SCHEME & SYLLABUS
Bachelor in Medical

(Choice Based Credit System)

Prograame Code: UG026

Department of Life Sciences and Allied Health Sciences (UIS)

Sant Baba Bhag Singh University

2021

ABOUT THE DEPARTMENT

The department of Life Sciences formerly known as the Department of Natural Sciences was established in the year 2015 with only two UG programmes. Over the years this department has flourished and is offering various Programmes and courses at graduate, post-graduate and doctorate level in field of Botany, Zoology, Biotechnology, Biochemistry, Microbiology and Laboratory Sciences.The department is nurtured by the highly qualified and dedicated Faculty, honoured by various international and national awards. The department is blessed to have specialized faculties in various fields of Life Sciences viz. Plant physiology, Plant Biochemistry, Plant Microbe interaction, Stress Physiology, Chemical ecology, Microbial Physiology, Industrial Microbiology, Clinical microbiology, Microbial Biotechnology, Animal Biotechnology, Fisheries, Parasitology, Molecular biology, Entomology, Sericulture, Animal toxicology, Endocrinology, Biochemistry and Biodiversity.

SALIENT FEATURES OF THE DEPARTMENT

1. At SBBS University the focus of Department is on conducting innovative teaching, fundamental multidisciplinary research in life sciences.
2. The department is disseminating various educational missions via e-learning platform in the form of SWAYAM, Virtual lab etc.
3. The department is equipped with a number of instruments and facilities like, UV- Visible Spectrophotometer, High Speed Centrifuge, Deep Freezer, Laminar Air flow, Air Samplers, Autoclave, Incubator, Photo actometer, Air condition Labs, WiFi, Library etc.
4. The department has organized a large number of conferences, seminars, symposia and workshops. National and International eminent scientists of the country have been associated with the Department as visiting and honorary professors.

B.Sc. in Medical (Bachelor of Science in Medical)

VISION

To bridge the gap between demand and supply for Life Sciences and Allied Health Professionals with grooming young generations along with their moral and spiritual development.

MISSION

To radiate the knowledge of Life Sciences and Allied Health Sciences through quality education by using latest technology, modern infrastructure and the framework needed for the development of professionals.

ELIGIBILITY CRITERIA

10+2 or its equivalent examination in any stream conducted by a recognized Board/University/Council

DURATION

3 Years

CAREER PATHWAYS

The program is designed to meet the growing requirement of qualified professionals in field of IT industry and education. B.Sc. graduates are hired both by Government and private organizations. They may join Post Graduation Courses further.

- Government Jobs: Prepare students for various government jobs such as banking sector, civil services etc.
- Higher Studies: This pathway prepares students for Higher Studies and helps in their researchalso.
- Entrepreneurship: To set up new ventures

PROGRAMME EDUCATIONAL OBJECTIVE (PEO)

PEO1. To provides a hands-on experience of the latest techniques that are in current usage both in the advanced research laboratories and in Industry.

PEO2. To improves critical and analytical abilities.

PEO3. To inculcates scientific ideas in the students for new discoveries in the fields of the biological sciences.

PEO4. To facilitate higher education and professional skills amongst students

PROGRAMME OUTCOMES (PO)

PO1. Apply the knowledge and skills appropriate to discipline for the advanced research.

PO2. Develop competency to think creatively, critically and objectively with core and inter-disciplinary excellence.

PO3. Have collaborative and multidisciplinary skills to work as an effective member or leader to achieve goals.

PO4. Be the government professionals, scientists, and mentors of the future.

PROGRAMME SPECIFIC OUTCOMES (PSO)

PSO1. Graduates will be able to explain how organisms function at the level of gene, genetic data, cells, tissues, organ and organ system level.

PSO2. Graduates will be able to understand the physiological adaptations, development, reproduction and diversity of different forms of life.

PSO3. Graduates will understand the different morphological features of animals & plants. They will also understand the genetics and variations of different organisms.

PSO4. Graduates will be able to understand chemical nomenclature, classification, structure and reactivity of organic and inorganic matter

ABOUT THE CHOICE BASED CREDIT SYSTEM (CBCS)

The CBCS provides an opportunity for the students to choose courses from the prescribed courses comprising core, elective/minor or skill-based courses. The courses can be evaluated following the grading system, which is considered to be better than the conventional marks system. The basic idea is to look into the needsof the students so as to keep up-to-date with development of higher education in India and abroad. CBCS aims to redefine the curriculum keeping pace with the liberalization and globalization in education. CBCS allows students an easy modeof mobility to various educational institutions spread across the world along withthe facility of transfer ofcredits earned by students.

1. **Curriculum Structure:** BCA degree programme will have a curriculum with Syllabiconsisting of following type of courses:

   I. **Ability Enhancement Courses (AEC):** The Ability Enhancement Courses (AEC) may be of two kinds: Ability Enhancement Compulsory Courses (AECC) and Skill Enhancement Courses (SEC). AECC courses are the courses based upon the content that leads to Knowledge enhancement; these are mandatory for alldisciplines.

   SEC courses are value-based and/or skill-based and are aimed at providing hands-on-training, competencies, skills, etc.

   A. Ability Enhancement Compulsory Courses (AECC): Environmental Science, English Communication/MILCommunication.

   B. Skill Enhancement Courses (SEC): These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based knowledge.

   II. **Core Courses (CR):** A course, which should compulsorily by studied by a candidate as a core requirement is termed as a Core course. These courses are employability enhancement courses relevant to the chosen program of study. Program core comprises of Theory, Practical, Project, Seminar etc. Project work is considered as a special course involving application of knowledge in solving/ analyzing/exploring a real-life situation/ difficultproblem.

   III. **Elective Courses:** Elective course is generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/subject of studyor with provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate’s proficiency/skill. Accordingly, elective course may be categorizesas:

A. Discipline Specific Elective (DSE) Course: Elective courses may be offered by the main discipline/subject of study is referred to as Discipline SpecificElective.
B. Project (I): An elective course designed to acquire special/advanced knowledge, such as supplement study/support study toa project work, and a candidate studies such a course on his own with an advisory support by a teacher/faculty member is called dissertation/project.

2. NOMENCLATURE USED:

A. Graduate Core Courses

A. Ability Enhancement Courses (AEC):

i. Core Courses (cc)
ii. Ability Enhancement Compulsory Courses (AECC)
iii. Skill Enhancement Courses (SEC).

B. Elective Courses (EL)

i. Discipline Specific Elective (DSE)
ii. Interdisciplinary (ID)S

Index

Skill Enhancement Courses (SEC)

Discipline Elective Courses (DSE)

(Semester- V-VI)

Any two of each subject in both semesters

21.	Chemistry of main group element, theories of acids and bases practical	CHM308	Semester-VI	112-113
22.	Economic Botany and Biotechnology	BOT302	Semester-VI	114
23.	Economic Botany and Biotechnology Practical	BOT304	Semester-VI	115
24.	Bioinformatics	BOT 306	Semester-VI	116-117
25.	Bioinformatics Practical	BOT 308	Semester-VI	118
26.	Immunology and Biostatics	ZOO302	Semester-VI	119
27.	Immunology and Biostatics Practical	ZOO304	Semester-VI	120
28.	Reproductive Biology	ZOO306	Semester-VI	121
29.	Reproductive Biology Practical	ZOO308	Semester-VI	122
30.	Insect, Vector and Diseases	ZOO310	Semester-VI	123
31.	Insect, Vector and Diseases Practical	ZOO312	Semester-VI	124
32.	Instrumental methods of Chemical Analysis	CHM326	Semester-VI	125-126
33.	Instrumental methods of Chemical Analysis Practical	CHM328	Semester-VI	127-128
34.	Communication Skills and Personality Development	ENG004	Semester-VI	129

- AECC refers to Ability Enhancement CompulsoryCourse
- SEC refers to Skill Enhancement Course
- DSE refers to Discipline SpecificElective
- PT PhysicalTraining

Course Scheme, B.Sc Medical

SEMESTER I

I. Theory Subjects

S. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT101	Plant Biodiversity	4:0:0	4:0:0	4	4	CC
2	CHM101	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4:0:0	4:0:0	4	4	CC
3	ZOO101	Animal Biodiversity	4:0:0	4:0:0	4	4	CC
4	ENG101	General English-I	3:0:0	3:0:0	3	3	AECC
5	PBI101/ HCP101	General Punjabi-I/History and Culture of Punjab	3:0:0	3:0:0	3	3	AECC

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT103	Plant Biodiversity Practical	0:0:4	0:0:2	4	2	CC
2	CHM103	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Practical	0:0:4	0:0:2	4	2	CC
3	ZOO103	Animal Biodiversity Practical	0:0:4	0:0:2	4	2	CC
4	PT101/PT103/PT105	Physical Training (NSO/NCC/NSS)	0:0:2	Non-credit	2	NC	

CC: Core courses

AECC: Ability Enhancement Core CourseTotal Contact hrs: 32

Total Credit Hours: 24

B.Sc. Medical

SEMESTER II

I. Theory Subjects

S. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT102	Plant Ecology and Taxonomy	4:0:0	4:0:0	4	4	CC
2	CHM102	Chemical Energetics, Equilibrium& Functional Groups Organic Chemistry-I	4:0:0	4:0:0	4	4	CC
3	ZOO102	Comparative Anatomy and Developmental Biology of Vertebrates	4:0:0	4:0:0	4	4	CC
4	ENG102	General English-II	3:0:0	3:0:0	3	3	AECC
5	PBI102/HCP 102	General Punjabi-II/History and Culture of Punjab	3:0:0	3:0:0	3	3	AECC

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT104	Plant Ecology and Taxonomy Practical	0:0:4	0:0:2	4	2	CC
2	CHM104	Chemical Energetics, Equilibrium & Functional Group Organic Chemistry-I Practical	0:0:4	0:0:2	4	2	CC
3	ZOO104	Comparative Anatomy and Developmental Biology of Vertebrates Practical	0:0:4	0:0:2	4	2	CC
4	PT102/PT104/PT106	Physical Training (NSO/NCC/NSS)	0:0:2	Non-credit	2	NC	AECC

CC: Core coursesTotal Contact hrs: 32
AECC: Ability Enhancement Core Course **Total Credit Hours: 24**

SEMESTER III

I. Theory Subjects

S. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT201	Anatomy and Embryology of Angiosperms	4:0:0	4:0:0	4	4	CC
2	CHM201	Solutions, Phase equilibrium, Conductance, Electrochemistry& Functional Group Organic Chemistry-II	4:0:0	4:0:0	4	4	CC
3	ZOO201	Animal Physiology and Biochemistry	4:0:0	4:0:0	4	4	CC
4	EVS001	Environmental Science	3:0:0	3:0:0	3	3	AECC
5		Elective subject (Skill Enhancement)-I	2:0:0	2:0:0	2	2	SEC

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT203	Anatomy and Embryology of Angiosperms Practical	0:0:4	0:0:2	4	2	CC
2	CHM203	Solutions, Phase equilibrium, Conductance, Electrochemistry &Functional Group Organic Chemistry-II Practical	0:0:4	0:0:2	4	2	CC
3	ZOO203	Animal Physiology and Biochemistry Practical	0:0:4	0:0:2	4	2	CC

CC: Core courses **Total Contact hrs: 29**

AECC: Ability EnhancementCore Course **Total Credit Hours: 23**

SEC: Skill Enhancement Cours

SEMESTER IV

I. Theory Subjects

S. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT202	Plant Physiology and Metabolism	4:0:0	4:0:0	4	4	CC
2	CHM202	Coordination Chemistry, States of Matter & Chemical Kinetics	4:0:0	4:0:0	4	4	CC
3	ZOO202	Genetics and Evolutionary Biology	4:0:0	4:0:0	4	4	CC
4		Elective subject (Skill Enhancement)-II	2:0:0	2:0:0	2	2	SEC
5	SSC001	Gender Equity	3:0:0	3:0:0	3	3	AEC

II. Practical Subjects

S. No	Subject Code	Subject Name		Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT204	Plant Physiology and Metabolism Practical	0:0:4	0:0:2	4	2	CC
2	CHM204	Coordination Chemistry, States of Matter & Chemical Kinetics Practical	0:0:4	0:0:2	4	2	CC
3	ZOO204	Genetics and Evolutionary Biology Practical	0:0:4	0:0:2	4	2	CC

CC: Core courses Total Credit Hours: 20
AECC: Ability EnhancementCore Course **Total Contact hrs: 26**
SEC: Skill Enhancement Course

SEMESTER V

I. Theory Subjects

S. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT	Discipline Specific Elective-I	4:0:0	4:0:0	4	4	DSE
2	CHM	Discipline Specific Elective – I	4:0:0	4:0:0	4	4	DSE
3	ZOO	Discipline Specific Elective-I	4:0:0	4:0:0	4	4	DSE
4		Elective subject (Skill Enhancement)-III	2:0:0	2:0:0	2	2	SEC
5	SSC006	Human values and professional ethics	3:0:0	3:0:0	3	3	AEC

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT	Discipline Specific Elective-I Practical	0:0:4	0:0:2	4	2	DSE
2	CHM	Elective Subject(Discipline)Practical-I	0:0:4	0:0:2	4	2	DSE
3	ZOO	Discipline Specific Elective-I Practical	0:0:4	0:0:2	4	2	DSE

DSE: Discipline Specific Elective
SEC: Skill Enhancement Courses

Total Contact hrs: 26
Total Credit Hours: 20

SEMESTER VI

I. Theory Subjects

S. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT	Discipline Specific Elective-II	4:0:0	4:0:0	4	4	DSE
2	CHM	Elective Subject (Discipline)-II	4:0:0	4:0:0	4	4	DSE
3	ZOO	Discipline Specific Elective-II	4:0:0	4:0:0	4	4	DSE
4		Elective Subject (Skill Enhancement)-IV	2:0:0	2:0:0	2	2	SEC
5	ENG004	Communication Skills and Personality Development	3:0:0	3:0:0	3	3	AEC

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours	Type of course
1	BOT	Discipline Specific Elective-II Practical	0:0:4	0:0:2	4	2	DSE
2	CHM	Elective Subject(Discipline) lab-II	0:0:4	0:0:2	4	2	DSE
3	ZOO	Discipline Specific Elective-II Practical	0:0:4	0:0:2	4	2	DSE

DSE:DisciplineSpecific Elective
SEC: Skill Enhancement Courses

Total Contact hrs: 29

Total Credit Hours: 23

Course Scheme Summary

Sem	L	T	P	Contact hrs/wk	Credits	CC	AEC	SEC	DSE	ID
1	18	0	14	32	24	18	6			
2	18	0	14	32	24	18	6			
3	17	0	12	29	23	18	3	2		
4	15	0	12	26	23	18	3	2		
5	17	0	12	29	23		3	2	18	
6	20	0	12	32	26		3	2	18	1
Total	**105**	**0**	**76**	**180**	**143**	**72**	**24**	**8**	**36**	**1**

Ist SEMESTER

PLANT BIODIVERSITY

Course Code	**BOT101**
Course Title	**Plant Biodiversity**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	To make students aware about biodiversity among different groups of plants, their characteristic features and preliminary knowledge of microbes
Course outcomes	CO1 Understanding about the diversity of virus, bacteriophages, bacteria and their economic importance CO2 Understanding aboutthe diversity, distribution, ecology life cycle and economic importance of algae CO3 Understanding aboutthe diversity, distribution, ecology life cycle of some genera of fungi, symbiotic association like lichens, mycorhizza and their significance CO4Understanding aboutthe diversity archaegoniates (Bryophytes, Pteridophytes, and Gymnosperm) their distribution, morphology, anatomy, ecology, life cycle and economic importance

UNIT-I

Microbes: Viruses – Discovery, general structure, replication (general account), DNA virus (T-phage);Lytic and lysogenic cycle, RNA virus (TMV); Economic importance; Bacteria – Discovery,General characteristics and cell structure; Reproduction – vegetative, asexual and recombination(conjugation, transformation and transduction); Economic importance.

Algae: General characteristics; Ecology and distribution; Range of thallus organization and reproduction; Classification of algae; Morphology and life-cycles of the following: *Nostoc*, *Chlamydomonas, Oedogonium, Vaucheria, Fucus, Polysiphonia*. Economic importance of algae

UNIT-II

Fungi: Introduction- General characteristics, ecology and significance, range of thallus organization, cell wall composition , nutrition, reproduction and classification; True Fungi- General characteristics, ecology and significance, life cycle of *Rhizopus* (Zygomycota) *Penicillium, Alternaria* (Ascomycota), *Puccinia, Agaricus*(Basidiomycota); Symbiotic Associations-Lichens: General account, reproduction and significance; Mycorrhiza: ectomycorrhiza and endomycorrhiza and their significance

UNIT-III

Introduction to Archegoniate: Unifying features of archegoniates, Transition to land habit, Alternation of generations.

Bryophytes: General characteristics, adaptations to land habit, Classification, Range of thallus organization. Classification (up to family), morphology, anatomy and reproduction of *Marchantia*and*Funaria*. (Developmental details not to be included). Ecology and economic importance of bryophytes with special mention of *Sphagnum*.

UNIT-IV

Pteridophytes: General characteristics, classification, Early land plants (*Cooksonia*and*Rhynia*). Classification (up to family), morphology, anatomy and reproduction of *Selaginella*, *Equisetum* and *Pteris*. (Developmental details not to be included). Heterospory and seed habit, stelar evolution. Ecological and economical importance of Pteridophytes.

Gymnosperms: General characteristics, classification. Classification (up to family), morphology, anatomy and reproduction of *Cycas* and *Pinus*. (Developmental details not to be included). Ecological and economical importance.

Text and Reference books:

Sr No.	Book Title	Author	Publisher
1	Diversity of Microbes and Cryptogams	H.N.Srivastava	Pradeep Publisher
2	Text Book of Thallophytes	O.P.Sharma	McGraw Hill Publishing Co.

3	Text Book of Pteridophyta	O.P.Sharma	McMillan India Ltd
4	Cryptogamic Botany, Vol. II, Bryophytes & Pteridophytes	G.M Smith	Tata McGraw Publisher
5	Botany for degree students B. Sc 1st Year	V K Aggarwal	S. Chand Publishing
6	A Text book of Botany-I	S.P. Jain	Rastogi Publishers
7	University Botany-I, Algae, Fungi, Bryophyta &Pteridophyta	S.M. Reddy	New Age International Publisher

Atomic Structure, Bonding, General Organic Chemistry &Aliphatic Hydrocarbons

Course Code	**CHM 101**
Course Title	**Atomic Structures, Bonding, General Organic Chemistry and Aliphatic Hydrocarbons**
Type of course	CORE (Theory)
L T P	4 0 0
Credits	4
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of the subject is to enhance the knowledge of students in Chemical bonding atomic / molecular structure, About basic concepts of organic chemistry, visualizing the organic molecules in a three-dimensional space.
Course outcome	**By the end of the course, the students will be able to:** CO1 Solve the conceptual questions using the knowledge gained from quantum mechanical model of the atom, quantum numbers, electronic configuration, radial and angular distribution curves, shapes of s, p, and d orbitals, and periodicity in atomic radii, ionic radii, ionization energy. and electron affinity of elements. CO2 Draw the plausible structures and geometries of molecules using Radius Ratio Rules, VSEPR theory and MO diagrams. CO3 Able to explains significance of quantum numbers , de-Broglie's dual behaviour of matter and Heisenberg's uncertainty principle and solve numerical problems. CO4 Understand and explain the different nature and behavior of organic compounds and able to analyse and evaluate fundamental concepts of stereochemistry

Unit-I

Atomic Structure: Review of: Bohr’s theory and its limitations, dual behavior ofmatter and radiation, de Broglie’s relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to Atomic structure. What is Quantum mechanics? Time independent Schrodinger equation and meaning of various terms in it. Significance of ψ and ψ^2, Schrödinger equation for hydrogen atom. Radial and angular parts of the hydogenic wavefunctions (atomic orbitals) and their variations for 1s, 2s , 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Significance of quantum numbers, orbital angular momentum and quantum numbers ml and ms . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). Rules for filling electrons in various orbitals, Electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Energies of atomic orbitals, Anomalous electronic configurations.

Unit-II

Chemical Bonding and Molecular Structure Ionic Bonding: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy and their importance in the context of stability and solubility of ionic compounds. Statement of Born Landé equation for calculation of lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bonding: VB Approach: Shapes of some inorganic molecules and ions on the basis of VSEPR and hybridization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahedral arrangements. **MO Approach:** Rules for the LCAO method, bonding and antibonding MOs and their characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals, MO treatment of homonuclear diatomic molecules of 1st and 2nd periods (including idea of s-p mixing) and heteronuclear diatomic molecules such as CO, NO and NO^+. Comparison of VB and MO approach

Unit-III

Fundamentals of Organic Chemistry: Physical Effects, Electronic Displacements: Inductive Effect, Electromeric Effect, Resonance and Hyper-conjugation. Cleavage of Bonds: Homolysis and Heterolysis.

Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals.

Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Aromaticity: Benzenoids and Hückel's rule.

Stereochemistry: Conformations with respect to ethane, butane and cyclohexane. Interconversion of Wedge Formula, Newmann, Sawhorse and Fischer representations. Concept of chirality (upto two carbon atoms). Configuration: Geometrical and Optical isomerism; Enantiomerism, Diastereomerism and Meso compounds). Threo and erythro; D and L; cis - trans nomenclature; CIP Rules: R/ S (for upto 2 chiral carbon atoms) and E / Z Nomenclature (for upto two C=C systems).

Unit-IV

Aliphatic Hydrocarbons Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure.

Alkanes: (Upto 5 Carbons). Preparation: Catalytic hydrogenation, Wurtz reaction,Kolbe's synthesis, from Grignard reagent. Reactions: Free radical Substitution : Halogenation.

