

CURRICULUM
B. Sc (Zoology, Botany, Chemistry)

B. Sc. ZBC Semester –I

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	BIOL-318	INTRODUCTION TO FUNGI, LICHEN AND PLANT PATHOLOGY	3	2	0	2
2	BIOL-319	CELL BIOLOGY	3	2	0	2
3	BIOL-302	INVERTEBRATE – I	3	2	0	2
4	BIOL-310	TECHNIQUES AND INSTRUMENTAION IN BIOLOGY	3	2	0	2
5	BIOL-307	INTRODUCTORY PARASITOLOGY	3	2	0	2
6	CHEM-414	INTRODUCTORY ORGANIC CHEMISTRY	3	2	0	2
7	CHEM-415	ATOMIC STRUCTURE & PERIODIC CLASSIFICATION	3	2	0	2
8	CHEM-416	CHEMICAL KINETICS & ELECTRO CHEMISTRY	3	2	0	2
9	GPT-301	MORAL & VALUE EDUCATION	2	2	0	0

B.Sc. ZBC Sem. –II

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM-423	HYDROCARBONS	3	2	0	2
2	CHEM-424	CHEMICAL BONDING & NUCLEAR CHEMISTRY	3	2	0	2
3	CHEM - 425	GASES, CHEMICAL EQUILIBRIUM & SURFACE CHEM.	3	2	0	2
4	BIOL-304	INVERTEBRATE – II	3	2	0	2
5	BIOL-308	ALGAE AND BRYOPHYTES	3	2	0	2
6	BIOL-309	GENETICS	3	2	0	2
7	BIOL-311	IPR, BIOETHICS AND BIOSAFETY	3	2	0	2
8	MBFT-349	INTRODUCTION TO MICROBIOLOGY	3	2	0	2
9	CSIT-301	INTRODUCTION TO COMPUTER APPLICATIONS	3	2	0	2

B.Sc. ZBC Sem. –III

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM-530	ALIPHATIC COMPOUNDS	3	2	0	2
2	CHEM-531	MAIN GROUP ELEMENTS	3	2	0	2
3	CHEM-532	THERMO DYNAMICS-I & IONIC EQUILIB.	3	2	0	2
4	BIOL-408	MOLECULAR BIOLOGY	3	2	0	2
5	BIOL- 411	PTERIDOPHYTE AND GYMNOSPERM	3	2	0	2
6	BIOL-415	ANIMAL TAXONOMY AND DISTRIBUTION	3	2	0	2
7	BIOL-416	ELEMENTARY BIOCHEMISTRY	3	2	0	2
8	BIOL-417	VERTEBRATE – I	3	2	0	2
9	LNG-302	PROFESSIONAL COMMUNICATION – I	3	3	0	0

B.Sc. ZBC Sem. –IV

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM -540	AROMATIC COMPOUNDS	3	2	0	2
2	CHEM - 541	<i>d & f</i> BLOCK ELEMENTS	3	2	0	2
3	CHEM - 542	THERMODYNAMIC – II, PHASE EQUILIB & RADIO CHEMISTRY	3	2	0	2
4	BIOL-405	INTRODUCTORY ANIMAL PHYSIOLOGY	3	2	0	2
5	BIOL-418	VERTEBRATE – II	3	2	0	2
6	BIOL-421	PLANT TAXONOMY AND MORPHOLOGY	3	2	0	2
7	BIOL-422	INTRODUCTORY BIOTECHNOLOGY	3	2	0	2
8	BIOL-423	ANIMAL EVOLUTION	3	3	0	0
9	LNG-303	PROFESIONAL COMMUNICATION – II	3	3	0	0

B.Sc. ZBC Sem. –V

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM-550	NATURAL PRODUCTS	3	2	0	2
2	CHEM-551	ISOMERISM & COORDINATIONS CHEMISTRY	3	2	0	2
3	CHEM - 552	SOLUTION CHEMISTRY & ADVANCED ELECTROCHEMISTRY	3	2	0	2
4	BIOL-516	ECONOMIC ZOOLOGY	3	2	0	2
5	BIOL-517	ANIMAL DISTRIBUTION & ECOLOGY	3	2	0	2
6	BIOL-518	ETHNOBOTANY & PALEOBOTANY	3	2	0	2
7	BIOL-520	INTRODUCTORY PLANT PHISIOLOGY	3	2	0	2
8	ENV-415	ENVIRONMENTAL STUDIES- I	2	2	0	0

B.Sc. ZBC Sem. –VI

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	CHEM-560	ADV. ORGANIC CHEMISTRY	3	2	0	2
2	CHEM - 561	SPECTROSCOPY	3	3	0	0
3	CHEM-562	PHOTO CHEMISTRY & ADVANCED WAVE MECHANICS	3	2	0	2
4	BIOL-521	ANATOMY AND EMBRYOLOGY	3	2	0	2
5	BIOL-522	CYTOGENETICS, PLANTBREEDING & EVOLUTION	3	2	0	2
6	BIOL-525	DEVELOPMENTAL BIOLOGY & ETHOLOGY	3	2	0	2
7	BIOL-527	GENETICS & CELL BIOLOGY	3	2	0	2
8	ENV-416	ENVIRONMENTAL STUDIES -II	2	2	0	0

**Course Title: Bacteria, Virus, Lichen, Fungi and Plant Pathology
Semester-I**

Course Code: BIOL 301

Credit: 3 (2-0-2)

- Unit I Bacteria, Virus, and Lichens: General description, Classification, Structure, Reproduction & Economic Importance.
- Unit II Fungi: General description, classification, structure reproduction and Economic importance (of Ascomycetes, Basidiomycetes & fungi imperfecti) viz. *Phytophthora*, *Rhizopus*, *Peziza* / *Morchella*, *Ustilago*, *Puccinia*, *Cercospora*
- Unit III Plant pathology: classification of plant diseases & their symptoms, Host - Parasite interaction. Study of few e.g. Citrus canker, Leaf curl of papaya Control mechanism of plant diseases.

