INVERTIS
UNIVERSITY BAREILLY

CBCS Scheme of Instruction & Syllabi

of

Bachelor of Science
(Zoology, Botany & Chemistry)
Third Year

(Effective from the academic session 2020- 2021)

Department of Applied Science & Humanities

INVERTIS UNIVERSITY

Invertis Village,
Bareilly-Lucknow NH-24,
Bareilly, U.P. (243123)

Dean
Faculty of Science
Invertis University, Bareilly (U.P.)

15-10-20 Saturday 18/10/20 15/10/20 15/10/2020

Head
Department of Applied Science
Invertis University, Bareilly (U.P.)

VICE CHANCELLOR
INVERTIS UNIVERSITY
BAREILLY

INVERTIS
UNIVERSITY BAREILLY

B.Sc. (Zoology, Botany and Chemistry)

This program provides an ability to identify and solve significant problems across a broad range of application areas, to develop the aptitude to apply the principles of Zoology, Botany and Chemistry to articulate an in depth understanding of core knowledge on various subjects of Biological Sciences. It is designed to help students understand the importance of biodiversity, sustainable development and the role of these in improving the quality of human life. It also helps students recognize and appreciate the contribution of great scientists in the field of Zoology, Botany and Chemistry.

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

The program acts as a foundation degree and helps to develop critical, analytical and problem solving skills at first level. The foundation degree makes the graduates employable in scientific organizations and also to assume administrative positions in various types of organizations. Further acquisitions of higher level degrees help the graduates to pursue a career in academics or scientific organizations as a researcher.

The Program Educational Objectives are to prepare the students to:

PEO-1. Work alongside engineering, medical, ICT professionals and scientists to assist them in scientific problem solving.

PEO-2. Act as administrators in public, private and government organizations or business administrator with further training and education.

PEO-3. Pursue masters and doctoral research degrees to work in colleges, universities as professors or as scientists in research establishments.

Dean
Faculty of Science
Invertis University, Bareilly (U.P.)

15/10/20

Head

INVERTIS
UNIVERSITY BAREILLY

PROGRAM OUTCOMES (POs)

After undergoing this programme, a student will be able to execute the following successfully:

PO-1. **Scientific knowledge**: Apply the knowledge of living world, science, scientific fundamentals, and scientific specialization to the solution of complex scientific problems.

PO-2. **Problem analysis**: Identify research literature, and analyze scientific problems to arrive at substantiated conclusions using basic principles of natural sciences.

PO-3. **Design/development of solutions**: Design solutions for scientific problems and design system components, processes to meet the specifications with consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4. **Conduct investigations of complex problems**: Application research-based knowledge including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern scientific tools including prediction and modeling to complex activities with an understanding of the limitations.

PO-6. **Scientific temper and society**: Apply reasoning informed by the contextual knowledge to assess societal, health,

Head
Department of Applied Scien
Invertis University, Bareilly

Dean
Faculty of Science
Invertis University, Bareilly

safety, legal, and cultural issues and the consequent responsibilities relevant to the practice.

PO-7. **Environment and sustainability**: Appreciate the impact of the professional scientific solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the work practice.

PO-9. **Individual and team work**: Act as an individual, and as a member or leader in teams, and in multidisciplinary settings.

PO-10. **Communication**: Connect with their community and with society at large. Be able to comprehend and write effective reports documentation. Make effective presentations, and give and receive clear instructions.

PO-11. **Project management and finance**: Establish knowledge and understanding of scientific and management principles and apply these to one's own work, as a member and leader in a team. Manage projects in multidisciplinary environments.

PO-12. **Life-long learning**: Identify the need for, and have the preparation and ability to engage in independent and life-long learning and research in the broadest context of scientific & technological change.

Head
Department of Applied Science
Invertis University, Bareilly (U.P.)

INVERTIS UNIVERSITY BAREILLY

Scheme of Instruction
B.Sc. III[rd] Year (Zoology and Botany)

Third Year (Zoology and Botany)									
V Semester			Teaching Scheme			Marks Distribution			
CATEGORY	CODE	SUBJECT	L	T	P	CA	EE	Total	Credits
DSE-1A	CZT501	DSE-1Z	3	1	0	30	70	100	4
DSE-2A	CZT502	DSE-2Z	3	1	0	30	70	100	4
DSE-3A	CBT501	DSE-3B	3	1	0	30	70	100	4
SEC	CSE501	SEC-3	2	0	0	15	35	50	2
DSE-1A (P)	CZT551	Zoology lab-V	0	0	4	15	35	50	2
DSE-2A(P)	CZT552	Zoology lab-VI	0	0	4	15	35	50	2
DSE-3A(P)	CBT551	Botany lab-V	0	0	4	15	35	50	2
Total			**11**	**3**	**12**	**150**	**350**	**500**	**20**
VI Semester									
CATEGORY	**CODE**	**SUBJECT**	**L**	**T**	**P**	**CA**	**EE**	**Total**	
DSE-1B	CZT601	DSE-3Z	3	1	0	30	70	100	4
DSE-2B	CBT601	DSE-2B	3	1	0	30	70	100	4
DSE-3B	CBT602	DSE-3B	3	1	0	30	70	100	4
SEC	CSE602	SEC-4	2	0	0	15	35	50	2
DSE-1B(P)	CZT651	Zoology lab-VII	0	0	4	15	35	50	2
DSE-2B(P)	CBT651	Botany lab-VI	0	0	4	15	35	50	2
DSE-3B(P)	CBT652	Botany lab-VII	0	0	4	15	35	50	2
Total			**11**	**3**	**12**	**150**	**350**	**500**	**20**

Dean
Faculty of Science
Invertis University, Bareilly

Head

INVERTIS UNIVERSITY BAREILLY

Scheme of Instruction
B.Sc. III[rd] Year (Zoology and Chemistry)

Third Year (Zoology and Chemistry)									
V Semester			Teaching Scheme			Marks Distribution			
CATEGORY	CODE	SUBJECT	L	T	P	CA	EE	Total	Credits
DSE-1A	CZT501	DSE-1Z	3	1	0	30	70	100	4
DSE-2A	CZT502	DSE-2Z	3	1	0	30	70	100	4
DSE-3A	CSR501	DSE-3C	3	1	0	30	70	100	4
SEC	CSE501	SEC-3	2	0	0	15	35	50	2
DSE-1A (P)	CZT551	Zoology lab-V	0	0	4	15	35	50	2
DSE-2A(P)	CZT552	Zoology lab-VI	0	0	4	15	35	50	2
DSE-3A(P)	CSR551	Chemistry lab-V	0	0	4	15	35	50	2
Total			11	3	12	150	350	500	20
VI Semester									
CATEGORY	CODE	SUBJECT	L	T	P	CA	EE	Total	
DSE-1B	CZT601	DSE-1Z	3	1	0	30	70	100	4
DSE-2B	CSR601	DSE-2C	3	1	0	30	70	100	4
DSE-3B	CSR602	DSE-3C	3	1	0	30	70	100	4
SEC	CSE602	SEC-4	2	0	0	15	35	50	2
DSE-1B(P)	CZT651	Zoology lab-VII	0	0	4	15	35	50	2
DSE-2B(P)	CSR651	Chemistry lab-VI	0	0	4	15	35	50	2
DSE-3B(P)	CSR652	Chemistry lab-VII	0	0	4	15	35	50	2
Total			11	3	12	150	350	500	20

Dean
Faculty of Science
Invertis University, Bareilly

INVERTIS UNIVERSITY BAREILLY

Scheme of Instruction
B.Sc. III[rd] Year (Botany and Chemistry)

Third Year (Botany and Chemistry)									
V Semester			Teaching Scheme			Marks Distribution			
CATEGORY	CODE	SUBJECT	L	T	P	CA	EE	Total	Credits
DSE-1A	CBT501	DSE-1B	3	1	0	30	70	100	4
DSE-2A	CBT502	DSE-2B	3	1	0	30	70	100	4
DSE-3A	CSR501	DSE-3C	3	1	0	30	70	100	4
SEC	CSE501	SEC-3	2	0	0	15	35	50	2
DSE-1A (P)	CBT551	Botany lab-V	0	0	4	15	35	50	2
DSE-2A(P)	CBT552	Botany lab-VI	0	0	4	15	35	50	2
DSE-3A(P)	CSR551	Chemistry lab-V	0	0	4	15	35	50	2
Total			**11**	**3**	**12**	**150**	**350**	**500**	**20**
VI Semester									
CATEGORY	**CODE**	**SUBJECT**	**L**	**T**	**P**	**CA**	**EE**	**Total**	
DSE-1B	CBT601	DSE-1B	3	1	0	30	70	100	4
DSE-2B	CSR601	DSE-2C	3	1	0	30	70	100	4
DSE-3B	CSR602	DSE-3C	3	1	0	30	70	100	4
SEC	CSE602	SEC-4	2	0	0	15	35	50	2
DSE-1B(P)	CBT651	Botany lab-VII	0	0	4	15	35	50	2
DSE-2B(P)	CSR651	Chemistry lab-VI	0	0	4	15	35	50	2
DSE-3B(P)	CSR652	Chemistry lab-VII	0	0	4	15	35	50	2
Total			**11**	**3**	**12**	**150**	**350**	**500**	**20**

Dean
Faculty of Science
Invertis University, Bareilly

INVERTIS UNIVERSITY BAREILLY

*There will be a 2-credit course on human ethics and entrepreneurship which students can choose at any semester during the program.

List of DSEs

DSE(Zoology)1A	Ecology and Systematics
DSE(Zoology)2A	Analytical Techniques in Animal Sciences
DSE(Zoology)3A	Immunology
DSE (Zoology)4A	Economic Zoology and Animal Biotechnology
DSE (Zoology)1B	Reproductive Biology
DSE(Zoology)2B	Parasitology and Disease management
DSE(Zoology)3B	Aquatic Biology
DSE(Zoology)4B	Cytogenetics and Human Genetics
DSE(Botany)1A	Cell and Molecular Biology
DSE(Botany)2A	Economic Botany and Plant Biotechnology
DSE(Botany)3A	Analytical Techniques in Plant Sciences
DSE(Botany)4A	Plant Breeding and Tissue Culture
DSE(Botany)1B	Microbiology and Plant Pathology
DSE(Botany)2B	Evolution and Paeleobotany
DSE(Botany)3B	Environment protection and Sustainable Development
DSE(Botany)4B	Plant Resource Utilization and Palynology
DSE(Chemistry)1A	Applied Organic Chemistry
DSE(Chemistry)2A	Physical chemistry
DSE(Chemistry)3A	Inorganic Chemistry
DSE(Chemistry)1B	Introduction to Nanoscience
DSE(Chemistry)2B	Advanced Physical Organic Chemistry
DSE(Chemistry)3B	Green Chemistry

Head
Department of Applied Science
Invertis University, Bareilly (U.P.)

List of SECs

SEC-1	Aquarium and fish keeping
SEC-2	Apiculture
SEC-3	Sericulture
SEC-4	Public Health and Hygiene
SEC-5	Biofertilizers
SEC-6	Medicinal Botany
SEC-7	Ethnobotany
SEC-8	Intellectual Property Rights (IPR)
SEC-9	Chemical Technology & Society
SEC-10	Pharmaceutical Chemistry

VICE CHANCELLOR
INVERTIS UNIVERSITY
BAREILLY

DSE (Zoology) 1A
CZT501: Ecology and Systematics

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: General knowledge of components of ecosystem and evolutionary relationship among animals.

Course Objectives:

1. To learn about the basic concepts of ecology.
2. To get basic idea of ecosystem and its functionality.
3. To understand the concept of biodiversity and its significance for survival of life on earth.
4. To discuss different environmental issues and their solutions.
5. To learn about various approaches to explore relatedness among organisms.
6. To get aware about various methods of tracing evolutionary history of different organism.

Detailed Syllabus:

Unit 1 Introduction to ecology: Introduction, history and scope of ecology, autecology, synecology; abiotic factors: temperature, light, pH and salinity, thermal stratification, factors influencing light penetration in water; Concept of limiting factors and laws governing these factors. Species (Sympatric and Allopatric), Population, Community.

Unit 2 Population and its growth: Unitary and Modular populations, Unique and group attributes of population: Density natality, mortality, life tables, fecundity tables, survivorship curves, age ratio, sex ratio, dispersal; Exponential and logistic growth, equation and patterns, r and K strategies, Population regulation: density-dependent and independent factors; Ecological niche; Gause's Principle with laboratory and field examples**.**

Unit 3 Community interaction and ecosystem: Community characteristics: Dominance, diversity, species richness, abundance, stratification; ecotone and edge effect; Types of interaction: Inter and intra-specific; Ecological succession; Types of ecosystem with detailed account of pond, desert and forest ecosystems; Detritus and grazing food chains, food web, energy flow through ecosystem; Ecological pyramids and Ecological efficiencies; Biogeochemical cycles: C, N, P & S cycles.

Unit 4 Systematics: Definition and role in biology, biological classification- theories and objectives, types of taxonomy, taxonomic diversity- definition and types, origination and extinction, rates of change in origination and extinction, causes of extinction, causes of differential rates of diversification, current status and future of biodiversity; human evolutionary history.

Practicals:

1. Use of pH meter for estimation of pH in water and soil samples
2. Study of microorganisms of water and soil samples
3. Determination of dissolved O2, free CO2 of water.
4. Zoo-plankton count by standard methods
5. Report on Environmental audit Local Biodiversity Record (in group/individual of a particular area)

– at least two records of faunal diversity along with ecological notes and photographic documentations in two seasons should be done. For example: butterfly community or bird community of a particular area.

6. Field work assessment Submission of field study report on any two of the following:
    a. Ecosystem and its biodiversity assessment. (Any suitable ecosystem) (Various diversity indices with explanation must be presented)
    b. Estuarine bheri /freshwater fish farm (species cultured/reared, whether exotic/ornamental fishes are cultured, viability of the farm, cost benefit accounts, impact on local people and prospect in the specific area)
7. General discussion, distinguishing characters and classification of respective phylum along with evolutionary trends.

