B. Sc (Chemistry, Botany, Zoology)

B. Sc. CBZ Semester –I

S.No	Course Code	Title of the Course	Total Credit	Credit Hrs.		
				L	T	P
1	BIOL-321	INTRODUCTION OF FUNGI, LICHEN AND PLANT PATHOOGY	3	2	0	2
2	MCE-301	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	3	3	0	0
10	NSS-318	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. CBZ 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 EQULIBRIUM & 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	IM-349	INTRODUCTORY MICROBIOLOGY	3	2	0	2
9	CSIT-301	INTRODUCTION TO COMPUTER APPLICATIONS	3	3	0	0
10	NSS-327	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. CBZ 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	MCE-302	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	BCBE-301	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
10	NSS-413	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. CBZ 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	*d* & *f* 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
10	CBBI-501	APPLICATION IN BIOINFORMATICS	3	2	0	2
11	NSS-414	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. CBZ 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	1	0
5	BIOL 520	INTRODUCTORY PLANT PHYSIOLOGY	3	2	0	2
6	BIOL 530	PLANT EVOLUTION AND PALEOBOTANY	3	3	0	0
7	BIOL 432	ETHNOBOTANY& ECONOMIC BOTANY	3	2	0	2
8	BIOL-531	BIOSTATISTICS	3	3	0	0
9	ENV-415	ENVIRONMENTAL STUDIES- I	2	2	0	0
10	NSS-516	NATIONAL SERVICE SCHEME	Non Credit Course			

B.Sc. CBZ 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-533	PLANT ANATOMY AND EMBRYOLOGY	3	2	0	2
5	BIOL-534	FUNDAMENTALS ANIMAL BEHAVIOUR	3	3	0	0
6	BIOL-535	CYTOGENETICS& PLANT BREEDING	3	2	0	2
7	BIOL-536	DEVELOPMENTAL BIOLOGY	3	2	0	2
8	BIOL-537	BIODIVERSITY AND CONSERVATION	4	3	1	0
9	BIOL-538	FISHERY SCIENCE	3	2	0	2
10	ENV-416	ENVIRONMENTAL STUDIES -II	2	2	0	0
11	BIOL-699	PROJECT WORK	5	5	0	0
12	NSS-527	NATIONAL SERVICE SCHEME	Non Credit Course			

Semester-I

BIOL- 314 **INTRODUCTION OF FUNGI, LICHEN AND PLANT PATHOOGY** **3 (2+2)**

Introduction, Important plant pathogenic organisms, different groups, fungi, bacteria, fastidious vesicular bacteria, phytoplasmas, spiroplasmas, viruses, viriods, algae, protozoa and phanerogamic parasites with examples of diseases caused by them. Prokaryotes: classification of prokaryotes according to Bergey's Manual of Systematic Bacteriology. General Characters of fungi, Definition of fungus, somatic structures, types of fungal thalli, fungal tissues, modifications of thallus, reproduction in fungi (asexual and sexual). Nomenclature, Binomial system of nomenclature, rules of nomenclature, classification of fungi. Key to divisions and sub- divisions. Introduction: Definition and objectives of Plant Pathology. History of Plant Pathology.Terms and concepts in Plant Pathology.Survival and Dispersal of Plant Pathogens. Phenomenon of infection – pre- penetration, penetration and post penetration. Pathogenesis – Role of enzymes, toxins, growth regulators and polysaccharides. Defense mechanism in plants – Structural and Bio-chemical (pre and postinfection).Plant disease epidemiology. Plant Disease Forcasting – Remote sensing – General principles of plant diseasesmanagement – Importance, general Principles – Avoidance, exclusion, protection – Plant Quarantine and Inspection – Quarantine Rules and Regulations. Cultural methods – Rougeing, eradication of alternate and collateral hosts, crop rotation, manure and fertilizer management, mixed cropping, sanitation, hot weather ploughing, soil amendments, time of sowing, seed rate and plant density, irrigation and drainage. Role and mechanisms of biological control and PGPR.Physical Methods – Heat and Chemical methods – Methods of application of fungicides.Host plant resistance – Application of biotechnology in plant disease management – Development of disease resistant treansgenic plants through gene cloning.Integrated plant disease management (IDM) – Concept, advantages and importance.