Alkenes: (Upto 5 Carbons) Preparation: Elimination reactions: Dehydration of alkenes and dehydrohalogenation of alkyl halides (Saytzeff's rule); cis alkenes (Partial catalytic hydrogenation) and trans alkenes (Birch reduction). Reactions: cis-addition (alk. $KMnO_4$) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymecuration-demercuration, Hydroboration-oxidatioN

Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides.

Reactions: formation of metal acetylides, addition of bromine and alkaline KMnO4, ozonolysis and oxidation with hot alk. $KMnO_4$

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Organic Chemistry	Morrison and Boyd	Prentice Hall

4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	Stereochemistry	P.S. Kalsi	New age International
6	Organic reaction mechanism	Singh and Mukharje	New age International

ANIMAL BIODIVERSITY

Course Code	**ZOO101**
Course Title	**Animal Biodiversity**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	1. To enable the students to develop an appreciation for the biodiversity of invertebrate species and to impart knowledge about co-existence of different forms of living organisms ranging from acelluar to multicellular animals. Classification and general characters of the following phyla up to classes.
Course Outcomes (CO)	1. Understand the evolution, history of phylum that help in furthur research work. 2. Understand the economical importance of different classes.

UNIT-I

Kingdom Protista: General characters and classification up to classes; Locomotory Organelles and locomotion in Protozoa

Phylum Porifera: General characters and classification up to classes; Canal System in *Sycon*

Phylum Cnidaria: General characters and classification up to classes; Polymorphism in Hydrozoa

Phylum Platyhelminthes: General characters and classification up to classes; Life history of *Taenia solium*

UNIT-II

Phylum Nemathelminthes: General characters and classification up to classes; Life history of *Ascaris lumbricoides* andits parasitic adaptations

Phylum Annelida: General characters and classification up to classes; Metamerism in Annelida

Phylum Arthropoda: General characters and classification up to classes; Vision in Arthropoda, Metamorphosis inInsects

Phylum Mollusca: General characters and classification up to classes; Torsion in gastropods

UNIT-III

Phylum Echinodermata: General characters and classification up to classes; Water-vascular system in Asteroidea

Protochordates: General features and Phylogeny of Protochordata

Agnatha: General features of Agnatha and classification of cyclostomes up to classes Pisces: General features and Classification up to orders; Osmoregulation in Fishes

UNIT-IV

Amphibia: General features and Classification up to orders; Parental care

Reptiles: General features and Classification up to orders; Poisonous and non-poisonous snakes, Bitingmechanism in snakes

Aves: General features and Classification up to orders; Flight adaptations in birds, Mammals: Classification up to orders; Origin of mammals.

Text and Reference Books:

S. No.	Title	Author(s)	Publisher
1	Invertebrate Zoology	P.S. Dhami	R Chand and Company
2	Cell Biology	V K Aggarwal	S. Chand Publishing
3	AText Book of Invertebrate Zoology	Gurcharn Singh	Campus Books International
4	Cell Biology	C B Pawar	Himalaya Publishing House
5	Modern's Zoology (Vol-I)	Ashok Sabharwal and Dr. S K Malhotra	Modern Publisher
6	Modern Text Book of Zoology Invertebrates	Prof. R. L. Kotpal	Rastogi Publisher
7	Zoology	P S Dhami	Pradeep Publishers

GENERAL ENGLISH-I

Course Code	**ENG101**
Course Title	**General English-I**
Type Course	Theory
L T P	3 0 0
Credits	3
Course Pre-requisite	10+2 any stream
Course Objective (CO)	1. The students will critically read and analyze the prescribed texts. 2. The students will demonstrate effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work. 3. The students will recognize the correct usage of present/past/future tenses in contextualized speech.
Course Outcomes (CO)	1. Students will heighten their awareness of correct usage of English grammar in writing and speaking. 2.Students will improve their speaking ability in English both in terms of fluency and comprehensibility. 3. Students will attain and enhance competence in the four modes of literacy: writing, speaking, reading & listening.

UNIT-I

Tales of Life :

a. The Umbrella (Henry Rene Albert Guy de Maupassant)
b. The Story Teller (H.H. Munro Saki)
c. The Lament (Anton Pavlovich Chakhov)

Prose for Young Learners:

a. Universal Declaration Of Human Rights (U.N. Charter)
b. Symptoms (Jerome K. Jerome)

Exploring Tenses in English:

a. Present and Past
b. Present Perfect and Past

UNIT-II

Tales of Life:

a.The Luncheon (William Somerset Maugham)
b.The Shroud (Prem Chand)

Prose for Young Learners:

a. On Spendthrifts(A.G.Gardinar)
b. The Power of Women(Richard Gardon)
c. A Dialogue On Democracy (Albert Sydney Horby)

Exploring Tenses in English:

a. Future
b.

Text and Reference Books:

S.No.	**Author(S)**	**Title**	**Publisher**
1	Singh, S	Tales of Life	Press and Publication Department, Guru Nanak Dev University, Amritsar.
2	Tewari, A. K, Midha,V.K, Sharma, R.K	Prose For Young Learners	Publication Bureau, Guru Nanak Dev University, Amritsar
3	Murphy, R	English Grammar in Use	Cambridge University Press

GENERAL PUNJABI-I

Course Code	**PBI101**
Course Title	**General Punjabi-I**
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	10+2 in any stream
Course Objectives	1. ividAwrQIAwDuinkpMjwbIkvIAWdIjIvnIqoNjwxUhoxgy[2. ividAwrQIAWnUMAwDuinkpMjwbIkivqwdIivSYgqjwxkwrI ho jwvygI[3. ividAwrQIAWiv`cryKwic`qrWdwAlocnwqmkAiDAYnkrndwhunrauqp Mnhovygw[

iekweI- a

1. **AwDuinkpMjwbIkivqw:**BweIvIrisMG (rauNru^, smW, ie`Cw bl qyfUMGIAWSwmW), DnIrwmcwiqRk(rwDwsMdyS, isdkWvwilAWdybyVypwrny), pRo.pUrnisMG(purwxypMjwbnUMAwvwzW), &IrozdIn Sr&(kurbwnI, ^YrpMjwbIdI), pRo.mohnisMG(Awaun`cIey, nvWkOqk), nMdlwlnUrpurI(cuMmcuMmr`Ko, mzdUr), AMimRqwpRIqm(bwrWmwh, sMXogivXog), fw. hrBjnisMG(qyryhzUrmyrIhwizrIdIdwsqW), iSvkumwrbtwlvI(ibrhoNdIrVHk, z^m), surjIqpwqr(cONkShIdW ‘c ausdwAwi^rIBwSx, Zzl)
2. **pMjwbdymhwnklwkwr(lyK):**ky.AY~l. sihgl, bVygulwmAlI KW, soBwisMG, ipRQvIrwjkpUr, BweIsmuMdisMG[

iekweI- A

1. pMjwbIDunIivauNq :aucwrnAMg, aucwrnsQwnqyivDIAW, svr, ivAMjn[
2. BwSwvMngIAW: BwSwdwtkswlIrUp, BwSwAqyaup- BwSwdwAMqr, pMjwbIaupBwSwvWdypCwxicMnH[

pusqksUcI

pwT- pusqkW

lyKk	Swl	Pusqk	pbilSr
sMpwdk, iF`loN; h.s.AqysrgoDIAw; p.s.	2014	do rMg	pblIkySnibaUro, gurUunwnkdyvXUnIvristI, AMimRqsr
gwrgI; b.	1995	pMjwbdymhwnklwkwr	pblIkySnibaUro, gurUunwnkdyvXUnIvristI, AMimRqsr

sMbMiDqpusqkW

lyKk	Swl	Pusqk	pbilSr
isMG; h.	1966	pMjwbIbwry	pMjwbIXUnIvristI, pitAwlw
isMG; qIrQ (fw.)	2014	pMjwbIAiDAwpn	AY~s. jI. pbilSrz, jlMDr
syKoN; suKivMdrisMG (fw.) AqysyKoN; mndIpkOr	2015	pMjwbIBwSwdwAiDAwpn	kilAwxIpbilSrz, luiDAwxw

ATOMIC STRUCTURES, BONDING, GENERAL ORGANIC AND CHEMISTRY AND ALIPHATIC HYDROCARBONS PRACTICAL

Course Code	**CHM 103**
Course Title	**Atomic Structures , Bonding , General Organic and Chemistry and Aliphatic Hydrocarbons**
Type of course	CORE (Practical)
L T P	0:0:4
Credits	2
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of this course is to impart practical knowledge to the students about the separation of organic molecules and estimation of inorganic salt and metal ions.
Course outcome	**By the end of the course, students will be able to:** CO1 Estimate and identify the various ions in stock solutions. CO2 Detection of elements (N, S and halogens) in organic compounds, Detection of functional groups CO3 Identify amino acid & sugars through chromatographic methods

Volumetric Analysis

Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.

Estimation of oxalic acid by titrating it with $KMnO_4$.

Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$.

Estimation of Fe (II) ions by titrating it with $K_2Cr_2O_7$ using internal indicator.

Estimation of Cu (II) ions iodometrically using $Na_2S_2O_3$.

Organic Chemistry

Detection of extra elements (N, S, Cl, Br, I) in organic compounds (containing upto two extra elements)

Separation of mixtures by Chromatography: Measure the Rf value in each case (combination of two compounds to be given)

Identify and separate the components of a given mixture of two amino acids (glycine, aspartic acid, glutamic acid, tyrosine or any other amino acid) by paper chromatography

Identify and separate the sugars present in the given mixture by paper chromatography.

Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography (TLC).

*<u>*Perform any four experiments from each section*</u>

Text and References Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis (7^{th} Edition).	G Svehla	Prentice Hall
2	Laboratory Manual in Organic Chemistry	R.K. Bansal,	Wiley Eastern
3	Advanced Experimental Chemistry. Vol. I	Physical, J.N. Gurtu and R. Kapoor	S. Chand & CO.
4	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
5	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham	ELBS

HISTORY AND CULTURE OF PUNJAB -I

Course code	**HCP101**
Course title	**History and Culture of Punjab -I**
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	Students who have not studied Punjabi in 10/12th class
Course objectives (CO)	1. The Student will acquire the knowledge about Punjab and its Historical Resources. 2. The Student will understand the Harppan Culture and different Vedic Periods. 3. The Students will analyze the Alexander's invasions.

UNIT I

Ancient Punjab: Physical features, Political, Social, Economic, Geographical, Religious impact on History, Historical Sources: Literacy, Archaeological, Harappan Culture: Extent and Town Planning.

UNIT II

Harppan Culture: Social, Economic and Religious life; Causes and Disappearance, Rig Vedic Age: The rise of Indo Aryans, Main features of the life in Early Vedic Age, Later Vedic Age: Political, Economic, Social, and Religious life of Later Vedic Aryans.

UNIT III

Caste system: Origin and Evolution, The Epics: Historical importance of Ramayan and Mahabharat, Political condition on eve Alexander's Invasion.

UNIT IV

Impact of Alexander's Invasion on Social and Culture Life., Position of Women: Harppan, Early Vedic and Later Vedic Age.

Important Historical places of Punjab: Mohenjodaro, Harappa, kotla Nihang khan, Sanghol, Banawali, Taxila, Hastinapur,Indraprastha,Srinagar, Sakala,Purusapura

Text and References Books:

S.NO.	Author's	Title	Publisher
1	Sukhdev Sharma	History And Culture Of Punjab	New Academic Publisher
2	Romila Thapar	A History of India, Vol. I	Penguin Books

PLANT BIODIVERSITY PRACTICAL

Course Code	**BOT103**
Course Title	**Plant Biodiversity Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective (CO)	To make students aware about biodiversity among different groups of plants, characteristic features of each group and to give preliminary knowledge of microbes
Course Outcomes (CO)	CO1. Student will know about the structure of irus and bacteriophages CO2 Student will aware about the structure and life cycles of Algae, fungi by preparing temporary and permanent slides CO2 Student will learn about the various forms of Lichens by watching the specimens and live samples CO3 Student will learn about the morphological structure, anatomy and reproductive structure of Byryophytes, Ptridophytes and Gymnosperms by watching the specimes of organism, live or preserved and by section cutting and experiencing the anatomical structure in microscope.

LIST OF EXPERIMENTS

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium, Vaucheria, Fucus* and Polysiphonia*through temporary preparations and permanent slides. (* *Fucus*- Specimen and permanent slides)
5. *Rhizopus and Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. *Alternaria:* Specimens; photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
11. ***Marchantia***- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).

12. ***Funaria***- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema. ***Selaginella***- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
13. ***Equisetum***- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s rhizome (permanent slide).
14. ***Pteris***- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
15. ***Cycas***- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
16. ***Pinus***- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, ,l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s.&r.l.s. stem (permanent slide).

Text and Reference Books:

Sr No.	**Book Title**	**Author**	**Publisher**
1	Diversity of Microbes and Cryptogams	H.N.Srivastava	Pradeep Publisher
2	Text Book of Thallophytes	O.P.Sharma	Tata McGraw Hill
3	Text Book of Pteridophyta	O.P.Sharma	McMillan India Ltd
4	The Fungi	P.D. Sharma	Rastogi Publisher
5	Cryptogamic Botany, Vol. II, Bryophytes & Pteridophytes	G.M Smith	Tata McGraw Hill
6	Biology	P H Raven, G B Johnson, SIR R Singer	Tata McGraw Hill
7	Gymnosperms	SP Bhatnagar and A Moitra	S Chand

ANIMAL BIODIVERSITY PRACTICAL

Course Code	**ZOO103**
Course Title	**Animal Biodiversity Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	Classification up to orders and study of the specimens mentioned against each phylum with ecological note
Course Outcomes (CO)	1.AbletoScomparing and contrasting structural features in members of different animal ph yla. 2. Demonstrate skills in library and field research, data and information gathering, collation and organisation suitable for the preparation of a scientific report.

LIST OF SUGGESTED LAB EXERCISES:

1. Study of the following specimens:
Amoeba, Euglena, Plasmodium, Paramecium, Sycon, Hyalonema, and *Euplectella, Obelia, Physalia, Aurelia, Tubipora, Metridium, Taenia solium,* Male and female *Ascaris lumbricoides, Aphrodite, Nereis, Pheretima, Hirudinaria, Palaemon, Cancer, Limulus, Palamnaeus, Scolopendra, Julus, Periplaneta, Apis, Chiton, Dentalium, Pila, Unio, Loligo, Sepia, Octopus, Pentaceros, Ophiura, Echinus, Cucumaria*and*Antedon, Balanoglossus, Herdmania, Branchiostoma, Petromyzon, Sphyrna, Pristis, Torpedo, Labeo, Exocoetus, Anguilla, Ichthyophis/Ureotyphlus, Salamandra, Bufo, Hyla, Chelone, Hemidactylus, Chamaeleon, Draco, Vipera, Naja, Crocodylus, Gavialis,* Any six common birds from different orders, *Sorex*, Bat, *Funambulus, Loris*

2. Study of the following permanent slides:
T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*

3. Key for Identification of poisonous and non-poisonous snakes

An "**animal album**" containing photographs, cut outs, with appropriate write up about the above mentioned taxa. Different taxa/ topics may be given to different sets of students for this purpose.

Text and Reference Books:

S. No.	Title	Author(s)	Publisher
1	Invertebrate Zoology	P.S. Dhami	R Chand and Company
2	Cell Biology	V K Aggarwal	S.Chand Publishing
3	A Text Book of Invertebrate Zoology	Gurcharn Singh	Campus Books International
4	Cell Biology	C B Pawar	Himalaya Publishing House

IInd SEMESTER

PLANT ECOLOGY AND TAXONOMY

Course Code	**BOT102**
Course Title	**Plant Ecology and Taxonomy**
Type of course	Theory
L T P	4 0 0
Credits	2
Course prerequisite	10+2 Medical
Course Objective (CO)	To make student understand basics of ecosystem, its working and components also diversity in angiosperm families.
Course Outcomes (CO)	CO1. Students will understand the basics of ecology with its ineraction of biotic and abiotic components. CO2. Understand the energy flow, trophic system and biogeochemical cycle operating in the ecosystems CO3. learn about the plant taxonomy, identification keys, herbarium and its function CO4. Learn about the various principle and rules of ICN, Binomial systems classification of angiosperms and few important families of the plants

UNIT-I

Introduction to Ecology: History of Ecology; Basic concepts in Ecology; Subdivisions of Ecology; Terminology related to Ecology; Scope of Ecology

Ecological factors: Soil: Origin, formation, composition, soil profile. Water: States of water in the environment, precipitation types. Light and temperature: Variation Optimal and limiting factors; Shelford lawof tolerance. Adaptation of hydrophytes and xerophytes.

Plant communities: Characters; Ecotone and edge effect; Succession; Processes and types.

UNIT-II

Ecosystem: Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramidsproduction and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen andphosphorous.

Phytogeography: Principle biogeographical zones; Endemism

UNIT-III

Introduction to plant taxonomy: Identification, Classification, Nomenclature. Identification Functions of Herbarium, important herbaria and botanical gardens of the world and India, Documentation: Flora, Keys: single access and multi-access, Taxonomic evidences from palynology, cytology, phytochemistry and moleculardata

Taxonomic hierarchy: Ranks, categories and taxonomic groups

UNIT-IV

Botanical nomenclature: Principles and rules (ICN); ranks and names; binominal system, typification, author citation, valid publication, rejection of names, principle of priority and its limitations.

Classification: Types of classification-artificial, natural and phylogenetic. Bentham and Hooker (upto series), Engler and Prantl (upto series).
Biometrics, numerical taxonomy and cladistics: Characters; variations; OTUs, character weighting and coding; cluster analysis; phenograms, cladograms (definitions and differences).

General characters Angiosperms: Important angiosperm families- habit, habitat, characters, important plants, economic importance. (Brassicaceae, Malvaceae, Fabaceae, RosaceaeUmbelliferae, Rutaceae, Asteraceae, Asclepiadaceae, Solanaceae, Euphorbiaceae, Lamiaceae, Liliaceae, Gramineae)

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Concepts of Ecology	Kormondy, E.J	Prentice Hall, U.S.A. 4th edition.
2	Ecology and Environment	Sharma, P.D	Rastogi Publications, Meerut, India. 8thed
3	Plant Systematics	Simpson, M.G.	Academic Press, San Diego, CA, U.S.A.
4	Plant Systematics: Theory and Practice.	Singh, G.	Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
5	An Introduction to Plant Taxonomy	Jeffrey, C.	Cambridge University Press, London
6	Fundamental of Plant Systematics	Radford, A.E.,	Harper and Row, New York
7	Principles of Angiosperm Taxonomy	Davis, P.H. and Heywood, V.H	Oliver and Boyd, London.

Chemical Energetic, Equilibrium and Functional Group Organic chemistry – I

Course Code	**CHM 102**
Course Title	**Chemical Energetic, Equilibrium and Functional Group Organic chemistry – I**
Type of course	CORE (Theory)
L T P	4:0:0
Credits	4
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of the subject is to enhance the knowledge of students regarding Physical concepts of chemistry like Chemical Energetic, Chemical Equilibrium. General organic chemistry of aromatic systems and functional groups.
Course outcome	**By the end of the course, students will be able to:** CO1 Acquire the knowledge of thermodynamic property of any system, Chemical & Ionic equilibria of various systems. CO2 Apply the concepts of concept of ionization of electrolytes with emphasis on weak acid and base and hydrolysis of salt, pH and electrolytes. CO3 Understand preparation, properties and reactions of haloalkanes, haloarenes and oxygen containing functional groups. CO4 Use the synthetic chemistry for functional group transformations & to propose plausible mechanisms for any relevant reaction.

Unit-I

Chemical Energetics: Review of thermodynamics and the Laws of Thermodynamics. Important principles and definitions of thermo-chemistry. Concept of standard state and standard enthalpies of formations, integral and differential enthalpies of solution and dilution. Calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data. Variation of enthalpy of a reaction with temperature – Kirchhoff's equation. Statement of Third Law of thermodynamics and calculation of absolute entropies of substances.

Unit-II

Chemical Equilibrium: Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between G and G^o, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.

Ionic Equilibria: Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, common ion effect. Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions.

Unit-III

Aromatic hydrocarbons Preparation (Case benzene): from phenol, by decarboxylation, from acetylene, from benzene sulphonic acid. Reactions: (Case benzene): Electrophilic substitution:

nitration, halogenation and sulphonation. Friedel-Craft's reaction (alkylation and acylation) (upto 4 carbons on benzene). Side chain oxidation of alkyl benzenes (upto 4 carbons on benzene).

Alkyl and Aryl Halides, Alkyl Halides (Upto 5 Carbons) Types of Nucleophilic Substitution (SN1, SN2 and SNi) reactions Preparation: from alkenes and alcohols. Reactions: hydrolysis, nitrite & nitro formation, nitrile & isonitrile formation. Williamson's ether synthesis: Elimination vs substitution.

Aryl Halides Preparation: (Chloro, bromo and iodo-benzene case): from phenol, Sandmeyer & Gattermann reactions. Reactions (Chlorobenzene): Aromatic nucleophilic substitution (replacement by –OH group) and effect of nitro substituent. Benzyne Mechanism: KNH_2/NH_3 (or $NaNH_2/NH_3$).Reactivity and Relative strength of C-Halogen bond in alkyl, allyl, benzyl, vinyl and aryl halides.

Unit-IV

Alcohols, Phenols and Ethers (Up to 5 Carbons)

Alcohols: Preparation: Preparation of 1º, 2º and 3º alcohols: using Grignard reagent,Ester hydrolysis, Reduction of aldehydes, ketones, carboxylic acid and esters. Reactions: With sodium, HX (Lucas test), esterification, oxidation (with PCC, alk.$KMnO_4$, acidic dichromate, conc. HNO_3). Oppeneauer oxidation Diols: (Upto 6 Carbons) oxidation of diols. Pinacol-Pinacolone rearrangement.