**Course Title: Invertebrate-I
Semester-I**

Course Code: BIOL 302

Credit: 3 (2-0-2)

- Unit I Phylum Protozoa: General characters, classification, structure, habit & habitat, life cycle of any two.
- Unit II Phylum Porifera & Coelenterate: General characters, classification, structure, habit & habitat, canal system in *Sycon*, polymorphism in coelenterate & coral reef formation.
- Unit III Phylum Platyhelminthes: General characters, classification, structure, habit & habitat, life cycle of *Taenia solium*, parasitic adaptations in platyhelminthes.
- Unit IV Phylum Aschelminthes: General characters, classification, structure, habit & habitat, plant parasitic nematodes, life cycle of *Ascaris*.

Course Title: Environmental Studies

Semester-I

Course Code: BIOL 305

Credit: 3 (2-0-2)

UNIT I Environmental pollution-such as air water, social & noise pollution. Their global, regional & local aspects. Air pollution, Water pollution, Noise pollution, Soil pollution –Their sources, effects on humans, plants & animals and their control.

UNIT II Deforestation and desertification, Chipko movement, overgrazing. Environmental hazards of radiation. Global warming, Acid rain, Ozone Layer depletion, Role of an individual in preventing pollution.

UNIT III Concept of Ecosystem, Producer, consumer, decomposers, Energy flow, Ecological succession, Food Chain, Food web, Ecological pyramid.

UNIT IV Introduction, types & characteristic features of (a) Forest (b)grass land (c)desert (d)pond.

Practical:

- Study of Biotic and Abiotic factors through project, charts and models.
- Study of aquatic ecosystem
 - a) Water temperature and pH
 - b) Turbidity using Sacchi disc
 - c) Determination of dissolved oxygen
 - d) Biotic components of pond ecosystem via chart
- Study of soil
 - a) composition,
 - b) pH
 - c) temperature
 - d) Moisture content
- Testing presence of carbonate in soil
- Testing presence of nitrate in soil
- Testing of inorganic salts in soil
- Minimum size of quadrat and species area curve of grassland vegetation
- To determine density abundance and frequency of grassland vegetation
- Basal cover of grassland vegetation

**Course Title: Introductory Parasitology
Semester-I**

Course Code: BIOL 307

Credit: 3 (2-0-2)

Unit-I Introduction about parasites, types, hosts, types of hosts, schematic steps in parasitological analysis.

Unit-II Habit, habitat, life cycle, pathogenicity, diagnosis, treatment and prophylaxis of *Leishmania donovani* and *Giardia intestinalis*.

Unit-III Habit, habitat, life cycle, pathogenicity, diagnosis, treatment and prophylaxis of *Fasciola hepatica*, *Diphyllobothrium latum*, *Paragonimus westermanii* and *Hymenolepis nana*.

Unit-IV Habit, habitat, life cycle, pathogenicity, diagnosis, treatment and prophylaxis of *Ancylostoma dodenale*, *Dracunculus mediansis* and *Wuchereria bancrofti*.

Practical:

1. Study of museum specimens of Platyhelminthes and Aschelminthes.
2. Study of morphology of parasites by means of charts.
3. Study of anatomy of parasites with the help of permanent slides.
- Study of parasitic adaptations with the help of model diagrams and specimens.

Semester – I
Course Title: INTRODUCTORY ORGANIC CHEMISTRY

Course Code-CHEM-414

Credit: 3(2-0-2)

Unit 1: IUPAC classification and Nomenclature.

Unit 2: Structure of Organic Molecules: Electronic theory of bonding. Wave mechanical model of Atom and Chemical bonding. Atomic Orbital theory, Nature and types of Covalent bond. Hybridization. Electro negativity Polarity Resonance. Hydrogen bonding.

Unit 3: Organic Reactions and their Mechanisms: Electron displacement effects. Bond fission, Carbonium ions Carbanions. Attacking reagent and their role. Types of reaction mechanisms and Organic reactions.

Unit 4: Isomerism: Introduction, Types of Isomerism, Asymmetric Carbon Atom, Chirality Absolute & Relative Configuration. R & S System. Optical isomerism, Racemic Mixtures.

Semester – I
Course Code: ATOMIC STRUCTURE & PERIODIC CLASSIFICATION

Course Code: CHEM-415

3(2-0-2)

Unit I: Structure of atom: Quantum and wave mechanical approaches to the structure of atom.

Unit II: Periodic classification and Properties: (a) Mendleef, Modern, Extended and long form.
(b) Periodic properties: Atomic and ionic radii, crystal co-ordination no., Radius ratio, factors influencing magnitude of ionic radii. Periodic variations of atomic and ionic radii.
Ionization energy, electron affinity and electronegativity.

Semester – I
Course Title: CHEMICAL KINETICS & ELECTROCHEMISTRY

Course Code: CHEM-416

3(2-0-2)

1. Chemical Kinetics:- Reaction rate, order and molecularity of reaction, zero, first, second and third order reaction (derivation included), methods for determining the order of reaction, complex reactions, opposing reactions, consecutive reactions and side reactions with reference to first order reactions. Effect of temperature on reaction on reaction velocity, Energy of activation and collision theory.

2. Electrochemistry:- Reversible and irreversible cells, EMF of a cell and free energy change, Nernst's equation, Equilibrium constant, standard electrode potential, types of reversible electrode, Application of EMF measurements (determination of solubility product, pH, dissociation constant of acids, hydrolysis constant, solubility of sparingly soluble salts.)