Practical: Acquaintance to plant pathology laboratory and equipments; Preparation of culture media for *fungi* and *bacteria*; Isolation techniques, preservation of disease samples; Study of *Pythium*, *Phytophthora* and*Albugo*; Study of *Sclerospora, Peronosclerospora, Pseudoperonospora, Peronospora, Plasmopara* and *Bremia*;Study of genera Mucor and Rhizopus. Study of *Oidium*, *Oidiopsis*, *Ovulariopsis, Erysiphe*, *Phyllactinia,Uncinula* and *Podosphaera*; Study of *Puccinia* (different stages), *Uromyces, Hemiliea*; Study of *Sphacelotheca,Ustilago* and *Tolyposporium*; Study of *Agaricus*, *Pleurotus* and *Ganoderma*; Study of *Septoria*, *Colletotrichum*, *Pestalotiopsis* and *Pyricularia*; Study of *Aspergillus, Penicillium, Trichoderma,* and *Fusarium*; Study of *Helminthosporium, Drechslera, Alternaria, Stemphyllium, Cercospora, Phaeoisariopsis*, *Rhizoctonia* and *Sclerotium*; Demonstration of Koch's postulates; Study of different groups of fungicides and antibiotics; Preparation of fungicides – Bordeaux mixture, Bordeaux paste, Chestnut compound; Methods of application of fungicides – seed, soil and foliar; Bio-assay of fungicides – poisoned food technique, inhibition zone technique and slide germination technique; Bio-control of plant pathogens – dual culture technique, seed treatment. Visitto quarantine station and remote sensing laboratory.

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: 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

BIOL 310 Techniques and Instrumentations in Biology 3 (2-0-2)

UNIT I

Principles and handling of Microscope, Spectrophotometer, Colorimeter, Flame photometer, Autoclave, Laminar air flow, Fermenter (Bioreactor), Electronic and Electrical balance, Refrigerator, minor Instrument and Glass wares.

UNIT II

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

UNIT III

Sterilization techniques.Preparation of different types of solutions.culture techniques &cryopreservation

UNIT IV

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

UNIT V

Seed viability testing, testing of pollen viability, Tissue culture of crop plants; description of flowering plants in botanical terms in relation to taxonomy.

UNIT VI

Preparation of different agrochemical doses in field and pot application;

PRACTICALS

- 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 electrophorectic apparatus

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 elctronegativity.

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:-** Lyophillic 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/ CBZ)

Course Code: GPT-301 **Credit Hrs.3-0-0**

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

Semester-II

BIOL 308 **Algae and Bryophytes** **3 (2-0-2)**

UNIT I

General Introduction of algae, Classification of Algae, theories of evolution, different types of life cycle in algae.

UNITII

Ultra-Cell structure and pigments in algae, types of thallus structure and evolution, Economic importance of algae, Concept of Single cell protein

UNIT III

Cell structure and life cycle of *Noctoc, Anabena, Cylindrospermum, Phormidium, Chlamydomonas, Volvox, Spyrogyra, Ulotrix, Chara, Chlorella.*

UNIT IV

Economic importance of cyanophyceae and Chlorophyceae: range of chlorophyll and pigments in Algae

UNIT V

Bryophytes: General introduction of, Characteristic feature and Classification, Affinities with algae and pteridophytes, Reproduction and life cycle, Economic importance

UNIT VI

Bryophytes (Liverworts)General characteristic feature, classification, type study of *Riccia* and *Marchantia,Hymenophyton, Porella, Anthceros, Notothylus, Sphagnum, Funaria*

PRACTICALS:

- Demonstration of permanent Slides
- Field visit for Algae collection
- Identification and Slide preparation
- Demonstration of permanent Slides
- Field visit for Bryophytes in locality collection

Semester-II

BIOL 309 **Genetics** **3 (2-0-2)**

UNIT I

Mendel and his experiments, symbols and terminology.principle of dominance and segregation, principle of independent assortment, test and back cross.