Text and Reference Books

1. Colinvaux, P. A. (1993). Ecology. II Edition. Wiley, John and Sons, Inc.
2. Krebs, C. J. (2001). Ecology. VI Edition. Benjamin Cummings.
3. Odum, E.P., (2008). Fundamentals of Ecology. Indian Edition. Brooks/Cole
4. Ricklefs, R.E., (2000). Ecology. V Edition. Chiron Press
5. Evolution, Barton, N. H., Briggs, D. E.G., Eisen, J. A., Goldstein, A. E., Patel, N. H., Cold Spring Harbor Laboratory Press, New York, USA
6. Evolution, Hall, B. K. and Hallgrimsson, B., Jones and Bartlett Publisher, Sudbury, USA
7. Evolution, Futuyma, D. J., Sinauer Associates, Inc., Sunderland, USA

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe the basic concepts of ecology.
CO2	Evaluate the importance of biodiversity and its conservation.
CO3	Determine significance of different organism to the environment.
CO4	Address and describe environmental issues.
CO5	Propose new methods and approaches for determining the relatedness among organisms.
CO6	Aware other people about systematics and its significance.

DSE (Zoology) 2A
CZT502: Analytical Techniques in Animal Sciences

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of animal organization, awareness of animal techniques.

Course Objectives:

1. To learn about the principles of microscopy.
2. To study various techniques in order to analyze cellular and microbial organization.
3. To study in detail the principle of immunological techniques.
4. To study culture techniques.
5. To learn about basic and advanced Zoological techniques.

Detailed Syllabus:

Unit 1 Microscopy and Microtomy: Introduction to Microscopy. Definitions-Resolving Power, Limit of Resolution and Magnification, Numerical Aperture. Types of microscopes. Basic principles of Light, Electron, Fluorescence and Confocal Microscopy. Tissue preparation and microtomy.

Unit 2 Analytical and separation techniques: Physiological Salines, Buffers and the use of pH meter. Extraction of Tissue Glycogen, Proteins, Lipids and Nucleic Acids by Graaf's Method. Subcellular Fractionation by Differential Centrifugation. Basic Principle and Application of Colorimetry and Spectrophotometry, Beer-Lambert's Law. Separation of Biomolecules by Native PAGE, 2D PAGE, Agarose gel electrophoresis and Chromatography.

Unit 3 Immunological techniques: Raising Polyclonal and Monoclonal Antibodies. Antigen-Antibody Interactions- Immunodiffusion, Ouchterlony's Double Immunodiffusion, Counter-Current Immunoelectrophoresis, Western Blotting, ELISA, Principle & Working of ELISA Reader, Hormones assay methods. Application of Immunological techniques in disease diagnosis.

Unit 4 Culture techniques: Cell culture and its basic requirements. Culture media-Nutrient and Non-nutrient, commonly used media for human cell lines. Sterilization of culture wares and Media. Cell harvesting and Storage Methods.

Practicals:

1. Micro-technique (whole mount preparation and histological preparation)
2. Fixatives, stains and preservatives (composition and method of preparation)
3. Basic principle and types of chromatography
4. Basic principle and types of electrophoretic apparatus with special emphasis on SDS PAGE
5. Basic working principle of centrifuge
6. Basic working principle of UV Spectrophotometer
7. Basic working principle of Colorimeter
8. Basic working principle of ESR and NMR spectrometer
9. Basic working principle of Microtome

10. Scientific visit to any institute for getting exposure on modern biological analytical instruments.
Text and Reference Books 1. Plummer, DI. (1996). An Introduction to Practical Biochemistry. Tata McGraw-lilt Publishing Co. Ltd. New Delhi. 3rd edition. 2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University press. 8th edition.

Course Outcomes:

After completing the course, students will be able to:

CO1	Handle the microscopes for their proper utilization.
CO2	Understand the organisms at cellular or molecular level.
CO3	Handle several instruments in order to analyze the biochemistry of organisms.
CO4	Know the molecular approaches for identification.
CO5	Evaluate the diversity of various groups of organisms.

DSE (Zoology) 3A
CZT503: IMMUNOLOGY

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of immune system and immune responses.

Course Objectives:

1. To learn about the basic principles of immunology.
2. To study components of immune system and types of immune responses.
3. To explore about immuno-techniques and the applications in research and diagnostics.
4. To get aware about basic concept of graft rejection during transplantation and autoimmune diseases.
5. To learn about vaccines and other medical application of immunology.
6. To observe the identifying features of lymphoid organs.

Detailed Syllabus:

Unit 1:Immune System and its components: Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system, Haematopoeisis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system.

Unit 2: Antigens and Antibodies: Basic properties of antigens, B and T cell epitopes, haptens and adjuvants Structure, classes and function of antibodies, monoclonal antibodies, antigen antibody interactions as tools for research and diagnosis.

Unit 3: Working of the immune system: Structure and functions of MHC, exogenous and -endogenous pathways of antigen presentation and processing, Basic properties and functions of cytokines, Complement system: Components and pathways.

Unit 4: Immune system in health and disease: Gell and Coombs' classification and brief description of various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency, General Introduction to vaccines, Various types of vaccines.

Practicals:

1. Demonstration of lymphoid organs
2. Histological study of spleen, thymus and lymph nodes through slides/ photographs
3. Preparation of stained blood film to study various types of blood cells.
4. Ouehterlony's double immuno-diffusion method.
5. ABO blood group determination.
6. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
7. Demonstration of
    a. ELISA
    b. Immunoelectrophoresis

Text and Reference Books

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition.
2. W.H. Freeman and Company. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VI Edition,
3. 3.Mosby, Elsevier Publication. Abbas, K. Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe about the basic principles of immunology.
CO2	Explain components of immune system and types of immune responses.
CO3	Apply immuno-techniques and the applications in research and diagnostics.
CO4	Come across the basic concept of graft rejection during transplantation and autoimmune diseases.
CO5	Signify the vaccines and other medical application of immunology.
CO6	Explain the identifying features of lymphoid organs.

DSE (Zoology) 4A
CZT504: Economic Zoology and Animal Biotechnology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Knowledge of economically important animal species and principles of biotechnology

Course Objectives:

1. To study basic concept of applied and economic Zoology.
2. To learn about the methodologies of animal culture techniques.
3. To learn about the economically important species of animals.
4. To get aware about the principles integrated pest management to improve crop yield.
5. To learn the principles of genetic engineering and gene cloning for conducting biotechnological experiments.
6. To learn about modern tools and techniques of biotechnology like PCR, DNA sequencing and in-situ hybridization etc.
7. To explore the methodologies of gene transfer and transformation in different organisms.
8. To study the principles for preparation of gene and cDNA libraries for storing valuable genes to be utilized at present and in future.

Detailed Syllabus:

Unit 1 Aqua culture: Introduction and scope of Economic Zoology; Edible species of fishes; Fish culture: Sources of fish feeds and induced breeding, Cultivable fish species, Fish by-products; Edible species of prawn, lobsters and molluscs; Shell fish farming: Prawn and pearl oyster**.**
Unit 2 Applied Zoology: Brief account of Sericulture, Apiculture and Lac-culture; Poultry industry and commercially important poultry breeds in India; Meat, leather and wool industries, their production and export potentials; Breeds of cattle and buffaloes, Dairy farming in India; Milk production and pasteurization.
Unit 3 Basic techniques of gene manipulation: Introduction and scope of biotechnology, Cloning vectors: Plasmids, Cosmids, Phagemids, Lambda Bacteriophage,M13, BAC, YAC, MAC and Expression vectors (characteristics), Restriction enzymes: Nomenclature, detailed study of Type II restriction endonuclease. Transformation techniques; Calcium chloride method and electroporation.
Unit 4 Gene libraries: Construction of genomic and cDNA libraries and screening by colony and plaque hybridization, Southern, Northern and Western blotting; DNA sequencing: Sanger method; Polymerase Chain Reaction, DNA Finger Printing and DNA micro array.
Unit 5 Transgenic animals: Genetically Modified Organisms; Production of cloned and transgenic animals: Nuclear Transplantation, Retroviral Method, DNA microinjection, Applications of transgenic animals: Production of pharmaceuticals, production of donor organs, knockout mice.

Practicals:

1. Study of *Plasmodium vivax, Entanweba histolytica, Trypanosoma gambiense, Ancylostoma duodenale* and *Wuchereria bancrolli* and their life stages through permanent slides/photomicrographs or specimens.
2. Different types of important edible fishes of India: Catla c atla, Labeo rohita, Cirrhinus mrigala, Cyprinus carpio, Clarias bartachus, Puntius sarana, Wallago attu, Heteropneustes fossilis, Latescalcarifer, Anabas testudineus, Pampus argenteus, Polynemusparadiseus.
3. Visit to poultry farm or animal breeding centre. Submission of visit report
4. Mainteitance of freshwater aquarium
5. To study following techniques through photographs
    a. Southern Blotting
    b. Northern Blotting
    c. Western Blotting
    d. DNA Sequencing (Sanger's Method)
    e. PCR
    f. DNA fingerprinting

Text and Reference Books

1. Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006). Immunology, VI Edition.
2. W.H. Freeman and Company. David, M., Jonathan, B., David, R. B. and Ivan R. (2006). Immunology, VI Edition,
3. 3. Mosby, Elsevier Publication. Abbas, K. Abul and Lechtman H. Andrew (2003.) Cellular and Molecular Immunology. V Edition. Saunders Publication.

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe the basic concept of applied and economic Zoology.
CO2	Explain about the methodologies of animal culture techniques.
CO3	Discuss about the economically important species of animals.
CO4	Use the integrated pest management to improve crop yield.
CO5	Utilize genetic engineering and gene cloning principles for conducting biotechnological experiments.
CO6	Explain about modern tools and techniques of biotechnology like PCR, DNA sequencing and in-situ hybridization etc.
CO7	Discuss the methodologies of gene transfer and transformation in different organisms.
CO8	Describe the principles for preparation of gene and cDNA libraries.

DSE (Botany) 1A
CBT501: Cell Biology and Molecular Biology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of cell organization and fundamental processes of cell.

Course Objectives:

1. Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles.
2. Students will understand how these cellular components are used to generate and utilize energy in cells.
3. Students will understand the cellular components underlying mitotic cell division.
4. Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function. These can include responses to environmental or physiological changes, or alterations of cell function brought about by mutation

Detailed Syllabus:

Unit 1 Techniques in Biology: Principles of microscopy, light microscopy; phase contrast microscopy; fluorescence microscopy, confocal microscopy; sample preparation for light microscopy; Electron Microscopy (EM)- Scanning Electron Microscopy (SEM) and Transmission Electron Microscope (TEM); sample preparation for electron microscopy; X-ray diffraction analysis
Unit 2 Cellular system: The Cell Theory, Overview of cell cycle, Mitosis and Meiosis; Molecular controls prokaryotic and eukaryotic cells, cell size and shape, eukaryotic cell components; functions of membranes, models of membrane structure, fluidity of membranes, membrane proteins and their functions, permeability of the membranes, cell wall. Nucleus, Mitochondria, Chloroplast, ER, Golgi bodies, Lysosomes, Peroxisomes, Glyoxisomes; mitochondria and chloroplast DNA, semiautonomous nature and symbiont hypothesis; biogenesis
Unit 3 Genetic material: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material. DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi-conservative, semi discontinuous RNA priming, 6 (theta) mode of replication, replication of linear, dsDNA, replicating the 5' end of linear chromosome including replication enzymes.
Unit 4 Central Dogma: Transcription (Prokaryotes and Eukaryotes), types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code. Regulation of gene expression, Prokaryotes:Lac operon and Tryptophan operon; and in eukaryotes.
Practicals: 1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells. 2. To study the structure of plant cell through temporary mounts. 3. Study of mitosis and meiosis (temporary mounts and permanent slides).

4. Biochemical tests of carbohydrates.
5. Study of plasmolysis and deplasmolysis.
6. Measure the cell size (either length or breadth/diameter) by micrometry.
7. Study the structure of nuclear pore complex by photograph (from Gerald Karp), Study of special chromosomes (Polytene & Lampbrush) either by slides or photographs.

Text and Reference Books

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons. Inc.
2. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G.M. and Hausman, R.E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinaucr Associates, MA.
4. Becker, W.M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of theCell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.

Course Outcomes:

After completing the course, students will be able to:

CO1	Gain knowledge about cell science.
CO2	Understand cell wall plasma membrane, cell organelles and cell division.
CO3	Learn the scope and importance of molecular biology.
CO4	Understand the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.
CO5	Understand the process of synthesis of proteins and role of genetic code in polypeptide formation

DSE (Botany) 2A
CBT502: Economic Botany and Plant Biotechnology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of economically important plant species and knowledge of fundamental processes of biotechnology.

Course Objectives:

1. To learn the concept of origin of crops.
2. To learn the major food crops in India and their economic importance.
3. To learn the methods of cultivation of crops and their harvesting.
4. To study the economic uses of crops that produce food, fibers, timber and spices.
5. To learn about the medicinal plants in India.
6. To learn about energy plantation and bio-fuels.

Detailed Syllabus:

Unit 1 Introduction: Origin of cultivated plants,concept of centers of origin, their importance with reference to Vavilov's work.

Unit 2 Cereals: wheat, origin, morphology, uses. **Legumes**: general account with special reference to gram and soya bean. **Spices:** general account with special reference to clove and black pepper (botanical name, family, part used, morphology and uses). **Beverages:** tea and coffee (morphology, processing, uses).**Oils and fats:** general description with special reference to groundnut. **Fibre yielding plants:** general description with special reference to cotton (botanical name, family, part used, morphology and uses).

Unit 3 Plant tissue culture: description, methods, micropropagation; haploid production through androgenesis and gynogenesis; brief account of embryo & endosperm culture with their applications

Unit 4 Recombinant DNA Techniques: Blotting techniques; Northern, Southern and Western Blotting, DNA Fingerprinting; Molecular DNA markers i.e. RAPD, RFLP, SNPs; DNA sequencing, PCR and Reverse Transcriptase-PCR. Hybridoma and monoclonal antibodies, ELISA and Immunodetection, Molecular diagnosis of human disease, Human gene Therapy.

