Theory)
CO-1	<ul style="list-style-type: none"> Understand the basics of molecular modelling
CO-2	<ul style="list-style-type: none"> Compare the computational and experimental results
CO-3	<ul style="list-style-type: none"> Aware of quantum mechanical, molecular dynamics and monte carlo simulations
CO-4	<ul style="list-style-type: none"> Learn QSAR role in drug designing and cheminformatics
CO-5	<ul style="list-style-type: none"> Hands-on through Argus lab and other softwares for geometry optimization of the molecules and so lving related problems
CO-6	<ul style="list-style-type: none"> Understand the basics of molecular modelling
DSE - V	Molecular Modelling & Drug Design (Practical)
CO-1	<ul style="list-style-type: none"> To optimize the geometrical parameters of molecules like shape, Bond length, bond angle using Argus Lab using different basis sets
CO-2	<ul style="list-style-type: none"> To plot HOMO, LUMO and ESP maps and explain the electron rich and deficient sites
CO-3	<ul style="list-style-type: none"> To perform conformational analysis of different molecules
CO-4	<ul style="list-style-type: none"> To compare the basicity of different compounds using mulliken charges and ESP maps
CO-5	<ul style="list-style-type: none"> To compute enthalpy of hydrogenation and Resonance
CO-6	<ul style="list-style-type: none"> Docking studies using Argus Lab
DSE - 8	Green Chemistry (Theory)
CO-1	<ul style="list-style-type: none"> Learn environment pollution and its impact
CO-2	<ul style="list-style-type: none"> Learn causes of environmental pollution such as depletion of natural resources, climate change, ozone depletion, heaps and heaps of landfills piling up.
CO-3	<ul style="list-style-type: none"> Role of chemistry in environment pollution
CO-4	<ul style="list-style-type: none"> Need to develop sustainable practices to remove the negative aspects of conventional chemistry.
CO-5	<ul style="list-style-type: none"> Enhance the industrial as well as well as economic and societal growth.
CO-6	<ul style="list-style-type: none"> Learn different aspects of green chemistry to enhance innovative skills, critical thinking and valuable skills to solve various environmental issues.
CO-7	<ul style="list-style-type: none"> Learn to develop environmentally efficient and benign reformations for conventional protocols.
CO-8	<ul style="list-style-type: none"> Learn green chemistry concepts such as twelve principles of green chemistry to develop the basic understanding of toxicity, hazard and risk of chemical substances.
CO-9	<ul style="list-style-type: none"> Understand the concept of stoichiometric calculations and relate them to green chemistry metrics, atom economy and their difference from percentage yield.
CO-10	<ul style="list-style-type: none"> Learn, to design safer chemical, products and processes, as compared to conventional alternatives to prevent accidents.
CO-11	<ul style="list-style-type: none"> Use of renewable feed stock for energy efficient process and protection of the environment, renewable energy sources,
CO-12	<ul style="list-style-type: none"> Learn important reactions in various green solvents.




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CO-13	<ul style="list-style-type: none"> Learn various green alternatives of energy such as Microwave, ultrasound for chemical reactions.
CO-14	<ul style="list-style-type: none"> Understand the role of catalyst and bio catalyst, photocatalyst.
CO-15	<ul style="list-style-type: none"> Learn to enhance profits and productivity, without generation of waste.
CO-16	<ul style="list-style-type: none"> Learn success stories and real world cases which motivate to practice green chemistry.
CO-17	<ul style="list-style-type: none"> Learn various career opportunities generated using Green chemistry.
DSE - 8	Green Chemistry (Practical)
CO-1	<ul style="list-style-type: none"> Learn about Safer starting materials such as preparation and characterization of metal nanoparticles using plant extracts.
CO-2	<ul style="list-style-type: none"> Learn to prepare biodiesel using renewable resources
CO-3	<ul style="list-style-type: none"> Learn to use of enzymes as catalysts as an alternative of toxic and harmful chemical catalysts.
CO-4	<ul style="list-style-type: none"> Learn to use green solvents such as liquid CO₂ generated from dry ice to extract d-limonene from orange peel.
CO-5	<ul style="list-style-type: none"> Learn to perform mechanochemical solvent free, solid-solid synthesis of azomethine
CO-6	<ul style="list-style-type: none"> Learn to utilize alternative sources of energy such as microwave, photocatalytic reactions to carry out different chemical reactions
CO-7	<ul style="list-style-type: none"> Also learn to utilize various and by products obtained in above preparations as starting materials for new reactions like use of nanoparticles as catalyst for a reaction, conversion of glycerol a byproduct of biodiesel into a useful product.
DSE - 9	Industrial Chemicals & Environment (Theory)
CO-1	<ul style="list-style-type: none"> Study in detail the listed industrial chemicals and gases w.r.t. production, uses, storage and hazards
CO-2	<ul style="list-style-type: none"> Introduction to different segments of environment and their importance
CO-3	<ul style="list-style-type: none"> Understand different chemical aspects of pollution. viz: air, water, energy etc
CO-4	<ul style="list-style-type: none"> Considering the sources, effects and controlling measures for different pollutants
CO-5	<ul style="list-style-type: none"> Industrial effluents and their treatment methods.
CO-6	<ul style="list-style-type: none"> Details of topics as biocatalysis, green chemistry and their applicability
DSE - 9	Industrial Chemicals & Environment (Theory)
CO-1	<ul style="list-style-type: none"> Measurement of different water quality parameters - DO, BOD, COD
CO-2	<ul style="list-style-type: none"> Analysis of bleaching powder
CO-3	<ul style="list-style-type: none"> Measurement of other water quality parameters--alkalinity, dissolved CO₂, chloride ion, sulphate ion
CO-4	<ul style="list-style-type: none"> Preparation of boric acid





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SKILL ENHANCEMENT ELECTIVE COURSES (SEC)


Paper No	Paper Name
SEC 1	IT Skills for Chemists (Theory)
CO-1	<ul style="list-style-type: none"> Understanding of mathematical techniques and basic computer skills in order to solve chemistry problems.
CO-2	<ul style="list-style-type: none"> Learning the concept of uncertainty and error in experimental data.
CO-3	<ul style="list-style-type: none"> Provides understanding of different software for data tabulation, calculation, graph plotting, data analysis and document preparation.
CO-4	<ul style="list-style-type: none"> Understanding of mathematical techniques and basic computer skills in order to solve chemistry problems.
SEC 1	IT Skills for Chemists (Practical)
CO-1	<ul style="list-style-type: none"> Hands on exercises on computers that helps in preparing a word processing document having tables, chemical structures and chemical equations.
CO-2	<ul style="list-style-type: none"> Solving chemistry problems and simulating graphs using basic computer skills.
CO-3	<ul style="list-style-type: none"> Usage of software for tabulating data, plotting graphs and charts, carry out statistical analysis of the data.
CO-4	<ul style="list-style-type: none"> Hands on exercises on computers that helps in preparing a word processing document having tables, chemical structures and chemical equations.
SEC 3	Chemical Technology and Society (Theory)
CO-1	<ul style="list-style-type: none"> To understand the basic concept of technology for societal benefits
CO-2	<ul style="list-style-type: none"> Prepare hypothesis for introduction clean technology
CO-3	<ul style="list-style-type: none"> Identify the consequences of technology to society and mitigate problems caused by technology
CO-4	<ul style="list-style-type: none"> To modernize aerospace using chemical technology.
CO-5	<ul style="list-style-type: none"> To understand the technology used in industries
CO-6	<ul style="list-style-type: none"> To know about various applications of chemical technology in medicinal chemistry
CO-7	<ul style="list-style-type: none"> The use of chemical technology in green chemistry
SEC 4	Cheminformatics (Theory)
CO-1	<ul style="list-style-type: none"> An Understanding of History of Cheminformatics and Molecular modelling
CO-2	<ul style="list-style-type: none"> To represent molecules and reactions using notations like SMILES, Matrix representations etc.
CO-3	<ul style="list-style-type: none"> To understand the importance of Molfiles and Sdfiles
CO-4	<ul style="list-style-type: none"> To carry out search for chemical structures using sub-structure, full structure, similarity search, three dimension search using different softwares available predict the properties of compounds using LEFR, QSAR, QSPR and Toxicity
CO-5	<ul style="list-style-type: none"> To understand the structure spectra correlation
CO-6	<ul style="list-style-type: none"> To understand the basics of Drug designing and apply that for prediction of good candidates for drug discovery
SEC 4	Cheminformatics (Practical)