UNIT II

Incomplete dominance, co-dominance, multiple alleles, gene interaction, penetrance, expressivity, epistasis, pleiotropism, interaction with environment.

UNIT III

Morphology of chromosomes, DNA- concept of gene, Human Chromosomes and chromosomal abnormalities, sex linked genes in humans, sex determination - Human, Drosophila, other animals, dosage compensation.

UNIT IV

Human genetics, pedigree analysis, amniocentesis, twins, human genetic disorders

UNIT V

Eugenics , Euthenics and Euphenics

PRACTICALS:

- Study of genetical problems
- Demonstration of Barr body & mitochondria in buccal epithelium of human
- Study of chromosomal disorders in man (text book photos and karyotypes)

REFERENCE BOOKS:

- **Gardner et al:** Principles of Genetics (John Wiley, 1991)
- **Klug and Cummings** : Concepts of Genetics .
- **P. K. Gupta** : Genetics – Rastogi Publications

Semester-II

BIOL 311 IPR, BIOSAFETY AND BIOETHICS 2 (2-0-0)

UNIT I

Bioethics: An Introduction:Introduction to Bioethics, purpose, ideology and methodology; Bioethics in Biodiversity, Ethics of Resource Management

UNIT II

Bioethics: Issues In Biological Sciences:Abortion, Alternative Medicine, Animal rights, Artificial insemination, Body modification, Brain-computer interface, Chimeras, Circumcision, Cloning,Eugenics, Euthanasia, Gene therapy, Genetically Modified Organisms, Organ donation and organ transplant, Population control, Reprogenetics, Sperm and egg donation, Stem cell research, Suicide, Surrogacy

UNIT III

Biosafety:Definition of Biosafety, Biosafety for human health and environment: Risk assessment & containment, Planned introduction of GM Crops and GM Foods, Special procedures for r-DNA based products, Biosafety during industrial production, Environmental Impact Assessment, Biosafety guidelines in India

UNIT IV

Intellectual Property Rights:Concept of property in relation to Intellectual Property, Theories of Intellectual Property Rights, Intellectual Property as an Instrument of Development, Intellectual Property Right, Farmers rights, Plant Breeder's rights, Copyright, Neighbouring Rights and Industrial Designs, Trademarks, Geographical Indications

UNIT V:

Patents and methods of application of patents, Patent Law: Paris Convention, Patent Cooperation Treaty, WTO-TRIPS, Harmonisation of CBD and TRIPs; Indian Patent Law: The Patents Act, 1970, Role of International Institutions

Books recommended:

1. Sasson A, Biotechnologies and Development, UNESCO Publications, 1988.
2. Sasson A. Biotechnologies in developing countries present and future, UNESCO publishers, 1993.
3. Raj Mohan Joshi, Biosafety and Bioethics, Isha Books publishers, 2006.
4. R. C. Dubey, A Textbook Of Biotechnology, Publisher. S. Chand & Company Ltd. 2005.
5. B. D. Singh, Biotechnology, Kalyani publishers, 2010.
6. Lori Gruen, Ethics and Animals: An Introduction, Cambridge University Press

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 stale, 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 mmass action, Significance of equilibrium constant, Relation between Kp and Kc, application in homogeneous and heterogeneous equlibria, Le-chatier's principle and its application to chemical equilibrium.

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

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 Arthopods.

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.

Semester-III

Introduction to Computer Applications

Code: CSIT-301 **Credits: 3(2 - 0-2)**

Unit - I

Introduction to Computers: Need and Role, Definition, Characteristics and Applications**. Hardware:** Basic block diagram & components**. Software:** System & Application

Unit - II

Introduction to Programming: Algorithm and flowchart, Program definition, Program life cycle, Principles and techniques, Characteristics of a good program.

Unit - III

Introduction to MS Word and PowerPoint: Introduction to Word Processing and its features, formatting documents, paragraph formatting, page formatting, headers and footers, bullets and numbering, tables, finding and replacing text.

Working with slides, adding content, working with text, color schemes, graphics, slide effects.