Practicals:

1. Study of economically important plants: Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests.
2. Familiarization with basic equipments in tissue culture.
3. Study through photographs: anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation.
4. Study of molecular techniques: PCR, Blotting techniques, AGE and PAGE.

Text and Reference Books

1. Kochhar, (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: TheoryPractice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, Bit, Pasternak (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.

Course Outcomes:

After completing the course, students will be able to:

CO1	Know the criteria of geological distribution.
CO2	Determine the trend of migration of crops globally.
CO3	Know different methodologies for crop cultivation.
CO4	Know the types of major crops in India.
CO5	Know the economic importance of plants.
CO6	Know the various fibers and their exploitation.
CO7	Know the major timber producing trees in India.
CO8	Determine the significance of energy plantation

DSE (Botany) 3A
CBT503: Analytical Techniques in Plant Sciences

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: - Knowledge of general principles of bio techniques used in botany.

Course Objectives:

1. To learn about the principles of microscopy.
2. To study various techniques in order to observe cellular and microbial organization.
3. To study in detail the principle of chromatography.
4. To study molecular techniques.
5. To calculate the variation and variability among organisms

Detailed Syllabus:

Unit 1 Microscopy: principles of microscopy, Light microscopy, Fluorescence microscopy, Confocal microscopy. Use of fluorochromes: Flow cytometry (FACS), applications of fluorescence microscopy: chromosome banding, FISH, chromosome painting; Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

Unit 2 Cell fractionation: Centrifugation, application, differential and density gradient centrifugation, sucrose density gradient, analytical centrifugation, ultracentrifugation, marker enzymes; radioisotopes; auto-radiography; pulse chase experiment; spectrophotometry.

Unit 3 Chromatography: Principle of chromatography; paper chromatography; column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; molecular sieve chromatography; affinity chromatography.

Unit 4 Mass spectrometry: X-ray diffraction; X-ray crystallography; electrophoresis (AGE, PAGE, SDS-PAGE).

Unit 5 Biostatistics: statistics, data, population, samples, parameters; representation of data: tabular, graphical; measures of central tendency: arithmetic mean, mode, median; measures of dispersion: range, mean deviation, variation, standard deviation; Chi-square test for goodness of fit.

Practicals:

1. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
2. Demonstration of ELISA.
3. To separate nitrogenous bases by paper chromatography.
4. To separate sugars by thin layer chromatography.
5. Isolation of chloroplasts by differential centrifugation,
6. To separate chloroplast pigments by column chromatography.
7. To estimate protein concentration through Lowry's methods.
8. To separate proteins using PAGE.

9. To separate DNA (marker) using AGE.
10. Study of different microscopic techniques using photographs/micrographs (freeze fracture, freeze etching, negative staining, positive staining, fluorescence and HSI I).

Text and Reference Books

1. Plummer, DI. (1996). An Introduction to Practical Biochemistry. Tata McGraw-lilt Publishing Co. Ltd. New Delhi. 3rd edition.
2. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University press. 8th edition.

Course Outcomes:

After completing the course, students will be able to:

CO1	Handle the microscopes for their proper utilization.
CO2	Understand the organisms at cellular or molecular level.
CO3	Handle several instruments in order to analyze the biochemistry of organisms.
CO4	Know the molecular approaches for identification.
CO5	Evaluate the diversity of various groups of organisms.
CO6	Students made in to distinguish even small variations by simple analysis
CO7	To choose the correct method and solve the problem by applying the specific techniques

DSE (Botany) 4A
CBT504: Plant Breeding and Tissue Culture

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: - Basic idea micropropogation and tissue culture

Course Objectives:

1. Identify characteristics of self- and cross-pollinated plants
2. Identify sources of genetic variation to conduct a breeding program
3. Determine breeding methodology appropriate for plants with different mating systems
4. Conduct basic statistical analyses related to plant breeding
5. Analyze journal articles related to cultivar development
6. Conduct and analyze a selection experiment
7. Communicate background information and original ideas related to breeding a specific crop
8. Know different techniques to improve the plant varieties using tissue culture techniques for commercial purposes.

Detailed Syllabus:

Unit 1 General account: history of plant breeding, the disciplines to be known by a breeder – botany of the crop, cytogenetics (agronomy, physiology, pathology, entomology, biochemistry, bacteriology, statistics, plant biotechnology); objectives of plant breeding: high yield, improved quality, disease and pest resistance, early maturity, photosensitivity, varieties for new seasons, resistant varieties; activities in plant breeding: creation of new varieties, selection, evaluation, multiplication and distribution; centres of origin: different centres and their significance; germplasm conservation: *in situ* seed banks, plant banks, shoot tip banks, cell and organ banks, DNA banks, germplasm evaluation, cataloguing, multiplication and distribution.
Unit 2 Plant introduction: history of plant introduction- primary and secondary, plant introduction agencies: procedure of plant introduction: quarantine, cataloguing, evaluation, multiplication, distribution, acclimatization, purpose of plant introduction, achievements, merits and demerits; methods of reproduction; incompatibility: different types – self incompatibility, homomorphic and heteromorphic incompatibility – gametophytic and sporophytic incompatibility, mechanism of self- incompatibility, pollen- stigma interaction, pollen tube -style interaction, pollen tube -ovary interaction –significance of self- incompatibility, methods to overcome self- incompatibility- bud pollination, surgical methods and off season pollination, high temperature, irradiation (iv) Sterility : male sterility – genetic male sterility - cytoplasmic male sterility – cytoplasmic genetic male sterility, application in crop improvement.
Unit 3 Selection: history of selection, pureline selection, mass selection, pedigree selection, bulk method of selection, merits and demerits, achievements of each type; backcross method of selection : Introduction, requirements, applications of back cross methods, genetic consequences of repeated back crossing, procedure of back cross method - transfer of a dominant gene, transfer of a recessive gene, number of plants necessary in backcross generation, selection of the characters being transferred, transfer of quantitative characters, modification of back cross method, production of F2 and F3, use of different recurrent parents, application of back cross method in cross pollinated crops, merits and demerits,

achievements; hybridization: history , techniques and consequences, objectives, types of hybridization – interspecific, intergeneric, distant 26 hybridization, procedure of hybridization, choice of parents, evaluation of parents, emasculation – different methods, bagging, tagging, pollination , harvesting and storing of the F1 seeds and selfing, consequences of hybridization.

Unit 4 Plant Tissue Culture: history of plant tissue culture research - basic principles of plant tissue callus culture, meristem culture, organ culture, Totipotency of cells, differentiation and dedifferentiation; methodology - sterilization (physical and chemical methods), culture media, Murashige and Skoog's (MS medium), phytohormones, medium for micro-propagation/clonal propagation of ornamental and horticulturally important plants; callus subculture maintenance, growth measurements, morphogenesis in callus culture – organogenesis, somatic embryogenesis; endosperm culture – Embryo culture -culture requirements – applications, embryo rescue technique; production of secondary metabolites; cryopreservation; Germ plasm conservation

Practicals:

1. Hybridization techniques - Emasculation, Bagging (for demonstration only).
2. Induction of polyploidy conditions in plants (for demonstration only).
3. Practice of hybridization techniques in a self-pollinated and cross pollinated plants (any available plant).
4. A visit to agricultural research centre for observation and record of inter variety, inter specified integration plants.
5. Study of tissue culture methodologies.
6. Methods of plant propagation a) Budding b) Grafting c) Rooting d) Layering e) Cutting.

Text and Reference Books

1. Gardner EJ, Simmons MJ, Snustad DP (2008). Principles of Genetics. 8th Ed. Wiley-India.
2. Klug WS, Cummings MR, Spencer, C, Palladino, M (2011). Concepts of Genetics, 10th Ed., Benjamin Cummings
3. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis. W. H. Freeman and Co., U.S.A. 10 edition.
4. Singh, B.D. (2005). Plant Breeding: Principles and Methods. Kalyani Publishers. 7th edition.
5. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding. Oxford – IBH. 2nd edition.
6. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Amsterdam, Netherlands: Elsevier Science.
7. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications. Washington, U.S.: ASM Press.
8. Kochhar, S.L. (2011). Economic Botany in the Tropics, 4th edition, New Delhi, Delhi: MacMillan Publishers India Ltd.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the role of population genetics in breeding plants
CO2	Understand the significance of different plant breeding systems
CO3	Understand the application of conventional breeding approaches and gene technology approaches in plant breeding programs
CO4	Appreciate the issues associated with breeding plants in a commercial setting.

CO5	Remember the scientific names by spell repeatedly.
CO6	Find the scope and opportunities in agriculture, horticulture and organic farming.
CO7	Identify characteristics of self- and cross-pollinated plants
CO8	Identify sources of genetic variation to conduct a breeding program
CO9	Determine breeding methodology appropriate for plants with different mating systems
CO10	Conduct basic statistical analyses related to plant breeding
CO11	Analyze journal articles related to cultivar development
CO612	Conduct and analyze a selection experiment
CO13	Communicate background information and original ideas related to breeding a specific crop
CO14	Know different techniques to improve the plant varieties using tissue culture techniques for commercial purposes

DSE (Zoology) 1B
CZT601: Reproductive Biology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of reproductive processes and its mechanisms.

Course Objectives:

1. To learn basic concepts of mammalian reproduction
2. To learn about the endocrinology of reproduction
3. To learn about anatomical features of the male reproductive system of mammals
4. To learn about anatomical features of the female reproductive system of mammals
5. To learn about the outlines of mammalian reproductive processes
6. To learn about the Assisted Reproductive Techniques (ART), such as IVF

Detailed Syllabus:

Unit 1 Reproductive Endocrinology: Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, and prostaglandins, hypothalarno- hypophyseal-gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

Unit 2 Functional anatomy of male reproduction: Outline and histological of male reproductive system in rat and human; Testis: Cellular functions, germ cell, system cell renewal; Spermatogenesis: kinetics and hotmonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract.

Unit 3 Functional anatomy of female reproduction Outline and histological of female reproductive system in rat and human; Ovary: folliculogenesis, ovulation, corpus luteum formation and regression; Steroidogenesis and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto — maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

Unit 4 Reproductive Health Infertility in male and female: causes, diagnosis and management; Assisted Reproductive Technology: sex selection, sperm banks, frozen embryos, in vitro fertilization, ET, EFT, IUT, ZIFT, GIFT, ICSI, PROST; Modern contraceptive technologies; Demographic terminology used in family planning.

Practicals:

1. Demonstration of reproductive organs
2. Histological study of testis, ovary and accessary reproductive structures through slides/ photographs
3. Observation of female reproductive cycle (Estrus cycle) in the given animal.
4. Study of major ART techniques.

Text and Reference Books

1. Austin, C.R. and Short, R.V. reproduction in Mammals, Cambridge University Press.
2. Degioot, L.J. and Jameson, J.L. (eds). Endocrinology. W.B. Saunders and Company.
3. Knobil, E. et al. (eds). The Physiology of Reproduction. Raven Press Ltd.
4. Hatcher, R.A. et al. The Essentials of Contraceptive Technology. Population Information Programme.

Course Outcomes:

After completing the course, students will be able to:

CO1	Explain the characteristic features of mammalian reproduction
CO2	Describe about the endocrinology of reproduction
CO3	Describe about anatomical features of the male reproductive system of mammals
CO4	Describe about anatomical features of the female reproductive system of mammals
CO5	Discuss about the outlines of mammalian reproductive processes.
CO6	Elaborate about the Assisted Reproductive Techniques(ART) in relation to human beings

DSE (Zoology) 2B
CZT602: Parasitology and Disease management

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic knowledge of host parasite interactions and mechanism of disease development.

Course Objectives:

1. To learn basic concepts of parasitology.
2. To get knowledge of some parasitic diseases that could be transmitted between animals and man (Zoonotic diseases).
3. To get aware how to protect man and domestic animals from parasites and their treatment.
4. To learn about basic knowledge of parasitism, the different biological inter-relationships and the host parasite relationships.
5. To learn about the principles of disease and epidemiology
6. To Disseminate of health awareness of among the people

Detailed Syllabus:

Unit 1 Parasitism: General consideration, Types of parasites, host and their types. Host-parasite Relationship; Symbiosis, Commensalism, Zoonosis.

Unit 2 Parasitic Protozoa: Life history and pathogenicity of *Entamoeba histolytica, Plasmodium vivax, Leishmania donovani* and *Trypanosoma gambiense***.**

Unit 3 Parasitic Helminthes: Life history and pathogenicity of *Ancylostorna duodenale* and *Wuchereria bancrofti.*

Unit 4 Principles of Diseases and Epidemiology: Transmission, Prevention and control of diseases. Different types of communicable diseases and their control measures — Tuberculosis, Measles, Dengue, and Leprosy. Different types of Life style related non-communicable diseases - Hypertension, Coronary Heart diseases, Stroke, Diabetes mellitus, Obesity and Mental ill-health - their causes and prevention through dietary and lifestyle modifications. Prevention of diseases through health education and environment improvements. Smoking, alcoholism, drug dependence and Acquired Immuno-Deficiency Syndrome (AIDS) - their causes, treatment and prevention.

Unit 5 Social health problems: Smoking, alcoholism, drug dependence and Acquired Immuno-Deficiency Syndrome (AIDS) - their causes, treatment and prevention**.**

Practicals:

1. Identification protozoan parasites from permanent slides.
   Trypanosoma : epimastigote or trypomastigote form.
   Leishmania : promastigote and amastigote form.
   Plasmodium : sporozoites and signet ring.
   Toxoplasma : tachyzoites and bradyzoites.
   Giardia
   Entamoeba: trophozoites
2. Identification and characterization of helminth parasites from permanent slides

Cercaria of *Fasciola.*
Eggs of *Schistosoma.*
Cyst of *Echinococcus granulosus.*
Microfilarie of *Wuchereria*.