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CO-1	<ul style="list-style-type: none"> To perform data mining using online databases
CO-2	<ul style="list-style-type: none"> To represent chemical information using SMILES, InChi and other In-silico representation
CO-3	<ul style="list-style-type: none"> To draw molecules using softwares like ChemDraw, MarvinSketch, ORTEP, Chimera, Rasmol and Pymol
CO-4	<ul style="list-style-type: none"> To carry out drug designing using molecular modelling tool, Structure - Homology modelling tools. Docking and screening tools
CO-5	<ul style="list-style-type: none"> To Build a ligand and asses its activity and toxicity
SEC 6	Intellectual Property Rights (Theory)
CO-1	<ul style="list-style-type: none"> Understand the theoretical concepts of Intellectual Property Laws, and to differentiate between the different kinds of IP.
CO-2	<ul style="list-style-type: none"> They will come to know the existing legal framework relating to IP in India.
CO-3	<ul style="list-style-type: none"> Comprehend the importance of IP and its significance in their respective domains.
CO-4	<ul style="list-style-type: none"> This course will motivate the students to make their career in multifaceted field of intellectual Property.
CO-5	<ul style="list-style-type: none"> The student learn the Basic concept of Intellectual Property.
CO-6	<ul style="list-style-type: none"> The students will get familiar about The World Intellectual Property Organization (WIPO), WTO and TRIPS Agreement.
CO-7	<ul style="list-style-type: none"> The students will have the brief Introduction and will understand the Criteria for obtaining patents.
CO-8	<ul style="list-style-type: none"> The students will understand the meaning of mark and Trademark, the various Categories of Trademark.
CO-9	<ul style="list-style-type: none"> The students will understand the concept of Geographical Indication.
CO-10	<ul style="list-style-type: none"> The students with get knowledge about the Plant Variety Protection and Farmer's Right.
CO-11	<ul style="list-style-type: none"> We will teach students the Enforcement of Intellectual Property Rights.
CO-12	<ul style="list-style-type: none"> Understand the theoretical concepts of Intellectual Property Laws, and to differentiate between the different kinds of IP.
SEC 7	Analytical Clinical Biochemistry (Theory)
CO-1	<ul style="list-style-type: none"> To understand the structure of biomolecules and determines their reactivity and biological uses.
CO-2	<ul style="list-style-type: none"> Gain an insight into concept of heredity through biological processes like replication, transcription and translation
CO-3	<ul style="list-style-type: none"> Understand the application of chemistry in biological systems
CO-4	<ul style="list-style-type: none"> Demonstrate an understanding of the biochemistry of diseases.
CO-5	<ul style="list-style-type: none"> Understand the basic principles of drug-receptor interaction and structure activity relation (SAR).
CO-6	<ul style="list-style-type: none"> To understand in brief about the different forms of lipid in our body like membrane lipids, cholesterol, lipoproteins, liposomes etc.
SEC 7	Analytical Clinical Biochemistry (Practical)
CO-1	<ul style="list-style-type: none"> Gain insight into qualitative analysis of lipids ad proteins
CO-2	<ul style="list-style-type: none"> Understand the concept of saponification number, iodine number and acid




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	value of different lipids sample
CO-3	• Estimation of DNA sample using diphenylamine method
CO-4	• Estimation of proteins by Lowry's method
CO-5	• Demonstrate the methods to determine the enzyme activity
SEC 8	Green Methods in Chemistry (Theory)
CO-1	• Learn the concept of environmental pollution and its impact.
CO-2	• Role of chemistry in environment pollution
CO-3	• Need to develop good practices in chemistry to remove the negative aspects of conventional chemistry
CO-4	• Learn the positive, less hazardous and beneficial aspects of chemistry.
CO-5	• Understand the concept of toxicity, hazard and risk of chemical substances, environmental law.
CO-6	• Learn green methods that aid to design and develop materials and processes to reduce the use and generation of hazardous substances in industry.
CO-7	• Understand various green chemistry concepts such as twelve principles of green chemistry
CO-8	• Understand to utilize renewable resources for sustainable development.
CO-9	• Learn to develop and utilize safer starting materials and synthetic routes for less hazardous substances
CO-10	• Learn to develop biodegradable materials such as plastics, antifoulants etc.
CO-11	• Learn to use green solvents as potential alternative of conventional solvents.
CO-12	• Learn important energy efficient reactions using green methods.
CO-13	• Learn to understand the role of different types of catalysts.
CO-14	• Learn success stories and real world cases which motivate to practice green chemistry.
SEC 8	Green Methods in Chemistry (Practical)
CO-1	• Learn to Prepare and characterize nanoparticles using plant extracts.
CO-2	• Learn to Prepare biodiesel from vegetable oil.
CO-3	• Learn to extract of D-limonene from orange peel using liquid CO ₂ prepared from dry ice.
CO-4	• Learn to perform mechanochemical solvent free, solid-solid synthesis of azomethine
CO-5	• Learn to perform solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper(II).
CO-6	• Also learn to perform design an experiment by utilizing the products and by-products obtained in above preparations which become waste otherwise if not used.
SEC 9	Pharmaceutical Chemistry (Theory)
CO-1	• Gain insight into retro-synthesis approach in relation to drug design and drug discovery.



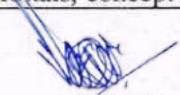

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CO-2	<ul style="list-style-type: none"> Learn synthetic pathways of major drug classes
CO-3	<ul style="list-style-type: none"> Understand the fermentation process and production of ethanol, citric acids, antibiotics and some classes of vitamins
CO-4	<ul style="list-style-type: none"> Information about the sources of drugs like marine, biological, minerals and plant tissue culture
CO-5	<ul style="list-style-type: none"> Study of pharmaceutical aids like talc, diatomite, kaolin, bentonite, gelatin and natural colours
SEC 9	Pharmaceutical Chemistry (Practical)
CO-1	<ul style="list-style-type: none"> Understand the method of synthesis of drugs (Aspirin, Paracetamol, sulphacetamide, Ibuprofen)
CO-2	<ul style="list-style-type: none"> Gain insight into the methods of qualitative analysis of drugs and their properties
CO-3	<ul style="list-style-type: none"> Demonstrate the method for the determination of alcohol content in liquid drug
CO-4	<ul style="list-style-type: none"> Understand difference between the iodometric and iodimetric titrations
CO-5	<ul style="list-style-type: none"> Learn the steps for the analysis of Vitamin C tablet available commercially
SEC 10	Chemistry of Cosmetics & Perfumes (Theory & Practical)
CO-1	<ul style="list-style-type: none"> Learn basic of cosmetics, various cosmetic formulation, ingredients and their roles in cosmetic products.
CO-2	<ul style="list-style-type: none"> Learn the use of safe, economic and body-friendly cosmetics
CO-3	<ul style="list-style-type: none"> Prepare new innovative formulations.