Unit - IV

Introduction to Spreadsheet: Worksheet basics, data entry of numbers, text, date and time. Editing and formatting of a worksheet. Calculations using formula and functions.Working with graph and charts.

Data Base Management System: Concept of database, Database terminologies, working with MS-Access.

Unit - V

Introduction to Computer Networks and Internet: Definition of Computer Network, Types of Computer Network, Network media and Toplogy.

What is Internet? , History of Internet, Services of Internet, Websites, email.

Reference Books:

Raja Raman V. (2004), "Introduction to Information Technology", PHI.
Jain, V.K.; "Information Technology", S.K. Kataria
V.K. Jain &PankajBhambri,"Fundamentals of Information Technology", S.K. Kataria
P.K Sinha&P.Sinha, " Foundation of Computing", BPB

Practicals:

1. Working with worksheet: editing and formatting, calculations through formula and functions.
2. Working with charts and graph.
3. Creating database, viewing database, Modifying data structure, Sorting and indexing, Querying and generating reports.

Course Title: Molecular biology

Semester-III

Course Code: MCE-302 **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

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-I
Semester-III

Course Code: BIOL 417 **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).

Semester-III

BIOL 415 ANIMAL TAXONOMY AND DISTRIBUTION 3 (2-0-2)

UNIT I

Introduction: History, Stages in Taxonomy; Problems of Taxonomists, Aims and tasks of a taxonomist, Taxonomy as a profession.

UNIT II

Newer trends in Taxonomy: Morphological approach, immature stages, Embryological approach, Behavioral approach, Cytological approach, Biochemical approach. Molecular taxonomy.

UNIT III

Taxonomic procedure: Collection, Preservation of collected material, Methods of identification and problems encountered in Identification

UNIT VI

Comparative Biogeography, Endemic Areas, Zoogeographic regions of the World, Zoogeographic regions of India, Major habitat types of the subcontinent

UNIT V

Natural history of Indian subcontinent: Role of physical and biotic environments in determining taxonomic distributions.Migrations of species in the subcontinent; common Indian mammals, birds

Practical:

- Collection and Taxonomy of Mosquitoes
- Collection of immature stages of insects
- Preservatives and methods of preservation
- Identifying local habitats and distribution of different anima l groups
- Study of the role of pH in determining animal distribution

Recommended Books

- Kapoor. 2013. Theory and practice of animal Taxonomy. Oxford & IBH Publishing.
- Rastogi. 2006. Palaeontology&Zoogeography.KedarNath Ram Nath
- Beddard. 2010. A Text- Book of Zoogeography. Nabu Press.

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.

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

Kinetics of Catalysed Reaction- Kinetics of homogenous acid-base catalysis, enzyme catalsis, negative catalysis and inhibition, Kinetics of gaseous reaction on solid surface, Uni and biomolecular 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

BIOL 418 VERTEBRATE II 3 (2-0-2)

UNIT-I

Reptilia: General characters and classification, General anatomy of *Uromastix*, Snakes, *Sphenodon*: The Living fossil.

UNIT-II

Aves:General characters and classification, General anatomy of *Columba livia*, Aerial adaptations in birds, Types of feathers and Migration in birds.

UNIT-III

Mammals: General characters and classification, General anatomy of *Oryctolagus*, Oviparous mammals, Aquatic mammals, aerial mammals.

UNIT-IV

Comparative Anatomy: Comparative account of digestive system, respiratory system, circulatory system, nervous system, exoskeletal system, endoskeletal system, excretory system of reptiles, aves and mammals.

UNIT-V

Connecting links: Definition,General characters of *Peripatus*, *Neopilina*, *Balanoglossus*, *Chimaera*, *Protopterus*, *Archaeopteryx* and egg laying mammals.

PRACTICALS

- To study the museum specimen of vertebrate (Aves and mammals).
- Study of Morphology and anatomy of Bird and Rat through the method Chart preparation.

Suggested Reading:

1. Vertebrates: R.L. Kotpal
2. Vertebrates: Jordan &Verma
3. A textbook of Zoology: Parker & Haswell

Semester-IV

BIOL 421 PLANT TAXONOMY, AND MORPHOLOGY 3 (2-0-2)

UNIT I

Broad outline of morphology of vegetative & reproductive organ of Angiosperms.