Phenols: (Phenol case) Preparation: Cumene hydroperoxide method, from diazonium salts. Reactions: Electrophilic substitution: Nitration, halogenation and sulphonation. Reimer-Tiemann Reaction, Gattermann-Koch Reaction, Houben–Hoesch Condensation, Schotten–Baumann Reaction.

Ethers (aliphatic and aromatic): Cleavage of ethers with HI.

Aldehydes and ketones (aliphatic and aromatic): (Formaldehyde, acetaldehyde, acetone and benzaldehyde)Preparation: from acid chlorides and from nitriles. Reactions – Reaction with HCN, ROH, NaHSO3, NH2-G derivatives. Iodoform test. Aldol Condensation, Cannizzaro's reaction, Wittig reaction, Benzoin condensation. Clemensen reduction and Wolff Kishner reduction. Meerwein-Pondorff Verley reduction.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Organic reaction mechanism, 3rd ed. Latest edition	V. K. Ahluwalia	Narosa publishing house, New Dehli
2	Organic Chemistry	Morrison and Boyd	Prentice Hall
3	Fundamentals of Organic Chemistry	Solomons	John Wiley
4	The Elements of Physical Chemistry	P.w.Aikins	Oxford
5	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

Course Code	**ZOO102**
Course Title	**Comparative Anatomy and Developmental Biology of Vertebrates**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	To enable the students to draw a comparative account of the morphology, general anatomy and physiology of the vertebrates
Course Outcomes (CO)	1.Figure out how to utilize the near strategy to examine and basically assess the structure and capacity of vertebrate frameworks. This data will empower you look at the developmental history of vertebrate species and evaluate the practical importance of morphological adjustments. 2.Compare and contrast the fertilization process in mammals and plants.

UNIT-I

Integumentary System: Derivatives of integument w.r.t. glands and digital tips

Digestive System: Brief account of alimentary canal and digestive glands

Respiratory System: Brief account of Gills, lungs, air sacs and swim bladder

Circulatory System: Evolution of heart

UNIT-II

Nervous System: Comparative account of brain

Sense Organs: Types of receptors

Urinogenital System: Succession of kidney, Evolution of urinogenital ducts

UNIT-III

Early Embryonic Development: Gametogenesis: Spermatogenesis and oogenesis w.r.t. mammals, vitellogenesis in birds; Fertilization: external (amphibians), internal (mammals), blocks to polyspermy; Early development of frog and humans (structure of mature egg and its membranes, patterns of cleavage, fate map, up to formation of gastrula);types of morphogenetic movements; Fate of germ layers; Neurulation in frog embryo.

UNIT-IV

Late Embryonic Development: Implantation of embryo in humans, Formation of human placenta and functions, other types of placenta on the basis of histology; Metamorphic events in frog life cycle and its hormonal regulation.

Control of Development: Fundamental processes in development (brief idea) – Gene activation, determination, induction, Differentiation, morphogenesis, intercellular communication, cell movements and cell death.

Text and Reference Books:

Sr No.	Title	Author(s)	Publisher
1	Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition.	K.V Kardong	McGraw-Hill
2	Comparative Anatomy of the Vertebrates. IX Edition	G.C. Kent and R.K Carr	McGraw-Hill
3	Analysis of Vertebrate Structure	M. Hilderbrand and G.E. Gaslow	John Wiley and Sons
4	Biology of Vertebrates	H.E. Walter and L.P. Sayles	Khosla Publishing House

GENERAL ENGLISH-II

Course Code	**ENG102**
Course Title	**General English-II**
Type Course	Theory
L T P	3 0 0
Credits	3
Course Pre-requisite	**10+2**
Course Objective (CO)	To develop understanding of the significance of English as a subject in the present context, to feel pleasure and to develop the understanding of the significance of basic competencies in language acquisition. This course will enable students to understand the foreign language as well as the use of language and to enable students to acquire language skills such as listening, speaking, reading, and writing and integrate them for communicative purposes.
Course Outcomes (CO)	1.Students will improve their speaking ability in English both in terms of fluency and comprehensibility. 2.Students will increase their reading speed and comprehension of academic articles.

1. Tales of Life
    a. The Doll's House (Katherine Mansfield)
    b. Eveline (James Joyce)
    c. Toba Tek Singh (Saadat Hassan Manto)
    d. The Taboo (Victor Astafyev)
    e. A Strand of Cotton (Suneet Chopra)
2. Prose for Young Learners
    a. Beauty And The Beast(R.K. Narayan)
    b. With A Song on Their Lips (Hugh & Colleen Gantzer)
    c. My Financial Careers (Stephen Leacock)
    d. The School For Sympathy (E.V. Lucas)
    e. AIDS (U.N.Report)

3. Exploring Grammar
    a. Modals
    b. Passive
    c. Reported Speech
    d. Questions and Auxiliary verbs

Text and Reference Books:

S.No.	Author(S)	Year	Title	Publisher
1	Singh, S	2008	Tales of Life	Press and Publication Department, Guru Nanak Dev University, Amritsar.
2	Tewari, A. K, Midha,V.K, Sharma, R.K	2011	Prose For Young Learners	Publication Bureau, Guru Nanak Dev University, Amritsar
3	Murphy, R	2015	English Grammar in Use	Cambridge University Press

GENERAL PUNJABI-II

Course Code	**PBI102**
Course Title	**General Punjabi-II**
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	10+2
Course Objective	1. ividAwrQIAwDuinkpMjwbIkhwxIkwrWdIjIvnIqoNjwxUhoxgy[2. ividAwrQIAWnUMAwDuinkpMjwbIkhwxIdIivSYgqjwxkwrI ho jwvygI[3. ividAwrQIAWiv`cryKwic`qrWdwAlocnwqmkAiDAYnkrndwhunra uqpMnhovygw[4. ividAwrQImuhwvry, AKwxWdIFu`kvINvrqoNkrnWis`Kjwxgy

iekweI- a

1. **pMjwbIin`kIkhwxI:** BUAw (nwnkisMG), bwZIdI DI (gurmuKisMGmuswi&r), pymIdyinAwxy(sMqisMGsyKoN), bwgWdwrwKw(sujwnisMG), qYNkIdrdnwAwieAw(krqwrisMGdu`gl), DrqIhyTlwbOlD(kulvMqisMGivrk), dUjIvwrjybk`tIgeI(nvqyjisMG), lCmI(pRympRkwS), bu`qiSkn(AjIqkOr), b`s kMfktr(dlIpkOritvwxw)[
2. **pMjwbdymhwnklwkwr (lyK):**sqISgujrwl, gurcrnisMG, TwkurisMG,blrwjswhnI, suirMdrkOr[

iekweI- A

1. SbdbxqrAqySbdrcnw: pirBwSwAqymu`FlysMklp
2. (a) pYrHwrcnw, muhwvryAqyAKwx[
   (A) pYrHwpVHkypRSnWdyau~qrdyxw[

pusqksUcI

pwT- pusqkW

LyKk	Swl	Pusqk	pbilSr
sMpwdk, iF`loN; h.s.AqysrgoDIAw, p.s+.	2014	do rMg	pblIkySnibaUro, gurUunwnkdyvXUnIvristI, AMimRqsr
gwrgI, b.	1995	pMjwbdymhwnklwkwr	pblIkySnibaUro, gurUunwnkdyvXUnIvristI, AMimRqsr

sMbMiDqpusqkW

LyKk	Swl	Psqk	pbilSr
isMG, h.	1966	pMjwbIbwry	pMjwbIXUnIvristI, pitAwlw
isMG, q.	2014	pMjwbIAiDAwpn	AY~s. jI. pbilSrz,

			jlMDr
syKoN, s.s.Aqy syKoN, m.k.	2015	pMjwbIBwSwdwAiDAwpn	kilAwxIpbilSrz, luiDAwxw

HISTORY AND CULTURE OF PUNJAB –II

Course ode	**HCP102**
Course title	**History And Culture Of Punjab –II**
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	Students who have not studied Punjabi in $10/12^{th}$ class
Course objectives (CO)	1. The Student will acquire the knowledge Of Mauryan Empire. 2. The Student will understand the impact of Buddhism & Jainism on Punjab. 3. To aware the learners Depiction of Punjab in the accounts of Chinese travelers.

UNIT-I

The Mauryan Empire: Social, Economic and Religious life, Buddhism and Jainism: Impact on Punjab with special reference to 4th Buddhist Council., The Kushanas: Impact of Kanishka's rule on Punjab.

UNIT-II

Gandhara School of Art: Salient features, The Guptas: Cultural and Scientific Developments.
Position of Women: Under the Mauryas, the Guptas and the Vardhanas.

UNIT-III

Depiction of Punjab in the accounts of Chinese travelers. Fahien and Hwen Tsang. Main developments in literature, Education: Significant Developments: Taxila.

UNIT IV

Society and Culture on the eve of the Turkish invasion of Punjab,Punjab in the Kitab-ul-Hind of Alberuni,Important Historical places: Lahore, Multan Bathinda, Uchh, Jalandhar, Thanesar, Kangra, Taxila, Kundalvana, Pehowa, Thatta.

Text and References Books:

S.NO.	Author's	Title	Publisher
1	Sukhdev Sharma	History And Culture Of Punjab	New Academic Publisher
2	Romila Thapar	A History of India, Vol. I	Penguin Books
3	L.M.Joshi	History and Culture of the Punjab, Vol. I	Punjabi University, Patiala

PLANT ECOLOGY AND TAXONOMY PRACTICAL

Course Code	**BOT104**
Course Title	**Plant Ecology and Taxonomy Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective (CO)	To give practical knowledge about Ecosystem components and floral description of important angiosperm families.
Course Outcomes (CO)	CO1. Aquantence of principle and use various instruments used in the study of the ecology CO2. Learn about the analysis of various physic chemical parameters of soil CO2. Learn about the morphological adaptaion of some special plants in different habitat CO4. Learn about the quantitative analysis of plant species diversity by using quadrat methods CO5. Learn about the classification of angiosperms and some families by observing the common members available for the experiment

LIST OF EXPERIMENTS

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (b)Study of biotic interactions of the following: Stem parasite (*Cuscuta)*, Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):

Brassicaceae –*Brassica/Alyssum / Iberis*
Asteraceae –*Tageteserecta/Ageratum conyzoides*
Solanaceae –*Solanum tuberosum, Withania*
Fabaceae-*Pisum sativum/Cassia fistula/Acacia nilotica*
Lamiaceae -*Salvia, Ocimum*
Liliaceae - *Asphodelus / Lilium / Allium.*
Gramineae-*Triticum*
Rosaceae-*Rosa indica*

Malvaceae-*Hibiscus Rosa sinensis*
Umbelliferae- *Coriandrum*
Asclepiadaceae- *Calotropis*
Euphorbiaceae- *Euphorbia*
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Concepts of Ecology	Kormondy, E.J	Prentice Hall, U.S.A. 4th edition.
2	Ecology and Environment	Sharma, P.D	Rastogi Publications, Meerut, India. 8thed
3	*Plant Systematics*	Simpson, M.G.	Academic Press, San Diego, CA, U.S.A.
4	*Plant Systematics:* Theory and Practice.	Singh, G.	Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
5	An Introduction to Plant Taxonomy	Jeffrey, C.	Cambridge University Press, London
6	Fundamental of Plant Systematics	Radford, A.E.,	Harper and Row, New York
7	Principles of Angiosperm Taxonomy	Davis, P.H. and Heywood, V.H	Oliver and Boyd, London.

Chemical energetic, Chemical Equilibrium and Functional Group organic chemistry

Course Code	**CHM 104**
Course Title	**Chemical energetic, Chemical Equilibrium and Functional Group organic chemistry-I**
Type of course	Core (Practical)
L T P	0:0:4
Credits	2
Course prerequisite	10+2 with chemistry as core subject
Course Objective	The aim of this course is to provide practical knowledge about the preparation of organic compounds, Thermo-chemistry and Ionic equilibrium.
Course outcome	**By the end of the course, students will be able to:** CO1 Acquire basic concepts of thermochemistry,Analyse thermodynamic parameters of solutions and salt mixtures. CO2 Find out the acidity, Basicity and pKa Value on pH meter. CO3 Accurately evaluate separation, purifications techniques, of organic compounds.

Section A: Physical Chemistry

Thermochemistry

1. Determination of heat capacity of calorimeter for different volumes.
2. Determination of enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
3. Determination of enthalpy of ionization of acetic acid.
4. Determination of integral enthalpy of solution of salts (KNO_3, NH_4Cl).
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH.

Ionic equilibria

1. Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps using pH-meter.
2. Preparation of buffer solutions: Sodium acetate-acetic acid; Ammonium chloride-ammonium hydroxide
3. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

Section B: Organic Chemistry

1. Purification of organic compounds by crystallization (from water and alcohol) and distillation.
2. Criteria of Purity: Determination of melting and boiling points.
3. Preparations: Mechanism of various reactions involved to be discussed. Recrystallisation, determination of melting point and calculation of quantitative yields to be done.
   Bromination of Phenol/Aniline ; Benzoylation of amines/phenols
   Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone; Acetylation of amines/phenols

*<u>*Perform any four experiments from each section</u>*

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.
2	Experimental Physical Chemistry	C. Das, B. Behera	Tata McGraw Hill Publishing Company

COMPARATIVE ANATOMY AND
DEVELOPMENTAL BIOLOGY OF VERTEBRATES PRACTICAL

Course Code	**ZOO104**
Course Title	**Comparative anatomy and developmental biology of vertebrates practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	Study of skeletons of different vertebrates, different types of developmental stages of frog and reproductive organs of mammals.
Course Outcomes (CO)	1. Figure out how to utilize the similar technique to break down and fundamentally assess the structure and capacity of vertebrate frameworks. 2.Build up the abilities important to extensively evaluate the huge decent variety of vertebrates, both living and wiped out, and to thinkcritically about the proposed connections between gatherings..

LIST OF EXPERIMENTS

1. **Osteology**:
    a) Disarticulated skeleton of fowl and rabbit
    b) Carapace and plastron of turtle /tortoise
    c) Mammalian skulls: One herbivorous and one carnivorous animal.
2. Study of developmental stages of frogs, metamorphosis from tadpole to adult though permanent slides.
3. **Study of the different types of placenta-**
    Histological sections through permanent slides or photomicrographs.
4. Study of placental development in humans by ultrasound scans.
5. **Examination of gametes - frog/rat**
    Sperm and ova through permanent slides or photomicrographs.

Study of histological section of testis and ovary through permanent slides.

Text and Reference Books:

Sr No.	Title	Author(s)	Publisher
1	Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition.	K.V Kardong	McGraw-Hill
2	Comparative Anatomy of the Vertebrates. IX Edition	G.C. Kent and R.K Carr	McGraw-Hill
3	Analysis of Vertebrate Structure	M. Hilderbrand and G.E. Gaslow	John Wiley and Sons
4	Biology of Vertebrates	H.E. Walter and L.P. Sayles	Khosla Publishing House

IIIrd SEMESTER

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Course Code	**BOT201**
Course Title	**Anatomy and Embryology of Angiosperms**
Type of course	Theory
L T P	4 0 0
Credits	4
Course Objective	i. To study basic body plan of flowering plant, various tissue systems in higher plants, their structure, development and function. ii. To study structure, development and function of reproductive structures in flowering plants.
Course Outcomes (CO)	CO1. Learn about the basic body and its parts of flowering plants CO2. Learn about the shoot and root apical meristem, cambium and secondary growth and its significance in the plant development. CO3. Learn about the diversity of plants and leaf origin and development CO4. Learn about the various methods of propagation of plant and development of flower and fruits

UNIT-I

The basic body plan of a flowering plant-modular type of growth.

The Shoot System: The shoot apical meristem and its histological organization; meristematic and permanent tissue, formation of internodes, branching pattern; monopodial and sympodial growth; canopy architecture; cambium and its functions; formation of secondary xylem; a general account of wood structure in relation to conduction of water and minerals; characteristics of growth rings, sapwood and heart wood; role of woody skeleton; secondary phloem-structurefunction relationships; periderm.

UNIT-II

Diversity in plant form in annuals, biennials and perennials; trees-largest and longest-lived.

Leaf: Origin, development, arrangement and diversity in size and shape; internal structure in relation to photosynthesis and water loss; adaptations to water stress; senescence and abscission.

UNIT-III

The Root System: The root apical meristem; differentiation of primary and secondary tissues
and their roles; structural modification for storage, respiration, reproduction and for interaction with microbes.

Vegetative Reproduction: Various methods of vegetative propagation. Detailed study and types of grafting and budding, economic aspects.

UNIT-IV

Flower: A modified shoot; structure, development and varieties of flower; functions; structure of anther and pistil; the male and female gametophytes; types of pollination; attractions and reward for pollinators; (sucking and foraging types); pollen-pistil interaction self incompatibility; double fertilization: formation of seed endosperm and embryo: fruit development and maturation.

Significance of Seed: Suspended animation; ecological adaptation; unit of genetic recombination with reference to reshuffling of genes and replenishment; dispersal strategies.

Text and reference books:

Sr No.	Title	Author	Publisher
1	The Embryology of Angiosperms	S SBhojwani and S P Bhatnagar	Vikas Publishing House, Delhi
2	Plant Propagation: Principles and Practices	H E Hartman and D E Kestler	Prentice Hall of India Pvt. Ltd., New Delhi
3	Plant Anatomy	J D Mauseth	Benjamin/Cummings Publishing Company Inc., California, USA
4	Anatomy of Seed Plants	K Peau	John Wiley & Sons, New York

Solutions, Phase Equilibrium, conductance, electrochemistry and functional group organic chemistry-II

Course Code	**CHM 201**
Course Title	**Solutions, Phase Equilibrium, conductance, electrochemistry and functional group organic chemistry-II**
Type of course	Core (Theory)
L T P	4:0:0
Credits	4
Course prerequisite	B.Sc. 1^{st} with chemistry as core subject
Course Objective	The aim of this course is to impart knowledge to the students about basic of solution chemistry, phase equilibia, Electrochemistry and organic chemistry and natural polymers.
Course outcome	**By the end of the course, students will be able to:** CO1 Acquire coherent knowledge of solutions, phase equilibrium and conductance CO2 Learn the working of electrochemical cells, EMF & pH determination. CO3 Understand structure and bonding in carboxylic acids and amine derivatives &Use the synthetic chemistry for functional group transformations. CO4 Identify & Analyse structural components, configuration of amino acids, proteins and Carbohydrates

Unit-I

Solutions: Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes.

Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications

Phase Equilibrium: Phases, components and degrees of freedom of a system, criteria of phase equilibrium. Gibbs Phase Rule and its thermodynamic derivation. Derivation of Clausius – Clapeyron equation and its importance in phase equilibria. Phase diagrams of one-component systems (water and sulphur) and two component systems involving eutectics, congruent and incongruent melting points (lead-silver, $FeCl_3$-H2O and Na-K only).

Unit-II

Conductance: Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte, solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt.

Electrochemistry: Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data. pH determination using hydrogen electrode and quinhydrone electrode.

Unit-III

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. Carboxylic acids and their derivatives

Carboxylic acids (aliphatic and aromatic) Preparation: Acidic and Alkaline hydrolysis of esters. Reactions: Hell – Vohlard - Zelinsky Reaction.

Carboxylic acid derivatives (aliphatic): (Upto 5 carbons) Preparation: Acid chlorides, Anhydrides, Esters and Amides from acids and their interconversion. Reactions: Comparative study of nucleophilicity of acyl derivatives. Reformatsky Reaction, Perkin condensation.

Amines and Diazonium Salts Amines (Aliphatic and Aromatic): (Upto 5 carbons)Preparation : from alkyl halides, Gabriel's Phthalimide synthesis, Hofmann Bromamide reaction. Reactions: Hofmann vs. Saytzeff elimination, Carbylamine test, Hinsberg test, with HNO_2, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation.

Unit-IV

Amino Acids, Peptides and Proteins: Preparation of Amino Acids: Strecker synthesis using Gabriel's phthalimide synthesis. Zwitterion, Isoelectric point and Electrophoresis Reactions of Amino acids: ester of –COOH group, acetylation of –NH2 group, complexation with Cu^{2+} ions, ninhydrin test.

Overview of Primary, Secondary, Tertiary and Quaternary Structure of proteins. Determination of Primary structure of Peptides by degradation Edmann degradation (N-terminal) and C–terminal (thiohydantoin and with carboxypeptidase enzyme).