GENERIC ELECTIVES (GE)


Paper No	Paper Name
GE - 1	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (Theory)
CO-4	<ul style="list-style-type: none"> Solving the conceptual questions by applying the learnt concepts about the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, s, p, and d orbital shapes, and periodicity in atomic radii, ionic radii, ionisation energy, and electron affinity of elements
CO-5	<ul style="list-style-type: none"> Constructing viable molecular shapes and geometries (homo- & hetero-nuclear diatomic molecules)
CO-6	<ul style="list-style-type: none"> To understand how to Solve the conceptual questions using the knowledge gained by studying the quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization energy and electron affinity of elements.
CO-7	<ul style="list-style-type: none"> Understand the Shapes of s, p and d atomic orbitals, nodal planes, discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms).
CO-8	<ul style="list-style-type: none"> Rules for filling electrons in various orbitals, electronic configurations of the atoms, stability of half-filled and completely filled orbitals, concept of




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	exchange energy, relative energies of atomic orbitals, anomalous electronic configurations.
CO-9	<ul style="list-style-type: none"> Know about the Draw the plausible structures and geometries of molecules using radius ratio rules, VSEPR theory and MO diagrams (homo- & hetero-nuclear diatomic molecules).
CO-10	<ul style="list-style-type: none"> Understand about the hybridization in inorganic complex with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements.
CO-11	<ul style="list-style-type: none"> Understand the concept of resonance and resonating structures in various inorganic and organic compounds.
CO-12	<ul style="list-style-type: none"> Learn and understand the fundamental concepts of organic chemistry
CO-13	<ul style="list-style-type: none"> To write mechanism of different organic reactions
CO-14	<ul style="list-style-type: none"> To understand the stereochemistry of organic compounds
CO-15	<ul style="list-style-type: none"> Understand and explain the preparation, Physical properties and chemical reactions associated with Aliphatic hydrocarbons
GE - 1	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons (Practical)
CO-1	<ul style="list-style-type: none"> Understanding the basic concept of titrimetric analysis
CO-2	<ul style="list-style-type: none"> Carrying out redox, acid base titrations for understanding the principles of the above titrations.
CO-3	<ul style="list-style-type: none"> Carry out purification via crystallization and distillation of organic compound and confirm same using melting point and boiling point
CO-4	<ul style="list-style-type: none"> Carry out chromatography for separation of mixtures and sugars
CO-5	<ul style="list-style-type: none"> Separate the components in a mixture of two amino acids
GE - 3	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry (Theory)
CO-1	<ul style="list-style-type: none"> Understanding thermodynamic aspects of equilibria between phases.
CO-2	<ul style="list-style-type: none"> Learning the concept of conductance and its variation with dilution, migration of ions in solutions and applications of conductance measurement.
CO-3	<ul style="list-style-type: none"> Understanding the applications of thermodynamic principles to solutions.
CO-4	<ul style="list-style-type: none"> Illustration of Nernst distribution law and its applications.
CO-5	<ul style="list-style-type: none"> Understanding the concept of EMF and calculating thermodynamic properties and other parameters from the EMF measurements.
CO-6	<ul style="list-style-type: none"> Understanding the relevance of structure of biomolecules and to determine chemical properties, reactivity and biological uses.
CO-7	<ul style="list-style-type: none"> Designing synthetic routes for various organic compounds
GE - 3	Solutions, Phase Equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry (Practical)
CO-1	<ul style="list-style-type: none"> To construct phase diagram of simple eutectic systems
CO-2	<ul style="list-style-type: none"> To determine CST of Phenol-water impurities and study the effect of impurities on CST
CO-3	<ul style="list-style-type: none"> To perform conductometric titrations
CO-4	<ul style="list-style-type: none"> To perform potentiometric titrations




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CO-5	<ul style="list-style-type: none"> To find the functional group present in a organic compound using systematic analysis
GE - 4	Chemistry of s- and p-block elements, states of matter and Chemical Kinetics (Theory)
CO-1	<ul style="list-style-type: none"> Understanding the most common modes of metal occurrence based on typical electrode potentials
CO-2	<ul style="list-style-type: none"> Developing a thorough understanding Ellingham diagrams for metal oxide reduction with carbon as the reducing agent.
CO-3	<ul style="list-style-type: none"> Understanding of the metallurgical processes like cyanide method for silver and gold. Electrolytic, oxidative refining, van Arkel-de Boer procedure, and Mond's process and all methods for purifying metals (Al, Pb, Ti, Fe, Cu, Ni, Zn)
CO-4	<ul style="list-style-type: none"> Critical thinking skills for understanding the concepts of Electronic configuration, atomic and ionic size, ionisation enthalpy, electronegativity (Pauling, Winker, and Allred-Rochow scales) all such aspects of periodicity in s- and p-block elements.
CO-5	<ul style="list-style-type: none"> Understanding of concepts of Inert pair effect, diagonal relationship, and anomalous behaviour of the first member of each group), oxidation states with reference to elements in unusual and rare oxidation states like carbides and nitrides), inert pair effect, diagonal relationship, and anomalous behaviour of the first member of each group s- and p-Block Elements Compounds Diborane and the multicentre bonding idea
CO-6	<ul style="list-style-type: none"> Understanding following compounds' structure, bonding, and essential features such as oxidation/reduction, acidic/basic nature, and uses in industrial and environmental chemistry : Nitrogen hydrides, Phosphorous and Sulphur halides and oxohalides
CO-7	<ul style="list-style-type: none"> Understanding and deriving the mathematical expressions for ideal gas law, real gas law and comment on deviation from ideal behaviour
CO-8	<ul style="list-style-type: none"> Derive and explain the Maxwell Boltzman distribution, critical constants and viscosity of gases
CO-9	<ul style="list-style-type: none"> Explain and derive mathematical equations to explain properties of liquids
CO-10	<ul style="list-style-type: none"> Understand symmetry elements in Solid state
CO-11	<ul style="list-style-type: none"> Understand rate of reaction and derive different rate of equation, theories of reaction rates and explain experimental observations
GE - 4	Chemistry of s- and p-block elements, states of matter and Chemical Kinetics (Practicals)
CO-1	<ul style="list-style-type: none"> To perform semi-micro qualitative analysis to determine the anion and cation in a mixture
CO-2	<ul style="list-style-type: none"> To use stalagmometer to determine the surface tension of unknown liquids
CO-3	<ul style="list-style-type: none"> To use viscometers to determine the viscometer of unknown liquids
CO-4	<ul style="list-style-type: none"> To study the kinetics of reaction using different methods
GE - 5	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (Theory)
CO-1	<ul style="list-style-type: none"> Understand the chemistry of d & f block elements, Latimer diagrams, VBT and CFT