3. Colloidal State:- Lyophilic and Lyophobic solution, origin of charge, zeta potential, electrophoresis, electro-osmosis, Tyndall effect, coagulation, Hardy Schulze rule, Donnan membrane equilibrium.

Semester-I
Course Title: MORAL & VALUE EDUCATION
B. Sc. (PCM/ PCFS/ PMCS/ LSCFS/ ZBC)

Course Code: GPT-301

Credit Hrs.2-0-0

OBJECTIVES

- To explicitly discuss that is implicitly communicated through Academic disciplines.
- To inculcate Life affirming values based on 'Fear of God as the beginning of wisdom'.
- To focus on specific values in decision making process.

Section I – BASICS

- Integrating 'Heart-Head-Hand' – Story of Sam Higginbottom.
- 'Contextual – Dialogical – Praxiological' character of value education.
- Different Values: Academic – Economic – Social – Material – Moral – Spiritual.

Section II – Biblical Foundation

- Proverbs Chapter 2 – 4
- Ten Commandments Exodus 20: 1 – 17
- Two Commandments of Jesus Mark 12: 29 – 31
- Sermon on Mount Matthew chapter 5 – 7
- Lord's Prayer Matthew 6: 9 – 13, Luke 11: 1 – 4
- Parable of Good Samaritan Luke 10: 29 – 37
- Parable of Two Brothers Luke 15: 11 – 32

Section III – Formation of Character

- Voice of Conscience
- Virtues Prudence – Justice – Courage – Discipline – Success – Faith – Hope – Love
- Values of Life Marriage – No same-sex marriage – Divorce – Abortion
- Values of Belonging Family - Friends – Faith Community – Nation – World

Section IV – God – Human – Plants – Animals

- Stewardship of Creation
- Biotechnological Advancement
- Exploitation of Animals & Plants & Micro-Organisms
- Environmental Hazards

Section V – Our Constitution

- Fundamental Rights
- Directive Principles of State Policy
- Fundamental Duties
- Enlightened Citizenship: Ten points of Dr. A. P. J. Kalam

Section VI – Interactive Sessions

- Sexual Harassment
- Corruption
- Substance Abuse
- Violence
- Communalism
- Cyber crime

Course Title: HYDROCARBONS
Semester-II

Course Code-CHEM-423

Credit: 3(2-0-2)

Unit-1: Alkanes: Structure, Nomenclature, Isomerism, Preparation, Properties.

Unit 2: Cycloalkanes: Nomenclature Preparation Properties stability of cyclohexanes-Baeyer strain theory. Sachse-Mohr Concept of Strain less Rings. Conformations of Cyclohexane and its derivatives.

Unit 3: Alkenes: Structure, Nomenclature, Isomerism, Preparation, Properties.

Unit4: Petroleum and Petrochemicals: Composition of Petroleum, Cracking, Octane Number. Synthesis of Pure Chemicals

Unit 5: Alkyl Halids: Structure, Nomenclature, Isomerism, Preparation, Properties.

Unit 6: Organo metallic compounds: Grignard Reagent Structure, Preparation, Properties.

Unit 7: Alcohols: Introduction, Classification. Structure, Nomenclature, Isomerism Preparation, Properties

Course Title: CHEMICAL BONDING & NUCLEAR CHEMISTRY
Semester-II

Course Code: CHEM-424

Credit: 3(2-0-2)

Unit I: Chemical Bonding: Co-valent, Ionic, Metallic, Hydrogen, Vander Waals, Lattice energy, Hydration energy, Fajan's rule, Co-ordinate bond.

Unit II: Nuclear and Radiochemistry.

Course Title: GASES, CHEMICAL EQUILIBRIUM & SURFACE CHEMISTRY
Semester-II

Course Code: CHEM-425

Credit: 3(2-0-2)

1. **Gases:-** Gas laws and kinetic theory of gases, Critical constants and their determination, specific heat ratio, Vander waals equation of state, other equations of state e.g. Berthelot and Dieterici principles of corresponding states. Qualitative treatment of Maxwell law Distribution of velocities.

2. **Chemical Equilibrium:-** Law of mass action, Significance of equilibrium constant, Relation between K_p and K_c , application in homogeneous and heterogeneous equilibria, Le-chatier's principle and its application to chemical equilibrium.

3. **Surface Phenomenon:-** Physical and chemical adsorption, Freundlich, Langmuir and Gibbs Adsorption isotherm, B.E.T. Theory.

Semester-II
Course Title: History of Botany, Algae and Bryophyte

Course Code: BIOL 303

Credit: 3 (2-0-2)

- Unit I Scope of Botany, Phylogenetic trends in botany, contribution of some India Scientist like B. Sahni, M.O.P. Iyengar, P. Maheswari, S. R. Kashyap
- Unit II General Description, classification & economic importance of Algae. Important feature of at least two members of each: Cyanophyceae, Chlorophyceae, Xanthrophyceae, Bacillariophyceae, Phaeophyceae & Rodophyceae.
- Unit III General description, classification & economic importance of Bryophytes. External morphology, Anatomy & reproduction & life cycle of thalloid & leafy bryophytes with special reference to alternation of generation.

**Course Title: Invertebrate – II
Semester-II**

Course Code: BIOL 304

Credit: 3 (2-0-2)

- Unit I Phylum Annelida: General characters, classification, structure, habit & habitat, metamerism in Annelida, Economic importance of Earthworm.
- Unit II Phylum: Arthropoda: General characters, classification, Insects metamorphosis, Palaemon, Economic importance of Arthropods.
- Unit III Phylum Mollusca: General characters, classification, Torsion & Desertion in Gastropoda, Economic importance of mollusca.
- Unit IV Phylum Echinodermata: General characters, classification, water vascular system in star fish, Regeneration & Autonomy.