3. Parasite culture (demonstration only

Text and Reference Books

1. Park, K. (2007), *Preventive and Social Medicine,* B.B. Publishers
2. Godkar P.B. and Godkar D.P. *Textbook of Medical Laboratory Technology,* II Edition, Bhalani Publishing House
3. Cheesbrough M., *A Laboratory Manual for Rural Tropical Hospitals, A Basis For Training Courses*
4. Guyton *4k.C.* and Hall J.E. *Textbook of Medical Physiology,* Saunders
5. Prakash, G. (2012), *Lab Manual on Blood Analysis and Medical Diagnostics,* S. Chand and Co. Ltd

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe basic concepts of parasitology.
CO2	Explain about parasitic diseases that could be transmitted between animals and man (Zoonotic diseases).
CO3	Describe the methods to protect man and domestic animals from parasites and their harmful effects.
CO4	Discuss the mechanisms of parasitism and the different biological inter-relationships and the host parasite relationships.
CO5	Describe about the principles of disease and epidemiology
CO6	Make society aware about health problems and cures

DSE (Zoology) 3B
CZT603: Aquatic Biology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea aquatic ecosystems and adaptations of aquatic animals.

Course Objectives:

1. To receive an introduction to the physico-chemical environment, and its role in aquatic ecosystem.
2. To learn about adaptations exhibited by organisms to survive in typical aquatic habitats.
3. To understand how Human activities influence the physicochemical environment of water bodies.
4. To learn about the laws governing the use of freshwater systems, as well as the local, state, federal, and international agencies that enforce these laws
5. To learn about scientific principle in the area of aquatic biology to protect endangered aquatic species.
6. To get skilled to educate others or work to conserve our natural resources

Detailed Syllabus:

Unit 1 Aquatic Biomes: Brief introduction of the aquatic biomes: Freshwater ecosystem (lakes, wetlands, streams and rivers), estuaries, intertidal zones, oceanic pelagic zone, marine benthic zone and coral reefs.

Unit 2 Freshwater Biology: Lakes: Origin and classification, Lake as an Ecosystem, Lake morphometry, Physico—chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide). Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous. Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.

Unit 3: Marine Biology: Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

Unit 4 Management of Aquatic Resources: Causes of pollution: Agricultural, Industrial, Sewage, Thermal and Oil spills, Eutrophication, Management and conservation (legislations), Sewage treatment Water quality assessment- BOD and COD.

Practicals:

1. Determine the area of a lake using graphimetric and gravimetric method.
2. Identify the important macrophyles, phytoplanktons and zooplanktons present in a lake ecosystem.
3. Determine the amount of Turbidity/transparency, Dissolved Oxygen, and free Carbon dioxide, Alkalinity (carbonates & bicarbonates) in water collected from a nearby lake/ water body. Turbidity meter, PONAR grab sampler) and their significance.
4. A Project Report on a visit to a Sewage treatment plant/Marine bioreserve/ Fisheries Institutes.

Text and Reference Books

1. Anathakrishnan : Bioresources Ecology 3rd Edition
2. Goldman : Limnology, 2" Edition
3. Odum and Barrett : Fundamentals of Ecology, 5th Edition
4. Pawlowski : Physicochemical Methods for Water and Wastewater Treatment, 1st Edition
5. Wetzel : Limnology, 3rd edition
6. Trivedi and Goyal : Chemical and biological methods for water pollution studies
7. Welch : Limnology Vols. I-II

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe about the physico-chemical environment, and its role in aquatic ecosystem.
CO2	Explain about adaptations exhibited by organisms to survive in typical aquatic habitats.
CO3	Emphasize that how Human activities influence the physicochemical environment of water bodies.
CO4	Describe about the laws governing the use of freshwater systems, as well as the local, state, federal, and international agencies that enforce these laws
CO5	Explain about scientific principle in the area of aquatic biology to protect endangered aquatic species.
CO6	Educate others or work to conserve our natural resources

DSE (Zoology) 4B
CZT604: Cytogenetics and Human Genetics

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of chromosome structure and human genetic disorders.

Course Objectives:

1. To learn about the basic architecture of chromosome and chromatin material.
2. To explore the mechanisms of chromosomal organization and gene expression.
3. To understand the mechanisms those underpin human inheritance.
4. To have an understanding of the role of genetic factors in health and disease
5. To acquire the ability to identify patients with or at a risk of genetic disease
6. To develop knowledge on human molecular genetics, cytogenetics and cell biology

Detailed Syllabus:

Unit 1 Chromatin structure and chromosome organization: Classes of DNA, Chromosomal proteins: histones and their modifications, non-histone proteins, scaffold/matrix proteins Giant chromosomes: models for studies on chromosome organization and gene expression.

Unit 2 Cell division: Mitosis: mechanism and significance, Role of maturation promoting factor, Chromosomal movement, Cytokinesis. Meiosis: mechanism and significance, Chromosome pairing and recombination, Genetic regulation of meiosis.

Unit 3 Human genetics: Pedigree analysis**,** Karyotype and nomenclature of metaphase chromosome bands, Chromosome anomalies and disease, Common syndromes caused by aneuploidy (Down, Turner and Klinefelter syndromes), mosaicism, deletion and duplication, Chromosomal anomalies in malignancy (chronic myeloid leukemia, Burkitt's lymphoma, retinoblastoma and Wilms'), chromosomal deletion ("cry of cat" syndrome), Gene mutation (sickle cell anemia), Genetic counseling.

Practicals:

1. Study of metaphase chromosomes: Chromosome banding (C, G, H banding).
2. Study of differences in number, shape and size of chromosomes in normal vs. tumor cells, or normal vs. irradiated cells (in human).
3. Preparation of human karyotype and study of chromosomal aberrations with respect to number, translocation, deletion etc. from the pictures provided.

Text and Reference Books

1. Alberts et al: Essential Cell Biology (Garland, 1998)
2. Alberts et al: Molecular Biology of the Cell (Garland, 2002)
3. Bostock & Sumner: Eukaryotic Chromosome (North-Holland, 1987)
4. DeRobertis & DeRobertis: Cell and Molecular Biology (Lee & Febiger, 1987)
5. Karp: Cell and Molecular Biology (John Wiley & Sons, 2002)

6. Lewin, Genes VIII (Wiley, 2004)
7. Lodish et al: Molecular Cell Biology (Freeman, 2000)
8. Pollard & Earnshaw: Cell Biology (Saunders, 2002).

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe about the basic architecture of chromosome and chromatin material.
CO2	Explain the mechanisms of chromosomal organization and gene expression.
CO3	Emphasize the mechanisms those underpin human inheritance.
CO4	Describe the role of genetic factors in health and disease.
CO5	Identify patients with or at a risk of genetic disease.
CO6	Discuss the principles of human molecular genetics, cytogenetics and cell biology

DSE (Botany) 1B
CBT601: Microbiology and Plant Pathology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of economically important microbes and pathogens of plants.

Course Objectives:

1. Understand the world of microbes
2. To classify microbes according to their habit and habitat
3. To study the mode of microbes transmission
4. To study the adaptive strategies of the microbes
5. To study the economic and pathological importance of bacteria and fungi
6. To study the mechanism of infection and host-pathogen interaction
7. To study the different plant pathogens and their interactions

Detailed Syllabus:

Unit 1 General characteristics: bacteria, viruses and fungi. Isolation and culture of microorganisms; microbial nutrition, types of media (semisolid and broth) antiseptics and antibiotics

Unit 2 Bacteria: classification, external and internal structure, reproduction, unusual bacteria (mycoplasma, photosynthetic, chemosynthetic and nitrogen fixing types of bacteria).

Unit 3 Viruses: classification, structure, viral components, transmission, multiplication; virus like infectious agents (virioids and prions), viral diseases, symptomatology, Bacteriophage, TMV.

Unit 4 Plant pathology: pathogenesis, mechanism of infection, host-pathogen interaction, principles of plant diseases control (physical, chemical and biological).

Unit 5 Common plant disease: detailed study of the following diseases and control measures.

1. Damping off of seedlings
2. Late Blight of Potato
3. Wilt disease of cotton
4. Citrus canker
5. Tobacco mosaic disease

Practicals:

1. Gram staining of bacteria.
2. Study of viral diseases of plants using locally available specimens.
3. Study of plant diseases caused by bacteria using locally available specimens.
4. Bacteria (types): *Coccus*, *Bacillus*, *Vibrio* etc.
5. Study of plant diseases mentioned in the syllabus
6. Study of rhizobium in the root nodules.
7. Staining and demonstration of vesicular and arbuscules in mycorrhizal roots.

Text and Reference Books

1. Ananthanarayanan R and Panicker J 1980, Text Book of Microbiology, Orient Longmans.
2. Talaro K and Talaro A 1996, Microbiology, NC Brown Publishers.
3. Dube H 1978, A Text Book of Fungi, Bacteria and Viruses, Vikas Publications.
4. Mc Kane L and Judy K 1996, Microbiology, Essentials and Application. McGraw Hill Publications.

Course Outcomes:

After completing the course, students will be able to:

CO1	Understand the role of microbes
CO2	Classify the pathogenicity of microbes based on their structure, transmission and mode of replication
CO3	Exploit microbes in human welfare
CO4	Determine the importance plant-microbial relationships
CO5	Find out the ecological importance of microbes
CO6	Analyze the remedies for infectious microbes

DSE (Botany) 2B
CBT602: Evolution and Paeleobotany

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of evolutionary processes and types of fossils.

Course Objectives:

1. Know how plants preserve and fossilize.
2. The origin and diversification of plant groups through Earth's history.
3. Geologic time periods in Earth's history.
4. The ecological changes and impacts of plants on the Earth.
5. To determine the age of fossils and importance of pollens.

Detailed Syllabus:

Unit 1 Origin of life: elementary knowledge of theories related to evolution of life; types of evolution; speciation; population genetics, HW Equilibrium; Genetic drift.

Unit 2 Plant fossils: fossils and ideal conditions for fossilization, kinds of fossils-impressions, casts, molds, petrifactions and coal ball; methods of preservation, investigation and their importance in Stratigraphy and economic geology. Taphonomy, coal, petroleum, origin and depositional environment coal and petroliferous basins of India; reconstruction of fossil plants; dating of fossils. Brief study of palynology.

Unit 3 Geological time scale: era, period, epoch, evolution of the different flora; brief study of the following fossils-Lepidodendron, Lepidocarpon and Calamites; importance of Paeleobotany; standard stratigraphic scale and the succession of representative floras in the various geological epochs and their bearing on plant morphology and evolution

Practicals:

1. Types of fossils and modes of preservation.
2. Techniques of study of plant fossils: Thin section method (demonstration and study of prepared slides), peel techniques (demonstration and study of prepared peel sections); maceration of peat, lignite, coal: (demonstration).
3. Systematic study of fossil plants through ages- Stromatolites, Precambrian biota, *Cooksonia*, *Rhynia*, *Lepidodendron*, *Sigillaria*, *Lepidophlois*, *Sphenophyllum*, Calamites, members of Filicopsida-Coenopteridales members of Lyginopteridales, Medullosales, Glossopteridales: *Vertebraria* root, Bennettitales, Cycadales, Ginkgoales, Pentoxylales, Cordaitales, Coniferales. Tertiary and Quaternary angiosperm plant remains.
4. Acetolysis method (demonstration); studies of morphology of modern spores (pteridophytes) and pollen grains (gymnosperms and angiosperms)
5. Extraction of pollen grains from honey samples and study of the frequency of different morpho-types.
6. Study of macerated sample (to be supplied) of peat, lignite and coal.

7. Quantitative and qualitative study of palynomorphs.
8. Interpretation of data on stratigraphic age and environment of deposition.
9. One visit to paeleobotany laboratory inside India and / or field study.

Text and Reference Books

1. Sharma P.D., Microbiology and Plant pathology, Rastogi Publication. New Delhi.
2. Alexopolous, C.J. Mims, C.W. and Blackwell, MM. Introduction to Mycology, John Wiley & Sons.
3. Dubey H.C. An Introduction to Fungi, Vikas Publishing, New Delhi
4. Mehrotra R.S. & Agrawal A., Plant Pathology, Tata McGraw, New Delhi
5. Sharma P.D. Plant Pathology, Rastogi Publishers, Meruth. Sristava, H.N. Fungi, Pradeep Publications, Jalandhar
6. Webster, J. & Weber, R. Introduction to Fungi, Cambridge University Press, Cambridge
7. Kumar H.D. Introduction to phycology, Aff. East-west Press, New Delhi Lee RE, Phycology, Cambridge University Press U.K.

Course Outcomes:

After completing the course, students will be able to:

CO1	Know the methods for plants preserve and fossilize.
CO2	Understand the origin and diversification of plant groups.
CO3	Understand geologic time scale.
CO4	To determine the age of fossils.
CO5	To know how age of fossil can be determine by pollens

DSE (Botany) 3B
CBT603: Environment Protection and Sustainable Development

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of safety measures to be followed for environmental protection and sustainable development.

Course Objectives:

1. To understand the impact of the plant diversity in societal and environmental contexts.
2. To demonstrate the knowledge of, and need for sustainable development.
3. To understand the principle, working and applications of instruments viz, pH meters, Spectrophotometer, centrifuge, viscometer, and laminar air flow.
4. To learn out the prevention and control measures of plant diseases and its effect on economy of crops.
5. To understand the concept, principle and types of sterilization methods.
6. To know the terminologies in plant pathology and the cultivation methods of bacteria, yeast, fungi and virus.
7. To practically analyze the different modified form of plants according to the environmental conditions
8. To practically analyze the biological means for pollution determination.
9. To interact society for environmental conservation.

Detailed Syllabus:

Unit 1 General account: environment definition, scope & importance, environmental structure and functions of environment; components of environment: atmosphere, hydrosphere, lithosphere, and biosphere. Ecosystem: balanced ecosystem, components of ecosystem. Human activities: food, shelter, economic and social security; effects of human activities on environment: agriculture, housing, industry, mining and transportation activities; basics of Environmental Impact Assessment; sustainable development; need of public awareness.
Unit 2 Natural resources: water resources, availability and quality aspects, water borne diseases, water induced diseases, fluoride problem in drinking water; mineral resources; forest wealth; material cycles-carbon, nitrogen and sulphur cycles; different types of energy, electro-magnetic radiation, conventional and non-conventional sources – hydro-electric, fossil fuel based, nuclear, solar, biomass and bio-gas, hydrogen as an alternative future source of energy.
Unit 3 Biodiversity and its conservation: definition, causes of reduction of biodiversity; wildlife conservation acts (1972 and 1984); national parks and sanctuaries, extinctions, vulnerable, rare and endangered species; Hot Spots of biodiversity in India; forest resources and its types; deforestation, causes and effects, Chipko movement.
Unit 4 Environmental pollution and control measures: water pollution, land pollution, noise pollution, air pollution, automobile pollution, public health aspects;solid waste management; current environmental

issues and importance; population growth, climate change and global warming, urbanization, acid rain, ozone layer depletion; animal husbandry; environmental protection: role of government, legal aspects, initiatives by non-governmental organizations (NGOs); environmental education, women education.