Carbohydrates: Classification, and General Properties, Glucose and Fructose (openchain and cyclic structure), Determination of configuration of monosaccharides, absolute configuration of Glucose and Fructose, Mutarotation, ascending and descending in mono-saccharides.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Natural Products: Chemistry and Biological Significance,	Mann, J.; Davidson, R.S.; Hobbs, J.B.; Banthrope, D.V.; Harborne, J.B.	Longman, Esse
2	Organic reaction mechanism, 3rd ed. Latest edition	V. K. Ahluwalia	Narosa publishing house, New Dehli
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	The Elements of Physical Chemistry	P.w.Aikins	Oxford
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd
7	Physical Electrochemistry-Fundamentals, Techniques and Applications	Eliezer Gileadi,	Wiley-VCH

ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

Course Code	**ZOO-201**
Type of course	CORE
L T P	4:0:0
Credits	4
Course prerequisite	BSc. 1st with chemistry as core subject
Course Objective	The aim of this course is to impart knowledge to the students about basic idea of the biological processes in the body and cellular respiration.
Course Outcomes (CO)	1.Understand the deep concepts of assimilation, breath, excretion the functioning of nervous system 2. Interactions and interdependence of physiological and biochemical processes

UNIT-I

Nerve and muscle: Structure of a neuron, Resting membrane potential, Graded potential, Origin of Action potential and its propagation in myelinated and non-myelinated nerve fibres, Ultra-structure of skeletal muscle, Molecular and chemical basis of muscle contraction

UNIT-II

Digestion: Physiology of digestion in the alimentary canal; Absorption of carbohydrates, proteins, lipids

Respiration: Pulmonary ventilation, Respiratory volumes and capacities, Transport of Oxygen and carbon dioxide in blood

Excretion: Structure of nephron, Mechanism of Urine formation, Counter-current Mechanism

Cardiovascular system: Composition of blood, Hemostasis, Structure of Heart, Origin and conduction of the cardiac impulse, Cardiac cycle

UNIT-III

Reproduction and Endocrine Glands : Physiology of male reproduction: hormonal control of spermatogenesis; Physiology of female reproduction: hormonal control of menstrual cycle. Structure and function of pituitary, thyroid, Parathyroid, pancreas and adrenal

UNIT –IV

Carbohydrate Metabolism: Glycolysis, Krebs Cycle, Pentose phosphate pathway, Gluconeogenesis, Glycogen metabolism, Review of electron transport chain

Protein metabolism: Transamination, Deamination and Urea Cycle

Enzymes: Introduction, Mechanism of action, Enzyme Kinetics, Inhibition and Regulation

Text and reference books:

S.No	Title	Author	Publisher
1	Principles of Anatomy and Physiology 8th edition	Tortora, G.J. and Derrickson, B.H.	John Wiley & Sons
2	Vander's Human	Widmaier, E.P., Raff, H. and	McGraw Hill

	Physiology, 11^{th} edition	Strang, K.T.	
3	Textbook of Medical Physiology, 12^{th} edition	Guyton, A.C. and Hall, J.E	Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
4	Biochemistry, 6^{th} edition	Berg, J. M., Tymoczko, J. L. and Stryer, L	W.H Freeman and Co.
5	Principles of Biochemistry, 6^{th} edition	Nelson, D. L., Cox, M. M. and Lehninger, A.L	W.H. Freeman and Co.

ENVIRONMENTAL SCIENCE

Course Code	EVS 001
Course Title	Environmental Science
Type of course	Theory
L T P	3 0 0
Credits	2
Course prerequisite	NA
Course Objective (CO)	To make students aware about environment and need of maintaining it with best possible knowledge.
Course Outcomes (CO)	The student will able to: CO1. Understand the importance of environment in their life. CO2. Learn about the concept of Ecosystem. CO3. Understand the relation between social issues and environment. CO4. Learn how human beings are affected with the pollution.

UNIT-I

Introduction to Environment and Ecosystem: Definition and scope and importance of multidisciplinary nature of environment. Need for public awareness, Concept of Ecosystem, Structure, interrelationship, producers, Consumers and decomposers, ecological pyramids-biodiversity and importance. Hot spots of biodiversity.

UNIT-II

Environmental Pollution & Natural Resources: Definition, Causes, effects and control measures of air pollution, Water pollution, Soil pollution, Marine pollution, Noise pollution, Thermal pollution, Nuclear hazards. Solid waste Management: Causes, effects and control measure of urban and industrial wastes.Role of an individual in prevention of pollution. Pollution case studies.Disaster Management: Floods, earthquake, cyclone and landslides, Natural Resources and associated problems, use and over exploitation, case studies of forest mresources and water resources.

UNIT-III

Social Issues and the Environment :From Unsustainable to Sustainable development, Urban problems related to energy, Water conservation, rain water harvesting, watershed management. Resettlement and rehabilitation of people; its problems and concerns. Case studies. Environmental ethics: Issues and possible solutions. Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies. Wasteland reclamation.Consumerism and waste products. Environment Protection Act. Air (Prevention and Control of Pollution) Act. Water (Prevention and control of pollution) Act. Wildlife Protection Act, Forest Conservation Act, Issues involved in enforcement of environmental legislation

UNIT-IV

Human Population and the Environment & Field Work: Population growth, variation among nations. Population explosion –Family Welfare Programme. Environment and human health, Human Rights, Value Education, HIV/AIDS. Women and child Welfare. Role of Information Technology in Environment and human health. Case studies

Visit to a local area to document environemntalassetsriver/forest/grassland/hill/mountain;Visit to a local polluted site-Urban/Rural/Industrial/Agricultural;Study of common plants, insects, birds;Study of simple ecosystems-pond, river, hill slopes, etc.

Text and reference books:

S. No	Title	Author(S)	Publisher
1	A Textbook for Environmental Studies	ErachBharucha	
2	Environmental Biology,	Agarwal, K.C. 2001	Nidi Publ. Ltd. Bikaner.
3	Environmental Science,	Miller T.G. Jr.	Wadsworth

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS PRACTICAL

Course Code	**BOT203**
Course Title	**Anatomy and Embryology of Angiosperms Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course Objective	To study plant anatomy and embryology through slides and specimens.
Course Outcomes (CO)	1.Explain the significance of Photosynthesis and respiration 2.Assess dormancy and germination in plants 3.Qualitative and quantitative determination of amino acids

LIST OF EXPERIMENTS

1. Study of any commonly occurring dicotyledonous plant (for example Solanum nigrum or Kalanchoe) to the body plan, organography and modular type of growth.
2. Life forms exhibited by flowering plants (by a visit to a forest or a garden, Study of tree-like habit in cycads, bamboo, banana, traveller's tree (*Revenalamadagascariensis*) and yucca and comparison with true trees as exemplified by conifers and dicotyledons.
3. L.S. Shoot tip to study the cytohistological zonation and origion of leaf primordia.
4. Monopodial and sympodial types of branching in stems (especially rhizomes).
5. Anatomy of primary and secondary growth in monocots and dicots using free hand razor technique (Solanum, Boerhavia Helianthus, Mirabilis, Nyctanthus, Draceana, Maize) hand sections (or prepared slides). Structure of secondary phloem and xylem. Growth rings in wood, Microscopic study of wood in T.S., T.L.S. and R.L.S.
6. Field study of diversity in leaf shape, size, thickness, surface properties. Internal structure of leaf. Structure and development of stomata (using epidermal peels of leaf.
7. Anatomy of the root. Primary and secondary structure.
8. Examination of a wide range of flowers available in the locality and methods of their pollination.
9. Structure of anther, microsperogenesis (using slides) and pollen grains (using whole mounts). Pollen viability using in vitro pollen germination.
10. Structure of ovule and embryo sac development using serial sections) from permanent slides.
11. Nuclear and cellular endosperm. Embryo development in monocots and dicots (using permanent slides/dissections).
12. Simple experiments to show vegetative propagation (leaf cuttings in Bryophyllum. Sansevieria, Begonia; stem cuttings in rose, salix, money plant, Sugarcane and Bougainvillea).
13. Germination of non-dormant and dormant seeds.

Text and reference books:

Sr No.	Title	Author	Publisher
1	The Embryology of Angiosperms	S SBhojwani and S P Bhatnagar	Vikas Publishing House, Delhi
2	Plant Propagation:	H E Hartman and D E Kestler	Prentice Hall of India Pvt.

	Principles and Practices		Ltd., New Delhi
3	Plant Anatomy	J D Mauseth	Benjamin/Cummings Publishing Company Inc., California, USA
4	Anatomy of Seed Plants	K Peau	John Wiley & Sons, New York
5	The Principles of Pollination Biology	K Pegeri and Vander Pijl	Pergamon Press, Oxford
6	Biology of Plants	P H Raven, R F Evert and S E Eichhorn	W.H.Freeman and Co., New York.
7	Trees: Their Natural History	P Thomas	Cambridge University Press, Cambridge

Solutions , phase equilibrium, conductance, electrochemistry and functional organic chemistry-IIPRACTICAL

Course Code	**CHM 203**
Course Title	**Solutions , Phase equilibrium, Conductance, Electrochemistry and Functional Organic Chemistry-II (Practical)**
Type of course	Core (Practical)
L T P	0:0:4
Credits	2
Course prerequisite	B.Sc. 1st with chemistry as core subject
Course Objective	To provide practical knowledge about conductometry , potentiometry and qualitative organic analysis.
Course outcome	**By the end of the course, students will be able to:** CO1 demonstrate and calculate various parameters ofdistribution & phase equilibria CO2Calculate molar and normal solution of various concentrations. CO3 perform and evaluate outcomes of conductometric & potentiometric titrations. CO4 Study Qualitative Organic Analysis & biochemical analysis of amino acids & carbohydrates.

Section A: Physical Chemistry

Distribution:

1. Study of the equilibrium of one of the following reactions by the distribution method:
2. I2(aq) + I^-(aq) $I3^-$(aq)Cu^{2+}(aq) + xNH2(aq) $[Cu(NH3)x]^{2+}$
3. Distribution of acetic/ benzoic acid between water and chloroform or cyclohexane.
4. To find EMF of the cell. To calculate the Gibbs free energy change of the cell reaction.
5. To calculate the equilibrium constant.

Phase equilibria

1. Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.
2. Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.
3. Study of the variation of mutual solubility temperature with concentration for the phenol water system and determination of the critical solubility temperature.

Conductance

Determination of cell constant

1. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.
2. Perform the following conductometric titrations: Strong acid vs. strong base ; Weak acid vs. strong base

Potentiometry

1. Perform the following potentiometric titrations:
   Strong acid vs. strong base;
   Weak acid vs. strong base;

Potassium dichromate vs. Mohr's salt

Section B: Organic Chemistry

1. Systematic Qualitative Organic Analysis of Organic Compounds possessingmonofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.
2. Determination of the concentration of glycine solution by formylation method.
3. Titration curve of glycine
4. Action of salivary amylase on starch
5. Effect of temperature on the action of salivary amylase on starch.
6. Differentiation between a reducing and a non reducing sugar.
7. Organic and inorganic synthesis

**Perform any four experiments from each section*

Text and Reference Books

S. No	Name	Author(S)	Publisher
01	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
02	Laboratory Experiments on Organic Chemistry	R. Edemas, J.R. Johnson and C.F. Wilcox	The Macmillan Limited, London,
	Laboratory Manual in Organic Chemistry	R.K. Bansal,	Wiley Eastern
03	Experimental Physical Chemistry	C. Das, B. Behera	Tata McGraw Hill Publishing Company Limited.

ANIMAL PHYSIOLOGY AND BIOCHEMISTRY PRACTICAL

Course Code	**ZOO203**
Course Title	**Physiology and Biochemistry Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.ScIst year
Course Objective	To study plant anatomy and embryology through slides and specimens.
Course Outcomes (CO)	1.Knowledge in the fundamentals of biochemistry of all the biomolecules like the carbohydrates ,proteins,lipids,nucleic acids,their classification structure and metabolism. 2.Understudies will pick up ability to execute the jobs of a science educator or clinical lab specialists with preparing as they have essential things

LIST OF EXPERIMENTS

1. Preparation of hemin and hemochromogen crystals
2. Study of permanent histological sections of mammalian pituitary, thyroid, pancreas, adrenal gland.
3. Study of permanent slides of spinal cord, duodenum, liver, lung, kidney, bone, cartilage
4. Qualitative tests to identify functional groups of carbohydrates (Glucose, Fructose, Sucrose, Lactose), aminoacids and proteins and lipids in given sample.
5. Estimation of total carbohydrates by Dubois/anthrone method and total proteins by Lowry's method.
6. Study of activity of salivary amylase under optimum conditions.
7. Determination coagulation and bleeding time of blood in man/rat/rabbit.
8. Determination of blood groups of human blood sample.
9. Recording of blood pressure of man.
10. Analysis of urine for urea, chloride, glucose and uric acid.
11. Estimation of haemoglobin content.

Text and reference books:

S. No	**Title**	**Author**	**Publisher**
1	Principles of Anatomy and Physiology 8th edition	Tortora, G.J. and Derrickson, B.H.	John Wiley & Sons
2	Vander's Human Physiology,11th edition	Widmaier, E.P., Raff, H. and Strang, K.T.	McGraw Hill
3	Textbook of Medical Physiology, 12th edition	Guyton, A.C. and Hall, J.E	Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
4	Biochemistry, 6th edition	Berg, J. M., Tymoczko, J. L. and Stryer, L	W.H Freeman and Co.

IVth SEMESTER

PLANT PHYSIOLOGY AND METABOLISM

Course Code	**BOT202**
Course Title	**Plant Physiology and Metabolism**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	To study underlying mechanism of basic plant metabolic and physiological processes. To study concepts behind working of plant body.
Course Outcomes (CO)	Student will able to understand CO1. Plant water realrtion and mineral nutrition absorption process CO2. Translocation of sap and Photosynthesis process in different types of plants CO3. Carbohydrate and Nitrogen metabolism in Plants CO4. Enzymes and various phases of plant development such as seed dormancy, germination and plant movement CO5. Plant response to light and its effect in the devepopment of plants

UNIT-I

Plant-water relations: Importance of water, physical properties of water, imbibitions, diffusion and osmosis, absorption, transport of water, water potential and its components; Transpiration and its significance; Factors affecting transpiration; Root pressure and guttation.

Mineral nutrition: Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps, Hydroponics.

UNIT-II

Translocation in phloem: Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading andunloading.

Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reactioncenter, antenna molecules; z-scheme, photophosphorylation, Electron transport and mechanism of ATP synthesis; C3, C4 andCAM pathways of carbon fixation; Photorespiration.

UNIT-III

Carbohydrate metabolism: Carbohydrates- classification, occurrence, structure of mono, oligo and polysaccharides (starch, cellulose, pectin).Carbohydrate breakdown-Glycolysis, anaerobic respiration, TCA cycle; Oxidative phosphorylation, electron transport mechanism (chemi-osmotic theory), redox potential, Glyoxylate cycle,Oxidative Pentose Phosphate Pathway.

Nitrogen metabolism: Protein and amino acid structure features and functions. Biology of nitrogen fixation, importance of nitrate reductase and its regulation, ammonium assimilation, structure and function of lipids, fatty acid biosynthesis, β-oxidation, saturated and unsaturated fatty acids, storage and mobilization of fatty acids.

UNIT-IV

Enzymes: Structure and properties; Discovery and nomenclature, characteristics of enzymes, concept of holoenzyme, apoenzyme, coenzymes and cofactors regulation of enzyme activity. Mechanism of enzyme catalysis and enzyme inhibition.

Plant growth development: Definitions, phases of growth and development, kinetics of growth, seed dormancy, seed germination and factors of their regulation, plant movements, physiology of flowering, florigen concept, biological clocks, physiology of senescence, fruit ripening, Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene.

Plant response to light and temperature: Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), redand far red light responses on photomorphogenesis; Vernalization.

Text and reference books:

S. No.	Title	Author	Publisher
1	Plant Physiology	H N Srivastava	Pradeep Publishers
2	A Textbook of Plant Physiology, Biochemistry and Biotechnology	Dr S K Verma and Mohit Verma	S. Chand Publishing
3	Fundamentals of Plant Physiology	V K Jain	S. Chand Publishing
4	Plant Physiology	S N Pandey and B K Sinha	Vikas Publishing House
5	Biochemistry and Molecular biology of Plants	Bob B Buchanan, Wilhelm Grissem and Russell L Jones	Wiley International
6	Experiments in Plant Physiology- A Laboratory Manual.	D Bajracharya	Narosa Publishing House

Coordination chemistry, states of matter and chemical kinetics

Course Code	**CHM 202**
Course Title	**Transition Metal & Coordination Chemistry, States of Matter and Chemical Kinetics**
Type of course	CORE (Theory)
L T P	4:0:0
Credits	4
Course prerequisite	BSc. 1st with chemistry as core subject
Course Objective	The aim of this course is to impart knowledge to the students about basic of transition elements, their bonding, states of matter and chemical kinetics.
Course Outcome	**By the end of the course, the students will beable to:** CO1 Understand the terms, ligand, denticity of ligands, chelate, coordination number and use standard rules to name coordination compounds. CO2 Explain the meaning of the terms Δo., Δt, pairing energy, CFSE, high spin and low spin and magnetic properties and colour of complexes on basis of Crystal Field Theory CO3 Derive mathematical expressions for different properties of gas, liquid and solids and understand their physical significance. CO4 Have understanding of rate law and rate of reaction, theories of reaction rates and catalysts

Unit-I

Transition Elements (3d series):General group trends with special reference to electronic configuration, variable valency, colour, magnetic and catalytic properties, ability to form complexes and stability of various oxidation states (Latimer diagrams) for Mn, Fe and Cu.

Lanthanoids and actinoids: Electronic configurations, oxidation states, colour, magnetic properties, lanthanide contraction, separation of lanthanides (ion exchange method only).

Coordination Chemistry: Valence Bond Theory (VBT): Inner and outer orbital complexes of Cr, Fe, Co, Ni and Cu (coordination numbers 4 and 6). Structural and stereoisomerism in complexes with coordination numbers 4 and 6.Drawbacks of VBT. IUPAC system of nomenclature.

Unit-II

Crystal Field Theory: Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry. Factors affecting the magnitude of D. Spectrochemical series. Comparison of CFSE for *Oh* and *Td* complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Kinetic Theory of Gases: Postulates of Kinetic Theory of Gases and derivation of the kinetic gas equation. Deviation of real gases from ideal behaviour, compressibility factor, causes of deviation. van der Waals equation of state for real gases. Boyle temperature. Critical phenomena, critical constants and their calculation from van der Waals equation.

Unit-III

Maxwell Boltzmann distribution laws of molecular velocities and molecular energies (graphic representation – derivation not required) and their importance. Temperature dependence of these distributions. Most probable, average and root mean square velocities (no derivation). Collision cross section, collision number, collision frequency, collision diameter and mean free path of molecules. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity (qualitative treatment only).

Liquids: Surface tension and its determination using stalagmometer. Viscosity of a liquid and determination of coefficient of viscosity using Ostwald viscometer. Effect of temperature on surface tension and coefficient of viscosity of a liquid (qualitative treatment only).

Solids: Forms of solids. Symmetry elements, unit cells, crystal systems, Bravais lattice types and identification of lattice planes. Laws of Crystallography - Law of constancy of interfacial angles, Law of rational indices. Miller indices. X–Ray diffraction by crystals, Bragg's law. Structures of NaCl, KCl and CsCl (qualitative treatment only). Defects in crystals.

Unit-IV

Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction. Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half–life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation.

Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only).

Text and Reference Books

S. No	**Name**	**Author(S)**	**Publisher**
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Introduction to Ligand Field	B.N. Figgis	Wiley Eastern.
4	Introduction to Liquid State	P.A. Eglestaff	Academic Press.
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford
6	Physical Chemistry, A Molecular Approach	MacQuarrie and Simon	University Science Books,
7	Principles of Inorganic Chemistry	Puri, Sharma and Kalia	Vishal publishers

GENETICS AND EVOLUTIONARY BIOLOGY

Course Code	**ZOO 202**
Course Title	**Genetics and Evolutionary Biology**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.ScIst year
Course Objective (CO)	To make student aware about genetic material, chromosomes, their structure and function, basis of genetics/inheritance and changes occurring in animal species during various evolutionary eras.
Course Outcomes (CO)	1.Students will understand the concept of mendels laws in genetics, inheritance law and central dogma in biology. 2.Understanding of genetic basis of evolution, human karyotyping and speciation 3. Students learn the concepts of ductless gland or endocrine system and homeostasis a brief account of genes and evolution.

UNIT-I

Introduction to Genetics: Mendel's work on transmission of traits, Genetic Variation, Molecular basis of Genetic Information

Mendelian Genetics and its Extension: Principles of Inheritance, Chromosome theory of inheritance, Incomplete dominance and codominance, Multiple alleles, Lethal alleles, Epistasis, Pleiotropy, sex linked inheritance,extra-chromosomal inheritance

UNIT-II

Linkage, Crossing Over and Chromosomal Mapping: Linkage and crossing over, Recombination frequency as a measure of linkage intensity, two factor and three factor crosses, Interference and coincidence, Somatic cell genetics – an alternative approach to gene mapping

Mutations: Chromosomal Mutations: Deletion, Duplication, Inversion, Translocation, Aneuploidy and Polyploidy; Gene mutations: Induced versus Spontaneous mutations, Back versus Suppressor Mutations.

Sex Determination: Chromosomal mechanisms, dosage compensation

UNIT-III

History of Life : Major Events in History of Life

Introduction to Evolutionary Theories: Lamarckism, Darwinism, Neo-Darwinism

Direct Evidences of Evolution: Types of fossils, Incompleteness of fossil record, Dating of fossils, Phylogeny of horse

Processes of Evolutionary Change: Organic variations; Isolating Mechanisms; Natural selection (Example: Industrial melanism);Types of natural selection (Directional, Stabilizing, Disruptive), Artificial selection

UNIT-IV

Species Concept : Biological species concept (Advantages and Limitations); Modes of speciation (Allopatric,Sympatric)

Macro-evolution: Macro-evolutionary Principles (example: Darwin's Finches)

Extinction : Mass extinction (Causes, Names of five major extinctions, K-T extinction in detail), Role of extinction in evolution

Text and Reference Books:

S.No	Title	Author	Publisher
1	Principles of Genetics, 8th edition	Gardner, E.J., Simmons, M.J., Snustad, D.P.	Wiley India
2	Principles of Genetics, 5th edition	Snustad, D.P., Simmons, M.J	John Wiley and Sons Inc.
3	Concepts of Genetics, 10th edition	Klug, W.S., Cummings, M.R., Spencer, C.A	Benjamin Cummings
4	Genetics- A Molecular Approach, 3rd edition	Russell, P. J.	Benjamin Cummings.
5	Introduction to Genetic Analysis, 9th edition	Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.	W. H. Freeman and Co.
6	Evolution, 3rd edition	Ridley, M.	Blackwell Publishing
7	Evolutionary Biology	Douglas, J. Futuyma	Sinauer Associates.