PRACTICAL

- Study of morphology of the preserved invertebrate animals in the laboratory.
- Dissection-Cockroach, Grasshopper, Prawn.

Course Title: Molecular biology

Semester-II

Course Code: BIOL 408

Credit: 3 (2-0-2)

UNIT I Basic introduction to molecular biology, Structural aspects of nucleic acids and proteins

UNIT II Replication and transcription in eukaryotes and prokaryotes; regulation and post transcriptional modification; concept of *lac & trp operon*

UNIT III Concept of genetic codon and modern concept of gene

UNIT IV Translation and post translational modification

UNIT V Transposons and extra nuclear inheritance

Practical:

- Basic methodology to molecular biology
- Preparation of reagent
- Protein isolation and quantization
- DNA isolation and agarose gel electrophoresis
- DNA purification

Course Title: Biological Techniques and Instrumentation

Semester-II

Course Code: BIOL 409

Credit: 3(2-0-2)

UNIT I Herbaria Techniques, Microtomy staining techniques, Preparation of permanent mount, specimen preservation techniques

UNIT II Sterilization techniques, culture techniques & cryopreservation

UNIT III Principles, types working and maintenance of: Microscopes, centrifuge, incubator, colorimeter, Spectrophotometer, Electrophoresis and Chromatography

PRACTICAL

- Study of different parts of simple and compound microscopes
- Preparation of Solutions and buffers
- Study of different parts of centrifuge and types of rotors
- Study of electrophoretic apparatus

Semester-II
Course Title: STRUCTURAL & SPOKEN ENGLISH
B. Sc. (PCM/ PCFS/ PMCS/ LSCFS/ ZBC)

Course Code: LNG-301

Credit Hours: (2-0-2)

Structure:

- a. Word enrichment (Antonyms, Synonyms, Homophones, Homonyms, Acronyms)
- b. Inflections – Noun
- c. Tenses
- d. Syntax- (SVO Pattern)
- e. Modifiers (Adjective, Adverb, Participle)
- f. Preposition (Usage)
- g. Concord
- h. Determiners (Central Specific)

Spoken English:

- a. Accent and Stress
- b. Rhythm
- c. Self Introduction
- d. Conversation in different Situations
- e. Group Discussions

Speech Techniques:

- a. Organizing
- b. Delivering

Written Communication:

- a. Organizing
- b. Writing (Process)
- c. Resume
- d. Curriculum Vitae
- e. Letter (Components, Request and orders)
- f. Other Communications (Advertisements, Circulars, Invitation, Reports, Proposals)
- g. Usage of Visual Aids in Technical writing.

Books Prescribed:

- Gerson, Sharon J. and Gerson, Steven M. Technical Writing-Process and product, I ed.2000, Pearson Education INC, New Delhi.
- Dickson, Grisalda J.S. Higgin's Technical writing 2004, Godwin Publication, Allahabad.
- Martinet A.V. and Thomason A.J.A Practical English Grammar, IV ed. 1986, Oxford University Press, Delhi
- Agarwal, Malti: Krishnan's Professional Communication, KRISHNA Prakashan Media (P) Ltd. Meerut.

Semester-III
Course Title: Pteridophyte and Gymnosperm

Course Code: BIOL 411

Credit: 3 (2-0-2)

- Unit I Introduction, classification & Economic importance of Pteridophytes. Evolutionary trends.
- Unit II Study of the following genera: *Rhynia Lycopodium, Selaginella, Marsilea* and *Pteris* stellar evolution, Heterospory, evolution of seed Habit in Pteridophytes.
- Unit III Introduction, classification and Economic importance of Gymnosperms
- Unit IV Study of the following genera: *Cycas, Pinus & Ephedra*.

Course Title: Vertebrate
Semester-III

Course Code: BIOL 412

Credit: 3 (2-0-2)

- Unit I Super class: Pisces & Class: Amphibia- General characters, classification, types of fins & scales of fishes, Economic importance of fish, parental care in Amphibia.
- Unit II Class-Reptilia: General characters, classification, Biting mechanism of poisonous snakes. Snake venom & antivenin, poisonous & non-poisonous snakes of India.
- Unit III Class: Aves General characters, classification, Birds migration, Adaptations of birds to aerial life.
- Unit IV General characters, classification and Origin of mammals, Aquatic mammals.

PRACTICAL

- To study the museum specimen of vertebrate.
- Dissection –candidates will be required to show knowledge of classification, Morphology & Anatomy of the following animals through the methods of
- Chart preparation – (Frog, Bird, Rat and Lizard).

**Course Title: Introductory Biotechnology and Applied Microbiology
Semester-III**

Course Code: BIOL 413

Credit:3(2-0-2)

- Unit I History, Development, scope & terminology of biotechnology Recombinant DNA technology, Gene manipulation through protoplast Culture somatic hybrids & cybrids. Gene transfer. Application of Genetic Engineering in Medicine, Industry & Agriculture.
- Unit II History, definition & scope of microbiology, classification & mode of Nutrition in bacteria. Basic knowledge of soil, water, sewage, milk, food Industrial & air microbiology.