Practicals:

1. Study of ecological adaptations: (morphological and anatomical) hydrophytes, xerophytes, halophytes and epiphytes.
2. Ecological instruments: a) Anemometer b) Rain Guage c) Maximum/ Minimum Thermometer d) Wet/Dry bulb Thermometer e) Hygrometer.
3. Analysis of water samples for pH, Chloride, CO_2,Dissolved Oxygenand total hardness.
4. Every student has to undertake a trip to nearby forest at least for 3 days to study the vegetation and submit a report.
5. Visit to a pond / forest to study communities/animal husbandry institute.
6. Study of biological mean to indicate pollution.
7. Conduction of public awareness programme.

Text and Reference Books

1. Benny Joseph, Environmental Studies,Tata Mcgraw Hill, 2005.
2. Dr. D.L. Manjunath, Environmental Studies, Pearson Education, 2006.
3. R. Rajagopalan, Environmental studies, Oxford Publication, 2005. Publications, Jalandhar

Course Outcomes:

After completing the course, students will be able to:

CO1	Define or describe all the kinds of plant based resources such as biogas.
CO2	Understand the significance of rich diversity of biostatic tests applicable.
CO3	Apply the different methods for estimation of biological data.
CO4	Analyse the role of various kinds of palynological resources in evaluating old climatic conditions and their relations with the origin of life and their effect.
CO5	Evaluate the comparative significance of biostatical aids in systematics.
CO6	Create the basic knowledge of all kinds of plant resources for daily life needs.
CO7	Analyze ecological adaptive characters of plants
CO8	Handle lab equipment to measure different parameters in ecological studies
CO9	Evaluate the pollution of particular landscape and forest health
CO10	Conduct public awareness programs such as conferences, workshops and seminars

DSE (Botany) 4B
CBT604: Plant Resource Utilization and Palynology

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment – 6 Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Basic idea of various plant resource and principles of palynology.

Course Objectives:

1. To learn a range of skills in mathematical modeling, probability and statistics and simple computer programming.
2. Apply reasoning informed by the contextual knowledge to assess plant diversity, its importance for society and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.
3. Understand the impact of the plant diversity in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
4. Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
5. Accurately interpretation of collected information and use taxonomical information to evaluate and formulate a position of plant in taxonomy.
6. To practically gain the knowledge and importance of different crops
7. To practically gain the importance of pollen grains

Detailed Syllabus:

Unit 1 Introduction: origin of cultivated plants, concept of centres of origin, their importance with reference to Vavilov's work; examples of major plant introductions; crop domestication and loss of genetic diversity; evolution of new crops/varieties, importance of germplasm diversity.
Unit 2 Crops: cereals, legumes, wheat and rice (origin, morphology, processing & uses); brief account of millets;origin, morphology and uses of chick pea, pigeon pea, fodder legumes; morphology and processing of sugarcane, products and by-products of sugarcane industry; potato morphology, propagation and uses.
Unit 3 Spices, beverages, oils and fats: listing of important spices, their family and part used; economic importance with special reference to fennel, saffron, clove, black pepper; tea, coffee (morphology, processing & uses);general description, classification, extraction, their uses and health implications; groundnut, coconut, linseed, soybean, mustard and coconut (botanical name, family and uses); essential oils.
Unit 4 Natural rubber and drug-yielding plants: para-rubber: tapping, processing and uses. Therapeutic and habit-forming drugs with special reference to *Cinchona*, *Digitalis*, *Papaver* and *Cannabis*; *Tobacco* (morphology, processing, uses and health hazards).
Unit 5 Timber and fibres: general account with special reference to teak and pine; classification based on the origin of fibres; cotton, coir and jute (morphology, extraction and uses).
Unit 6 Palynology: pollen structure, pollen morphology, pollen allergy, economic and taxonomic importance.

Practicals:

1. Study of agriculture practices.
2. Study of timber samples and growth rings.
3. Study of fibre samples.
4. Visit to tea estate located nearby.
5. Visit to Agriculture Research Institute located nearby.
6. Preparations of herbarium file for economically important plants.
7. Study of non-living inclusions - Cystolith, Raphide, Sphaero-raphide, Aleurone grains.
8. Visit to sugarcane/rubber industry located nearby.

Text and Reference Books

1. Kochhar, S.L. (2012). Economic Botany in Tropics, MacMillan & Co. New Delhi, India.
2. Chrispeels, M.J. and Sadava, D.E. 1994 Plants, Genes and Agriculture. Jones & Bartlet pulishers
3. Nair, P. K. K., Pollen Morphology of Angiosperms – A Historical and Phylogenetic Study, Barnes and Noble, New York , 1970.

Course Outcomes:

After completing the course, students will be able to:

CO1	Develop and implement mathematical modeling, probability and statistics and simple computer programming in the ecological and environmental studies
CO2	Assess plant diversity, its importance for society and environmental issues and the consequent responsibilities relevant to the biodiversity conservation practice.
CO3	Evaluate the impact of the plant diversity in societal and environmental contexts, and gain the knowledge of, and need for sustainable development.
CO4	Implement knowledge and understanding of the engineering and management principles and apply these into multidisciplinary environments approaches.
CO5	Accurately determine different taxonomical information to evaluate diversity and classify plants.
CO6	Evaluate the usefulness of different crop plants and forests

DSE – Chemistry
1. Applied Organic Chemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of alkene, carbonyl compound, heterocyclic, carbohydrates and organometallic compounds.

Course Objectives:

1. To know about alkene Stereoisomers: (E)-2-Butene and (Z)-2-Butene.
2. To understand the more than One C=C in a Molecule.
3. To learn the alkenes with OH or NH_2 Groups.
4. To learn the acidity of C≡C-H Hydrogens.
5. To know the mechanisms of Aldol condensation.
6. To understand the aromatic characteristics of pyrrole.

Detailed Syllabus:

Unit 1 Chemistry of Alkenes and alkynes : Alkenes: Ethene, Propene, 1-Butene, 2-Butene and other Alkenes and Cycloalkenes. Alkene Stereoisomers: (E)-2-Butene and (Z)-2-Butene. E,Z Assignment Rules. E and Z Stereoisomers are Diastereomers. cis and trans Isomers. More than One C=C in a Molecule, Polyenes. Allenes. Nomenclature of Substituted Alkenes, Alkyl and Halogen Substituted Alkenes. Alkenes with OH or NH_2 Groups. Relative Stability of Isomeric E and Z Alkenes. Alkynes: Nomenclature, Alkyne Structure, Alkyne Stability. Acidity of C≡C-H Hydrogens Allenes: Nomenclature, Structure, Bonding and Bond Lengths.
Unit 2 Chemistry of Carbonyl Compounds: Structure, reactivity and preparation; Mechanisms of Aldol condensation, Cannizzaro reaction, Haloform reaction and Beckmann rearrangement.
Unit 3 Hetrocyclic Compounds: Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine, Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution, Mechanism of nucleophilic substitution reaction in pyridine derivatives, Comparison of basicity of pyridine, piperidine and pyrrole. Introduction to condensed five and six membered heterocycles, Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, and Skraup synthesis. Mechanism of electrophilc substitution reactions of indole, quinoline and isoquinoline.
Unit 4 Bioorganic Chemistry: Carbohydrates: Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, Configuration of monosaccharides, Erythro and threodiastereomers, Conversion of glucose intro mannose, Formation of glcosides, ethers and esters, Determination of ring size of monosaccharides, Cyclic structure of D(+)-glucose, Mechanism of mutarotation. Structures of ribose and deoxyribose, An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose) without involving structure determination.

Unit 5 Organometallic Compounds: Preparation, properties and important reactions of Oragnomagnesium, organozinc, Organolithium compounds.

Text and Reference Books

1. *"Organic Chemistry",* R. T. Morrison and R. N. Boyd, 6th Edition (1992), Prentice-Hallof India (P) Ltd., New Delhi.
2. *"Organic Chemistry"*,S. M. Mukherji , S. P. Singh, and R. P. Kapoor, 1st Edition(1985), 5th Reprint (1999), New Age International (P) Ltd.Publishers, New Delhi.
3. *"Organic Chemistry – Structure and Reactivity",* Seyhan N. Ege, AITBS publishers,Delhi (1998).
4. *"Organic Chemistry",* Paula Y. Bruice, 2nd Edition , Prentice-Hall InternattionalInc,New Jersey, International Edition (1998).

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the cannizzaro reaction, Haloform reaction and Beckmann rearrangement.
CO2	Understand the alkyne Stability.
CO3	Explain the important reactions of oragnomagnesium.
CO4	Develop the disaccharides (maltose, sucrose and lactose) and polysaccharides (starch and cellulose)
CO5	Calculate the quinoline and isoquinoline with special reference to Fisher indole synthesis
CO6	Illustrate the E and Z Stereoisomers are Diastereomers.

2. Physical Chemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of conductivity measurements, chemical kinetics, catalysis and surface chemistry.

Course Objectives:

1. To know about ionic velocities
2. To understand the rate laws in terms of the advancement of a reaction.
3. To learn the consecutive reactions.
4. To learn the acid and base catalysis.
5. To know the applications of colloids.
6. To understand the Fermi golden rule.

Detailed Syllabus:

Unit 1 Applications of conductivity measurements: Ionic velocities, mobilities and their determinations, transference numbers and their relation to ionic mobilities, determination of transference numbers using Hittorf and Moving Boundary methods. Applications of conductance measurement: (i) degree of dissociation of weak electrolytes, (ii) ionic product of water.

Unit 2 Chemical Kinetics: Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions first & second order reactions, Temperature dependence of reaction rates; Arrhenius equation; activation energy.Reversible (first order in both directions), consecutive reactions. Unimolecular gas reactions (Lindemann theory), steady-state approximations, theory of absolute reaction rate and its thermodynamical formulation, temperature dependence of frequency factor.

Unit 3 Catalysis: Definition of catalysis, mechanisms of catalysis, acid and base catalysis, general and specific catalysis, Enzyme catalysis.

Unit 4 Surface Chemistry: Adsorption- Langmuir and Freundlich isotherms. Sols (reversible and irreversible), emulsions and emulsifiers, association colloids (micelles), gels. Applications of colloids.

Unit 5 Molecular Spectroscopy: Introduction to spectroscopy, electromagnetic radiation, Heisenberg Uncertainty principle, Spectral intensity, linewidth, position, Einstein coefficients, Fermi golden rule. Brief introduction to rotational and vibrational spectroscopy.

Text and Reference Books

1. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 8th Ed., Oxford University Press (2006).
2. Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).
3. Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the degree of dissociation of weak electrolytes.
CO2	Understand the temperature dependence of reaction rates.
CO3	Explain the unimolecular gas reactions (Lindemann theory).
CO4	Develop the mechanisms of catalysis.
CO5	Calculate the adsorption- Langmuir and Freundlich isotherms.
CO6	Illustrate the electromagnetic radiation.

3. Inorganic Chemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of d-block elements, Metal-Ligand Bonding, Electronic Spectra and Bio-inorganic Chemistry.

Course Objectives:

1. To know about coordination complex.
2. To understand the chelates.
3. To learn the Limitations of Valence Bond Theory.
4. To learn the electronic spectra, magnetic properties.
5. To know the metal ethylenic Complexes.
6. To understand the Nature of bonding in metal carbonyls.

Detailed Syllabus:

Unit 1 d-block elements: General introduction of coordination complex, common shape, EAN rule, classification of ligands in terms of denticity, chelates, isomerism in coordination complex.
Unit 2 Metal-Ligand Bonding, Electronic Spectra and Magnetic Properties in Transition Metal Complexes: Limitations of Valence Bond Theory, Crystal Field Splitting in Octahedral, Tetrahedral and Square Planar Complexes, d-d transitions, selection rule, electronic spectra, magnetic properties.
Unit-3 Organometallic Chemistry: Organometallic Compounds, Preparation, Properties. A Brief account of metal ethylenic Complexes, Nature of bonding in metal carbonyls, A Brief account of metal-ethylenic Complexes.
Unit 4 Bio-inorganic Chemistry: Essential and *Tace* elements in biological processes, Metalloporphyrins with special reference to hemoglobin, and myoglobin, Biological role of alkali (Na+, K+) and alkaline earth metal ions(Mg^{2}+, Ca^{o}+). Nitrogen Fixation.

Text and Reference Books

1. *Concise Inorganic Chemistry",* J. D. Lee, 5th Edition (1996), Chapman & Hall, London.
2. *"Modern Inorganic Chemistry",* R. C. Aggarwal, 1st Edition (1987), KitabMahal, Allahabad.
3. *"Basic Inorganic Chemistry",* F. A Cotton, G. Wilkinson,and Paul L. Gaus, 3rd Edition(1995), John Wiley & Sons, New York.
4. *"Inorganic Chemistry",* A. G. Sharpe, 3rd International Student Edition (1999), ELBS /Longman, U.K.
5. *"Inorganic Chemistry",* D. F. Shriver and P. W. Atkins, 3rd Edition (1999),ELBS, London.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the nitrogen Fixation.
CO2	Understand the metalloporphyrins with special reference to hemoglobin, and myoglobin.
CO3	Explain the metal-ethylenic Complexes.
CO4	Develop the d-d transitions, selection rule.
CO5	Calculate the crystal Field Splitting in Octahedral.
CO6	Illustrate the ligands in terms of denticity.

4. Green Chemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of Green Chemistry and its 12 principles, Green Solvents and Renewable Resources.

Course Objectives:

1. To know about green chemistry and its 12 principles.
2. To understand the environmental factor calculations.
3. To learn the volatile organic compounds.
4. To learn the aqueous solvents.
5. To know the homogenous catalysis.
6. To understand the phase transfer catalysis.