PLANT PHYSIOLOGY AND METABOLISM PRACTICAL

Course Code	**BOT204**
Course Title	**Plant Physiology and Metabolism Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	To impart knowledge about plant functions through simple physiological experiments
Course Outcomes (CO)	Student will able to understand CO1.Various plants physiological processes with the help of experiments CO2.Study and calculation of stomatal index CO3.Impact of light on chlorophyll and phytochrome pigment

LIST OF EXPERIMENTS

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. To study the rate of transpiration from foliar surfaces.
3. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
4. Demonstration of Hill reaction.
5. Demonstrate the activity of catalase and study the effect of pH and enzyme concentration.
6. To study the effect of light intensity and bicarbonate concentration on O2 evolution in photosynthesis.
7. Comparison of the rate of respiration in any two parts of a plant.
8. To obtain the action spectrum of chlorophyll pigment.
9. Separation of amino acids by paper chromatography.

Demonstration experiments (any two)

1. Bolting.
2. Effect of auxins on rooting.
3. Suction due to transpiration.
4. R.Q.

Text and reference books:

S. No.	**Title**	**Author**	**Publisher**
1	Plant Physiology	H N Srivastava	Pradeep Publishers
2	A Textbook of Plant Physiology, Biochemistry and Biotechnology	Dr S K Verma and Mohit Verma	S. Chand Publishing

COORDINATION CHEMISTRY, STATES OF MATTER AND CHEMICAL KINETICSPRACTICAL

Course Code	**CHM 204**
Course Title	**Transition Metal & Coordination Chemistry, States of Matter and Chemical Kinetics (Practical)**
Type of course	Core (Practical)
L T P	0:0:4
Credits	2
Course prerequisite	BSc. 1^{st} with chemistry as core subject
Course Objective	The aim of this course is to impart practical knowledge to the students about semi micro qualitative analysis and physical properties of solutions.
Course Outcome	**By the end of the course, students will be able to:** CO1Analyse and estimate Qualitative analysis of inorganic cations & anions. CO2Calculate viscosity and surface tension of different liquids and solutions. CO3Understand and apply gravimetric analysis and complexometric titrations. CO4Derive mathematical expressions of chemical kinetics methods.

Section A: Inorganic Chemistry

1. **Semi-micro qualitative analysis** (using H_2S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following:
2. Cations : NH_4^+, Pb^{2+}, Bi^{3+}, Cu^{2+}, Cd^{2+}, Fe^{3+}, Al^{3+}, Co^{2+}, Ni^{2+}, Mn^{2+}, Zn^{2+}, Ba^{2+}, Sr^{2+}, Ca^{2+}, K^+
3. Anions : CO_3^{2-} , S^{2-}, SO^{2-}, $S_2O_3^{2-}$, NO_3^-, CH_3COO^-, Cl^-, Br^-, I^-, NO_3^-, SO_4^{2-}, PO_4^{3-},BO_3^{3-}, $C_2O_4^{2-}$, F^-*(Spot tests should be carried out wherever feasible)*
4. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximato) nickel(II) or aluminium as oximate in a given solution gravimetrically.
5. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
6. Estimation of total hardness of a given sample of water by omplexometric titration.

Section B: Physical Chemistry

Surface tension measurement (use of organic solvents excluded).

Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.

Study of the variation of surface tension of a detergent solution with concentration.

Viscosity measurement (use of organic solvents excluded).

Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.

Study of the variation of viscosity of an aqueous solution with concentration of solute.

Chemical Kinetics

Study the kinetics of the following reactions.

Initial rate method: Iodide-persulphate reaction

Integrated rate method:

Acid hydrolysis of methyl acetate with hydrochloric acid.

Saponification of ethyl acetate.

Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate

*<u>*Perform any four experiments from each section*</u>

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
2	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham	ELBS
3	Advanced Practical Physical Chemistry	J.B. Yadav	KRISHNA Prakashan Media (P) Ltd,

GENETICS AND EVOLUTIONARY BIOLOGY PRACTICAL

Course Code	**ZOO204**
Course Title	**Genetics and Evolutionary Biology Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	To impart knowledge about plant functions through simple physiological experiments
Course Outcomes (CO)	1.Gains knowledge about gamete formation, cleavage , gastrula formationn and role of hormones in metamorphosis and regeneration in organisms. 2.Gives understudies knowledge into keeping up sound associations with their contrary sexual orientation and permits them tomake right decision about their life accomplice consequently forestalling innate/consanguial sicknesses.

LIST OF EXPERIMENTS

1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from plaster cast models and pictures
5. Study of homology and analogy from suitable specimens/ pictures
6. Charts:
   a) Phylogeny of horse with diagrams/ cut outs of limbs and teeth of horse ancestors
   b) Darwin's Finches with diagrams/ cut outs of beaks of different species
7. Visit to Natural History Museum and submission of report

Text and Reference Books:

S.No	Title	Author(s)	Publisher
1	Principles of Genetics, 8^{th} edition	Gardner, E.J., Simmons, M.J., Snustad, D.P.	Wiley India
2	Principles of Genetics, 5^{th} edition	Snustad, D.P., Simmons, M.J	John Wiley and Sons Inc.

Course Code	**SSC001**
Course Title	**Gender Equity**
Type of course	**ID**
L T P	**3:0:0**
Credits	**3**
Course prerequisite	**NA**
Course Objectives (CO)	1. The students will be able to acquire knowledge and understanding of theory and concepts related to gender and gender relations 2. The students will be able to critically reflect how gender is a development issue.
Course Outcome	The students will analyse the evolution of thinking and approaches around gender and development.

UNIT I

Concept of sex and gender

Gender attributes and questions of identity.

UNIT II

Empowerment- concept and meaning.

Definition of feminism, feminist and women movements in U.S.A, U.K., France and India

UNIT III

Women development and development organizations.

Impact of development on gender.

UNIT IV

Policies and current debates on women rights.

Role of UN in establishing gender equality.

Violence against women and need for reforms.

Text and Reference Books:

S.No.	Author(S)	Year	Title	Publisher
1	Jayachandran, Seema	2014	The Roots of Gender Inequality in Developing Countries	NBER Working Paper No.20380. Issued in August 2014
2	Duflo, Esther	2012	Women's Empowerment and Economic Development	*Journal of Economic Literature, 50(4): 1051-79.*

Skill Enhancement Courses

Semester (III-VI)

Medicinal Botany

Course Code	**BOT 205**
Course Title	**Medicinal Botany**
Type of course	**Skill Enhancement Courses**
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To understand medicinal plant with references to Botany.
Course Outcome	Student will able to understand CO1. Scope and importance of medicinal plants and traditional medical systems in India CO2. Conservation of endangered and endemic plants their use in ethnobotany. CO3. Propagation of medicinal plants, objective of nursery CO4. Use of Ethnobotany and folk medicine in India and application of natural products for curing some diseases

Unit 1: History, Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences;Definition and Scope-Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridoshaconcepts, Rasayana, plants used in ayurvedic treatments, Siddha: Origin of Siddha medicinalsystems, Basis of Siddha system, plants used in Siddha medicine. Unani: History, concept:Umoor-e- tabiya, tumors treatments/ therapy, polyherbal formulations. **(10 Lectures)**

Unit 2: Conservation of endangered and endemic medicinal plants. Definition: endemic andendangered medicinal plants, Red list criteria; In situ conservation: Biosphere reserves,sacred groves, National Parks; Ex situ conservation: Botanic Gardens, Ethnomedicinal plantGardens. Propagation of Medicinal Plants: Objectives of the nursery, its classification,important components of a nursery, sowing, pricking, use of green house for nurseryproduction, propagation through cuttings, layering, grafting and budding. **(10 Lectures)**

Unit 3: Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods tostudy 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. **(10 Lectures)**

Text and Reference Books

S.No	Title	Author(s)	Publisher
1	Medicinal Plants: Ethnobotanical Approach, Agrobios, India.	Trivedi P C,	Tata McGraw-Hill Publishing Co. Ltd
2	Medicinal Plant Cultivation:	Purohit and Vyas	Oxford University

	A Scientific Approach, 2nd edn. Agrobios, India.		Press, New York

MEDICAL DIAGNOSTICS

Course Code	**ZOO 205**
Course Title	Medical Diagnostics
Type of course	Skill Enhancement Courses
L T P	2 0 0
Credits	2
Course prerequisite	B.ScIst year
Course Objective	To make students familiar with latest techniques available to diagnose different diseases, their preventive measures and treatments.
Course Outcome	1. Students will able to diagnose the different symptoms of the diseases in family members and relatives and able to provide them a advice to consult a doctor. 2. Students understand the some lab techniques related to blood. 3. Gets the knowledge regarding different types of tumours 4. Understanding of PET scan, MRI,CT scan and X-Rays.

UNIT-I

Introduction to Medical Diagnostics and its Importance

UNIT-II

Diagnostics Methods Used for Analysis of Blood: Blood composition, Preparation of blood smear and Differential Leucocyte Count(D.L.C) using Leishman's stain, Platelet count using haemocytometer, ErythrocyteSedimentary Rate (E.S.R), Packed Cell Volume (P.C.V.)

Diagnostic Methods Used for Urine Analysis: Urine Analysis: Physical characteristics; Abnormal constituents.

UNIT-III

Non-infectious Diseases: Causes, types, symptoms, complications, diagnosis and prevention of Diabetes (Type Iand Type II), Hypertension (Primary and secondary), Testing of blood glucose usingGlucometer/Kit

UNIT-IV

Infectious Diseases: Causes, types, symptoms, diagnosis and prevention of Tuberculosis and Hepatitis

Tumours: Types (Benign/Malignant), Detection and metastasis; Medical imaging: X-Ray of Bone fracture, PET, MRI and CT Scan (using photographs).

Text and reference books:

S. No	Title	Author(s)	Publisher
1	Preventive and Social Medicine	Park K	B.B. Publishers
2	Textbook of Medical Laboratory Technology, II	Godkar P.B. and Godkar D.P.	Bhalani Publishing

	Edition		House
3	A Laboratory Manual for Rural Tropical Hospitals, A Basis for Training Courses	Cheesbrough M	
4	Textbook of Medical Physiology	Guyton A.C. and Hall J.E	Saunders

BASIC ANALYTICAL CHEMISTRY

Course Code	**CHM 209**
Course Title	**Basic Analytical Chemistry**
Type of course	**Skill Enhancement Course**
L T P	2:0:0
Credits	2
Course prerequisite	B.sc. Ist, Iind year with Chemistry as core subject
Course Objective (CO)	The objective of this course is to make student aware about concepts of analytical Chemistry various spectrophotometric, electroanalytical methods of analysis Students are exposed to important separation methods like solvent extraction and chromatography.
Course outcome	**By the end of this course, students will be able to:** CO1 Handle analytical data &Expresses the role of analytical chemistry in science. CO2Determine composition and pH of soil, which can be useful in agriculture CO3Do qualitative and quantitative analysis of water, food adultrants & cosmetics CO4 Estimate macro nutrients using Flame photometry & Separate mixtures using separation techniques

UNIT I:

Introduction: Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurements. Presentation of experimental data and results, from the point of view of significant figures.

Analysis of soil: Composition of soil, Concept of pH and pH measurement, Complexometric titrations, Chelation, Chelating agents, use of indicators a. Determination of pH of soil samples. B. Estimation of Calcium and Magnesium ions as Calcium carbonate by complexometric titration.

Analysis of water: Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods. A. Determination of pH, acidity and alkalinity of a water sample. B. Determination of dissolved oxygen (DO) of a water sample.

UNIT II:

Chromatography: Definition, general introduction on principles of chromatography, paper chromatography, TLC etc.

a. Paper chromatographic separation of mixture of metal ion (Fe^{3+} and Al^{3+})

b. To compare paint samples by TLC method.

Ion-exchange: Column, ion-exchange chromatography etc. Determination of ion exchange capacity of anion / cation exchange resin (using batch procedure if use of column is not feasible).

UNIT III:

Analysis of food products: Nutritional value of foods, idea about food processing and food preservations and adulteration.

a. Identification of adulterants in some common food items like coffee powder, 59safetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

b. Analysis of preservatives and colouring matter.

Analysis of cosmetics: Major and minor constituents and their function

a. Analysis of deodorants and antiperspirants, Al, Zn, boric acid, chloride, sulphate.

b. Determination of constituents of talcum powder: Magnesium oxide, Calcium oxide, Zinc oxide and Calcium carbonate by complexometric titration.

Unit IV:

Suggested Applications (Any one):

a. To study the use of phenolphthalein in trace cases.

b. To analyze arson accelerants.

c. To carry out analysis of gasoline.

Suggested Instrumental demonstrations**:**

a. Estimation of macro nutrients: Potassium, Calcium, Magnesium in soil samples by flame photometry.

b. Spectrophotometric determination of Iron in Vitamin / Dietary Tablets.

c. Spectrophotometric Identification and Determination of Caffeine and Benzoic Acid in Soft drink

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Analytical Chemistry,	Christian, G.D. (2004),	John Wiley & Sons.
2	Principles of Instrumental Analysis,	Skoog, D.A.; Holler F.J.; Nieman, T.A. (2005),	Thomson Asia Pvt. Ltd.
3	Vogel's Qualitative Inorganic Analysis (7th Edition).	G Svehla	Prentice Hall
4	Instrumental Analysis	G.D. Christian and J.E.G. Reily	Allegn Becon, Latest edition
5	Instrumental Methods of Chemical Analysis	G.W.Ewing,	McGraw Hill Pub, 1975.

FLORICULTURE

Course Code	**BOT206**
Course Title	**Floriculture**
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	B.ScIInd year
Course Objective (CO)	To provide knowledge about commercial aspect of floriculture in India which may motivate students to take up it as professional occupation
Couirse Outcome	Student will able to understand CO1. The history, importance and scope of gardening in India CO2. Nursery management and routine gardening operation CO3. Various types of ornamental plants and their propatgation in different gardens area CO4. Various types of gardens in the world and landscaping design in public areas CO5. Cultivation of commercial flowering plants

UNIT-I

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening.

Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators.

UNIT-II

Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai.

UNIT-III

Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India.

Landscaping Places of Public Importance: Landscaping highways and Educational institutions.

UNIT-IV

Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of Important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolous, Marigold,Rose, Lilium, Orchids).

Diseases and Pests of Ornamental Plants.

Text and reference books:

S. No.	Title	Author	Publisher
1	Floriculture in India	Randhawa, G.S. and Mukhopadhyay, A	Allied Publishers.

GREEN METHODS IN CHEMISTRY

Course Code	**CHM 210**
Course Title	**Green Methods in Chemistry**
Type of course	**Skill Enhancement Course**
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with Chemistry as core subject
Course Objective (CO)	The aim of this course is to impart Coherent knowledge principles and scope of Green chemistry and applications of green chemistry in current scenario.
Course outcome	**By the end of this course, students will be able to:** CO1 Understand the twelve principles of green chemistry and will build the basic understanding of toxicity,hazard and risk of chemical substances. CO2 Analyze a process and identify parameters that make environmentally friendly/sustainable/green. CO3 Learn to design safer chemical ,products and processes that are less toxic,than current alternatives. CO4 Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.

UNIT – I

Introduction: Definitions of Green Chemistry. Brief introduction of twelve principles of Green Chemistry, with examples, special emphasis on atom economy, reducing toxicity, green solvents, Green Chemistry and catalysis and alternative sources of energy, Green energy and sustainability.

UNIT – II

The Real world Cases in Green Chemistry:

Surfactants for carbon dioxide – Replacing smog producing and ozone depleting solvents with CO for precision cleaning and dry cleaning of garments.

Designing of environmentally safe marine antifoulant.

UNIT –III

Right fit pigment: Synthetic azo pigments to replace toxic organic and inorganic pigments.

An efficient, green synthesis of a compostable and widely applicable plastic (poly lactic acid) made from corn.

UNIT – IV

Practical Aspects: Preparation and characterization of biodiesel from vegetable oil.

Extraction of D-limonene from orange peel using liquid CO prepared from dry ice.

Mechano- chemical solvent free synthesis of azomethine.

Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Green Chemistry- Theory and Practical, 1998	Anastas, P.T. & Warner, J.K.	Oxford University Press
2	Introduction to Green Chemistry, 2001	Matlack, A.S.	Marcel Dekker
3	Real-World cases in Green Chemistry, 2000	Cann, M.C. & Connely, M.E.	American Chemical Society, Washington
4	Introduction to Green Chemistry, 2002	Ryan, M.A. & Tinnesand, M.	American Chemical Society, Washington

Ethnobotany

Course Code	**BOT204**
Course Title	**Ethnobotany**
Type of course	Theory
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	To impart knowledge about plant functions through simple physiological experiments
Course Outcomes	Students will understand CO1. Concept, scope and importance of ethnobotany CO2. Knowledge about various ethnic gtribals groups and use of plants in their daily life style CO3. Filed work, collection of plants and herbarium preparation, CO4. Knowledge about plant sources of various modern drug and their conservation by ethnic tribal people CO5. Legal aspects of ethnobotany, Biopiracy, IPR and Traditional Knoeledge.

Unit 1: Ethnobotany

Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The 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: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses. **(6 Lectures)**

Unit 2: Methodology of Ethnobotanical studies

B) Field work b) Herbarium c) Ancient Literature d) Archaeological findings e) temples and sacred places. **(6 Lectures)**

Unit 3: Role of ethnobotany in modern Medicine

Medico-ethnobotanical sources in India;Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadiracthaindica*b) *Ocimum sanctum* c) *Vitex negundo*. D) *Gloriosa superba*e) *Tribulus terrestris*f) *Pongamiapinnata*g) *Cassia auriculata*h) *Indigoferatinctoria*. Role of ethnobotany in modern medicine with special example *Rauvolfiasepentina*, *Trichopuszeylanicus*, *Artemisia*,*Withania*. Role of ethnic groups in conservation of plant genetic resources. Endangered taxa and forest management (participatory forest management). **(10 Lectures)**

Unit 4: Ethnobotany and 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. **(8 Lectures)**

Text and reference books:

S. no.	Title	Author	Publisher
1	Manual of Ethnobotany	S.K. Jain	Scientific Publishers, Jodhpur, 1995
2	Glimpses of Indian. Ethnobotany	S.K. Jain	Oxford and I B H, New Delhi – 1981
3	Ethnobotany – Principles and applications	Colton C.M1997	John Wiley and sons – Chichester
4	The Ethnobotany of Eastern Ghats in AndhraPradesh	Rama Ro, N and A.N. Henry (1996).	Botanical Survey of India. Howrah
5	Ethnobotany The Renaissance of Traditional Herbal Medicine	Rajiv K. Sinha	INA –SHREE Publishers, Jaipur-1996

Apiculture and Sericulture

Course code	**ZOO315**
Course title	**Apiculture and Sericulture**
Type of course	Theory
LTP	2 0 0
Credits	2
Course objective	To impart basic knowledge about reaing of honey bess and silkworms for commercial production of honey and silk.
Course Outcome	1.Understand different honey bee species, their 67ehavior67ion and different bee products , 2. Understand different silk worm species, life cycle of silkworm andsericulture in detail.

UNIT-I

Biology of Bees: Classification and Biology of Honey Bees**;** Social Organization of Bee Colony

Rearing of Bees and Bee Economy: Artificial Bee rearing (Apiary), Beehives – Newton and Langstroth**;** Products of Apiculture Industry and its uses

UNIT-II

Introduction and Biology of Silkworm: Sericulture: Definition, history and present status

Mulberry and non-mulberry Sericulture; Life cycle of *Bombyx mori*

UNIT-III

Rearing of Silkworms: Rearing house and rearing appliances**;** Disinfectants: Formalin, bleaching powder**;** Silkworm rearing technology: Early age and Late age rearing**;** Spinning, harvesting and storage of cocoons

UNIT-IV

Pests and Diseases of honey bees and silkworm: Bee Diseases and Enemies**;** Pests of silkworm: Uzi fly, dermestid beetles and vertebrates**;** Pathogenesis of silkworm diseases: Protozoan, viral, fungal and bacterial

Text and reference books:

S. no.	Title	Author	Publisher
1	Apiculture	P J Prost	Oxford and IBH, New Delhi
2	Apiculture	D S Bisht	ICAR Publication
3	Beekeeping in India	S Singh	ICAR Publication
4	Handbook of Practical Sericulture	S.R. Ullal and M.N. Narasimhanna	CSB,Bangalore
5	Handbook of Silkworm Rearing	Agriculture and Technical Manual-1	Fuzi Pub. Co. Ltd., Tokyo, Japan

AQUATIC BIOLOGY

Course Code	**ZOO317**
Course Title	**Aquatic Biology**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To provide the knowledge of different types of habitats in ecosystem and their importance for the living being, so that we can make our environment a pollution free.
Course Outcome	1. Understand the ecology and behavior of plants, animals, and microbes living water. 2. Basic oceanography to understand influence of unique characteristics of marine environments on marine life. 3. Quantitative approaches to collecting and understanding information. 4. Collaboration to work together effectively in teams to solve problems

UNIT-I

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-II

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).

UNIT-III

Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous. Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.Marine Biology: Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

UNIT-IV

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.

Text and Reference Books:

S. No	Title	Author(s)	Publisher
1	Bioresources Ecology 3rd Edition	Anathakrishnan	
2	Limnology, 2nd Edition	Goldman	
3	Fundamentals of Ecology, 5th Edition	Odum and Barrett	
4	Chemical and biological methods for water pollution studies	Trivedi and Goyal	

FUEL CHEMISTRY

Course Code	CHM 313
Course Title	**Fuel chemistry**
Type of course	**Skill enhancement Course**
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, Iind year with CHEMISTRY as core subject
Course Objective (CO)	The course aims to provide students with a basic scientific and technical understanding of the production, 70ehavior and handling of hydrocarbon fuels and lubricants, including emerging alternative & renewable fuels. This will enable them to be industry ready to contribute effectively in the field of petroleum chemistry and technology.
Course outcome	**By the end of this course, students will be able to:** CO1 Understanding of both conventional petroleum-based fuels, and alternative & renewable fuels, including gaseous fuels. CO2understand the refining processes used to produce fuels and lubricants and their usage in different applications. CO3 Analyze origin of petroleum, crude oil, composition, different refining processes employed industrially to obtain different fractions of petroleum. CO4Catagorize alternative and renewable fuels like Biofuels (Different generations), Gaseous Fuels (e.g. CNG, LNG, CBG, Hydrogen etc.). CO5 Apply various test methods used to qualify different types of fuels as well characterization methods.