**Course Title: Fisheries
Semester-III**

Course Code: BIOL 402

Credit: 2(2-0-0)

- Unit I A general account of the classification of Elasmobranchii, Holocephali, Dipnoi and Teleostomi
- Unit II Study of external structures – fins, skin, scales and other dermal structures. Anatomy and Physiology of fish. Economic importance of fish and its products
- Unit III Diseases of fish – external and internal – its remedies
- Unit IV Fishery technology – methods of curing, preservation, canning, refrigeration and transport, fishing gear and their uses

PRACTICAL

- Dissection of the internal Anatomy – Heart, Afferent and Efferent Branchial Arteries of locally available fish.
- Study of permanent mounts of various kinds of fish scales
- Collection of fresh and marine water fishes by a variety of coarse mesh nets – preserving them by wet preservation method – study of their characteristics.

Semester-III
Course Title: ALIPHATIC COMPOUNDS

Course Code: CHEM-530

Credit: 3(2-0-2)

Unit 1: Ethers: Structure, Preparation, Properties and uses.

Unit 2: Carbonyl Compounds: Structure, Preparation and properties of Aldehydes and Ketones.

Unit 3: Carboxylic Acid: Classification, Structure, Preparation, Properties.

Unit 4: Di-Carboxylic Acid: Classification, Structure, Preparation, and Properties.

Unit 5: Esters: Structure, Preparation, Properties.

Unit 6: Urea: Structure, Preparation, Properties.

Unit 7: Fats and Oils: Structure and Composition, Properties and Analysis of fats & oils.

Unit 8: Aliphatic Amines: Structure, Preparation, and Properties.

Course Title: MAIN GROUP ELEMENTS
Semester – III

Code-CHEM-531

Credit: 3(2-0-2)

Unit I: Main group elements: Alkali and Alkaline earth metals and p- block elements.

Unit II: Inter halogen compound and pseudo halogens.

Course Title: THERMODYNAMICS –I & IONIC EQUILIBRIUM

Semester – III

CHEM-532

Credit: 3(2-0-2)

1st Law of Thermodynamics- Thermodynamics terms, statement of law, thermodynamics reversibility and maximum work, enthalpy of the system, heat capacity at constant volume and as constant pressure, Extensive and intensive properties, state functions cyclic rule, temperature and volume, enthalpy as a function of temperature and pressure, Joule-Thomson effect.

Thermochemistry- Heat of reaction, formation, combustion and neutralization, Hess's law and its application, Kirchoff's equation, bond energy and resonance energy.

Kinetics of Catalysed Reaction- Kinetics of homogenous acid-base catalysis, enzyme catalysis, negative catalysis and inhibition, Kinetics of gaseous reaction on solid surface, Uni and bimolecular surface reaction, Effect of temperature on surface reaction. Primary salt effect.

Ionic Equilibrium- Concept of acids and bases and their relative strength. Bronsted and Lewis acids and bases, pH and pKa, acid-base concept in non aqueous media, buffer solutions, Theory of acid-base indicators, Salt hydrolysis, Solubility product.

Semester-IV
Course Title: AROMATIC COMPOUNDS

Code-CHEM-540

Credit: 3 (2-0-2)

Unit 1: Chlorobenzene: Structure, Preparation, Properties and uses.

Unit 2: Nitrobenzene: Structure, Preparation, Properties and uses.

Unit 3: Aniline: Structure, Preparation, Properties and uses.

Unit 4: Phenols: Structure, Preparation, Properties and uses.

Unit 5: Benzaldehyde: Structure, Preparation, Properties and uses.

Unit 6: Benzophenone: Structure, Preparation, Properties and uses.

Unit 7: Benzoic Acid: Structure, Preparation, Properties and uses.

Course Title: *d* & *f* BLOCK ELEMENTS
Semester-IV

Code-CHEM-541

Credit: 3(2-0-2)

Unit I: *d*-block elements.

Unit II: Platinum metals.

Unit III: *f*- block elements.

Course Title: THERMODYNAMICS-II, PHASE EQUILIBRIUM & RADIO CHEM.
Semester-IV

CHEM-542

Credit 3(2-0-2)

Thermodynamics II: Spontaneous processes, carnot cycle, statement of second law, concept of entropy, combined form of the first and second law of Thermodynamics, enthalpy and entropy. Thermodynamics equation of state (energy as a function of V, & T, enthalpy as a function of T & P), entropy in isolated system, variation of entropy with temperature & volume, variation of entropy with temperature and pressure, Entropy change in chemical reaction. Helmholtz and Gibbs free energies. Properties of Gibbs-Helmholtz equation.

Phase Rule: Phase, component and degree of freedom. Phase rule and its application to one component (water and Sulpher), biocomponent system (Ag + Pb), KI + H₂O).

Radiochemistry: Definition and measurement of radioactivity, rate of atomic disintegration radioactive equilibrium, theory of radioactivity artificial transmutation of elements, induced radioactivity and nuclear energy, nuclear fission and fission, radioactive isotopes.

**Course Title: Taxonomy, Morphology and Economic Botany
Semester-IV**

Course Code: BIOL 510

Credit: 3 (2-0-2)

- Unit I Broad outline of morphology of vegetative & reproductive organ of Angiosperms.
- Unit II Principles of Systematics, classical & modern taxonomy, Rules of nomenclature. Comparative study of different classification systems proposed. General morphology of flower & its parts. Taxonomic studies of some important families.
- Unit III Use of plants for human welfare with special reference to: Food plants, Drug yielding plants, Timber, Masticatories & Fumicatories, Beverages, Rubber, Edible oils, Dyes, Resin, Toxin & Gums.

**Course Title: Introductory Animal Physiology
Semester-IV**

Course Code: BIOL 414

Credit: 3 (2-0-2)

- UNIT I** Physiology of nervous transmission- Neurons, reflex and conditioned reflexes, synaptic transmission
- UNIT II** Composition of blood – properties and functions, the immune response and mechanism of coagulation.
- UNIT III** Physiology of respiration in mammals and birds.
- UNIT IV** Feeding mechanisms, digestion in mouth, stomach absorption.