UNIT II

Principles of Systematic, classical & modern taxonomy,

UNIT III

Rules of nomenclature. Comparative study of different classification systems proposed. UNIT IV General morphology of flower & its parts.

UNIT V

Taxonomic studies of some important families. Brassicaceae, Poaceae, SolanaceaeLeguminoseae

PRACTICAL

- Study of floral parts and role of different flower parts
- Study of inflorescence
- Study of different plant families eg. Brassicaceae, Poaceae, SolanaceaeLeguminoseae

Semester-IV

BIOL 422 INTRODUCTORY BIOTECHNOLOGY 3 (2-0-2)

UNIT I

Introduction to Biomolecules: Definition, general classification and important functions of carbohydrates, lipids, proteins, Nucleic Acids: Structure of DNA and RNA, DNA replication, translation and transcription

UNIT II

Enzymes as biocatalysts: General characteristics, nomenclature and classification of Enzymes, Effect of temperature, pH, enzyme and substrate concentrations on the activity of enzymes, Elementary concept of cofactors and coenzymes

UNIT III

Microbial System and Biotechnology**:** Types of microbes and their properties; Basic concepts, scope and achievements in biotechnology, Significance of genetic engineering, Tools used in biotechnology, Elementary knowledge of Recombinant DNA Technology, Bio-informatics and Genomics

UNIT IV

Gene libraries: Construction and screening of genomic DNA library and cDNA library, Construction and use of cloning vectors**,** Modes of gene transfer, Molecular markers: RAPD, RFLP, SSLP, AFLP, VNTR, SSR, SNP STR, SFP, DArT and RAD

UNIT V

Applications of Biotechnology in Agriculture, Medicine and Environment: an elementary knowledge, Biotechnology in paper industry, biofertilizers, bioinsecticides, sewage treatment using microbial system, Application of genetically engineered microbes, Prospects and public perception of Biotechnology

PRACTICALS:

- Introduction to lab equipment: Autoclave, Laminar Air Flow, Microscope,
- Sterilization techniques: Dry and Hot,
- Electrophoresis: Types and instrumentation,
- Preparation of plant tissue culture media, Isolation and staining of bacteria, DNA detection by gel electrophoresis

BOOKS RECOMMENDED:

1. Cell Biology and Genetics, 9th edition. Starr, C. and Taggard; R. (2001) Thomson Learning USA.

2. Life Science of Biology, 6th edition, Purves W.K.; Sadava, D.; Orians, G.H. and Heller, H.C. (2001). W.H. Freeman & company, USA.

3. Basic Biotechnology, Ignacimuthu, S.J. (2002) Tata McGraw-Hill Pub., New Delhi

4. Genes VII, Lewis Benjamin (2002). Oxford Univ. Press Oxford.

5. Biotechnology, 3rd Edition. Smith, J.E. (2003) Cambridge University Press.

Semester-IV

BIOL 423 ANIMAL EVOLUTION 3 (2-0-2)

UNIT I

Introduction and importance of evolutionary biology.A short history of evolutionary biology.

UNIT II

Evolutionary Genetics and diversity.

UNIT III

Species Concepts and Intraspecific Geographic variation, genetic drift.

UNIT IV

Macroevolution the History of Life Fossils as evidence of evolution, The origin of life, The origin of cells, The origin of multicellular life Evolutionary Genomics andhorizontal gene transfer.

UNIT V

Evolutionary Developmental Biology.Rates of Evolution Coevolution and coadaptation. Extinction and Radiation

PRACTICALS

- Study of adaptive modification of feet/claws in birds
- Study of adaptive modification in mouth parts in insects
- Study of connecting links during the period of evolution

Recommended Books

- ✓ Hall and Hallgrimsson.2007.Strickberger's Evolution.Jones and Barnett Publishers.
- ✓ Agarwal andVerma. 2004. Cell Biology,Genetics, Molecular Bio., Evolution & Ecology. Rastogi Publications.
- ✓ Tomar and Singh. 2013.Evolutionary Biology (General Biology). RastogiPublicataions.