UNIT I:

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value. Determination of calorific value by Bomb calorimeter and Junker's calorimeter.

Coal: Uses of coal (fuel and nonfuel) in various industries, its composition, carbonization of coal. Coal gas, producer gas and water gas—composition and uses.

Fractionation of coal tar, uses of coal tar bases chemicals, requisites of a good metallurgical coke, Coal gasification (Hydro gasification and Catalytic gasification), Coal liquefaction and Solvent Refining.

UNIT II:

Petroleum and Petrochemical Industry: Composition of crude petroleum, Refining and different types of petroleum products and their applications. Fractional Distillation (Principle and process), Cracking (Thermal and catalyticcracking)

UNIT III:

Reforming Petroleum and non-petroleum fuels (LPG, CNG, LNG, bio-gas, fuels derived from biomass), fuel from waste, synthetic fuels (gaseous and liquids), clean fuels. **Petrochemicals:** Vinyl acetate, Propylene oxide, Isoprene, Butadiene, Toluene and its derivatives Xylene.

UNIT IV:

Lubricants: Classification of lubricants, lubricating oils (conducting and nonconducting) Solid and semisolid lubricants, synthetic lubricants. Properties of lubricant (viscosity index, cloud point, pore point) and determination.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.
2	Engineering Chemistry	Jain, P.C. & Jain, M.	Dhanpat Rai & Sons, Delhi
3	Instrumental methods of chemical analysis	B.K.sharma	Krishna prakashan media LTD
4	Industrial Chemistry	Sharma, B.K. & Gaur, H.	Goel Publishing House, Meerut
5	Industrial Chemistry Vol-I,	Stocchi, E.	Ellis Horwood Ltd. UK (1990).

MUSHROOM CULTURE TECHNOLOGY

Course Code	**BOT310**
Course Title	Mushroom Culture Technology
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	B.ScIInd year
Course Objective	To provide knowledge about commercial aspect of mushroom cultivation in India which may motivate students to take up it as professional occupation
Course Outcomes	Students will learn CO1. Various types of edible and poisionous mushrooms available in india CO2. Cultivation of mushroom and preparation of low cost composting material for mushroom cultivation CO3. Storage of mushroom and their post harvesting till marketing CO4. Mushroom research centers, and their marketing

UNIT-I

Introduction, history: Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariellavolvacea, Pleurotuscitrinopileatus, Agaricusbisporus*.

UNIT-II

Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Pure culture: Medium, sterilization, preparation of spawn, multiplication. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, Composting technology in mushroom production.

UNIT-III

Storage and nutrition : Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickels, papads), drying, storage in saltsolutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content - Vitamins.

UNIT-IV

Food Preparation : Types of foods prepared from mushroom. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Mushroom Cultivation	S C Tewari and Pankaj Kapoor	Mittal Publications
2	Mushroom Production and Processing Technology	V N Pathak	Agrobios India

3	Mushroom Cultivation and Uses	Suman and B C Sharma	Agrobios India
4	Food and Nutrition	M Swaminathan	Bangalore Printing and Publishing Co.

AQUARIUM FISH KEEPING

Course Code	**ZOO314**
Course Title	**AQUARIUM FISH KEEPING**
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	B.ScIInd year
Course Objective	To provide knowledge about commercial aspect of mushroom cultivation in India which may motivate students to take up it as professional occupation
Course Outcome	

Unit1: Introduction to Aquarium Fish Keeping
The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic andEndemic species of Aquarium Fishes

Unit 2: Biology of Aquarium Fishes
Common characters and sexual dimorphism of Fresh water and Marine Aquariumfishes 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

PHARMACEUTICAL CHEMISTRY

Course Code	**CHM 318**
Course Title	**Pharmaceutical Chemistry**
Type of course	Skill enhancement course
L T P	2:0:0
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The objective of this paper is to develop basic understanding of drugs discovery, design, development and their side effects, an overview of fermentation process and production of certain dietary supplements and certain common antibiotics.
Course outcome	**By the end of this course, students will be able to:** CO1Gain insight into retro-synthesis approach in relation to drug design and drug discovery. CO2Learn synthetic pathways of major drug classes. CO3Understand the fermentation process and production of ethanol, citric acids, antibiotics and some classes of vitamins.

UNIT I

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

UNIT-II

Antibiotics (Chloramphenicol); antibacterial and antifungal agents (Sulphonamides; Sulphanethoxazol, Sulphacetamide, Trimethoprim); Antiviral agents (Acyclovir),

UNIT –III

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

UNIT –IV

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

Practicals

1. Preparation of Aspirin and its analysis.
2. Preparation of magnesium bisilicate (Antacid).

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Introduction to Medicinal Chemistry	G.L. Patrick	Oxford University Press, UK.
2	Medicinal and Pharmaceutical	Hakishan, V.K.	Vallabh

	Chemistry,	Kapoor	Prakashan, Pitampura, New Delhi
3	Principles of Medicinal Chemistry	William O. Foye, Thomas L., Lemke , David A. William	B.I. Waverly Pvt. Ltd. New Delhi
4	Medicinal Chemistry-the role of organic chemistry in drug, 1993	C. R. Ganellin, and S. M. Roberts	Academic Press
5	Medicinal Chemistry-principles and practice,1994	F. D. King	Royal Society of Chemistry

Discipline Elective Courses

(Semester-V-VI)

(Any two of each subject in both semesters)

V^{th} SEMESTER

CELL AND MOLECULAR BIOLOGY

Course Code	**BOT301**
Course Title	**Cell and Molecular Biology**
Type of course	Discipline Elective Courses (Theory)
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To impart knowledge about details of cell structure, cell organelles and their functions along with structural and functional details of genetic material
Course Outcomes (CO)	Students will understand CO1. Various types of equipments, their principles and application for studing plants development, physiology and functions CO2.Basic structure of plant cell, cell wall and organelles CO3.Structure of chloroplast, golgi bodies, ER, mitochondria and nucleus CO4. Cell cycle, Structure of DNA, DNA replication, translation and transcription CO5. Regulation of gene expression

UNIT-I

Techniques in Biology: Principles of microscopy; Light Microscopy; Phase contrast microscopy; Fluorescence microscopy; Confocal microscopy; Sample Preparation for light microscopy; Electron microscopy (EM)- Scanning EM and Scanning Transmission EM (STEM); Sample Preparation for electron microscopy; X-ray diffraction analysis.

UNIT-II

Cell as a unit of Life: The Cell Theory; Prokaryotic and eukaryotic cells; Cell size and shape; Eukaryotic Cell components.

Cell Membrane and Cell Wall; The functions of membranes; Models of membrane structure; The fluidity of membranes; Membrane proteins and their functions; Carbohydrates in the membrane; Faces of the membranes; Selective permeability of the membranes; Cell wall. Cell Organelles: Mitochondria: Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA

UNIT-III

Cell Organelles: Chloroplast Structure, marker enzymes, composition; semiautonomous nature, chloroplast DNA. ER, Golgi body & Lysosomes: Structures and roles. Peroxisomes and Glyoxisomes: Structures, composition, functions in animals and plants and biogenesis.

Nucleus: Nuclear Envelope- structure of nuclear pore complex; chromatin; molecularorganization, DNA packaging in eukaryotes, euchromatin and heterochromatin, nucleolus and ribosome structure (brief).

UNIT-IV

Cell Cycle: Overview of Cell cycle, Mitosis and Meiosis; Molecular controls. Genetic material: DNA: 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, Ǿ (theta) mode of replication, replication of linear, ds-DNA, replicating the 5′end of linear chromosome including replication enzymes.

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.

CELL AND MOLECULAR BIOLOGY PRACTICAL

Course Code	**BOT303**
Course Title	**Cell and Molecular Biology Practical**
Type of course	Discipline Elective Courses (Practical)
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To impart practical knowledge about details of cell structure, cell organelles and their functions along with structural and functional details of genetic material
Course Outcomes (CO)	Students will understand CO1. Structure of bacteria, virus, prokaryotic and eukaryoitic cells through various types microscopy CO2. Structure of plant cells by preparing temporary mounts CO3. Study of mitosis and meosis through preparation of temporary slides CO4.Study of various physiologuical processes through experiments CO5.Measurement of cell size with the help of micrometry

LIST OF EXPERIMENTS

1. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light and electron micrographs.
2. Study of the photomicrographs of cell organelles
3. To study the structure of plant cell through temporary mounts.
4. To study the structure of animal cells by temporary mounts-squamous epithelial cell and nerve cell.
5. Preparation of temporary mounts of striated muscle fiber
6. To prepare temporary stained preparation of mitochondria from striated muscle cells /cheek epithelial cells using vital stain Janus green.
7. Study of mitosis and meiosis (temporary mounts and permanent slides).
8. Study the effect of temperature, organic solvent on semi permeable membrane.
9. Demonstration of dialysis of starch and simple sugar.
10. Study of plasmolysis and deplasmolysis on Rhoeo leaf.
11. Measure the cell size (either length or breadth/diameter) by micrometry.
12. Study the structure of nuclear pore complex by photograph (from Gerald Karp)
13. Study of special chromosomes (polytene &lampbrush) either by slides or photographs.
14. Study DNA packaging by micrographs.

Text and Reference Books:

S.No	Title	Author(s)	Publisher
1	Genetics- A Molecular Approach, 3rd edition	Russell, P. J.	Benjamin Cummings.

2	Introduction to Genetic Analysis, 9th edition	Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.	W. H. Freeman and Co.
3	Evolution, 3rd edition	Ridley, M.	Blackwell Publishing
4	Evolutionary Biology	Douglas, J. Futuyma	Sinauer Associates.

ANALYTICAL TECHNIQUES IN PLANT SCIENCES

Course Code	**BOT305**
Course Title	**Analytical Techniques in Plant Sciences**
Type of course	Discipline Elective Courses (Theory)
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To study various techniques used to study plant cell structure and functions
Course Outcomes	Students will understand CO1. Principle and functions of various types of microscopes CO2. Principle and functions of centrifuge and spectroscopy CO3. Concept and use of radioisotopes in biological studies CO4. Characterization of protiens and nucleic acids CO5. Use of biostatics in plant sciences

UNIT-I

Imaging and related techniques: Principles of microscopy; Light microscopy; Fluorescence microscopy; Confocal microscopy; Use of fluorochromes: (a) Flow cytometry (FACS); (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

UNIT-II

Cell fractionation: Centrifugation: Differential and density gradient centrifugation, sucrose density gradient, CsCl2, gradient, analytical centrifugation, ultracentrifugation, marker enzymes.

Radioisotopes: Use in biological research, auto-radiography, pulse chase experiment.

Spectrophotometry: Principle and its application in biological research.

UNIT-III

Chromatography: Principle; Paper chromatography; Column chromatography, TLC, GLC, HPLC, Ion-exchange chromatography; Molecular sieve chromatography; Affinity chromatography.

Characterization of proteins and nucleic acids: Mass spectrometry; X-ray diffraction; X-ray crystallography; Characterization of proteins and nucleic acids; Electrophoresis: AGE, PAGE, SDS-PAGE

UNIT-IV

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.

ANALYTICAL TECHNIQUES IN PLANT SCIENCES PRACTICAL

Course Code	**BOT307**
Course Title	**Analytical Techniques in Plant Sciences Practical**
Type of course	Discipline Elective Courses (Practical)
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To demonstrate basic techniques used in cell biology
Course Outcomes	Student will learn CO1. Different tyoes of chromatography used to study plant's structure and functions by performing exepriments CO2.Use of blotting techniques to transfer DNA, RNA and Protiens CO3. Use of centrifuge in the separation of biomolecules in plants CO4.Use of different microscopic techniques to study plant structure.

LIST OF EXPERIMENTS

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 FISH).
11. Preparation of permanent slides (double staining).

Text and Reference Books:

S.No	Title	Author(s)	Publisher
1	An Introduction to Practical Biochemistry	Plummer, D.T.	Tata McGraw-Hill Publishing Co. Ltd
2	Plant Microtechnique and Microscopy	Ruzin, S.E.	Oxford University Press, New York
3	Short Protocols in Molecular Biology	Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith	John Wiley & Sons
4	Biostatistical Analysis.	Zar, J.H	Pearson Publication

CELL BIOLOGY, BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY

UNIT-I

Introduction to cell and molecular biology: Discovery of cell, basic properties, eukaryotic and prokaryotic cells, viruses. Structure and functions of Plasma membrane: Chemical composition of membrane, structure and function of membrane proteins, Fluid

Course Code	**ZOO301**
Course Title	**Cell Biology, Biotechnology and Reproductive Biology**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc. III year
Course Objective (CO)	1. To enable the students to learn various aspects of cell biology and techniques of biotechnology. 2. To aware the students about various reproductive processes and the modern techniques to assist these processes.
Course Outcomes (CO)	1.To enable the students to learn various aspects of cell biology and techniques of biotechnology. 2.To aware the students about various reproductive processes and the modern techniques to assist these.

Mosaic Model, Membrane potential and nerve impulse

Interaction between cell and their environment: Interaction of cell with extracellular material, Tight Junctions, Gap Junctions and Plasmodesmata mediating intracellular communications, cell wall.

Membrane Trafficking: Endoplasmic Reticulum, Golgi complex, Types of vesicle transport and their functions, lysosomes.

Cytoskeleton and Cell motility: Study of cytoskeleton, microtubules, intermediate filaments, microfilaments.

UNIT-II

Biotechnology: Recombinant DNA technology and its applications, Cloning vectors: Plasmids, Cosmids, Phasmids, Lamda Bacteriophage, BAC, YAC, MAC and Expression vectors.

Restriction enzymes: Nomenclature, detailed study of Type II

Construction of genomic and cDNA libraries, Southern, Northern and Western Blotting, DNA sequencing (Sanger Method), Polymerase Chain Reaction.

UNIT-III

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

UNIT-IV

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

Text and reference books:

S.No	Title	Author	Publisher
1.	Cell and Molecular Biology	P.K. Gupta	Rastogi publications
2.	Knobil, E. et al. (eds).	The Physiology of Reproduction.	Raven Press Ltd
3.	Animal Physiology	Mohan P. Arora	Himalyan Publishing, House
4.	G Karp, EDP & De Robertis	Cell and Molecular Biology	EMF , WB Saunders, Co Philadelphia , 8thEdn 1995.
5.	Albert	Essential Cell Biology	, New York , 3rdEdn , 1997

CELL BIOLOGY, BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY PRACTICAL

Course Code	**ZOO 303**
Course Title	**Cell Biology, Biotechnology and Reproductive Biology Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.ScIInd year
Course Objective	To impart practical knowledge about basic animal cell structure and cytological details of reproductive cells and organs
Course Outcomes (CO)	1.Comprehend the nature and essential ideas of cell science, hereditary qualities, scientific classification, physiology, environment and applied Zoology 2.Increases information about research methods, communication skills and abilities of critical thinking techniques 3.Idea driving hereditary issue, quality changes different causes related with natural errors in metabolism.

List of experiments:

1. Study of cell cycle through model.
2. Cells present in human blood (WBC, RBC count and hemoglobin estimation)
3. Study the phenomenon of osmosis using blood.
4. Blood clotting and bleeding time
5. Erythrocyte sedimentation rate
6. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.

Text and reference books:

S.No	Title	Author	Publisher
1.	Cell and Molecular Biology	P.K. Gupta	Rastogi publications
2.	Knobil, E. et al. (eds).	The Physiology of Reproduction.	Raven Press Ltd

APPLIED ZOOLOGY

Course Code	**ZOO305**
Course Title	**Applied Zoology**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To aware students about the various types of parasites and their relationship with their hosts. To find out some organisms which are fetal to animals and try for the control measures against them.

UNIT-I

Introduction to Host-parasite Relationship: Host, Definitive host, Intermediate host, Parasitism, Symbiosis, Commensalism, Reservoir, Zoonosis; Epidemiology of Diseases: Transmission, Prevention and control of diseases: Tuberculosis, Typhoid

UNIT-II

Rickettsiae and Spirochaetes: Brief account of Rickettsia prowazekii, Borrelia recurrentis and Treponema pallidum; Parasitic Protozoa: Life history and pathogenicity of Entamoeba histolytica, Plasmodium vivax and Trypanosoma gambiense

UNIT-III

Parasitic Helminthes: Life history and pathogenicity of Ancylostoma duodenale and Wuchereriabancrofti; Insects of Economic Importance: Biology, Control and damage caused by Helicoverpaarmigera, Pyrillaperpusilla and Papiliodemoleus, Callosobruchuschinensis, Sitophilus oryzae and Triboliumcastaneum; Insects of Medical Importanc: Medical importance and control of Pediculus humanus corporis, Anopheles, Culex, Aedes, Xenopsyllacheopis

UNIT-IV

Animal Husbandry: Preservation and artificial insemination in cattle; Induction of early puberty and synchronization of estrus in cattle; Poultry Farming: Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs

Fish Technology: Genetic improvements in aquaculture industry; Induced breeding and transportation of fish seed

Text and Reference Books:

S.No	Title	Author(s)	Publisher
1	Preventive and Social Medicine, 16th Edition	Park, K.	B.B Publishers
2	Medical Parasitology, 2nd Edition	Arora, D. R and Arora, B	CBS Publications
3	Agricultural Pests of India and South East Asia	Atwal, A.S	Kalyani Publishers
4	Agricultural Entomology	Dennis, H	Timber Press
5	Reproduction in Farm Animals	Hafez, E. S. E	Lea &Fabiger Publisher

APPLIED ZOOLOGY PRACTICAL

Course Code	**ZOO307**
Course Title	**Applied Zoology Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To aware students about different techniques used in studying various types of causative agents of diseases. So that they can easily findout the symptoms of different diseases.

LIST OF EXPERIMENTS

1. Study of Plasmodium vivax, Entamoeba histolytica, Trypanosoma gambiense, Ancylostoma duodenale and Wuchereriabancrofti and their life stages through permanent slides/photomicrographs or specimens.
2. Study of arthropod vectors associated with human diseases: Pediculus, Culex, Anopheles, Aedes and Xenopsylla.
3. Study of insect damage to different plant parts/stored grains through damaged products/photographs.
4. Identifying feature and economic importance of Helicoverpa (Heliothis) armigera, Papiliodemoleus, Pyrillaperpusilla, Callosobruchuschinensis, Sitophilus oryzae and Triboliumcastaneum
5. Visit to poultry farm or animal breeding centre. Submission of visit report
6. Maintenance of freshwater aquarium

Text and Reference Books:

S.No	Title	Author(s)	Publisher
1	Medical Parasitology, 2nd Edition	Arora, D. R and Arora, B	CBS Publications
2	Agricultural Entomology	Dennis, H	Timber Press

AQUATIC BIOLOGY

Course Code	**ZOO309**
Course Title	**Aquatic Biology**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To provide the knowledge of different types of habitats in ecosystem and their importance for the living being, so that we can make our environment a pollution free.

UNIT-I

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-II

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).

UNIT-III

Nutrient Cycles in Lakes-Nitrogen, Sulphur and Phosphorous. Streams: Different stages of stream development, Physico-chemical environment, Adaptation of hill-stream fishes.Marine Biology: Salinity and density of Sea water, Continental shelf, Adaptations of deep sea organisms, Coral reefs, Sea weeds.

UNIT-IV

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.

Text and Reference Books:

S. No	Title	Author(s)	Publisher
1	Bioresources Ecology 3rd Edition	Anathakrishnan	
2	Limnology, 2nd Edition	Goldman	
3	Fundamentals of Ecology, 5th Edition	Odum and Barrett	
4	Chemical and biological methods for water pollution studies	Trivedi and Goyal	

AQUATIC BIOLOGY PRACTICAL

Course Code	**ZOO311**
Course Title	**Aquatic Biology Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To give the training to the students regarding different techniques used in determination of various parameters of water and soil, so that we can check the their quality.

LIST OF EXPERIMENTS

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

Text and Reference Books:

S. No	**Title**	**Author(s)**	**Publisher**
1	Bioresources Ecology 3rd Edition	Anathakrishnan	
2	Limnology, 2nd Edition	Goldman	

ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

Course Code	**CHM 305**
Course Title	**Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR spectroscopy**
Type of course	Discipline Elective course (theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as one core subject
Course Objective (CO)	The aim of this course is to impart coherent knowledge to the students about organometallic chemistry, polynuclear hydrocarbons and organic spectroscopy.
Course outcome	**On completion of this course, the students will be able to:** CO1Apply 18-electron rule to rationalize the stability of organomettalic compounds CO2 Identify important structural features of the of Zeise's salt, metal alkyls tetrameric methyl lithium and dimeric trialkyl aluminium and explain the concept of multicenter bonding in these compounds CO3 Diagrammatically explain the working of the sodium-potassium pump in organisms and sources and consequences of excess and deficiency of trace elements CO4Analyse and elaborate structure & properties of polynuclear hydrocarbons CO5 Gain insight into the basic principles of UV, IR spectroscopic techniques & Use spectroscopic techniques to determine structure and stereochemistry of known and unknown compounds.

UNIT I

Chemistry of 3d metals: Oxidation states displayed by Cr, Fe, Co, Ni and Co.

A study of the following compounds (including preparation and important properties); Peroxo compounds of Cr, $K_2Cr_2O_7$, $KMnO_4$, $[Fe(CN)_6]$, Sodium nitroprusside, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(NO_2)_6]$.