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CO-2	<ul style="list-style-type: none"> Understanding the basic principles of quantum mechanics: operators
CO-3	<ul style="list-style-type: none"> Provides understanding of basic concepts of microwave
CO-4	<ul style="list-style-type: none"> Illustration of Lambert-Beer's law
GE -5	Chemistry of d-block elements, Quantum Chemistry and Spectroscopy (Practical)
CO-1	<ul style="list-style-type: none"> Learn about the Estimation of the amount of nickel present in a given solution as bis - (dimethylglyoximate) nickel(II) or aluminium as oxinate in a given solution gravimetrically.
CO-2	<ul style="list-style-type: none"> Understand about the Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
CO-3	<ul style="list-style-type: none"> Learn about the Estimation of total hardness of a given sample of water by complexometric titration.
CO-4	<ul style="list-style-type: none"> Determination of the composition of the Fe^{3+} - salicylic acid complex / Fe^{2+} - phenanthroline complex in solution by Job's method.
CO-5	<ul style="list-style-type: none"> Verify Lambert-Beer's law and determine the concentration of $CuSO_4/KMnO_4/K_2Cr_2O_7/CoSO_4$ in a solution of unknown concentration
CO-6	<ul style="list-style-type: none"> Know about the chemical Kinetics; Study the kinetics of the following reactions. 1. Initial rate method: Iodide-persulphate reaction 2. Integrated rate method: Saponification of ethyl acetate.
GE -6	Organometallic, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (Theory)
CO-1	<ul style="list-style-type: none"> Inorganic chemistry topics, organometallics and bioinorganic chemistry were discussed in detail, and students accomplished better insights about basic terminology involved.
CO-2	<ul style="list-style-type: none"> Students were excited and curiously learned about basic concepts on structure elucidation of various polynuclear aromatic compounds and their important reactions.
CO-3	<ul style="list-style-type: none"> They were explained about active methylene compounds, particularly ethylacetoacetate.
CO-4	<ul style="list-style-type: none"> An extensive discussions were made on the basic spectroscopic techniques and their usage in structure elucidation of known compounds.
CO-5	<ul style="list-style-type: none"> Based on the discussion and assignments attempted by the students, the course played an important role to obtain better insight about polynuclear, heteronuclear aromatic compounds, and spectral analysis.
GE -6	Organometallic, Bioinorganic chemistry, Polynuclear hydrocarbons and UV, IR Spectroscopy (Practical)
CO-1	<ul style="list-style-type: none"> Students were exposed to the basic/preliminary separation technique, paper chromatography, which plays an important role while isolation or divorce of metal ions or organic compounds.
CO-2	<ul style="list-style-type: none"> A few inorganic preparations were dictated and discussed in detail, in turn students revealed their insightful questions, which were further elaborated with appropriate responses by the class teachers.
CO-3	<ul style="list-style-type: none"> An extensive discussions were made on the basic spectroscopic techniques and their usage in structure elucidation of known compounds.
CO-4	<ul style="list-style-type: none"> Separately, systematic qualitative analysis of organic compounds was




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	explained, performed and demonstrated to the students.
CO-5	<ul style="list-style-type: none"> Students were exposed to the basic/preliminary separation technique, paper chromatography, which plays an important role while isolation or divorce of metal ions or organic compounds.
GE - 7	Molecules of Life (Theory)
CO-1	<ul style="list-style-type: none"> Learn and demonstrate how the structure of biomolecules determines their chemical properties, reactivity and biological uses.
CO-2	<ul style="list-style-type: none"> Gain an insight into mechanism of enzyme action and inhibition.
CO-3	<ul style="list-style-type: none"> Know and understand the basic principles of drug-receptor interaction and SAR.
CO-4	<ul style="list-style-type: none"> Understand biological processes like replication, transcription and translation.
CO-5	<ul style="list-style-type: none"> Demonstrate an understanding of metabolic pathways, their inter-relationship, regulation and energy production from biochemical processes.
GE - 7	Molecules of Life (Practical)
CO-1	<ul style="list-style-type: none"> Learn about separation of amino acids by paper chromatography
CO-2	<ul style="list-style-type: none"> Understand the titration curve of amino acid (glycine)
CO-3	<ul style="list-style-type: none"> Learn how to estimate protein by Lowry's method.
CO-4	<ul style="list-style-type: none"> Understand the action of salivary amylase on starch under optimum conditions.
CO-5	<ul style="list-style-type: none"> Learn how to determine Saponification value and Iodine value of any oil or fat and their significance also.
CO-6	<ul style="list-style-type: none"> Learn how to isolate and estimate DNA from plant source e.g. onion, cauliflower.
CO-7	<ul style="list-style-type: none"> Learn to perform qualitative test for presence of carbohydrates such as Molisch Test, Rapid furfural test, Tollen's test and Fehling's Test




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B.Sc (H) Chemistry

After completing this programme as per CBCS, a student will have conceptual understanding of the basics of chemistry covering various principles and aspects. This course will also provide a brief introduction to recent frontiers and tools required in research in chemistry. This course will not only help in developing interdisciplinary knowledge but will also inculcate critical thinking ability in students.


Program Outcomes

- Developing a holistic approach in understanding basic principles and fundamentals of pure and applied branch of chemistry
- Forming an integrated perspective which is inclusive of Inorganic, Organic and Physical Chemistry.
- Exploring complex theories in a miniature form through laboratory experience.
- Orienting analytical insights to relate chemistry to wider spectrum of scientific disciplines.

Program Specific Outcomes

- Abilities to conduct experiments in researchable areas and applied fields.
- Solid theoretical grounding in Chemistry.
- Providing exposure to wider application of chemistry in Agriculture, Industry, Services and Environmental fields.
- Developing inter and intra disciplinary knowledge within the various branches of chemistry and the ways chemistry is related to other scientific disciplines.
- Bridging the connection between theory and application through elaborate design of laboratory experiments.
- Providing training to conduct practical's in Laboratory environment.
- Developing computational skill through programming and simulation of data derived from experiments in chemistry.




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Course Outcome

B.Sc. Statistics


Programme	Semester	Course Code	Course	Outcome
F.Y.B.Sc.	Sem I	USST101	Descriptive Statistics-I	This course is designed to introduce the student to elementary concepts in Statistics. Clarity of these concepts would enable the student to realize their relevance to the practical world and to build on these concepts to acquire a deeper understanding of analytical methods to be used in varied fields of study
		USST102	Statistical Methods-I	This course is designed to introduce the student to the concept and calculation of probability which forms the basis of all theoretical knowledge of statistics. As also random variable and their probability distributions. With this knowledge, student is able to classify data of any real life phenomenon into some or the other distribution and develop a deeper understanding of the underlying patterns in nature.
F.Y.B.Sc.	Sem II	USST201	Descriptive Statistics-II	This course is designed to introduce the student to elementary concepts in Statistics. Clarity of these concepts would enable the student to realize their relevance to the practical world and to build on these concepts to acquire a deeper understanding of analytical methods to be used in varied fields of study
		USST202	Statistical Methods-II	This course is designed to introduce the student to the concept and calculation of probability which forms the basis of all theoretical knowledge of statistics. As also random variable and their probability distributions. With this knowledge, student is able to classify data of any real life phenomenon into some or the other distribution and develop a deeper understanding of the underlying patterns in nature.
S.Y.B.Sc.	Sem I	USST301	Probability Distributions	Having introduced the students to the concept of probability distribution, other advanced characteristics are introduced related to discrete probability distributions to the students so as to develop in them a deeper understanding of various aspects of the natural patterns and thereby formulating and calculating their values mathematically.
		USST302	Sampling Techniques	Statistical Investigation about any phenomenon is dependent upon the collection of numerical information called as data. Data collection involves a process called as Sampling which enables the investigator to study the entire population from a small portion of it. This course is designed to enable