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.
Semesater-IV

CHEM-542 **Credit 3(2-0-2)**

Thermodynamics II: Spontaneous processes, carnot cycle, staement of second law, concept of entropy, combined form of the first and second law of Thermodynamics, enthalpy and entropy. Thermodynamicsequation of state (energy as a function of V, & T, enthalpy as a function of T & P), entropy in isolated system, variation of entropy with temperatuture & volume, variation of entropy with temperature and pressure, Entropy change in chemical reaction. Helmoltz and Gibbs free energies. Properties of Gibbs-Helmoltz 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 + H_2O).

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: Introductory Animal Physiology
Semester-IV

Course Code: BIOL 405 **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 IIIPhysiology 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

Semester-IV

Course Title: Applications in Bioinformatics **Course Code:** CBBT-501
Credits Hours: 3(2-0-2)

Theory:

Bioinformatics and Internet: Internet Basics, FTP, www, connecting to Internet, Electronic mail, internet resources.

The NCBI data model: Introduction, Seq-id, Sequence, collection of sequence, annotation of sequence, describing sequence.

GenBank Sequence Database: Introduction to structure, Primary and secondary database,

Sequence Alignment And Database Searching : FASTA , BLAST ,

Multiple Sequence Alignment

Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation, Tree building and tree evaluation, Phylogenetic software.

Introduction to Structure , PDB , MMDB , Structure file format , visualizing structure information , Structure viewers , structure similarity searching , Advanced structure modeling.

Comparative Genome Analysis: Introduction, application, genome analysis and annotation.

Practicals:
1. Understanding Linux Operating System and Commands.
2. Introduction to NCBI.
3. Using Entrez to search Literature Databases.
4. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored.
5. Retrieving Protein sequence from GenPept (NCBI) and Expasy.
6. Analyzing Protein Sequences.
7. Analyzing DNA sequence.
8. Sequence alignment using BLAST (Basic Local Alignment Search Tool).
9. Sequence alignment using FASTA.
10. Multiple sequence alignment using ClustalW.

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, Delye and Clausius-Mossottic 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: Hetrocyclic 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 Mycrene, 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

BIOL 432 ETHNOBOTANY AND ECONOMIC BOTANY 3 (2-0-2

UNIT I

Ethnobotany – definition, its significance within the limits of the state, the nation and the conservation of rare heritage from global point of view.

UNIT II

Relationship between man and plants – for benefit of both and developmental strategies of both.Relationship between man and plants – mutually destructive approaches.

UNIT III

Linkage of Ethnobotany with other sciences and disciplines in biology – food and nutrition, medicine, sociological and cultural practices, religions and social costumes and economic relations,

UNIT IV

Major tribes of South India and their ethnobotanical and ethno-biological heritage – Parayar, Kurichiar, Paniyar, Mulla, Karuman, Kanikkars

UNIT IV

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.

PRACTICALS

- Study of different types fossils.
- Study of plant specimens used by ethnic groups.
- Identification, description and study of economically important plants for human with special reference to Food plants, Drug yielding plants, Timber, Masticatories &Fumicatories, Beverages, Rubber, Edible oils, Dyes, Resin, Toxin & Gums.

Semester-V

BIOL 530 PLANT EVOLUTION AND PALEOBOTANY 3 (3-0-0)

UNIT – I

Introduction, Origin of Plants, Geological time scale

UNIT – II:

Evolutionary pattern and diversification in plants, rise and dominance of seed plants

UNIT – III

Fossils;Introduction, Types of fossils, Formation of fossils, evidences from fossils

UNIT – IV:

Subdiscipline of paleobatany; Biostratigraphy, Biomechanics and allmetery, Paleoecology, Dendrochronology

UNIT –V:

Fossil records of different era, Paleobotanical methods, Time line of plant evolution, Plant adaptations

Reference Book:

- ✓ Principles of Paleobotany by Lily Bora
- ✓ Text Book of Paleobotany by S.R.Mishra
- ✓ Paleobotany and Evolution of Plant by Wilson Nichols Stewarts
- ✓ Plant diversity and Evolution by Robert J. Henry
- ✓ Palaeobotany and Plant evolution by Iqbal Hussain

Semester-V

BIOL 531 BIOSTATISTICS 3 (2-0-2)

UNIT I

Biostatistics: An Introduction**,** Aim, scope, definition and elementary idea of Statistics in Biology, Compilation, classification, tabulation and diagrammatic presentation of statistical data, concepts of statistical population and sample, elementary account of Random samples, Frequency distributions.