Detailed Syllabus:

Unit 1 Introduction to Green Chemistry: Green Chemistry and its 12 principles. Concepts of green chemistry. History of Green Chemistry and Sustainability Contributions of Paul Anastas, Roger Sheldon (E-Factor), and Barry Trost (Atom Efficiency). History of Environmental Legislation Process Flow Sheet Development, Environmental Factor Calculations, and Atom Utilization Comparisons.
Unit 2 Green Solvents: Industrial Applications Volatile Organic Compounds (VOC's).
Unit 3 Benign Solvents: Industrial uses of , Super Critical Fluids, and Ionic liquids.
Unit 4 Catalysis: Indusrial catalysis-Organometallics. Homogenous catalysis-Phase Transfer Catalysis (PTC) Hydroformylation Carboynlation Metathesis. Heterogeneous Catalysis- History of Zeolites Zeolite Nomenclature Zeolite Structure Zeolite usage in Menthol synthesis, Caprolactam synthesis, Electophilic Aromatic Substitutions, and the Asahi Process.
Unit 5 Renewable Resources: Overview of Synthesis and Uses of Biofuels (Ethanol, Biodiesel, and Fuel Cells).
Unit 6 Consumer Products Derived From Renewal Resources: Plastics from Plant Oils Lignin-Based Bottles Synthesis and Properties of 2-Methyltetrahydrofuran.
Text and Reference Books 1. Green Chemistry: Fundamentals and Applications by Suresh C. Ameta, RakshitAmeta, 2013 by Apple Academic Press; ISBN: 9781926895437. 2. Green Chemistry: An Introductory Text: Edition 3 by Mike Lancaster; RSC Publishing House, ISBN: 978-1-78262-294-9.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the properties of 2-Methyltetrahydrofuran.
CO2	Understand the plant oils lignin-based bottles synthesis.
CO3	Explain the structure zeolite usage in menthol synthesis.
CO4	Develop the phase transfer catalysis.
CO5	Calculate the super critical fluids.
CO6	Illustrate the atom utilization comparisons.

5. Introduction to Nanoscience

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of Scientific Revolution-Atomic Structure, Quantum Dots shell structures and Supra molecular aspects in Chemistry.

Course Objectives:

1. To know about emergence and challenges of nanoscience and nanotechnology.
2. To understand the surface effects on the properties.
3. To learn the properties of nanomaterials.
4. To learn the mechanical-physical-chemical properties.
5. To know the micelles and polymers.
6. To understand the hydrolyticenzymes.

Detailed Syllabus:

Unit 1 Background to Nanoscience: Definition of Nano, Scientific Revolution-Atomic Structure and atomic size, emergence and challenges of nanoscience and nanotechnology, carbon age-new form of carbon (CNT to Graphene), influence of nano over micro/macro, size effects and crystals, large surface to volume ration, surface effects on the properties.

Unit-2: Types of nanostructure and properties of nanomaterials: One dimensional, Two dimensional and three-dimensional nanostructured materials, Quantum Dots shell structures, metal oxides, semiconductors, composites, mechanical-physical-chemical properties.

Unit 3 Application of Nanomaterial: Ferroelectric materials, coating, molecular electronics and nanoelectronics, biological and environmental, membrane-based application, polymer-based application.

Unit-4: Supramolecular aspects in Chemistry: Fundamental understanding, Host-guest complexation chemistry, micelles, polymers, cyclodextrins, functionalization reactions, Introduction to supramolecular catalysis and enzymes, Multifunctional catalysis and simple models, Hydrolyticenzymes.

Text and Reference Books

1. Chemistry of nanomaterials: Synthesis, properties and applications by CNR Rao et.al
2. Textbook of Nanoscience and Nanotechnology by T. Pradeep, 2012 McGraw Hill Education (India) Private Limited, ISBN: 9781259007323.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the supramolecular catalysis and enzymes.
CO2	Understand the host-guest complexation chemistry.
CO3	Explain the ferroelectric materials, coating, molecular electronics and Nanoelectronics.
CO4	Develop the metal oxides, semiconductors and composites.
CO5	Calculate the influence of nano over micro/macro and size effects.
CO6	Illustrate the emergence and challenges of nanoscience and nanotechnology.

6. Advanced Physical Organic Chemistry

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Class Test -12 Marks
Tutorials: 1 hr/Week	Teachers Assessment - 6Marks Attendance – 12 Marks
Credits: 4	End Semester Exam – 70 marks

Prerequisite: Concept of Reaction Mechanisms, Chemical Kinetics to Decipher Reaction Mechanisms and Diagnostic Tools.

Course Objectives:

1. To know about writing reaction mechanisms.
2. To understand the kinetic vs Thermodynamic Control.
3. To learn the distinguishing reaction mechanism using rate laws.
4. To learn the Hammett Plots for electronic effects.
5. To know the secondary kinetic isotope effect.
6. To understand the reaction coordinate diagram.

Detailed Syllabus:

Unit 1 Introduction to Reaction Mechanisms: Writing reaction mechanisms: Arrow pushing; Types of polar reactions; Radical reactions; Reaction coordinate diagram; The Hammond Postulates; The Kinetic vs Thermodynamic Control; Curtin-Hammett control.
Unit 2 Chemical Kinetics to Decipher Reaction Mechanisms: An introduction to reaction kinetics; Deriving the rate laws; Distinguishing reaction mechanism using rate laws; Methods to monitor a reaction.
Unit 3 Diagnostic Tools: The Hammett Equation; Linear Free Energy relationships (LFER); Hammett Plots for electronic effects; Scales used in Hammett Plots; Deviation from Linear energy relationships; Solvents effects; Kinetic isotope effect; Primary kinetic isotope effect; Secondary kinetic isotope effect; Isotope labeling; Trapping of Intermediates.
Unit 4 Catalysis: Enzyme catalysis; Electrophilic catalysis; Other types of catalysis.
Text and Reference Books 1. Determination of Organic Reaction Mechanisms by Barry K. Carpenter; David O. Carpenter, ISBN: 0471893692. 2. Kinetics and Mechanism by John W. Moore; Ralph G. Pearson, ISBN: 0471035580. 3. Physical Organic Chemistry by C. A. Ritchie, ISBN: 0824783077.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the polar reactions and radical reactions.
CO2	Understand the kinetic vs thermodynamic control.
CO3	Explain the Hammond postulates.
CO4	Develop the pprimary kinetic isotope effect.
CO5	Calculate the linear energy relationships.
CO6	Illustrate the reaction mechanisms.

Physical Organic Chemistry Lab

Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week	Internal – 15 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: To develop skills for the physical organic experiments.

Course Objectives:

1. To know about rate constant of ester hydrolysis reaction.
2. To understand the chemical kinetics.
3. To learn the pseudo first order condition.

Detailed Syllabus:

Practicals:

1. Determination of rate constant of ester hydrolysis reaction under pseudo first order condition.
2. Measuring UV-visible spectrum of iodine in polar and non-polar solvent.
3. Constructing Erying plot for ester hydrolysis.
4. Distinguishing S_N1 and S_N2 using chemical kinetics.
5. Construction of Hammett plot for a standard reaction.

Text and Reference Books

1. Practical Physical Chemistry by B. Vishwanathan, P.S. Raghavan.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the determination of rate constant of ester hydrolysis reaction
CO2	Understand the measuring UV-visible spectrum.
CO3	Explain the iodine in polar and non-polar solvent.
CO4	Develop the distinguishing S_N1 and S_N2 using chemical kinetics.
CO5	Calculate the construction of Hammett plot for a standard reaction.
CO6	Illustrate the pseudo first order reaction.

Organic Chemistry Lab

Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week	Internal – 15 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: To develop skills for the organic experiments.

Course Objectives:

1. To know about primary, secondary and tertiary amines
2. To understand the qualitative analysis of unknown organic compounds.
3. To learn the preparation of Picric acid.

Detailed Syllabus:

Practicals:

1. Qualitative analysis of following types of unknown organic compounds:
   - I. Carbohydrates
   - II. Primary, secondary and tertiary amines
   - III. Nitro compounds
   - IV. Amides
   - V. Aryl halides
2. Preparation of following organic compounds:
   - I. Acetanilide
   - II. Picric acid
   - III. Aspirin

Note: Experiments may be added/deleted subject to availability of time and facilities

Text and Reference Books

1. Bansal, R. K, (2008). Laboratory Manual of Organic Chemistry (IV Edition). New Delhi: New Age, Publishers.
2. 3.Arun Sethi, (2003). Laboratory experiments in Organic Chemistry. New Delhi: New Age Publisher.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Expertise the various techniques of preparation and analysis of organic substances
CO2	Understand the techniques involving drying and recrystalliation by various method
CO3	Learned two stage preparation involving molecular rearrangement and well known organic reactions.
CO4	Learned the pilot separation of bimixtures and familiarize the systematic procedure of organic substances analysis
CO5	Calculated a limiting reagent, yield, and percent yield
CO6	Evaluated collected data to determine the identity, purity, and yield of products

Physical Chemistry lab

Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week	Internal – 15 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: To develop practical skills for physical chemistry experiments.

Course Objectives:

1. To know about Surface tension-composition curve for a binary liquid mixture.
2. To understand the Beer's Law - Determination of concentration of solution by colorimetry.
3. To learn the Equilibrium constant of methyl acetate hydrolysis reaction.

Detailed Syllabus:

Practicals:

1. Viscosity-composition curve for a binary liquid mixture.
2. Surface tension-composition curve for a binary liquid mixture.
3. Determination of indicator constant - colorimetry.
4. Determination of pH of a given solution using glass electrode.
5. Beer's Law - Determination of concentration of solution by colorimetry.
6. Order of reaction of I_2 / Acetone / H^+.
7. Equilibrium constant of methyl acetate hydrolysis reaction.
8. Dissociation constants of weak acid, base.
9. Conductometrictitration : acid-base.
10. Potentiometric titration : acid-base.
11. Kinetics of catalytic decomposition of H_2O_2.
12. Kinetics of acid-catalysed hydrolysis of sugar (chemical method).

Text and Reference Books

1. Palit, S.R., Practical Physical Chemistry Science Book Agency
2. Mukherjee, N.G., Selected Experiments in Physical Chemistry J. N. Ghose & Sons

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the viscosity-composition curve for a binary liquid mixture.
CO2	Understand the indicator constant – colorimetry.
CO3	Explain the pH of a given solution using glass electrode.
CO4	Describe the kinetics of catalytic decomposition of H_2O_2.
CO5	Calculate the equilibrium constant of methyl acetate hydrolysis reaction.
CO6	Illustrate the kinetics of acid-catalysed hydrolysis of sugar

Inorganic Chemistry Lab

Teaching Scheme	Examination Scheme
Practical: 4 hrs/Week	Internal – 15 Marks
Credits: 2	End Semester Exam – 35 marks

Prerequisite: Develop the skills for inorganic chemistry experiments.

Course Objectives:

1. Learned about the conductance of the complexes with that of M/1000.
2. Learned the preparation of inorganic complexes.
3. Learnt the estimation metals in a mixture by volumetric and gravimetric analysis.

Detailed Syllabus:

Practicals:

1. Preparation of any two of the following complexes and measurement of their conductivity:
   (i) tetraamminecarbonatocobalt (III) nitrate
   (ii) tetraamminecopper (II) sulphate
   iii) potassium trioxalatoferrate (III) trihydrate
   iv) other inorganic complexes.
2. Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$ and other compounds.
3. Iodimetric estimation of ascorbic acid in fruit juices.
4. Estimation of dissolved oxygen in water samples.
5. Gravimetric estimation of sulphate as barium sulphate

Text and Reference Books

1. Ramanujam, V. V. (2004). Inorganic Semi-micro Qualitative Analysis (III Edition). Chennai: The National Publishing Company.
2. Venkateswaran, V., Veeraswamy, R., & Kulandaivelu, A. R. (2004). Basic Principles of Practical Chemistry (II Edition). New Delhi: S. Chand Publications.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Gained the knowledge about maintain high standards of professional and scientific ethics.
CO2	Known about the chromatographic separation techniques.
CO3	Explain the preparation of coordination complexes and their mechanisms.
CO4	Explain the importance of the volumetric and gravimetric analysis of cations and anions.
CO5	Calculate the number of ions present in the solution.
CO6	Illustrate the various complex preparations.

SEC (Zoology) 1
CSE301: Aquarium and Fish Keeping

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic idea of aquarium fish species and their characters.

Course Objectives:

1. To get Knowledge of different kinds of fishes, their compatibility in aquarium.
2. To be Aware of Aquarium as commercial, decorative and of scientific studies.
3. To Gain thorough knowledge about the techniques involved in maintenance of aquarium.
4. To know about various measures for setting an Aquarium and making it cost effective.
5. To develop entrepreneurial skills in fish keeping through practical sessions, team work, group discussions, assignments and projects.

Detailed Syllabus:

Unit 1 Introduction to Aquarium Fish Keeping: The potential scope of Aquarium Fish Industry as a Cottage Industry Exotic and Endemic species of Aquarium Fishes.

Unit 2 Biology of Aquarium Fishes: Common characters and sexual dimorphism of Fresh water and Marine Aquarium fishes such as Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish and Butterfly fish.

Unit 3 Food and feeding of Aquarium fishes: Use of live fish feed organisms. Preparation and composition of formulated fish feeds.

Unit 4 Fish Transportation: Live fish transport - Fish handling, packing and forwarding techniques.

Unit 5 Maintenance of Aquarium: General Aquarium maintenance — budget for setting up an Aquarium Fish Farm as a Cottage Industry.

Practicals:

1. Study of different species of Aquarium fishes and their biology (Breeding, Feeding economic importance etc) of exotic and endemic fish.
2. Study of Sexual Dimorphism of Fresh water and Marine Aquarium Fish.(Guppy, Molly, Sword tail, Gold fish, Angel fish, Blue morph, Anemone fish, Butterfly fish)
3. Type, compostion and Formulation of Fish feed (using Pearson Square Methods)
4. Construction and maintenance of Glass Aquarium and Filter System Using Indigenous Locally available materials.
5. Monitoring of Aquarium Water Quality (Temperature, pH, Dissolved Oxygen, Carbon dioxide, Ammonical N-Load) through titrimetry methods.
6. To write a project proposal for setting up a small aquarium fish keeping as a cottage industry to a funding agency for self-employment of youths or for helping poor farmers.