Practical:

- To determine the bleeding time and clotting time
- Determination of blood groups
- Estimation of hemoglobin in own blood
- Study the blood cells with the help of slide preparation
- To record diastolic and systolic blood pressure.
- To study permanent slides of various animal tissues

Course Title: Limnology and Marine Biology
Semester-IV

Course Code: BIOL 512

Credit: 3 (2-0-2)

Unit I Elementary knowledge of marine biology & limnology. Factors influencing growth of fresh water & marine flora.

Unit II A general study of morphological & reproductive features of micro & macrophytes growing in sea water. A knowledge of a biotic factors (physical & chemical properties of-water) and biotic factors (plankton, periphyton, macrophytes, benthos & decomposers).

Course Title: Taxonomy & Evolution
Semester-IV

Course Code: BIOL 515

Credit: 3 (2-0-2)

Unit I Principles of systematics & taxonomy, general classification of animals, Definition, use & application of International code of Zoological nomenclature. Biological species concept.

Unit II Origin of life, Synthetic theory of evolution selection, mutation, migration and mimicry.

PRACTICAL

- Study of preserved animals in the laboratory for identification of various Species.

Semester-V
Course Title: CO-ORDINATION CHEMISTRY & ISOMERISM

Course Code-CHEM-551

Credit: 3(2-0-2)

Unit I: Co-ordination Chemistry: Introduction, Nomenclature, Crystal field theory, Valence-shell electron pair theory.

Unit II: Isomerism

Unit III: Non aqueous solvent

Course Title: SOLUTION CHEM. & ADVANCED ELECTROCHEMISTRY
Semester-V

Course Code: CHEM-552

Credit: 3(2-0-2)

Conductance and Transference: Electrolytic conductance and measurement of specific/equivalent. Molecular conductance. Effect of dilution on specific and equivalent conductance. Kohlrausch's law and its applications. Transport number and its determination.

Physical Properties and Chemical Constitution: Molar volume, Parachor, Molecular refraction and polarization, Dipole moment, Debye and Clausius-Mossotti equation (Derivation not required).

Electrochemical Cell: E.M.F. determination, concentration cells with and without transference, liquid junction potential, Chemical cells without transference, fuel cells and their applications.

Course Title: NATURAL PRODUCTS
Semester-V

Course Code-CHEM-550

Credit: 3(2-0-2)

Unit 1: Heterocyclic Compounds: Five membered rings Pyrrole: Structure, Preparation, Properties Furan structure, preparation, properties. Thiophene: structure, preparation, properties. Six membered rings: structure, preparation, properties. Pyridine: structure preparation, properties.

Unit 2: Alkaloids: Classification, Determination of Structure Coniine, Nicotine, Atropine Structure and Properties.

Unit 3: Terpenoids: Isoprene rule, Classification, Structure and Properties of Myrcene, Citral, Camphor.

Unit 4: Polymers: Addition Polymers, Copolymers, condensation Polymers, Thermoplastic and Thermo setting Polymers, Natural and Synthetic Rubber.

Unit 5: Introduction to Spectroscopy: Ultraviolet and Visible Spectroscopy (UV), Infrared Spectroscopy (IS), Nuclear Magnetic Resonance Spectroscopy (NMR), Mass Spectroscopy (MS).

Books Recommended:

1. Reaction Mechanism: S.M.Mukherjee & S.P.Singh.
2. Advanced Organic Chemistry: B.S.Bahl & Arun Bahl.
3. Advanced Organic Chemistry: P.L.Soni & H.M.Chawla
4. Advanced Organic Chemistry: M.K.Jain.
5. Chemistry of Natural Products: O.P.Agarwal.
6. Chemistry of Natural Products: I.L.Finar.

Semester-V
Course Title: Economic Zoology

Course Code: BIOL 516

Credit: 3 (2-0-2)

- Unit I Protozoa: Protozoan parasitic diseases of man & domestic animals with special reference to *Endameba histolytic* & *plasmodium*. Platyhelminthes: Life cycle & zoonotic significance of *Taenia solium*.
- Unit II Arthropoda: Beneficial & harmful insects-Honeybee, silkworm, lac, Termite,& locust, dengue, encephalitis-their prevention & control.
- Unit III Aqua culture- basic concepts, management & economics (pearl culture, Prawn culture fish & fisheries).

PRACTICAL

- Study the life cycle of economically important animals-sericulture, apiculture & Lac culture.
- Collection of harmful & useful insects from field & to study their cycle- -by project work.

Course Title: Animal Distribution & Ecology
Semester-V

Course Code: BIOL 517

Credit: 3 (2-0-2)

- Unit I Animal distribution-geological & geographical distribution of animals. Factors influencing large scale animal distribution, barriers & dispersal. Nature, age & importance of animal fossils of different geological strata. Wildlife conservation.
- Unit II Ecology-definition & scope of ecology, concept of structure & function of ecosystem Tropic levels. Energy flow & concept of pyramids, adaptations of animals in deserts & freshwaters.

PRACTICAL

- Qualitative study of planktons; Study of adaptation in animals of different ecosystems eg.- Ocean Sea, desert, nocturnal & hills team by chart preparation methods.
- Qualitative & Quantitative study of soil organisms.

Course Title: Ethnobotany and Paleobotany

Semester-V

Course Code: BIOL 518

Credit: 3(2-0-2)

UNIT I Introduction to Ethnobotany, Study of few ethnic groups and the floristic diversity used as neutraceuticals, ornamentation, medicinal food etc. by these groups.

UNIT II Bioprospecting, biopiracy and protection of traditional medicinal knowledge (IPR). Medicinal plants research scenario in India.