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				the student to know various sampling techniques, and to employ them effectively for estimating unknown parameters of the larger population
		USST303	Operations Research - I	A branch of Statistics called as Operations Research deals with techniques to be applied to problems in a number of organizations so as to optimize the output in the face of limiting factors or constraints. This course is designed to study the application of these techniques to problems in industry, transportation, assignment, sequencing, etc
S.Y.B.Sc.	Sem II	USST401	Probability and Sampling Distributions	In this course, continuous probability distributions are introduced to the students so as to develop in them a deeper understanding of various aspects of the natural patterns and thereby formulating and calculating their values mathematically.
		USST402	Analysis of Variance and Designs of Experiments	This course enables the student to appreciate the variance in natural phenomenon while understanding its causes and studying its mathematical formulation and analysis. Also, planning of experiments so as to arrive at reliable conclusions is studied under the topic called Designs of Experiments.
		USST403	Operations Research - II	A branch of Statistics called as Operations Research deals with techniques to be applied to problems in a number of organizations so as to optimize the output in the face of limiting factors or constraints. This course is designed to study the application of these techniques to problems in Project Management, Decision making and Game Theory.
T.Y.B.Sc.	Sem I	USST501	Probability and Distribution Theory	
		USST502	Theory of Estimation	A branch of Statistics that deals with the development and application of methods for estimating unknown parameters in a statistical model. This course is designed for students to gain knowledge about the various techniques of estimation
		USST503	Bio-Statistics	This course is designed for students to know the application of statistical theory in the study of biological sciences. In this Course, topics such as Epidemic theory, BioAssays, Clinical Trials and Bioequivalence have been dealt with from a statistician's perspective.
		USST504A	Regression Analysis using R Software	This course is designed to introduce students to the basics of R software which is highly efficient in computing of statistical measures. In this course, Regression Analysis is also studied through the use of R software.
T.Y.B.Sc.	Sem II	USST601	Distribution Theory and Stochastic Processes	
		USST602	Testing of	Testing of hypothesis is a statistical method used to




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			Hypothesis	make inference or draw conclusions about a population based on sample data. This course enables students to know the technique of formulating hypotheses, collecting and analyzing data and then drawing conclusions about the population based on the results.
		USST603	Operations Research Techniques	A branch of Statistics called as Operations Research deals with techniques to be applied to problems in a number of organizations so as to optimize the output in the face of limiting factors or constraints. This course is designed to study the application of these techniques to problems in Advanced Linear Programming, Replacement Theory, Reliability and Simulation Models
		USST604A	Acturial Science	Acturial Science is the application of probability and statistical techniques to life insurance. Concepts such as Assurance and Annuities are also important aspects in life insurance. This course is designed to introduce students to above branch of study also from the point of view of career opportunities in the field of Life Insurance.

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B.Sc.(Physics)

Class	Sem	Course	Outcome
F YBSc	SemI	Classical Physics	<ol style="list-style-type: none"> 1. Understand Newton's laws and apply them in calculations of the motion of simple systems 2. Use the free body diagram to analyze the forces on the object. 3. Understand the concepts of friction and the concepts of elasticity, fluid mechanics and be able to perform calculations using them 4. Understand the concepts of lens system and interference 5. Apply the laws of thermodynamics to formulate the relations necessary to analyze a thermodynamic process 6. Demonstrate quantitative problem solving skills in all the topics covered
		Modern Physics	<ol style="list-style-type: none"> 1. Understand nuclear properties and nuclear behavior 2. Understand the type isotopes and their applications 3. Demonstrate and understand the quantum mechanical concepts 4. Demonstrate quantitative problem solving skills in all the topics covered
F YBSc	SemII	Mathematica I Physics	<ol style="list-style-type: none"> 1. Understand the basic mathematical concepts and applications of them in physical situations 2. Demonstrate quantitative problem solving skills in all the topics covered
		Electricity and Electronic s	<ol style="list-style-type: none"> 1. Understand the alternating current theory, AC bridges & circuit theorem 2. Understand Digital electronics, DC power supply 3. Understand static electric and magnetic fields
SYBSc	SemIII	Mechanics and Thermodynamics	<ol style="list-style-type: none"> 1. Understand the concepts of mechanics & properties of matter & to apply them to problems. 2. Comprehend the basic concepts of

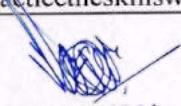


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			<p>thermodynamics & its applications in physical situation.</p> <ol style="list-style-type: none"> Learn about situations in low temperature. Demonstrate tentative problem solving skills in all above areas
		Vector calculus, Analog Electronics	<ol style="list-style-type: none"> Understand the basic concepts of mathematical physics and their applications in physical situations. Understand the basic laws of electrodynamics and be able to perform calculations using them. Understand the basics of transistor biasing, operational amplifiers, their applications. Understand the basic concepts of oscillators and be able to perform calculations using them. Demonstrate quantitative problem solving skill in all the topics covered.
		Applied Physics-I	<ol style="list-style-type: none"> Appreciate the role of Physics in 'interdisciplinary areas related to materials, Bio Physics, Acoustic etc. Understand the scope of the subject in Industry & Research.
SYBSc	Sem IV	Optics and Digital Electronics	<ol style="list-style-type: none"> Understand the diffraction and polarization processes and applications of them in physical situations. Understand the working of digital circuits Use IC 555 timer for various timing applications. Demonstrate quantitative problem solving skills in all the topics covered.
		Quantum Physics	<ol style="list-style-type: none"> Understand the postulates of quantum mechanics and understand its importance in explaining significant phenomena in Physics. Demonstrate quantitative problem solving skills in all the topics covered.
		Applied Physics-II	<ol style="list-style-type: none"> Understand the concepts of geophysics. Understand 8085 microprocessor, basic assembly language programming, instruction set of 8085 microprocessor Write programs for 8085 microprocessor Understand the concept of radiation, its types and the concept of radio communication
F YBSc		Practical Course	<ol style="list-style-type: none"> To understand and practice the skills while




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& SYBSc	Sem I,II,III,IV		<p>doing physics practical</p> <ol style="list-style-type: none"> 2. To understand the use of apparatus and their use without fear 3. To correlate their physics theory concepts through practical 4. Understand the concepts of errors and their estimation
TYBSc	Sem V	Mathematical, Thermal and Statistical Physics	<ol style="list-style-type: none"> 1. Learn some mathematical techniques required to understand the physical phenomena at the undergraduate level 2. Get exposure to important ideas of statistical mechanics 3. Solve simple problems in probability, understand the concept of independent events and work with standard continuous distributions. 4. Get idea of the functions of complex variables; solve non-homogeneous differential equations and partial differential equations using simple methods.
		Solid State Physics	<ol style="list-style-type: none"> 1. Understand the basics of crystallography, Electrical properties of metals, Band Theory of solids, demarcation among the types of materials, Semiconductor Physics and Superconductivity. 2. Understand the basic concepts of Fermi probability, distribution function, Density of states, conduction in semiconductors and BCS theory of superconductivity. 3. Demonstrate quantitative problem solving skills in all the topics covered.
		Atomic and Molecular Physics	<ol style="list-style-type: none"> 1. The application of quantum mechanics in atomic physics 2. The importance of electron spin, symmetric and antisymmetric wavefunctions and vector atom model 3. Effect of magnetic field on atoms and its application 4. Learn Molecular physics and its applications.
		Electrodynamics	<ol style="list-style-type: none"> 1. Understand the laws of electrodynamics and be able to perform calculations using them. 2. Understand Maxwell's electrodynamics and its relation to relativity. 3. Understand how optical laws can be derived from electromagnetic principles. 4. Develop quantitative problem solving skills.