UNIT II

Measures of Central Tendency**,** Measures of central location: Mean, Median and Mode

UNIT III

Measures of Dispersion,Measures of dispersions: Range, Quartile deviation, Mean deviation, Variance, Standard deviation and Standard error

UNIT IV:

Probability and Distributions,Definition; Simple theorems on probability; Simple measures of skewness and kurtosis; Standard distributions: Binomial, Poison, Normal

UNIT V:

Statistical Estimation and Tests of Significance,Some commonly used tests of significance: Independence, normality and homogeneity of variance, t-test, correlation and regression, ANOVA, post-hoc analysis

PRACTICAL:

- Sample collection; Data entry, compilation and tabulation with Microsoft Excel
- Problems based on measures of central tendency and dispersion, probability, standard distributions and significance tests
- SPSS: Data entry, analysis of data for independence, normality and homogeneity; ANOVA

BOOKS RECOMMENDED:

1. Dr. Satguru Prasad, Elements of Biostatistics, Rastogi Publications

2. Norman T. J. Bailey, 2007. Statistical methods in biology, Cambridge University Press

3. Mackenzie, 2007. Mathematics and statistics for life sciences, Bios Scientific Pub Ltd.

4. Hays, W. L. 1981. Statistics, 3rd ed. New York: Holt, Rinehart, and Winston.

5. Norusis, M. 2004. SPSS 13.0 Statistical Procedures Companion. Upper Saddle-River,

N.J.: Prentice Hall, Inc.

6. Chap T. Le, Introductory Biostatistics, John Wiley & Sons

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 Arthopoda: 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: 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, C_3 & C_4 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 CO_2 are essential for photosynthesis
- To demonstrate that O_2 is consuming during respiration

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

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, Chacretistics 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
- Resculement 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, Nomencalture, 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 Immportance:- 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 verfication (Davisson and Germer's experiment), Heisenbergs uncertainity principle and its derivation-Schrocdinger 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 mechanism, free particle, particles in potential barrier, Particle in one dimensional box, Particle in 3 dimentional box, SimpleHarmonic Oscillator, Hydrogen Atom.

Semester-VI

BIOL 533 PLANT ANATOMY AND EMBRYOLOGY 3 (2-0-2)

UNIT I

Broad outline of anatomy of vegetative & reproductive organs of angiosperms.An account of normal primary & woody plants.

UNIT II

Primary anomaly. Anomalous secondary growth in Boerhaavia, Bignonia, Dracaena andChenopodium

UNIT III

Nodal Anatomy and Anatomy of leaf

UNIT IV

A brief history of Embryology, development of anther & pollen, Microsporogenesis, anther dehiscence & viability curvature of ovule leading to different types,

UNIT V

megasporogenesis & mono, bi & tetra sporic type of embryo-sacs. Types of embryogeny.

UNIT VI

General account of apomixes & polyembryony.Development of seed.

PRACTICALS:

- Slide study of parenchyma, collenchyma, sclerenchymatous tissues.
- Study of L.S. of Dicot and Monocot shoot
- Study of L.S. of Dicot and Monocot roots
- Study of Trichomes
- Section cutting for anatomical studies of root
- Section cutting for anatomical studies of shoot

BOOKS:

•A text book of Botany Angiosperms – Singh, Pande and Jain
•College Botany – Gangulee, Das and Dutta
•Anatomy – A. Fahn

Semester-VI

BIOL 534 FUNDAMENTALS OF ANIMAL BEHAVIOUR 3 (3-0-0)

UNIT-I

Selection of habitat: Factors affecting survival, dispersal, behaviour, Physical and chemical factors, Choice of breeding sites, Environmental cues and Determinants of habitat preference.