UNIT -II

Organometallic Compounds: Definition and Classification with appropriate examples based on nature of metal-carbon bond (ionic, s, p and multicentre bonds). Structures of methyl lithium, Zeiss salt and ferrocene. EAN rule as applied to carbonyls. Preparation, structure, bonding and properties of mononuclear and polynuclear carbonyls of 3d metals. p-acceptor behaviour of carbon monoxide. Synergic effects (VB approach)- (MO diagram of CO can be referred to for synergic effect to IR frequencies).

UNIT – III

Bio-Inorganic Chemistry: A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na +,K+,Mg2+ ions, Na/K pump; Role of Mg2+ions in energy production and chlorophyll. Role of Ca2+in blood clotting, stabilization of protein structures and structural role (bones).

Polynuclear and heteronuclear aromatic compounds: Properties of the following compounds with reference to electrophilic and Nucleophilic substitution: Naphthalene, Anthracene , Furan, Pyrrole, Thiophene, and Pyridine.

Active methylene compounds: Preparation: Claisen ester condensation. Keto-enol tautomerism. Reactions: Synthetic uses of ethylacetoacetate (preparation of non-hetero molecules)

UNIT IV

Application of Spectroscopy to Simple Organic Molecules: Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λmax& εmax , chromophore, auxochrome, bathochromic and hypsochromic shifts, Solvent Effect in UV and IR Spectroscopy. Application of electronic spectroscopy and Woodward rules for calculating l max of conjugated dienes and α,β– unsaturated compounds.

Infrared radiation and types of molecular vibrations, functional group and fingerprint region.

IR spectra of alkanes, alkenes and simple alcohols (inter and intramolecular hydrogen bonding), aldehydes, ketones, carboxylic acids and their derivatives (effect of substitution on >C=O stretching absorptions.

Text and Reference Books

S. No	**Name**	**Author(S)**	**Publisher**
1.	Concise Inorganic Chemistry	1.D. Lee	ELBS
2.	Inorganic Chemistry: Principles of Structure and Reactivity	James E. Huheey, Ellen Keiter & Richard Keiter	Pearson Publication.
3.	Bioinorganic Chemistry	Bertini, H. B. Grey, S. J. Lippard and J. S. Valentine	Viva Books Pvt. Ltd., New Delhi (1998
4.	Biological Inorganic Chemistry: An Introduction	Robert Crichton	.Elsevier Science (2008)
5.	Biological Inorganic Chemistry: Structure and Reactivity	Harry B. Gray, Edward I. Stiefel et al.,	University Science Books.
6.	Inorganic Chemistry	G.L. Miessler & Donald A. Tarr	Pearson Publication.
7.	Basic Inorganic Chemistry	F.A. Cotton & G. Wilkinson:	John Wiley & Sons
8.	Shriver & Atkin’s Inorganic Chemistry (5^{th} Edition),	P Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, M. Hagerman	Oxford University Press,
9.	Organic Chemistry (Vol. I & II),	I.L. Finar	E.L.B.S.
10.	Applications of Absorption Spectroscopy of Organic Compounds,	John R. Dyer:	Prentice Hall.

11.	Spectroscopic Identification of Organic Compounds	R.M. Silverstein, G.C. Bassler & T.C. Morrill	John Wiley & Sons
12.	Organic Chemistry,	R.T. Morrison & R.N. Boyd	Prentice Hall.
13.	A Guide Book to Mechanism in Organic Chemistry	Peter Sykes:	Orient Longman.

ORGANOMETALLICS, BIOINORGANIC CHEMISTRY, POLYNUCLEAR HYDROCARBONS AND UV, IR SPECTROSCOPY

Course Code	**CHM 307**
Course Title	**Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy (Practical)**
Type of course	Discipline elective(Practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as one core subject
Course Objective	The aim of this course is to impart practical knowledge to the students about organometallic chemistry and organic qualitative analysis.
Course outcome	**On completion of this course, the students will be able to:** CO1 Interpret the structures of various complexes and understand their properties. CO2 Impart knowledge about handling the spectrophotometer and carry out qualitative &quantitative analysis CO3 Employ spectroscopy for characterization of metal complexes and organic compounds

Section A: Inorganic Chemistry

1. Separation of mixtures by chromatography: Measure the Rf value in each case. (Combination of two ions to be given)

Paper chromatographic separation of Fe^{3+}, $A1^{3+}$ and Cr^{3+}

Paper chromatographic separation of Ni^{2+}, Co^{2+}, Mn^{2+} and Zn^{2+}.

2. Preparation of any two of the following complexes and measurement of their conductivity:

(i) tetraamminecarbonatocobalt (III) nitrate

(ii) tetraamminecopper (II) sulphate

(i) potassium trioxala toferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, $MgCl_2$ and $LiCl_3$

Section B: Organic Chemistry

Verification of Lambert-Beer's law and determination of concentration of a coloured species (CuSO4, KMnO4, CoCl2, CoSO4)

Identification of simple organic compounds by IR spectroscopy(Spectra to be provided).

Determination of a mixture of cobalt and nickel (UV-visible spectroscopy).

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis (7th Edition).	A.I. Vogel , G Svehla	Prentice Hall
2	Vogel's Quantitative Chemical Analysis (6th Edition),	A.I. Vogel , J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
3	Advanced Practical Inorganic Chemistry	Ayodha Singh	Campus Books 2002
4	Textbook of Practical Organic Chemistry, 5th edition, 1996.	Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G	Prentice-Hall
5	Practical Organic Chemistry	Mann, F.G. & Saunders, B.C.	Orient-Longman,

INDUSTRIAL CHEMICAL AND ENVIRONMENT

Course Code	**CHM 309**
Course Title	**Industrial Chemical and Environment**
Type of course	Discipline elective(Theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with Chemistry as core subject
Course Objective	The objective of this course is to make students aware about the concepts of different gases and their industrial production, uses, storage and hazards. Manufacturing, applications, analysis and hazards of the Inorganic Chemicals, Air and Water pollution, control measures for Air and Water Pollutants, Catalyst and Biocatalyst, Energy and Environment.
Course outcome	**By the end of this course students will be able to understand:** CO1Understand the vital role played by chemistry in industry. CO2 Give solution based on chemical knowledge in the field of various industries such as manufacturing processes, handling and storage of inorganic chemicals & hazardous effects of the inorganic chemicals. CO3 Composition of air, various air pollutants, effects and control measures of air pollutants. CO4 Different sources of water, water quality parameters, impacts of water pollution, water treatment. CO5 Different industrial effluents and their treatment methods. CO6 Different sources of energy & generation of nuclear waste and its disposal.

UNIT I

Industrial Gases and Inorganic Chemicals

Industrial Gases: Large scale production, uses, storage and hazards in handling of the following gases: oxygen, nitrogen, argon, neon, helium, hydrogen, acetylene, carbon monoxide, chlorine, fluorine, sulphur dioxide and phosgene.

Inorganic Chemicals: Manufacture, application, analysis and hazards in handling the following chemicals: hydrochloric acid, nitric acid, sulphuric acid, caustic soda, common salt, borax, bleaching powder, sodium thiosulphate, hydrogen peroxide, potash alum, chrome alum, potassium dichromate and potassium permanganate.

UNIT II

Industrial Metallurgy Preparation of metals (ferrous and nonferrous) and ultrapure metals for semiconductor technology. Environment and its segments Ecosystems. Biogeochemical cycles of carbon, nitrogen and sulphur.

Air Pollution: Major regions of atmosphere. Chemical and photochemical reactions in atmosphere. Air pollutants: types, sources, particle size and chemical nature; Photochemical smog: its constituents and photochemistry. Environmental effects of ozone, Major sources of air pollution. Pollution by SO_2, CO_2 , CO, NOx, H_2S and other foul smelling gases. Methods of estimation of CO, NOx, SOx and control procedures. Effects of air pollution on living organisms and vegetation. Greenhouse effect and Global warming, Ozone depletion by oxides of nitrogen, chlorofluorocarbons and Halogens, removal of sulphur from coal. Control of particulates.

UNIT III

Water Pollution: Hydrological cycle, water resources, aquatic ecosystems, Sources and nature of water pollutants, Techniques for measuring water pollution, Impacts of water pollution on hydrological and ecosystems. Water purification methods. Effluent treatment plants (primary, secondary and tertiary treatment).

Industrial effluents from the following industries and their treatment: electroplating, textile, tannery, dairy, petroleum and petrochemicals, agro, fertilizer, etc. Sludge disposal. Industrial waste management, incineration of waste. Water treatment and purification (reverse osmosis, electro dialysis, ion exchange). Water quality parameters for waste water, industrial water and domestic water.

UNIT IV

Energy & Environment: Sources of energy: Coal, petrol and natural gas. Nuclear Fusion / Fission, Solar energy, Hydrogen, geothermal, Tidal and Hydel, etc. Nuclear Pollution: Disposal of nuclear waste, nuclear disaster and its management.

Biocatalysis Introduction to biocatalysis: Importance in "Green Chemistry" and Chemical Industry.

Text and Reference Books

S. No	**Name**	**Author(S)**	**Publisher**
1	Standard methods for the examination of water and waste water- 19th Edn. 1995.	Andrew D. Eaton, Lenore, S. Clesceri and A. E. Greenberg,	EPS group, INC Roman,
2	Environmental Chemistry, , 2nd edition, 1990.	A. K. DE	Wiley Eastern Ltd
3	(2010), Environmental Pollution Analysis,	Khopkar, S.M.,	New Age International Publisher.
4	2003),Industrial Inorganic Chemistry,	Buchel, K.H.; Moretto, H.H.; Woditsch, P.	Wiley-VCH.
5	Waste water treatment disposal and release-, INC second Edn.,1990.	Metcalf and eddy	Tata Mc Graw Hill
6	Environmental pollution control and engineering, 1995.	C. S. Rao	Wiley Eastern Ltd.
7	Chemical and Biological methods for water pollution studies, 1986.	R. K. Trivedy, and P. K. Goel,	Environmental publications
8	Environmental Chemistry, 1994.	B. K. Sharma & H. Kaur	Goel publishing House,

9	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder’s College Publ. Latest edition.

INDUSTRIAL CHEMICAL AND ENVIRONMENT PRACTICAL

Course Code	**CHM 311**
Course Title	**Industrial chemical and environment (Practical)**
Type of course	Discipline elective (practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with Chemistry as one core subject
Course Objective	The aim of this course is to impart practical knowledge to the students in Industrial processes and environmental chemistry.
Course outcome	**By the end of this course students will be able to:** CO1 Identify and analyse various water quality parameters CO2Analyse quantitively air,water pollutants. CO3 Estimate bioindicators of pollution through titrimetrically and spectrophotometrically.

1. Determination of dissolved oxygen in water.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Percentage of available chlorine in bleaching powder.
5. Measurement of chloride, sulphate and salinity of water samples by simple titration method (AgNO3 and potassium chromate).
6. Estimation of total alkalinity of water samples ($CO3^{2-}$, $HCO3^{-}$) using double titration method.
7. Measurement of dissolved CO_2.
8. Study of some of the common bio-indicators of pollution.
9. Estimation of SPM in air samples.
10. Preparation of borax/ boric acid.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	(2008),A Laboratory Manual for Environmental Chemistry,	Gopalan, R.; Anand, A.; Sugumar R.W.	I. K. International.
2	(2010), Environmental Pollution Analysis,	Khopkar, S.M.,	New Age International Publisher.
3	(1980),Experiments in Environmental Chemistry: A Laboratory Manual, Vol.4,	Vowles, P.D.; Connell, D.W.	Pergamon Series in Environmental Science.

4	Waste water treatment disposal and release-, INC second Edn.,1990.	Metcalf and eddy	Tata Mc Graw Hill
5	Environmental pollution control and engineering, 1995.	C. S. Rao	Wiley Eastern Ltd.
6	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.

Course Code	**SSC006**
Course Title	**Human values & Professional Ethics**
Type of Course	ID
L T P	3:0:0
Credits	3
Course Prerequisites	None
Course Objectives (CO)	To help the students to discriminate between valuable and superficial in the life. To help students develop sensitivity and awareness; leading to commitment and courage to act on their own belief. This Course will encourage the students to discover what they consider valuable. Accordingly, they should be able to discriminate between valuable and the superficial in real situations in their life. This course is an effort to fulfill our responsibility to provide our students significant input about understanding
Course Outcome	1. Students will behave ethically and promote human values in society. 2. Students will behave professionally.

UNIT-I:Course Introduction-Need, Basic Guidelines, Content and Process for ValueEducation

Understanding the need, basic guidelines, content and process for Value Education,Understanding Happiness and Prosperity correctly.

Understanding Harmony in the Human Being : Understanding the harmony with self and theBody: Sanyam and Swasthya.

UNIT II:Harmony in Human Relationship:

Understanding harmony in the Family- the basic unit of human interaction, visualizinga universal harmonious order in society **Understanding Harmony in the Nature and** Existence: Understanding the harmony in the Nature, Holistic perception of harmony at all levels of existence

UNIT III: Understanding of Harmony on Professional Ethics:

Ability to utilize the professional competence for augmenting universal human order,Ability to identify the scope and characteristics of people-friendly and eco-friendly production systems

.

UNIT IV:Strategy for transition from the present state to Universal Human Order:

At the level of individual, at the level of society. **Case studies**: typical holistictechnologies, management models and production systems

S. No.	Author(S)	Year	Publisher
1	A Foundation Course in Value Education	R R Gaur, R Sangal	Excel Books Publishers
2	Energy & Equity	Ivan Illich	.The Trinity Press, Worcester, and HarperCollins, USA
3	Human Values and Professional Ethics	RishabhAnand	Satya Prakashan, New Delhi
4	Jeevan VidyaekParichay.	A Nagraj	Divya Path Sansthan

VIth SEMESTER

GREEN CHEMISTRY

Course Code	**CHM 310**
Course Title	**Green Chemistry**
Type of course	**Discipline Elective Course (Theory)**
L T P	**4:0:0**
Credits	**4**
Course prerequisite	**Bsc. Ist, IInd year with CHEMISTRY as core subject**
Course Objective (CO)	**The aim of this course is to impart Coherent knowledge principles and scope of Green chemistry and applications of green chemistry in current scenario**
Course Outcome	**By the end of this course, students will be able to:** **CO1 Understand the twelve principles of green chemistry and will build the basic understanding of toxicity, hazard and risk of chemical substances.** **CO2 Learn to design safer chemical ,products and processes that are less toxic, than current alternatives as well as safer design for accident prevention.** **CO3 Appreciate the use of green chemistry in problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.** **CO4 Observe the current environmental issues and their appropriate solutions by chemical approach.**

UNIT I

Introduction to Green Chemistry: What is Green Chemistry? Need for Green Chemistry. Goals of Green Chemistry. Limitations/ Obstacles in the pursuit of the goals of Green Chemistry.

Principles of Green Chemistry and Designing a Chemical synthesis: Twelve principles of Green Chemistry with their explanations and examples and special emphasis on the following: Designing a Green Synthesis using these principles; Prevention of Waste/ byproducts; maximum incorporation of the materials used in the process into the final products , Atom Economy, calculation of atom economy of the rearrangement, addition, substitution and elimination reactions. Prevention/ minimization of hazardous/ toxic products reducing toxicity. risk = (function) hazard × exposure; waste or pollution prevention hierarchy.

UNIT II

Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorous biphasic solvent, PEG, solvent less processes, immobilized solvents and how to compare greenness of solvents. Energy requirements for reactions – alternative sources of energy: use of microwaves and ultrasonic energy.

Selection of starting materials; avoidance of unnecessary derivatization – careful use of blocking/protecting groups. Catalysis and green chemistry, comparison of heterogeneous and homogeneous catalysis, biocatalysis, asymmetric catalysis and photocatalysis.

Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical process

UNIT III

Examples of Green Synthesis/ Reactions and some real world cases

Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)

Microwave assisted reactions in water: Hofmann Elimination, methyl benzoate to benzoic acid, oxidation of toluene and alcohols; microwave assisted reactions in organic solvents Diels-Alder reaction and Decarboxylation reaction

Ultrasound assisted reactions: Sono chemical Simmons-Smith Reaction (Ultrasonic alternative to Iodine)

Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO2 for precision cleaning and dry cleaning of garments.

Designing of Environmentally safe marine antifoulant.

UNIT IV

Future Trends in Green Chemistry Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solvent less reactions; co crystal controlled solid state synthesis (C^2S^3); Green chemistry in sustainable development.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Green Chemistry	V. K. Ahluwalia	New Age International
2	Green Chemistry- Theory and Practical, 1998	Anastas, P.T. &Warner, J.K.	Oxford University Press
3	Introduction to Green Chemistry,2001	Matlack, A.S.	Marcel Dekker
4	Real-World cases in Green Chemistry, 2000	Cann, M.C. &Connely, M.E.	American Chemical Society, Washington
5	Introduction to Green Chemistry,2002	Ryan, M.A. &Tinnesand, M.	American Chemical Society, Washington
6	Green Chemistry Experiments: A monograph	Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K.	I.K. International Publishing House Pvt Ltd. New Delhi
7	Green Chemistry: An introductory text	Lancaster, M.	RSC publishing, 2nd Edition.

GREEN CHEMISTRY PRACTICAL

Course Code	CHM 312
Course Title	Green Chemistry (Practical)
Type of course	Discipline Elective Course (Practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to equip students about practical aspects of green chemistry applications of green chemistry in current scenario
Course Outcome	By the end of this course, students will be able to: CO1 Apply twelve principles of green chemistry for synthesis and analysis. CO2 design safer chemical ,products and processes that are less toxic, than current alternatives CO3 Incorporate problem solving skills, critical thinking and valuable skills to innovate and find out solution to environmental problems.

1. **Safer starting materials**

Preparation and characterization of nanoparticles of gold using tea leaves/silver nanoparticles using plant extracts.

2. **Using renewable resources:** Preparation of biodiesel from vegetable/ waste cooking oil.

3. **Avoiding waste:** Principle of atom economy. Use of molecular model kit to stimulate the reaction to investigate how the atom economy can illustrate Green Chemistry.

Preparation of propene by two methods can be studied

Triethylamine ion + OH^- → propene + trimethylpropene + water

(II) 1-propanol $\xrightarrow{H_2SO_4/\square}$ propene + water

Other types of reactions, like addition, elimination, substitution and rearrangement should also be studied for the calculation of atom economy.

4. **Use of enzymes as catalysts**Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide.

5. **Alternative Green solvents** Extraction of D-limonene from orange peel using liquid CO2 prepared form dry ice. Mechanochemical solvent free synthesis of azomethines.

6. **Alternative sources of energy:** Solvent free, microwave assisted one pot synthesis of phthalocyanine complex of copper (II).

Photoreduction of benzophenone to benzopinacol in the presence of sunlight.

Reducing waste

Designing and conducting an experiment by utilizing the products and by products obtained in abovepreparations which become waste otherwise if not used. This is done by critical thinking and literaturesurvey.

Students should be taught to do spot tests for qualitative inorganic analysis for cations and anions, andqualitative organic analysis for preliminary test and functional group analysis

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Green Chemistry	V. K. Ahluwalia	New Age International
2	Green Chemistry- Theory and Practical, 1998	Anastas, P.T. &Warner, J.K.	Oxford University Press
3	Introduction to Green Chemistry,2001	Matlack, A.S.	Marcel Dekker
4	Real-World cases in Green Chemistry, 2000	Cann, M.C. &Connely, M.E.	American Chemical Society, Washington
5	Introduction to Green Chemistry,2002	Ryan, M.A. &Tinnesand, M.	American Chemical Society, Washington
6	Green Chemistry Experiments: A monograph	Sharma, R.K.; Sidhwani, I.T. & Chaudhari, M.K.	I.K. International Publishing House Pvt Ltd. New Delhi
7	Green Chemistry: An introductory text	Lancaster, M.	RSC publishing, 2nd Edition.

ANALYTICAL METHOD IN CHEMISTRY

Course Code	**CHM 314**
Course Title	**Analytical Method in Chemistry**
Type of course	Discipline Elective Course(theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with Chemistry as core subject
Course Objective (CO)	The objective of this course is to make student aware about concepts of analytical Chemistry various spectrophotometric, electroanalytical and themalmethods of analysis Students are exposed to important separation methods like solvent extraction and chromatography.
Course Outcome	**By the end of this course, students will be able to:** CO1 Understand basic principle of instrument of various spectrophotometric, electroanalytical and themal methods of analysis CO2Develop experience and knowledge to operate and use effectively the analytical tools and instruments available in laboratory. CO3.Understand the significance, quality and limitations of the results produced by various separation techniques. CO4 Develop methods of analysis for different samples independently.

UNIT I

Qualitative and quantitative aspects of analysis: Sampling, evaluation of analytical data, errors, accuracy and precision, methods of their expression, normal law of distribution if indeterminate errors, statistical test of data; F, Q and t test, rejection of data, and confidence intervals.

Optical methods of analysis: Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law. UV-Visible Spectrometry: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers. Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

UNIT II

Infrared Spectrometry: Basic principles of instrumentation (choice of source, NM monochromatic & detector) for single and double beam instrument; sampling techniques. Structural illustration through interpretation of data, Effect and importance of isotope substitution.

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromatic, detector, choice of flame and Burner designs. Techniques of atomization and sample introduction; Method of background correction, sources of chemical interferences and their method of removal. Techniques for the quantitative estimation of trace level of metal ions from water samples.

UNIT III

Thermal methods of analysis: Theory of thermogravimetry (TG), basic principle of instrument Techniques for quantitative estimation of Ca and Mg from their mixture .

Electro-analytical methods: Classification of electro analytical methods, basic principle of pH metric, potentiometric and conduct metric titrations. Techniques used for the determination of equivalence points. Techniques used for the determination of pKa values.

UNIT IV

Separation techniques: Solvent extraction: Classification, principle and efficiency of the technique. Mechanism of extraction: extraction by solvation and chelation. Technique of extraction: batch, continuous and counter current extractions. Qualitative and quantitative aspects of solvent extraction: extraction of metal ions from aqueous solution, extraction of organic species from the aqueous and non-aqueous media.