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TYBSc	SemV	ElectiveI Applied Component Electronic Instrumentation	<ol style="list-style-type: none"> 1. Understand the difference between a transducer and a sensor. 2. Understand the construction, working and uses of different types of transducers. 3. Understand the concept of signal conditioning, devices used and their operations. 4. Get acquainted with the measuring instruments used in laboratory. 5. Get the insight of the modern medical instruments in principle, which are used in day to day life.
TYBSc	SemVI	Classical Mechanics	<ol style="list-style-type: none"> 1. Understand the kinds of motion that can occur under a central potential and their application to planetary orbits. 2. Learn the concepts needed for the important formalism of Lagrange's equations and derive the equations using D'Alembert's principle. 3. Appreciate the drastic effect of adding nonlinear corrections to usual problems of mechanics and nonlinear mechanics can help understand their irregularity we observe around us in nature.
		Electronics	<ol style="list-style-type: none"> 1. Understand the basics of semiconductor or devices and their applications. 2. Understand the basic concepts operational amplifier: its prototype and applications as instrumentation amplifier, active filters, comparators and waveform generation. 3. Understand the basic concepts of timing pulse generation and regulated power supplies 4. Understand the basic electronic circuits for universal logic building blocks and basic concepts of digital communication. 5. Develop quantitative problem solving skills in all the topics covered.
		Nuclear Physics	<ol style="list-style-type: none"> 1. Understand the fundamental principles and concepts governing classical nuclear and particle physics 2. Have knowledge of their applications interactions of ionizing radiation with matter the key techniques for particle accelerator the physical processes involved in nuclear power generation.



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			<ol style="list-style-type: none"> Understand the fundamental constituents of matter and lay foundation for the understanding of unsolved questions about dark matter, antimatter and other research oriented topics.
		Special Theory of Relativity	<ol style="list-style-type: none"> Understand the significance of Michelson Morley experiment and failure of the existing theories to explain the null result Understand the importance of postulates of special relativity, Lorentz transformation equations and how it changed the way we look at space and time, Absolutism and relativity, Common sense versus Einstein concept of Space and time. Solve problems based on length contraction, time dilation, velocity addition, Doppler effect, mass energy relation and resolve paradoxes in relativity like twin paradox etc.
		Elective II Applied Component Electronic Instrumentation	<ol style="list-style-type: none"> Analyze/design and implement combinational logic circuits. Develop assembly language programming skills and real time applications of microprocessor. Illustrate how to interface the I/O peripheral (PPI) with 8085 microprocessor Understand architecture, silent features, instruction set, programming and interfacing of 8051 microcontroller. Develop the programming skills in programming Language C++. Train their practical knowledge through lab experiments.
TYBSc	Sem V & VI	Practical Course Core & Applied Component	<ol style="list-style-type: none"> Understanding relevant concepts. Planning of the experiments Layout and adjustment of the equipments Understanding designing of the experiments Attempts to make the experiments open ended Recording of observations and plotting of graphs Calculation of results and estimation of possible errors in the observation of results



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M.Sc	Sem-I&II	Classical Mechanics	<p>At the end of the course, the learner is able to</p> <ol style="list-style-type: none"> 1. Understand the principle of virtual work and the concepts of least action, the formalisms of Lagrange and Hamiltonian (CO1) 2. Describe the motion of a system in Lagrangian and Hamiltonian formalisms (CO2) 3. Understand the features of motion under central force, periodic motion, small oscillations as they appear in other areas of Physics (CO3) 4. Use the Poisson brackets in Hamiltonian dynamics and solve related problems (CO4) 5. Understand the linkages of the techniques of Classical Mechanics in solving problems in areas of Statistical Mechanics (Phase space), Molecular Physics (CO5)
		QUANTUM MECHANICS I	<p>At the end of the course, the learner is able to</p> <ol style="list-style-type: none"> 1. Understand the basic principles of Quantum mechanics and the need for its formalism (CO1) 2. Understand the Uncertainty Principle and formulation of Schrodinger equation (CO2) 3. Understand the importance of Dirac formalism, vector spaces and apply the same in solving problems of potential barrier, square well potential (CO3) 4. Apply the techniques of solving differential equations using various special functions as they appear in the solution of Schrodinger equation for Hydrogen atom problem (CO4) 5. Solve the various boundary value and potential problems using the techniques of quantum mechanics
		MATHEMATICAL METHODS IN PHYSICS	<p>At the end of the course the learner will be able to</p> <ol style="list-style-type: none"> 1. Solve eigenvalue problems using matrices as they appear in Classical and Quantum Mechanics (CO1) 2. Apply tensor analysis to understand the formulation of relativistic electrodynamics and other areas of Physics (CO2) 3. Apply residue theorem of complex variables to solve real and definite integrals (CO3) 4. Understand the emergence of special functions as solutions of differential equations and to solve problems in physics (CO4) 5. Solve partial differential equations using integral transforms in boundary value problems




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		Introduction to Programming	<p>At the end of the course, the learner can</p> <ol style="list-style-type: none"> 1. Understand the use of programming language and write simple programs for mathematical problems (CO1) 2. Develop flowcharts for analyzing a given mathematical problem and solve them numerically (CO2) 3. Apply the techniques of numerical methods in interpolation to generate difference tables of a given data set (CO3) 4. Analyze a given data set and fit them to a suitable polynomial equation and present them graphically (CO4) 5. Simulate models for a given mathematical problem by techniques of Monte Carlo and other related techniques (CO5)
		QUANTUM MECHANICS II	<p>At the end of the course, the learner can</p> <ol style="list-style-type: none"> 1. Gain understanding of the mathematical foundations of the angular momenta of a system of particles (CO1) 2. Apply the concept of non-relativistic Hamiltonian for an electron with spin and perform calculation using angular momentum techniques (CO2) 3. Apply various approximation methods in the solution of time independent and time dependent Schrodinger equations (CO3) 4. Apply the perturbation theory to various forms of Schrodinger equation in scattering theory and partial wave analysis (CO4) 5. Apply the quantum mechanical principles to
		NUCLEAR PHYSICS	<p>se Outcome: At the end of the course, the learner</p> <ol style="list-style-type: none"> 1. Gains knowledge about the nuclear properties such as mass, size, spin and the methods adopted for their estimation 2. Gains awareness of safety and regulatory norms adopted in the nuclear programme in the country 3. Understands the various nuclear models, 4. Understands the nuclear reactions with the ideas of decay mechanisms, interaction of radiation with matter and the experimental methods of analysis 5. Gains insight into the basics of Particle Physics with introductory ideas of the fields of Quantum Electrodynamics and Quantum




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Programme Name: Bachelor of Science

Course Name: Mathematics.

1.Aims and Objectives:

- (i) Give the students a sufficient knowledge of fundamental principles, methods and a clear perception of innumerable power of mathematical ideas and tools and know how to use them by modeling, solving and interpreting.
- (ii) Reflecting the broad nature of the subject and developing mathematical tools for continuing further study in various fields of science
- (iii) Enhancing students' overall development and to equip them with mathematical modeling various kinds of employment.
- (iv) A student should get adequate exposure to global and local concerns that explore them many aspects of Mathematical Sciences.

2.Programme Outcomes:

- (i) Enabling students to develop positive attitude towards mathematics as an interesting and valuable subject.
- (ii) Enhancing students overall development and to equip them with mathematical modeling, abilities, problem solving skills, creative talent and power of communication.
- (iii) Acquire good knowledge and understanding in advanced areas of mathematics and physics.

3.Course outcomes:

1. Calculus (Sem I & II): This course gives introduction to basic concepts of Analysis with rigor and prepares students to study further courses in Analysis. Formal proofs are given lot of emphasis in this course which also enhances understanding of the subject of Mathematics as a whole. The portion on first order, first degree differentials prepares learner to get solutions of so many kinds of problems in all subjects of Science and also prepares learner for further studies of differential equations and related fields.
2. Algebra I (Sem I) & Discrete Mathematics (Sem II): This course gives expositions to number systems (Natural Numbers & Integers), like divisibility and prime numbers and their properties. These topics later find use in advanced subjects like cryptography and its uses in cyber security and such related fields.