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe about different kinds of fishes, their compatibility in aquarium.
CO2	Explain Aquarium as commercial, decorative and of scientific studies.
CO3	Be informed about the techniques involved in maintenance of aquarium.
CO4	Discuss about various measures for setting an Aquarium and making it cost effective.
CO5	Be aware about entrepreneurial skills in aquarium and fish keeping.

SEC (Zoology) 2
CSE401: Apiculture

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic idea of insect physiology specially honey bee.

Course Objectives:

1. To learn about the various species of honey bees in India, their social organization and importance.
2. To be aware about the opportunities and employment in apiculture – in public, private and government sector.
3. To Gain thorough knowledge about the techniques involved in bee keeping and honey production.
4. To know about various products obtained from beekeeping sector and their importance.
5. To Getting familiarized with the skills necessary for self-employment in beekeeping sector
6. To develop entrepreneurial skills in beekeeping. Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.

Detailed Syllabus:

Unit 1 Biology of Bees: History, Classification and Biology of Honey Bees Different species of honey bees – Apis dorsata, Apis cerana indica, Apis florea, Apis mellifera, Melipona sp. Social Organization of Bee Colony, Behavioural patterns (Bee dance, swarming).

Unit 2 Rearing of Bees: Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth Bee Pasturage Selection of Bee Species for Apiculture - Apis cerana indica, Apis mellifera Bee Keeping Equipment Methods of Extraction of Honey (Indigenous and Modern) & processing Apiary management – Honey flow period and Lean period.

Unit 3 Diseases and Enemies: Bee Diseases, control and preventive measures Enemies of bees and their control.

Unit 4 Bee Economy: Products of Apiculture Industry (Honey, Bees Wax, Propolis, Royal jelly, Pollen etc.) and their uses Modern Methods in employing artificial Beehives for cross pollination in horticultural gardens.

Unit 5 Maintenance of Aquarium: General Aquarium maintenance — budget for setting up an Aquarium Fish Farm as a Cottage Industry.

Practicals:

1. Study of the life stages of honey bee, Apis cerana indica and Apis mellifera - Egg, larva, pupa, adult (queen, drone, worker) from specimen/ photographs.
2. Study of natural bee hive and identification of queen cells, drone cells and brood.
3. Study of morphological structures of honey bee through permanent slides/ photographs – mouth part, antenna, wings, legs (antenna cleaner, mid leg, pollen basket), sting apparatus.
4. Permanent/temporary mount of antenna cleaner, mid leg and pollen basket OR mount of pollen grains from flowers
5. Study of artificial hive (Langstroth/Newton), its various parts and beekeeping equipment.
6. Analysis of honey – purity, biochemical analysis (Any two constituents)
7. Visit to an apiary/honey processing unit/institute and submission of a report.

Text and Reference Books

1. Prost, P. J. (1962). Apiculture. Oxford and IBH, New Delhi.
2. Bisht D.S., Apiculture, ICAR Publication.
3. Singh S., Beekeeping in India, Indian council of Agricultural Research, New Delhi.

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe about the various species of honey bees in India, their social organization and importance.
CO2	Be informed about the opportunities and employment in apiculture – in public, private and government sector.
CO3	Be aware about the techniques involved in bee keeping and honey production.
CO4	Get informed about various products obtained from beekeeping sector and their importance.
CO5	Have knowledge of the skills necessary for self-employment in beekeeping sector
CO6	Be informed about entrepreneurial skills in beekeeping. Enhance collaborative learning and communication skills through practical sessions, team work, group discussions, assignments and projects.

SEC (Zoology) 3
CSE501: Sericulture

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic idea of insect physiology specially silk worm.

Course Objectives:

1. To learn about the various species of silk moths in India, and Exotic and indigenous races.
2. To be aware about the opportunities and employment in sericulture – in public, private and government sector.
3. To Gain thorough knowledge about the techniques involved in silk worm rearing and silk reeling.
4. To Getting familiarized with the skills necessary for self-employment in mulberry and seed production
5. To develop entrepreneurial skills in sericulture and be apprised about practicing sericulture as a profit-making enterprise through practical sessions, team work, group discussions, assignments and projects.

Detailed Syllabus:

Unit 1 Introduction of Sericulture: Definition, history and present status; Silk route Types of silkworms, Distribution and Races in India; Exotic and indigenous races Mulberry sericulture; Non-mulberry Sericulture – Eri, Muga, Tasar.

Unit 2 Biology of Silkworm: Life cycle of Bombyx mori; Structure of silk gland and secretion of silk Composition and properties of silk.

Unit 3 Rearing of Silkworms: Selection of mulberry variety and establishment of mulberry garden Rearing house and rearing appliances Disinfectants: Formalin, bleaching powder, RKO Silkworm rearing technology: Early age and Late age rearing Types of mountage Harvesting and storage of cocoons Post-harvest technology – Silk reeling, Dyeing and Weaving, Ahimsa silk.

Unit 4 Pests and Diseases: Pests of silkworm: Uzi fly, dermestid beetles and vertebrates Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial Control and prevention of pests and diseases.

Unit 5 Silk Industry and Its Importance: Silk usage and application in Textile and non-textile industry

Unit 6 Entrepreneurship in Sericulture: Prospects of Sericulture in India: Sericulture industry in different states, Employment opportunities in mulberry and nonmulberry sericulture sector, Economics in small scale and large scale silkworm rearing, Scope for women entrepreneurs in sericulture sector.

Practicals:

1. Study of the life cycle of different species of silk moths - Bombyx mori, Philosamia ricini, Antheraea paphia/Antheraea mylitta, Antheraea assama and silk secreted by them.
2. Study of the sexual dimorphism in caterpillar, pupae and adults of Bombyx mori.
3. Study of the structure of silk gland of mulberry silk worms.
4. Study of rearing house and different appliances used in rearing of mulberry silk worms.
5. Study of the different disinfectants used in silkworm rearing houses.
6. Study of different types of mountages from specimen/photographs.
7. Analysis of silk fibre quality – Visual examination, thickness, purity.
8. Study of the parasites and predators of silk worms and their control - Uzi fly, Dermestid beetle,

Vertebrates.

9. Study of silkworm diseases and their control – Pebrine, Flacherie, Grasserie, Muscardine.
10. Submission of a report on visit to 'Sericulture Institute'/ 'Various Sericulture Centres in India'.

Text and Reference Books

1. Yonemura, M. and Rama Rao, N. (1951) A Handbook of sericulture. I. Rearing of silk-worms. Government Branch Press, Mysore.
2. Ananthanarayanan, S. K. (2008). Silkworm rearing. Daya Publishing House Aruga, H. (1994).
3. Principles of sericulture. CRC Press Sathe, T. V. and Jadhav, A. (2002) Sericulture and Pest Management. Daya Publishing House
4. Yup-Lian, L. (1991) Silkworm diseases. Food and Agricultural Organization.

Course Outcomes:

After completing the course, students will be able to:

CO1	Describe about the various species of silk moths in India, and Exotic and indigenous races.
CO2	Be informed about the opportunities and employment in sericulture – in public, private and government sector.
CO3	Explain about the techniques involved in silk worm rearing and silk reeling.
CO4	Have skills necessary for self-employment in mulberry and seed production
CO5	Discuss entrepreneurial skills in sericulture and be apprised about practicing sericulture as a profit-making enterprise through practical sessions, team work, group discussions, assignments and projects

SEC (Zoology) 4
CSE601: Public health and hygiene

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic awareness and knowledge of hygiene practices.

Course Objectives:

1. To learn about general practices for maintaining hygiene.
2. To get knowledge of diseases to whom people can be affected.
3. To get aware how to protect man from diseases and their treatment.
4. To learn about importance of public health and hygiene.
5. To disseminate of health awareness among the people.

Detailed Syllabus:

Unit 1 Introduction to Public health and Hygiene: Significance of Public health and Hygiene, Nutrition and health, classification of foods, Major nutritional Deficiency diseases- Protein Energy Malnutrition (kwashiorkor and marasmus), Vitamin deficiency disorders, Iron deficiency disorders, Iodine deficiency disorder.
Unit 2 Environment and Health hazards: Environmental degradation, Environmental Pollution — Air, water, soil and noise; Associated health hazards.
Unit 3 Communicable diseases: Different types of communicable diseases and their control measures — Tuberculosis, Measles, Dengue, and Leprosy.
Unit 4 Life Style related Non-Communicable diseases: Different types of Life style related non-communicable diseases - Hypertension, Coronary Heart diseases, Stroke, Diabetes mellitus, Obesity and Mental ill-health - their causes and prevention through dietary and lifestyle modifications.
Unit 5 Social health problems: Smoking, alcoholism, drug dependence and Acquired Immuno-Deficiency Syndrome (AIDS) - their causes, treatment and prevention.
Practicals: 1. To study the characteristic features of different types of pathogens. 2. To study the methods of prevention of disease and maintaining hygiene. 3. Institutional visits and submission of report.

Course Outcomes:

After completing the course, students will be able to:

CO1	Follow general practices for maintaining hygiene.
CO2	Explain about diseases to whom people can be affected.
CO3	Describe the methods to protect man protect man from diseases and their treatment .
CO4	Speak about importance of public health and hygiene
CO5	Make society aware about health problems and cures

SEC (Botany) 1
CSE302: Biofertilizers

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic idea of fertilizers and its utility in crop production.

Course Objectives:

1. To categorize different types of biofertilizers
2. To study the interaction of microbes with plants and their importance
3. To study the mode of working in symbiotic associations
4. To study the importance cyanobacteria
5. To learn about organic farming and recycling of waste and its utility
6. To study the characteristics of biofertilizers.

Detailed Syllabus:

Unit 1 Fertilizers: introduction, types of fertilizers and their advantages and disadvantages, brief account of microbes used as biofertilizer, marketable forms of biofertilizers.
Unit 2 *Rhizobium*: general account, isolation, identification, mass multiplication, carrier based inoculants, application, crop response.
Unit 3 Actinorrhizal symbiosis- *Frankia*, host-microsymbiont relationship, isolation, culture, application and advantages.
Unit 4 *Azospirillum*: isolation and mass multiplication, carrier based inoculant, crop response
Unit 5 *Azotobacter*: characteristics, isolation and mass multiplication, application and crop response.
Unit 6 Phosphate solubilizing organisms: introduction, isolation, culture and applications.
Unit 7 Cyanobacteria (blue-green algae): *Azolla* and *Anabaena* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.
Unit 8 Mycorrhizal association: types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield; VAM – isolation and inoculum production, influence on growth and yield of crop plants.
Unit 9 Organic Farming: green manuring and organic fertilizers; recycling of biodegradable municipal, agricultural and industrial wastes; biocompost making methods; types and method of vermicomposting, field application.
Practicals: 1. Sampling of fertilizers and pesticides. 2. Quick tests for identification of common fertilizers. 3. Isolation and purification of *Azospirillum*, *Azotobacter*, *Rhizobium* and cyanobacteria. 4. Mass multiplication and inoculums production of biofertilizers. 5. Isolation of AM fungi -Wet sieving method and sucrose gradient method. 6. Mass production of AM inoculants.

Text and Reference Books

1. Dubey, R.C., 2005 A Text book of Biotechnology S. Chand& Co, New Delhi.
2. Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.
3. John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
4. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.
5. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
6. Thakur, A.K., Bassi, S.K. and Singh, K.J. 2017. Biofertilizers. S. Dinesh & Co., Jalandhar.
7. Vayas, S.C, Vayas, S. and Modi, H.A. 1998. Biofertilizers and Organic Farming Akta Prakashan, Nadiad

Course Outcomes:

After completing the course, students will be able to:

CO1	Follow general practices for maintaining hygiene.
CO2	Explain about diseases to whom people can be affected.
CO3	Describe the methods to protect man protect man from diseases and their treatment .
CO4	Speak about importance of public health and hygiene
CO5	Make society aware about health problems and cures

SEC (Botany) 2
CSE402: Medicinal Botany

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic knowledge of medicinal plants species.

Course Objectives:

1. To study the ancient history of medicines in India
2. To study the medicinally important plants
3. To study the conservation strategies for economically and medicinally plants
4. To study various applications of ethonobotany
5. To learn about the cultivation of medicinal plants
6. To study the ethnic communities practices for folk medicines.

Detailed Syllabus:

Unit 1 Introduction: history, scope and importance of medicinal plants; indigenous medicinal sciences; ayurveda: history, origin, panchamahabhutas, saptadhatu and tridosha concepts, rasayana, plants used in ayurvedic treatments, siddha: origin of siddha medicinal systems, basis of siddha system, plants used in siddha medicine; unani: history, concept: umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations.

Unit 2 Conservation: definition, endemic and endangered medicinal plants, Red list criteria; *In situ* conservation: biosphere reserves, sacred groves, national parks; *ex situ* conservation: botanic gardens, ethnomedicinal plant gardens; propagation of medicinal plants: objectives of the nursery, its classification, important components of a nursery, sowing, pricking, use of green house for nursery production, propagation through cuttings, layering, grafting and budding.

Unit 3 Ethnobotany and folk medicines: definition, ethnobotany in India, methods to study ethnobotany, applications of ethnobotany, national interacts, palaeo-ethnobotany, folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India; application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.

Practicals:

1. Ethnobotanical specimens studied in theory syllabus
2. Detailed morphological and anatomical study of medicinally important part(s) of locally available plants (minimum 8 plants) used in traditional medicine.
3. 3. Field visits to identify and collect ethno medicinal plants used by local tribes/folklore.

Text and Reference Books

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi, 1981.
3. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
4. S.K. Jain, 1990. Contributions of Indian ethnobotny.Scientific publishers, Jodhpur.
5. Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons, Chichester.

6. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
7. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.

Course Outcomes:

After completing the course, students will be able to:

CO1	Recognize the basic medicinal plants
CO2	Apply techniques of conservation and propagation of medicinal plants
CO3	Setup process of harvesting, drying and storage of medicinal herbs
CO4	Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India
CO5	Understand the practices for the cultivation of medicinal plants

SEC (Botany) 3
CSE502: Ethnobotany

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic knowledge of uses of plants for welfare of human being.