Patterns of behaviour: Tropism, Taxes, Reflexes, Drives.

UNIT-II

Territoriality, Aggression, Conflict:Territory and foraging, Territory and breeding, Interspecific territoriality, Aggression, Types, Endogenous factors and aggression, External stimuli and aggression, Threat displays.

Antipredator behaviour: Strategies adopted to escape from predators.

UNIT-III

Learning: Characters, types, learning in invertebrates and vertebrates.

Motivation: Measurements, Studies of motivation on guppies, newts and Phesus monkeys, Lorenz's model and neurophysiology of motivation**.**

UNIT-IV

Biological communication and Biological clock: Crypsis, forms of signals, receptors for communication, nature of biological clock, types of rhythms.

Social behaviour: Types, advantages, social behaviour in insects.

UNIT-V

Sexual Behaviour: Mating systems, courtship patterns and significance.

Hormones and behaviour: Hormones important to behavioural regulation, hormones controlling sexual behaviour, maternal behaviour.

Suggested Reading:

1. Animal Behaviour: M.P. Arora
2. Animal Behavior: Reena Mathur
3. Animal Behavior: An Evolutionary Approach: John Alcock

Course Title: Cytogenetics & Plant Breeding
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.

Semester-VI

BIOL 536 DEVELOPMENTAL BIOLOGY 3 (2-0-2)

UNIT I:

Basic concepts of development: Potency, commitment, specification, induction, competence, determination and differentiation; morphogenetic gradients; cell fate and cell lineages; stem cells; genomic equivalence and the cytoplasmic determinants; imprinting; mutants and transgenics inanalysis of development.

UNIT II:

Gametogenesis: Spermatogenesis, Oogenesis, Oogenesis in insects and mammals

UNIT III:

Fertilization and early development cell surface molecules in sperm-egg recognition in animals; embryo sac development zygote formation, cleavage, blastula formation, embryonic fields,gastrulation and formation of germ layers in animals.

UNIT IV:

Morphogenesis and organogenesis in animals: Cell aggregation and differentiation, Axes and pattern formation, amphibia and chick; organogenesis –eye lens induction, limb development and regeneration in vertebrates; differentiation of neurons,

UNIT V:

Post embryonic development: larval formation, metamorphosis; environmental regulation of normal development; sex determination.

PRACTICALS

- Study of different types of placenta in mammals by charts,
- identification of cross sections of chick embryo through eye and ear part, vital staining of chick embryo (in vitro), induced ovulation and fertilization in fishes, Study of fish embryo

Recommended Books:

1. Gilbert. 2013. *Developmental Biology*. SinauerAssociates.
2. Sastry and Shukal. 2007. Developmental Biology. Rastogi publications.
3. Verma and Agarwal. 2012.Chordate Embryology: Developmental Biology.

Semester-VI

BIOL 537 BIODIVERSITY AND CONSERVATION 3 (2-1-0)

UNIT I

Introduction, Distribution, types of biodiversity, Hot spots of biodiversity

UNIT II

Ecosystem: Definition and concept, Component and structure, Ecosystem energetic, Types of ecosystem, Ecological succession

UNIT III

Biodiversity conservation: In-situ and Ex-situ, advantages and disadvantages, Importance of biodiversity, Cultural and aesthetical values

UNIT IV

Threats to biodiversity, classification of species based on threats, National parks, Biosphere reserves, Botanical garden,

UNIT V

National and international Laws on biodiversity, Project Tiger, Project Elephant, Project Crocodile, Project Rhino

Reference Book:

- ✓ Biodiversity and its conservation by S.S. Negi
- ✓ Biodiversity conservation and Environmental Management by D.R. Khanna
- ✓ Environmental studies by Deswal and Deswal
- ✓ Biodiversity and Conservation by Mike J. Jeffries
- ✓ Biodiversity: Monitoring and Utilization by B.B. Hosetti and K.L. Naik

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

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.