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(i) Multivariable Calculus II (Sem V): In this course students will learn the basic ideas, tools and techniques of integral calculus and use them to solve problems from real-life applications including science and engineering problems involving areas, volumes, centroid, Moments of mass and center of mass Moments of inertia. Examine vector fields and define and evaluate line integrals using the Fundamental Theorem of Line Integrals and Green's Theorem; compute arc length.

(ii) Complex Analysis (Sem VI): Students Analyze sequences and series of analytic functions and types of convergence, Students will also be able to evaluate complex contour integrals directly and by the fundamental theorem, apply the Cauchy integral theorem in its various versions, and the Cauchy integral formula, they will also be able to represent functions as Taylor, power and Laurent series, classify singularities and poles, find residues and evaluate complex integrals using the residue theorem.

(iii) Group Theory, Ring Theory (Sem V, Sem VI) Students will have a working knowledge of important mathematical concepts in abstract algebra such as definition of a group, order of a finite group and order of an element, rings, Euclidean domain, Principal ideal domain and Unique factorization domain. Students will also understand the connection and transition between previously studied mathematics and more advanced mathematics. The students will actively participate in the transition of important concepts such as homomorphisms & isomorphisms from discrete mathematics to advanced abstract mathematics

(iv) Topology of metric spaces (Sem V), Topology of metric spaces and real analysis (Sem VI):

This course introduces students to the idea of metric spaces. It extends the ideas of open sets, closed sets and continuity to the more general setting of metric spaces along with concepts such as compactness and connectedness. Convergence concepts of sequences

and series of functions, power series are also dealt with. Formal proofs are given a lot of emphasis in this course. This course serves as a foundation to advanced courses in analysis. Apart from understanding the concepts introduced, the treatment of this course will enable the learner to explain their reasoning about analysis with clarity and rigour.

(v) Number Theory and its applications I and II (Sem V, Sem VI):

The student will be able to

- a) Identify and apply various properties of and relating to the integers including primes, unique factorization, the division algorithm, and greatest common divisors.
- b) Understand the concept of a congruence and use various results related to congruences including the Chinese Remainder Theorem. Investigate Pseudo-primes, Carmichael number, primitive roots.
- c) Identify how number theory is related to and used in cryptography. Learn to encrypt and decrypt a message using character ciphers. Learn to encrypt and decrypt a message using Public-Key cryptology.
- d) Express a rational number as a finite continued fraction and hence solve a linear diophantine equation. Express a given repeated continued fraction in terms of a



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surd. Expand a surd as an infinite continued fraction and hence find a convergent which is an approximation to the given surd to a given degree of accuracy. Solve a Pell equation from a continued fraction expansion.

- e) Solve certain types of Diophantine equations. Represent a Primitive Pythagorean Triples with a unique pair of relatively prime integers.
- f) Identify certain number theoretic functions and their properties. Investigate perfect numbers and Mersenne prime numbers and their connection. Explore the use of arithmetical functions, the Mobius function, and the Euler function.




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Programme/Courses

Under Graduate programme- Zoology

- F.Y.B.Sc.
- S.Y.B.Sc.
- T.Y.B.Sc.

Programme specific outcomes

PSO1: Gain the comprehensive knowledge and understanding of major concepts, theoretical

principles and experimental findings in Zoology and its different subfields

PSO2: Learn a wide range of approaches, from genetics to molecular and cellular biology, as well as physiological processes and anatomy, and diseases

PSO3: Spread awareness about wildlife and ecology as well as the environment and its conservation in the society

PSO4: Gain knowledge of Agro based Small Scale industries like sericulture, aquaculture and vermicomposting.

PSO5: Develop the interest and employability, program includes learning experiences which offer opportunities for higher studies and research at reputed laboratories

PSO6: Understand the concept of research and its type along with basic knowledge of qualitative research techniques, data collection and process of scientific documentation.

PSO7: Analyse the ethical aspects of research and evaluate the different methods of scientific writing and reporting by appropriate documentations and presentations.

Course outcomes



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Course Outcomes

Class: F.Y.B. Sc. Zoology

Semester I

Course (Paper) Name and No.: Kingdom Animalia, Wonders of Animal World, Biodiversity and its Conservation

CO1	Curiosity will be ignited in the mind of learners, to know more about the fascinating world of animals which would enhance their interest and love for the subject of Zoology.
CO2	Learner would come to know about basic of systematic and the hierarchy in invertebrates. Learner would have knowledge about different phyla with their respective examples.
CO3	Learners would appreciate treasure of Biodiversity, its importance and hence would contribute their best for its conservation

Course (Paper) Name and No.: Laboratory safety units and measurement, Instrumentation and Animal biotechnology

CO1	Learners would work safely in the laboratory and avoid occurrence of accidents (mishaps) which will boost their scholastic performance and understanding of economy in use of materials/chemicals during practical sessions.
CO2	Learner would be able to select and operate suitable instruments for the studies of different components of Zoology. Further learner would be skilled in the area of research.
CO3	Learner would understand the recent advances in the subject, its applications for the betterment of mankind; and that the young minds would be tuned to think out of the box

Semester II

Course (Paper) Name and No.: Laboratory safety units and measurement, Instrumentation and Animal biotechnology




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CO1	This lesson explores the classification system used to identify animals. This unit is specifically designed to move quickly beyond the knowledge level to high-level thinking.
CO2	Learners will grasp the concept of interdependence and interaction of physical, chemical and biological factors in the environment and will lead to better understanding about implications of loss of fauna specifically on human being.
CO3	Learners would be inspired to choose career options in the field of wild life conservation, research, photography and ecotourism.

Course (Paper) Name and No.: Laboratory safety units and measurement, Instrumentation and Animal biotechnology

CO1	Healthy dietary habits would be inculcated in the life style of learners in order to prevent risk of developing health hazards in younger generation due to faulty eating habits.
CO2	Learners will be able to promptly recognize stress related problems at initial stages and would be able to adopt relevant solutions which would lead to psychologically strong mind set promoting positive attitude important for academics and would be able to acquire knowledge of cause, symptoms and precautions of infectious diseases




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Class: S.Y.B. Sc. Zoology

Semester III

Course (Paper) Name and No.: Fundamentals of Genetics, Chromosomes and Heredity, Nucleic acids

CO1	Learner shall comprehend and apply the principles of inheritance to study heredity. Learner will understand the concept of multiple alleles, linkage and crossing over
CO2	Learner will comprehend the structure of chromosomes and its types. Learner shall understand the mechanisms of sex determination. Learner would be able to correlate the disorders linked to a particular sex chromosome.
CO3	Learner will understand the importance of nucleic acids as genetic material. The learner shall comprehend and appreciate the regulation of gene expressions.

Course (Paper) Name and No.: Study of Nutrition and Excretion, Respiration and circulation, Control and coordination, Locomotion and Reproduction

CO1	Learner would understand the increasing complexity of nutritional, excretory and osmoregulatory physiology in evolutionary hierarchy.
CO2	Learner would be able to
CO3	Learner would understand the increasing complexity of respiratory and
CO4	Learner would be able to correlate the habit
CO5	Learner would understand the process of control and coordination by nervous and endocrine regulation.
CO6	Learner would be fascinated by various locomotory structures found in the animal kingdom.
CO7	Learner would be acquainted with various reproductive strategies present in animals.