UNIT III Introduction to Paleobotany, types of fossils, geological time scale, Reconstruction of fossil genera. Applications of paleobotany

Practical:

- Study of different types fossils.
- Study of plant specimens used by ethnic groups.

Course Title: Introductory Plant Physiology

Semester-V

Course Code: BIOL 520

Credit: 3 (2-0-2)

UNIT I Water relations in plant: - Osmosis, Diffusion Inhibition, Plasmolysis, Permeability, Concept of diffusion pressure deficit & water potential, Water absorption, Ascent of sap, Transpiration, Guttation, Potassium ion transport theory in relation to stomatal opening, Antitranspirants.

UNIT II Nitrogen assimilation, Nitrogen fixation, symbiosis, nitrogen fixing organisms, biofertilizers, nitrogen cycle.

UNIT III Importance of macro & micro nutrients, their deficiency and symptoms, Ash analysis, nutrient uptake, Donnan equilibrium, Carrier transport, Hydroponics.

UNIT IV Role of plant hormones such as Auxins, Gibberellins, Cytokinins, Ethylene, Abscicic acid, Photoperiodism, Vernalisation, Tropisms, Senescence and Abscission.

UNIT V Photosynthesis, historical perspective, structure of chlorophyll, light reaction, Emerson enhancement effect, photo phosphorylation, C₃ & C₄ plants, photorespiration, law of limiting factors.

UNIT VI Stress physiology- Stress and strain, kinds of stress, mechanism of stress adaptation of plant to stress

Practical:

- Demonstration of osmosis
- Demonstration of osmotic potential of a cell
- Stomatal studies
- Measurement of rate of transpiration
- Nutrients deficiency symptoms in plants
- Measurement of rate of photosynthesis in an aquatic plant
- To demonstrate that light and CO₂ are essential for photosynthesis
- To demonstrate that O₂ is consuming during respiration

Semester-V
Course Title: ENVIRONMENTAL STUDIES – I
B. Sc. (PCM/ PCFS/ PMCS/ LSCFS/ ZBC)

Course Code: ENV-415

Credit: (2-0-0)

1: The Multidisciplinary Nature of Environmental Studies
Definition, Scope and Importance

(i) Ecosystems

- Concept of an ecosystem
- Structure and function of an ecosystem
- Producers, consumers and decomposes
- Energy flow in the ecosystem
- Ecological succession
- Food chains, types, Characteristics features, structures and function of the following ecosystem:
 - (a) Forest Ecosystem
 - (b) Grassland Ecosystem
 - (c) Desert Ecosystem
 - (d) Aquatic ecosystem (Ponds, streams, lakes, river, oceans, estuaries.)

(ii) Social Issues and the Environment

- From Unsustainable of sustainable development
- Urban problems related to energy
- Water conservation, rain water harvesting, water shed management
- Rescurement and rehabilitation of people; Its problems and concerns Case studies
- Environmental ethics, Issues and possible solutions
- Climate change, global warming, and rain ozone layer depletion, nuclear accidents and holocaust, Case studies.
- Wasteland reclamation.
- Consumerism and waste products.
- Environment Protection Act.
- Air (Prevention and Control of pollution) Act.
- Visit to local polluted site-Urban/ Rural/ Industrial/ Agricultural
- Study of Common plants, insects, birds
- Study of simple ecosystems-Ponds, river, Hills/ Pocs etc (Field work equal to 5 lecture hours).
- Issues involved in enforcement of environmental legislation, Public awareness.

Semester-VI

Course Title: ADVANCED ORGANIC CHEMISTRY

Course Code: CHEM-560

Credit: 3(2-0-2)

Unit-1 Organic Photochemistry:- Heterocyclic, Nomenclature, synthesis & reaction of following compounds containing one heteroatom – Structure, preparation & properties.

- (i) Five membered ring system:- Furan, pyrrole, thiophene.
- (ii) Six membered ring:- Pyridine

Unit 2:Polymers: Addition Polymers, Copolymers, condensation Polymers, Thermoplastic and Thermo setting Polymers, Natural and Synthetic Rubber, polyethene & PVC.

Unit-3 Introduction to Spectroscopy:- UV & Visible, IR, NMR, Mass Spectroscopy.

Unit-4 Some reactions of Industrial Importance:- Hoffman, Diel's Alder, Skraup, Bechmann, Cannizaro and Riemann Teimann.

Course Title: SPECTROSCOPY

Semester-VI

Course Code-CHEM-561

Credit: 3(3-0-0)

Unit I: Spectroscopy

- (a) UV
- (b) IR
- (c) NMR
- (d) Raman
- (e) Mass

Books Recommended:

1. Advanced Inorganic Chemistry: Gurdeep Raj, Goel publications Meerut.
2. Text-Book of Inorganic Chemistry: PL.Soni, S.Chand & Sons.
3. Inorganic Chemistry: Satya Prakash Tuli, Basu & Sons, S.Chand & Co.
4. Advanced Inorganic Chemistry: S.K.Agarwala & Keeti Lal, Pragati Prakasan.
5. Inorganic Chemistry: Cotton & Wilkinson.

Course Title: PHOTOCHEMISTRY & ADVANCED WAVE MECHANICS

Semester-VI

Course Code: CHEM-562

Credit: 3(2-0-2)

Photochemistry: Photochemistry and thermal reactions, Chain reaction, free radical chains, thermal decomposition of acetaldehyde and ethane, Lambert and Beer's law, Grothus Draper's law, Elinstin law of decomposition of hydrogen-iodide, hydrogen-bromine etc, Fluoescence, Photosensitization, Phosphorescence Chemiluminescence.