Course Objectives:

1. To study the ethnic communities practices for economically important plants.
2. To learn about the various artifacts and their conservation strategies by ethnic groups.
3. To study the ancient history of economically important in India.
4. To study the conservation strategies for economically and medicinally plants by tribes.
5. To study various applications of ethonobotany.
6. To learn about the cultivation of economically important plants .
7. To learn about the impact and legal aspect of biopiracy.

Detailed Syllabus:

Unit 1 General account: introduction, concept, scope and objectives; ethnobotany as an interdisciplinary science; relevance of ethnobotany in the present context; major and minor ethnic groups or tribals of India, and their life styles; plants used by the tribals: food plants, intoxicants and beverages, resins and oils and miscellaneous uses.

Unit 2 Methodology of ethnobotanical studies: field work; herbarium; ancient literature; archaeological findings; temples and sacred places.

Unit 3 Significance of ethnobotany: role of ethnobotany in modern medicine and medico-ethnobotanical sources in India; significance of the following plants in ethno botanical practices (along with their habitat and morphology): *Azadiractha indica*, *Ocimum sanctum*, *Vitex negundo*, *Gloriosa superba*, *Tribulus terrestris*, *Pongamia pinnata*, *Cassia auriculata*, *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauvolfia sepentina*, *Trichopus zeylanicus*, *Artemisia*, *Withania*. Role of ethnic groups in conservation of plant genetic resources; endangered taxa and forest management (participatory forest management).

Unit 4 Legal aspects: ethnobotany as a tool to protect interests of ethnic groups; sharing of wealth concept with few examples from India; biopiracy; Intellectual Property Rights and traditional knowledge.

Practicals:

1. Proper documentation of indigenous knowledge about medicinal plants.
2. Field trip to create awareness about ethnobotany role in cultural social and health of people.
3. Train people or students for utilization and conservation of medicinal plants.
4. Preparation of herbarium of plants having traditional values.

Text and Reference Books

1. S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
2. S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981
3. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.

4. S.K. Jain, 1990. Contributions of Indian ethnobotany. Scientific publishers, Jodhpur.
5. Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons, Chichester
6. 6. Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.

Course Outcomes:

After completing the course, students will be able to:

CO1	Explain the basic concepts about ethnobotany.
CO2	Know the historical development of ethnobotany.
CO3	Understand working methods of ethnobotany.
CO4	Recognize the ethnobotanically important plants species.
CO5	Know and/or identify important plant species.
CO6	Explain which parts of these plants are important for usage.
CO7	Give information about their natural habitats and cultivated lands.
CO8	Explain in which sectors these plants are used.

SEC (Botany) 4
CSE602: Intellectual Property Rights

Teaching Scheme	Examination Scheme
Lectures: 3 hrs/Week	Attendance – 5 Marks
Credits: 2	Teachers Assessment - 10Marks
	End Semester Exam – 35 marks

Prerequisite: Basic idea of IPR and its applicability.

Course Objectives:

1. To provide knowledge to the students regarding the general principles of IPR,
2. To learn Concept and Theories, Criticisms of Intellectual Property Rights, International Regime Relating to IPR
3. To provide knowledge to the students regarding Indian position of the Copyright Law, Historical background and Development of Copyright Law, Infringement.
4. To provide knowledge to the students regarding the effect of IPR especially of patents on emerging issues like public health, climate, Domain Name Disputes and Cybersquatting, Biopiracy etc. and the ways to tackle this problem
5. To provide knowledge on Legal issues on biotic products availability and utility

Detailed Syllabus:

Unit 1 Objectives of Intellectual Property Rights: origin and evolution of IPR; tangible and intangible property.

Unit 2 Classification of Intellectual Property: copyrights and related rights, patent, industrial design, trademarks and geographical indications, rights of traditional knowledge and protection of plant varieties.

Unit 3 IPR: National and international perspective; TRIPS; WIPO.

Unit 4 Patent: Basic criterion for patentability; patentable subjects; patentable inventions; patent acquisition; infringement of patent; discovery vs. invention; product patenting vs. process patenting; special issue in biotechnology patent; patenting laws in indian and international perspective; case study: basmati case, neem controversy, turmeric case

Unit 5 Biosafety: definition and requirement; biosafety in relation to human health, environment; transgenic research and applications; biosafety laws, guidelines and conventions; biosafety regulation: principles and practices in microbial and biomedical labs, guidelines for research involving DNA molecule; regulation bodies at national and International level

Unit 6 Impact and issues: Legal and socioeconomic impact of the products and techniques in biotechnology and ethical issues; bioethics in plant, animal and microbial genetic engineering; Ethical issues in healthcare, Biopiracy and ethical conflicts

Practicals:

1. Industrial visits
2. Institutional visits
3. Sampling

Text and Reference Books

1. Coyle's Information Highway Handbook: A Practical File on the New Information Order (2000) American Library Association
2. 2. Practical Approach To Intellectual Property Rights by Rachna Singh Puri, Arvind Viswanathan (2009) I. K. International Pvt Ltd

Course Outcomes:

After completing the course, students will be able to:

CO1	Gain the knowledge on different types of laws and rights
CO2	Be encourage the creation of a wide variety of intellectual goods
CO3	Understand that law gives people and businesses property rights to the information and intellectual goods they create, usually for a limited period of time.
CO4	Know that filing for intellectual property rights not only helps to protect their invention but also provides better collaboration and funding opportunities.
CO5	Know the importance of Patents and its piracy and legal solutions.

(SEC Chemistry)
Chemical Technology & Society

Teaching Scheme	Examination Scheme
Lectures: 2 hrs/Week	Class Test -6 Marks
	Teachers Assessment - 3Marks Attendance – 6 Marks
Credits: 2	End Semester Exam – 70 marks

Prerequisite: Concept of Chemical Technology Basic principles and Society Exploration of societal and technological issues from a chemical perspective.

Course Objectives:

1. To know about solvent extraction.
2. To understand the distillation columns.
3. To learn the chemical and scientific literacy.
4. To learn the energy from natural sources.
5. To know the plastics and polymers.
6. To understand the genetic engineering and the manufacture of drugs.

Detailed Syllabus:

Section – A Unit-1: Chemical Technology Basic principles of distillation, solvent extraction, solid-liquid leaching and liquidliquid extraction, separation by absorption and adsorption.
Unit-2: An introduction into the scope of different types of equipment needed in chemical technology, including reactors, distillation columns, extruders, pumps, mills, emulgators. Scaling up operations in chemical industry. Introduction to clean technology.
Section – B Unit-3: Society Exploration of societal and technological issues from a chemical perspective. Chemical and scientific literacy as a means to better understand topics like air and water (and the trace materials found in them that are referred to as pollutants).
Unit-4: energy from natural sources (i.e. solar and renewable forms), from fossil fuels and from nuclear fission; materials like plastics and polymers and their natural analogues, proteins and nucleic acids, and molecular reactivity and interconversions from simple examples like combustion to complex instances like genetic engineering and the manufacture of drugs.
Text and Reference Books
1. John W. Hill, Terry W. McCreary & Doris K. Kolb, Chemistry for changing times 13th Ed.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the solid-liquid leaching.
CO2	Understand the absorption and adsorption.
CO3	Explain the combustion to complex instance.
CO4	Develop the scaling up operations in chemical industry.
CO5	Calculate the molecular reactivity.
CO6	Illustrate the fossil fuels.

Pharmaceutical chemistry

Teaching Scheme	Examination Scheme
Lectures: 2 hrs/Week	Class Test - 6 Marks
	Teachers Assessment – 3 Marks Attendance – 6 Marks
Credits: 2	End Semester Exam – 70 marks

Prerequisite: Concept of drugs and pharmaceuticals drug discovery.

Course Objectives:

1. To know about Retrosynthetic approach.
2. To understand the antibacterial.
3. To learn the antiviral agents.
4. To learn the Chloromycetin and Streptomycin.
5. To know the Vitamin C.
6. To understand the analgesics agents.

Detailed Syllabus:

Unit 1: Drugs & Pharmaceuticals Drug discovery, design and development; Basic Retrosynthetic approach. Synthesis of the representative drugs of the following classes: analgesics agents, antipyretic agents, 112 anti-inflammatory agents (Aspirin, paracetamol, lbuprofen).

Unit 2: Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); antiviral agents (Acyclovir).

Unit 3: Central Nervous System agents (Phenobarbital, Diazepam),Cardiovascular (Glyceryl trinitrate), antilaprosy (Dapsone), HIV-AIDS related drugs (AZT- Zidovudine).

Unit 4: Fermentation Aerobic and anaerobic fermentation. Production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin, Chloromycetin and Streptomycin, (iii) Lysine, Glutamic acid, Vitamin B2, Vitamin B12 and Vitamin C.

Text and Reference Books

1. G.L. Patrick: Introduction to Medicinal Chemistry, Oxford University Press, UK.
2. Hakishan, V.K. Kapoor: Medicinal and Pharmaceutical Chemistry, Vallabh Prakashan, Pitampura, New Delhi.
3. William O. Foye, Thomas L., Lemke , David A. William: Principles of Medicinal Chemistry, B.I. Waverly Pvt. Ltd. New Delhi.

Course Outcomes:

After completing this course, students will be able to achieve the followings:

CO1	Describe the drugs and pharmaceuticals drug discovery.
CO2	Understand the sulphacetamide, Trimethoprim.
CO3	Explain the production of (i) Ethyl alcohol and citric acid, (ii) Antibiotics; Penicillin, Cephalosporin.
CO4	Develop the vitamin B2, Vitamin B12.
CO5	Calculate the glutamic acid.
CO6	Illustrate the chloramphenicol.

Human Values & Ethics	
Teaching Scheme Lectures: 2 hrs/Week Tutorials: 0 hr/Week Credits: 2	**Examination Scheme** Class Test -6 Marks Teachers Assessment – 3 Marks Attendance – 6 Marks End Semester Exam – 35 marks

Prerequisite: - Basic requirement for fulfillment of human aspiration.

Course Objectives:

1. To help students distinguish between values and skills, and understand the need, basic guidelines, content and process of value education.
2. To help students initiate a process of dialog within themselves to know what they 'really want to be' in their life and profession
3. To help students understand the meaning of happiness and prosperity for a human being.
4. To facilitate the students to understand harmony at all the levels of human living, and live accordingly.
5. To facilitate the students in applying the understanding of harmony in existence in their profession and lead an ethical life.

Detailed Syllabus

Unit-1 Need for values education, Self Exploration, Happiness and Prosperity, Basic Features of a good human, life management.
Unit-2 Understanding Harmony in Human Being, Social Health and Concept of Dharma.
Unit-3 Understanding harmony in family and relations, Value of trust and relationship management, Role of religion in human life.
Unit-4 Understanding Harmony in environment, Role of individuals in nation building, Conscious Business.
Unit-5 Comparison of Indian and western view of ethics and values.

Course Outcomes:

After completing the course, students will be able to:

1. Understand the significance of value inputs in a classroom and start applying them in their life and profession.
2. Distinguish between values and skills, happiness and accumulation of physical facilities, the Self and the Body, Intention and Competence of an individual, etc.
3. Understand the value of harmonious relationship based on trust and respect in their life and profession.
4. Understand the role of a human being in ensuring harmony in society and nature.
5. Distinguish between ethical and unethical practices, and start working out the strategy to actualize a harmonious environment wherever they work.

Entrepreneurship Development	
Teaching Scheme Lectures: 2 hrs/Week Tutorials: 0 hr/Week Credits: 2	**Examination Scheme** Class Test - 6Marks Teachers Assessment - 3Marks Attendance – 6 Marks End Semester Exam – 35 marks

Course Objectives:

1.	Understanding basic concepts in the area of entrepreneurship.
2.	Understanding the role and importance of entrepreneurship for economic development.
3.	Developing personal creativity and entrepreneurial initiative.
4.	Adopting of the key steps in the elaboration of business idea.
5.	Understanding the stages of the entrepreneurial process and the resources needed for the successful development of entrepreneurial ventures.

Detailed Syllabus

Unit-1

Entrepreneurship: Definition of Entrepreneur, Internal and External Factors, Functions of an Entrepreneur, Entrepreneurial motivation and Barriers, Classification of Entrepreneurship, Theory of Entrepreneurship, The entrepreneurial Culture; Stages in entrepreneurial process. Concept of Entrepreneurship-Evolution of Entrepreneurship; Development of Entrepreneurship;

Unit-2

Entrepreneurship and environment-Policies governing entrepreneurs, entrepreneurial development programmes (EDP's) - Institutions for - entrepreneurship development. Problems of EDP's.

.

Unit-3

Entrepreneurial Venture; Idea Generation, Screening and Project Identification, Creative Performance, Feasibility Analysis: Economic, Marketing, Financial and Technical; Project Planning: Evaluation, Monitoring and Control segmentation..

Unit-4

International Entrepreneurship Opportunities: The nature of international entrepreneurship, Importance of international business to the firm, International versus domestics' entrepreneurship, Stages of economic development.

Unit-5

Women entrepreneurship: Need – Growth of women entrepreneurship, Problems faced by women entrepreneurs, prospects.

Unit-6 Entrepreneurship in Informal Sector: Rural Entrepreneurship – Entrepreneurship in Sectors like Agriculture, Tourism, Health Case, Transport & Allied Services.
Text and Reference Books- 1. Entrepreneurship: New Venture Creation, Holt; Prentice-Hall, 1998 2. Entrepreneurship, Dollinger M J; Prentice-Hall, 1999 3. Entrepreneurship, Hisrich; McGraw-Hill Higher Education, 7th edition 4. Dynamics of Entrepreneurship Development, Vasant Desai Himalaya Publications, 11th edition.

Course Outcomes:

1. Appreciate the importance of embarking on self-employment and has developed the confidence and personal skills for the same.
2. Identify business opportunities in chosen sector / sub-sector and plan and market and sell products / services.
3. Consider the legal and financial conditions for starting a business venture.
4. Specify the basic performance indicators of entrepreneurial activity.