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Course (Paper) Name and No.: Ethology, Parasitology, Economic Zoology

CO1	Learners would gain an insight into different types of animal behavior and their role in biological adaptations. Learners would be sensitized to the feelings instrumental in social behavior.
CO2	Learners would understand the general epidemiological aspects of parasites that affect humans and apply simple preventive measures for the same. Learners would comprehend the life cycle of specific parasites, the symptoms of the disease and its treatment
CO3	Learners would gain knowledge on animals useful to mankind and the means to make the most of it. Learners would learn the modern techniques in animal husbandry. Learners would be pursuing entrepreneurship as careers

Semester IV

Course (Paper) Name and No.: Origin and Evolution of Life, Population and Evolutionary Genetics, Scientific Attitude, Methodology, Scientific Writing and Ethics in Scientific Research

CO1	Learner will gain insight about origin of life. Learner will ponder and critically view the different theories of evolution.
CO2	Learner would understand the forces that cause evolutionary changes in natural populations. Learner would comprehend the mechanisms of speciation. Learner will be able to distinguish between microevolution, macroevolution and megaevolution.
CO3	The learner shall develop qualities such as critical thinking and analysis.
CO4	The learner will imbibe the skills of scientific communication and he/she will understand the ethical aspects of research.



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Course (Paper) Name and No.: Cell biology, endomembrane system and biomolecule

CO1	Learner would acquire insight of transport mechanisms for the maintenance and composition of cell.
CO2	Learner would appreciate the intricacy of endomembrane system. Learner would understand the interlinking of endomembrane system for functioning of cell
CO3	The learner will realize the importance of biomolecules and their clinical significance

Course (Paper) Name and No.: Comparative Embryology, Aspects of Human Reproduction, Pollution and its effect on organisms

CO1	Learner will be able to understand and compare the different pre- embryonic stages
CO2	Learner will be able to appreciate the functional aspects of extra embryonic membranes and classify the different types of placentae.
CO3	Learners will able to understand human reproductive physiology.
CO4	Learners will become familiar with advances in ART and related ethical issues
CO5	The learners will be sensitized about the adverse effects of pollution and measures to control it



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Class: T.Y.B. Sc. Zoology

Semester V

Course (Paper) Name and No.: Course 11 Principles of Taxonomy, Modern Trends in Taxonomy and study of invertebrates

CO1	Learners will understand the basics concept of taxonomy and learn to classify animals on the basis of their relation to other animals by body structure, external characters and development
CO2	Learners will apply the International rules of Nomenclature to give a scientific name to animals which are found during research.
CO3	Learners will understand the gradual development and evolutionary history of different kinds of living organisms from earlier forms over several generations
CO4	Learners will understand and demonstrate the internal anatomy of various animals, biodiversity and related indices
CO5	Learners can learn about the historical development of systematic biology from 18th century to the present

Course (Paper) Name and No.: Course 12 Haematology and Immunology

CO1	Learners can achieve proficiency in the skills necessary for the study of haematology
CO2	Learners will be better equipped for taking any further pathological course or working in a diagnostic laboratory
CO3	Learners can identify the major cellular and tissue components which comprise the innate and adaptive immune system.
CO4	Learners would realize the significant role of immune system in giving resistance against diseases
CO5	Learners shall understand immune related pathologies and the principles and applications of vaccines

Course (Paper) Name and No.: Course 13 Histology, Biostatistics



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CO1	The students can learn about various aspects of enzymological assays and their applications in industries
CO2	The students can study basics histological techniques
CO3	The learners will gain a broad understanding of different areas of toxicology
CO4	Present course will also develop critical thinking and assist students in preparation for employment in pharmaceutical industry and related areas.
CO5	Learners will know basic concepts of probability and statistics which help them to describe statistical methods and probability distributions relevant for biological data analysis.

Course (Paper) Name and No.: Course 14 Integumentary system, Human Osteology and Endocrinology

CO1	Learners can understand the basic concepts of Integumentary system, Human osteology and Endocrinology.
CO2	Learners will be able to understand the importance of epidermal and dermal derivatives and their functions.
CO3	Learners will be able to understand the structure, types and functions of human skeleton.
CO4	Learners can understand the basic concepts of endocrinology and learn about the hypothalamus and hypophysial axis, endocrine glands and mechanism of hormone action.
CO5	Learners shall be able to understand the types & secretions of endocrine glands and their functions

Course (Paper) Name and No.: Applied Component: Oceanography, Aquaculture Practices, Marketing and Finance

CO1	Learner shall understand and learn about the use of sea safety, navigational equipment's and oceanographic instruments
CO2	Learner shall comprehend boat building techniques and design of engines used in mechanized



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	boats
CO3	Learner will gain knowledge about how to breed and rear ornamental fishes and commercially viable fish species
CO4	Learner shall comprehend the value of maintaining and taking sanitary precautions during the processing and packaging operations
CO5	Learner shall acquire knowledge about traditional marketing practices and role of cooperatives in selling fish

Semester VI

Course (Paper) Name and No.: Course 15 Phylum Chordata, Group Euchordata- I, Group Euchordata II and Type study - Shark

CO1	Learners will get an idea of origin of Chordates, its taxonomy up to class with reference to phylogeny and their special features
CO2	Learners will understand the characteristic features and examples of class of Reptilia, Aves and Mammalia.
CO3	Learners will get an idea of vertebrate animal life after studying one representative animal Shark.

Course (Paper) Name and No.: Course 16 Molecular Biology, Genetic Engineering, Human Genetics and Bioinformatics

CO1	Learner shall get an insight into the intricacies of chemical and molecular processes that affect genetic material
CO2	The course shall prepare learner to recognize the significance of molecular biology as a basis for the study of other areas of biology and biochemistry
CO3	Learner shall also understand related areas in relatively new fields of genetic engineering and biotechnology
CO4	Learners shall understand the concepts, mechanisms, evolutionary significance and relevance of molecular biology in the curriculum



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CO5	Learners will know the theory behind fundamental bioinformatics analysis methods and acquire knowledge of various databases of proteins, nucleic acids, primary, secondary and composite databases like BLAST, FASTA etc.
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Course (Paper) Name and No.: Course 17 Developmental biology

CO1	Learners can familiarize with early and later stages of development.
CO2	Learners can understand embryo development by studying the important process of cell differentiation, stages of development and morphogenesis
CO3	Learners get acquainted with process of early and late embryonic development in animals.
CO4	Learners get acquainted with post Embryonic Development and Implications of Developmental Biology.
CO5	Learners will be able to understand the processes involved in embryonic development and its application.

Course (Paper) Name and No.: Course 18 Environment and Wildlife management, Bioprospecting, Zoopharmacognosy and Zoogeography

CO1	Learners will understand about environment and Wildlife management
CO2	Learners will understand the basic concepts of bioprospecting, zoopharmacognosy and Zoogeography
CO3	Learners will understand the different factors affecting environment, its impact and environment management laws
CO4	Learners will be able to understand the wildlife habitat projects for animal protection.
CO5	Learners will understand the paradigms of discovery and commercialization of biological resources and knowledge gained by self-medication by animals.

Course (Paper) Name and No.: Applied Component: (Fishery Biology) Marine resources, Post-harvest and Farm Engineering

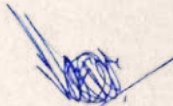
CO1	Learner shall understand and learn about the use of sea navigational equipments and oceanographic instruments
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CO2	Learner will understand breeding techniques and skills for culture of major carps and comprehend hatchery and nursery management of major carps
CO3	Learner will be equipped to carry out entrepreneurial operations or gain confidence to work in freshwater prawn unit and also gain knowledge about how to breed and rear ornamental fishes and commercially viable fish species
CO4	Learner shall understand deep sea and coastal fishes, crustacean and molluscan fisheries and its commercial potential.
CO5	Learners will acquire the knowledge and would put in to practice the preservation and processing techniques for commercial ventures
CO6	Learner will gain sound knowledge about the fish by-products and value-added products as well as explore good manufacturing practices while manufacturing these products.




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