Thermodynamics: Law of mass action (thermodynamic derivation, reaction isotherm and Vant Hoff equation (influence of temperature on equilibrium constant), Partial molar quantities, Chemical potential, Gibbs Duhem equation, Effect of temperature and pressure on chemical potential, Chemical potential of real gases and fugacity, Thermodynamic treatment of colligative properties (lowering vapour pressure, elevation of boiling point, depression of freezing point, osmotic pressure).

Atomic Structure & Wave Mechanic: Bohr's theory, Sommerfeld's model, dual nature of electron, De Broglies concept of the dual nature of the electron, de-Broglies equation, experimental verification (Davisson and Germer's experiment), Heisenbergs uncertainty principle and its derivation-Schrodinger wave equation (derivation), Schrodinger equation with respect to time, Eigen values and functions, Operators (Addition and Substraction of operators, Multiplication, Linear, Hamiltonian, Hermitian), Postuates of Quantum mechanisim, free particle, particles in potential barrier, Particle in one dimensional box, Particle in 3 dimentional box, Simple Harmonic Oscillator, Hydrogen Atom.

Semester-VI
Course Title: Anatomy and Embryology

Course Code: BIOL 521

Credit: 3 (2-0-2)

- Unit I Broad outline of anatomy of vegetative & reproductive organs of angiosperms. An account of normal primary & woody plants. Primary anomaly. Anomalous secondary growth in *Boerhaavia*, *Bignonia*, *Dracaena* and *Chenopodium*.
- Unit II Nodal Anatomy and Anatomy of leaf
- Unit III A brief history of Embryology, development of anther & pollen, Microsporogenesis, anther dehiscence & viability curvature of ovule leading to different types, megasporogenesis & mono, bi & tetra sporic type of embryo-sacs. Types of embryogeny. General account of apomixes & polyembryony. Development of seed.

Course Title: Cytogenetics, Plant Breeding and Evolution
Semester-VI

Course Code: BIOL 522

Credit: 3 (2-0-2)

- Unit I Structure of Prokaryotic & Eukaryotic cells. Organization & function of cell & its components cell cycle, Mitosis, amitosis & meiosis. Elements of heredity and variation: Mendel & his experiments, Principles of segregation & independent assortment, test & back cross. Concept of gene, Linkage & crossing over, mutation & mutagens. Sex determination in plants
- Unit II Introduction to plant breeding, methods, principles & practices of convention. Methods of breeding in self & cross pollinated crops & asexual or vegetatively propagated plants.
- Unit III Organic origin of life & evolution, evidences, mechanisms & theories.

Course Title: Developmental Biology & Ethology
Semester-VI

Course Code: BIOL 525

Credit: 3 (2-0-2)

- Unit I Growth & aging- concept of growth, degrowth & cell death. Mechanism of Growth, Growth curves & their interoperation. Types of cell growth, Aging.
- Unit II Ant predator behavior- fighting, fleeing protective armour, chemical defense, camouflage, warning signals & startle displays. Fighting behavior- Low animals mark their territories & defend them, Perform threat displays.
- Unit III Social behavior – advantage of being social, Low animals establish social Leirarchies, mating groups. Courtship displays & behavior.

PRACTICAL

- Field study of various kinds of animal behavior.
- Preparing projects & charts on the related topics.

Course Title: Genetics & Cell Biology
Semester-VI

Course Code: BIOL 527

Credit: 3 (2-0-2)

- Unit I Genetics- Mitosis & meiosis. Mendel's law of inheritance, linkage & Crossing over, Human Chromosomes & human chromosomal abnormalities, Sex-linkage & Sex determination in Drosophila & man, Blood group & Hemoglobin Genetics in man, DNA & RNA structure Genetic code
- Unit II Cell Biology – Nucleus, Nuclear membrane & nucleolus, polytene & lampbrush chromosomes, structure & function of plasma membrane, Golgi apparatus, mitochondria, lysosomes, Endoplasmic reticulum & Ribosomes, Cilia, Flagella, Microtubules & Microfilaments.

PRACTICALS

- Construction of human familial pedigree utilizing inheritance pattern of a single Autosomal or sex linked gene.
- Genetical problems
- Demonstration of Bare body & mitochondria in buccal epithelium of man
- Study of temporary squash preparation of grasshopper testes for mitosis, meiosis.

Semester-VI
Course Title: ENVIRONMENTAL STUDIES-II
B. Sc. (PCM/ PCFS/ PMCS/ LSCFS/ ZBC)

Course Code: ENV-416

Credit: (2-0-0)

1) Natural Resources

- (a) Forest resources
- (b) Water resources
- (c) Mineral resources
- (d) Food resources
- (e) Energy resources
- (f) Land resources

Role of an individual in conservation of natural resources.

Equitable use of resources for sustainable life style.

2) Biodiversity and its conservation

- (a) introduction- Definition genetic, species and ecosystem diversity
- (b) Bio geographical classification of India.
- (c) Value of diversity consumptive use, productive use, social, ethical aesthet and option values.
- (d) Biodiversity at global, National and local levels.
- (e) India as mega-diversity nation
- (f) Hot – Spots of biodiversity
- (g) Threats to biodiversity habitat loss, poaching of wild life, man-wild life conflicts.
- (h) Endangered and endemic species of India
- (i) Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

3) Environment Pollution

Definition

Causes effect and control measures of

- (a) Air Pollution
- (b) Water Pollution
- (c) Soil Pollution
- (d) Marine Pollution
- (e) Noise Pollution
- (f) Thermal Pollution
- (g) Nuclear hazards

Solid waste Management; Causes, effect and control measures of urban and industrial wastes.

Role of an individual in prevention of pollution

Pollution case studies

Disaster Management: floods, earthquake, cyclone and landslides.