Chromatography: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.
4	Vogel's Qualitative Inorganic Analysis (7th Edition).	G Svehla	Prentice Hall
5	Vogel's Quantitative Chemical Analysis (6th Edition),	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
6	Instrumental Analysis	G.D. Christian and J.E.G. Reily	AllegnBecon, Latest edition
7	Instrumental Methods of Chemical Analysis	G.W.Ewing,	McGraw Hill Pub, 1975.

ANALYTICAL METHOD IN CHEMISTRY PRACTICAL

Course Code	**CHM 316**
Course Title	**Analytical Method in Chemistry(Practical)**
Type of course	Discipline Elective(Practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to impart practical knowledge of analytical methods of chemical analysis . It expose students to latest instrumentation and they learn to detect analytes in a mixture.
Course Outcome	**By the end of this course, students will be able to:** CO1 Perform experiment with accuracy and precision. CO2 Perform various types of titrations i.e redox, colorimetric, complexometric and acid- base titration. CO3 Determine composition of soil, water analysis, Estimation of macronutrients using Flame Photometery CO4 Learn separation of analytes by chromatography.

I. Separation Techniques

Chromatography:

1. Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the Rf values.
2. Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their Rf values.
3. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC
4. Separation of compounds using column chromatography.

II. Solvent Extractions:

1. To separate a mixture of Ni^{2+}& Fe^{2+} by complexation with DMG and extracting the Ni^{2+}- DMG complex in chloroform, and determine its concentration by spectrophotometry.
2. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.
3. Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.

III Analysis of soil and water:

1. Determination of pH of soil.
2. Total soluble salt
3. Estimation of calcium, magnesium, phosphate, nitrate
4. Determination of physical and chemical parameters of water .
5. Determination of dissolved oxygen in water.
6. Determination of chemical oxygen demand (COD).
7. Determination of Biological oxygen demand (BOD).
8.

IV Ion exchange:

(i) Determination of exchange capacity of cation exchange resins and anion exchange resins.
(ii) Separation of metal ions from their binary mixture.
(iii) Separation of amino acids from organic acids by ion exchange chromatography.

V Spectro-photometry

1. Verification of Lambert-Beer's law and determination of concentration of a coloured species ($CuSO_4$, $KMnO_4$, $CoCl_2$, $CoSO_4$)
2. Determination of pKa values of indicator using spectrophotometry.
3. Structural characterization of compounds by infrared spectroscopy.

Text and Reference Books

S. No	**Name**	**Author(S)**	**Publisher**
1	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.
4	Vogel's Qualitative Inorganic Analysis (7th Edition).	G Svehla	Prentice Hall
5	Vogel's Quantitative Chemical Analysis (6th Edition),	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
6	Instrumental Analysis	G.D. Christian and J.E.G. Reily	AllegnBecon, Latest edition
7	Instrumental Methods of Chemical Analysis	G.W.Ewing,	McGraw Hill Pub, 1975.

CHEMISTRY OF MAIN GROUP ELEMENT, THEORIES OF ACIDS AND BASES

Course Code	**CHM 306**
Course Title	**Chemistry of Main Group Element, Theories of Acids and Bases**
Type of course	Discipline Elective Course(Theory)
L T P	4:0:0
Credits	4
Course prerequisite	Bsc. Ist, IInd year with Chemistry as core subject
Course Objective (CO)	The aim of this course is to impart detailed knowledge of Main group elements and industrial important processes based upon main group chemistry.
Course Outcome	**By the end of the course, the students will beable to:** CO1 Learn the fundamental principles of metallurgy and understand the importance of recovery of byproducts during extraction. CO2 Understand the periodicity in atomic and ionic radii, electronegativity, ionization energy, electron affinity of elements of the periodic table. CO3 Understand structure & properties, role of inorganic polymers. CO4 Elaborate different acid and base reactions & covalent and ionic bonding using Lewis dot structure.

UNIT I

Acids and Bases Brönsted–Lowry concept, conjugate acids and bases, relative strengths of acids and bases, effects of substituent and solvent, differentiating and levelling solvents. Lewis acid-base concept, classification of Lewis acids and bases, Lux-Flood concept and solvent system concept. Hard and soft acids and bases (HSAB concept), applications of HSAB process

General Principles of Metallurgy: Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agents. Hydrometallurgy with reference to cyanide process for gold and silver. Methods of purification of metals (Al, Pb, Ti, Fe, Cu, Ni, Zn, Au): electrolytic refining, zone refining, van Arkel-de Boer process, Parting Process, Mond’s process and Kroll Process.

UNIT II

***s*- and *p*-Block Elements** Periodicity in *s*- and *p*-block elements with respect to electronic configuration, atomic and ionic size, ionization enthalpy, electron gain enthalpy, electronegativity (Pauling scale).General characteristics of *s*-block metals like density, melting and boiling points, flame colour and reducing nature.Oxidation states of *s*- and *p*-block elements, inert-pair effect, diagonal relationships and anomalous behaviour of first member of each group. Allotropy in C, P and S. Complex forming tendency of *s* block elements and a preliminary idea of crown ethers and cryptates, structures of basic beryllium acetate, salicylaldehyde/ acetylacetonato complexes of Group 1 metals. Solutions of alkali metals in liquid ammonia and their properties. Common features, such as ease of formation, solubility and stability of oxides, peroxides, superoxides, sulphates and carbonates of *s*-block metals.

UNIT III

Structure, bonding and properties (acidic/ basic nature, oxidizing/ reducing nature and hydrolysis of the following compounds and their applications in industrial and environmental chemistry wherever applicable: Diborane and concept of multicentre bonding, hydrides of Groups 13 (EH3), 14, 15, 16 and 17.Oxides

Noble gases: Rationalization of inertness of noble gases, catharses, preparation and properties of XeF2, XeF4 and XeF6 ,bonding in these compounds using VBT and shapes of noble gas compounds using VSEPR Theory.

UNIT IV

Inorganic Polymers Types of inorganic polymers and comparison with organic polymers, structural features, classification and important applications of silicates. Synthesis, structural features and applications of silicones. Borazines and cyclophosphazenes – preparation, properties and reactions. Bonding in $(NPCl_2)_3$. of N and P, Ox acids of P, S and Cl. Halides and ox halides of P and S (PCl3, PCl5, SOCl2 and SO2Cl2). Interhalogen compounds. A brief idea of pseudo halides.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Inorganic Chemistry Principles of Structure and Reactivity	J.E. Huheey	Harper Inter science
4	Principles of Inorganic Chemistry	Puri, Sharma and Kalia	Vishal publishers
5	Synthesis and Technique in Inorganic chemistry	G. S.Girlomi; R.J. Angleci	Latest edition, University Science Books.
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd
7	Shriver & Atkin's Inorganic Chemistry (5^{th} Edition),	P Atkins, T. Overton, J. Rourke, M. Weller, F. Armstrong, M. Hagerman	Oxford University Press,

CHEMISTRY OF MAIN GROUP ELEMENT, THEORIES OF ACIDS AND BASES PRACTICAL

Course Code	**CHM 308**
Course Title	**Chemistry of Main Group Element, Theories of Acids and Bases(Practical)**
Type of course	Discipline Elective Course(Practical)
L T P	0:0:4
Credits	2
Course prerequisite	Bsc. Ist, IInd year with CHEMISTRY as core subject
Course Objective (CO)	The aim of this course is to impart practical knowledge of iodometric, complexometric and gravimetric titration used for analysis of Main group elements,.
Course Outcome	**By the end of the course, the students will be able to:** CO1 Carry out iodometric/iodimetric analysis. CO2 Perform and estimate constituent ions through complexometric titrations & gravimetrically CO3Handle and prepare some industrially significant complex salts

(A) Iodo / Iodimetric Titrations

1. Iodometric estimation of potassium dichromate and copper sulphate
2. Iodimetric estimation of antimony in tartaremetic
3. Estimation of amount of available chlorine in bleaching powder and household bleaches.
4. Iodimetric estimation of ascorbic acid in fruit juices.
5. Estimation of iodine in iodized salts.

(B) Complexometric titrations using disodium salt of EDTA

(i) Estimation of Mg^{2+},Zn^{2+}

(ii) Estimation of Ca^{2+} by substitution method

(C) Gravimetric Analysis

1. Gravimetric estimation of sulphate as barium sulphate.
2. Gravimetric estimation of aluminium as oximato complex

(D) Inorganic preparations

1. Preparation of the following :

(i) Cuprous Chloride, Cu_2Cl_2

(ii) Aluminium potassium sulphate $KAl(SO_4)_2 .12H_2O$ (potash alum) or Chromium potassium sulphate
$KCr(SO_4)_2.12H_2O$ (chrome alum).

(iii)tetraamminecopper(II) sulphate monohydrate, potassium trioxalatoferrate(III)
(any two, including one double salt and one complex).

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis (7th Edition). ISBN-13:978-0582218666,	G Svehla	Prentice Hall
2	Vogel's Quantitative Chemical Analysis (6th Edition), ISBN-13:978-0582226289,	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
3	Advanced Practical Inorganic Chemistry	Ayodha Singh	Campus Books 2002

ECONOMIC BOTANY AND BIOTECHNOLOGY

Course Code	**BOT302**
Course Title	**Economic Botany and Biotechnology**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To study economically important plants and recombinant DNA techniques.
Course Outcomes (CO)	Students will learn about CO1. Core concepts of Economic Botany and relate with environment, populations, communities, and ecosystems CO2. The various types of cereal, pulses, spices, oil, brevage, fibre crops, their origin, cultivation and uses CO3. Micropropagation techniques and tissue culture CO4. Ricombinant DNA Techniques

UNIT-I

Origin of Cultivated Plants: Concept of centres of origin, their importance with reference to Vavilov's work

Cereals : Wheat, Rice, Maize –Origin, morphology, uses

Legumes: General account with special reference to Gram, Pea, Soybean,

UNIT-I

Spices: General account with special reference to clove and black pepper (Botanical name, family, part used morphology and uses)

Beverages: Tea, Coffee (morphology, processing, uses)

UNIT-III

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)

Plant tissue culture: Micropropagation ; haploid production through androgenesis and gynogenesis; brief account ofembryo& endosperm culture with their applications

UNIT-IV

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

Text and reference books:

S. no.	Title	Author	Publisher
1	Economic Botany in the Tropics	Kochhar, S.L.	MacMillan Publishers India
2	Plant Tissue Culture: Theory and Practice	Bhojwani, S.S. and Razdan, M.K	Elsevier Science
3	Molecular Biotechnology-Principles and Applications of recombinant DNA	Glick, B.R., Pasternak, J.J.	ASM Press

ECONOMIC BOTANY AND BIOTECHNOLOGY PRACTICAL

Course Code	**BOT304**
Course Title	**Economic Botany and Biotechnology Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To impart practical knowledge about economically important plants and recombinant DNA techniques.
Course Outcomes (CO)	Student will learn about CO1. Wheat, Gram, Soybean, Black pepper, Clove Tea, Cotton, Groundnut through specimens, sections and microchemical tests CO2. Tissue culture through photographs: Anther culture, somatic embryogenesis, endosperm and embryo culture; micropropagation CO3. Molecular techniques: PCR, Blotting techniques, AGE and PAGE by performing experiments

LIST OF EXPERIMENTS

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:

S. no.	Title	Author	Publisher
1	Economic Botany in the Tropics	Kochhar, S.L.	MacMillan Publishers India
2	Plant Tissue Culture: Theory and Practice	Bhojwani, S.S. and Razdan, M.K	Elsevier Science
3	Molecular Biotechnology-Principles and Applications of recombinant DNA	Glick, B.R., Pasternak, J.J.	ASM Press

BIOINFORMATICS

Course Code	**BOT306**
Course Title	**Bioinformatics**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To give knowledge about creation and usefulness of plant databases and softwares related to it.
Course Outcomes	Students will learn about CO1. Aim, scope and application of bioinformatics CO2. Biological databases and their classification CO3.national center for biotechnology information (NCBI), Tools used in bioinformatics such as BLAST, various types of databases CO4. DNA DDBJ, PIR. MSA, PAM, Blosum CO5. Structural bioinformatics drug discovery, QSAR, Drug designing and crop improvement using bioinformatic's tools

UNIT-I

Introduction to Bioinformatics: Introduction, Branches of Bioinformatics, Aim, Scope and Research areas of Bioinformatics.

Databases in Bioinformatics: Introduction, Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System.

UNIT-II

Biological Sequence Databases: National Center for Biotechnology Information (NCBI): Tools and Databases of NCBI, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST), Nucleotide Database, Protein Database, Gene Expression Database.

EMBL Nucleotide Sequence Database (EMBL-Bank): Introduction, Sequence Retrieval, Sequence Submission to EMBL, Sequence analysis tools.

UNIT-III

DNA Data Bank of Japan (DDBJ): Introduction, Resources at DDBJ, Data Submission at DDBJ. Protein Information Resource (PIR): About PIR, Resources of PIR, Databases of PIR, Data Retrieval in PIR.

Swiss-Prot: Introduction and Salient Features **Sequence Alignments:** Introduction, Concept of Alignment, Multiple Sequence Alignment (MSA), MSA by CLUSTALW, Scoring Matrices, Percent Accepted Mutation (PAM), Blocks of Amino Acid Substitution Matrix (BLOSUM).

UNIT-IV

Molecular Phylogeny: Methods of Phylogeny, Software for Phylogenetic Analyses, Consistency of Molecular Phylogenetic Prediction.

Applications of Bioinformatics: Structural Bioinformatics in Drug Discovery, Quantitative structure-activity relationship (QSAR) techniques in Drug Design, Microbial genome applications, Crop improvement.

Text and reference books:

S. no.	Title	Author	Publisher
1	Bioinformatics: Principles and Applications	Ghosh Z. and Bibekanand M	Oxford University Press
2	Bioinformatics and Functional Genomics	Pevsner J	Wiley-Blackwell
3	Discovering Genomics, Proteomics and Bioinformatics	Campbell A. M., Heyer L. J	Benjamin Cummings

BIOINFORMATICS PRACTICAL

Course Code	**BOT308**
Course Title	**Bioinformatics Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To give practical knowledge about creation and usefulness of plant databases and softwares related to it.
Course Outcomes	Student will learn about CO1. How to use nucleic and protein databses CO2. Hoe to retrieve the sequences from the databases CO3. Sequence homology and Gene annotation CO4. Construction of phylogenetic tree using various software

LIST OF EXPERIMENTS

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree.

Text and reference books:

S. no.	Title	Author	Publisher
1	Bioinformatics: Principles and Applications	Ghosh Z. and Bibekanand M	Oxford University Press
2	Bioinformatics and Functional Genomics	Pevsner J	Wiley-Blackwell
3	Discovering Genomics, Proteomics and Bioinformatics	Campbell A. M., Heyer L. J	Benjamin Cummings

IMMUNOLOGY

Course Code	**ZOO302**
Course Title	**Immunology**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To make students aware about the immunological reaction taking place in your body.
Copurse Outcomes (CO)	1.Imparts in depth knowledge of tissues, cells and molecules involved in host defense mechanisms 2.Interactions of antigens, antibodies, complements and other immune components

UNIT I

Overview of the Immune System: Introduction to basic concepts in immunology, components of immune system, principles of innate and adaptive immune system, Cells and Organs of the Immune System Haematopoiesis, Cells of immune system and organs (primary and secondary lymphoid organs) of the immune system

UNIT-II

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

UNIT-III

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, Classical pathway of Complement system.

UNIT-IV

Immune system in health and Vaccines: General introduction to vaccines, various types of vaccines,various types of hypersensitivities, Introduction to concepts of autoimmunity and immunodeficiency,

Text and Reference Books:

S.No	Title	Author	Publisher
1.	Immunology, VI Edition	Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006)	W.H. Freeman and Company
2.	Immunology, VII Edition	David, M., Jonathan, B., David, R. B. and Ivan R. (2006)	Mosby, Elsevier Publication
3.	Text book ofImmunology	Dr. P. MadhaveeLatha	S. Chand publications
4.	*Cellular and Molecular Immunology*. V Edition	Abbas, K. Abul and Lechtman H. Andrew (2003.)	Saunders Publication.
5.	Biostatistics	P. Ramakrishnan	Saras Publications

IMMUNOLOGY PRACTICAL

Course Code	**ZOO304**
Course Title	**Immunology**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To study histology of immune system and physiology of immunological reactions; graphical representation of data
Course Outcomes (CO)	1.Provides basics knowledge about immune system and allows the student to create insight as how to improve their immune system and good health. 2. Use of Math in science for study of different data

LIST OF EXPERIMENTS

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. ABO blood group determination.
5. Demonstration of Immunoelectrophoresis
6. Demonstration of ELISA
7. Chromatography (Paper and TLC).

Text and reference books:

S. no.	Title	Author	Publisher
1	Immunology	Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J	W.H. Freeman and Company
2	Immunology	David, M., Jonathan, B., David, R. B. and Ivan R	Elsevier Publication
3	Cellular and Molecular Immunology	Abbas, K. Abul and Lechtman H. Andrew	Saunders Publication

REPRODUCTIVE BIOLOGY

Course Code	**ZOO306**
Course Title	**Reproductive Biology**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To aware students about the organs of reproduction and their hormonal secretions and the role played by each hormone for the development of reproductive organs in humans.

UNIT-I

Reproductive Endocrinology: Gonadal hormones and mechanism of hormone action, steroids, glycoprotein hormones, andprostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophinsecretion in male and female; Reproductive System: Development and differentiation ofgonads, genital ducts, external genitalia, mechanism of sex differentiation.

UNI-II

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 hormonal regulation; Androgen synthesis and metabolism; Epididymal function and sperm maturation; Accessory glands functions; Sperm transportation in male tract

UNIT-III

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 andsecretion 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-IV

Reproductive Health Infertility in male and female: causes, diagnosis and management; Assisted ReproductiveTechnology: 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.

Text and reference books:

S. no.	Title	Author	Publisher
1	Reproduction in Mammals	Austin, C.R. and Short, R.V	Cambridge University Press
2	Endocrinology	Degroot, L.J. and Jameson, J.L.	W.B. Saunders and Company
3	The Physiology of Reproduction	Knobil, E	Raven Press Ltd

REPRODUCTIVE BIOLOGY PRACTICAL

Course Code	**ZOO308**
Course Title	**Reproductive Biology Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To aware students about the different techniques used in studying various types of cells involved in formation of reproductive organs.

LIST OF EXPERIMENTS

1. Study of animal house: set up and maintenance of animal house, breeding techniques, care of normal and experimental animals.
2. Examination of vaginal smear rats from live animals.
3. Surgical techniques: principles of surgery in endocrinology. Ovarectomy, hysterectorny, castration and vasectomy in rats.
4. Examination of histological sections from photomicrographs/ permanent slides of rat/human: testis, epididymis and accessory glands of male reproductive systems; Sections of ovary, fallopian tube, uterus (proliferative and secretory stages), cervix and vagina.
5. Human vaginal exfoliate cytology.
6. Sperm count and sperm motility in rat
7. Study of modern contraceptive devices

Text and reference books:

S. no.	Title	Author	Publisher
1	Reproduction in Mammals	Austin, C.R. and Short, R.V	Cambridge University Press
2	Endocrinology	Degroot, L.J. and Jameson, J.L.	W.B. Saunders and Company
3	The Physiology of Reproduction	Knobil, E	Raven Press Ltd

INSECT, VECTOR AND DISEASES

Course Code	**ZOO310**
Course Title	**Insect, Vector And Diseases**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To aware students about the role different insects in spreading the various diseases so that they can aware a general human being to take precautionary measure from insects

UNIT-I

Introduction to Insects: General Features of Insects, Morphological features, Head – Eyes, Types of antennae, Mouth parts w.r.t. feeding habits

Concept of Vectors: Brief introduction of Carrier and Vectors (mechanical and biological vector), Reservoirs, Host-vector relationship, Vectorial capacity, Adaptations as vectors, Host Specificity

Unit II

Insects as Vectors: Classification of insects up to orders, detailed features of orders with insects asvectors – Diptera, Siphonaptera, Siphunculata, Hemiptera

Dipteran as Disease Vectors: Dipterans as important insect vectors – Mosquitoes, Sand fly, Houseflies;Study of mosquito-borne diseases – Malaria, Dengue, Chikungunya, Viral encephalitis, Filariasis; Control of mosquitoes Study of sand fly-borne diseases – Visceral Leishmaniasis, Cutaneous Leishmaniasis, Phlebotomus fever; Control of Sand fly

Study of house fly as important mechanical vector, Myiasis, Control of house fly

UNIT-III

Siphonaptera as Disease Vectors: Fleas as important insect vectors; Host-specificity, Study of Flea-borne diseases– Plague, Typhus fever; Control of fleas

Siphunculata as Disease Vectors: Human louse (Head, Body and Pubic louse) as important insect vectors; Study oflouse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

UNIT-IV

Hempitera as Disease Vectors: Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs asmechanical vectors, Control and prevention measures.

Text and reference books:

S. no.	Title	Author	Publisher
1	A General Text Book of Entomology	Imms, A.D	Chapman & Hall
2	The Insects: Structure and Function	Chapman, R.F	Cambridge University Press
3	Entomology and Pest Management	PedigoL.P	Prentice Hall Publication
4	Integrated Vector Management	Mathews, G.	Wiley-Blackwell

INSECT VECTORS AND DISEASES PRACTICAL

Course Code	**ZOO312**
Course Title	**Insect, Vector And Diseases Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To give hands on training to the students about the different types of insects and their body parts which are involved in spreading disease, so that they will remain away from them.

LIST OF EXPERIMENTS

1. Study of different kinds of mouth parts of insects
2. Study of following insect vectors through permanent slides/ photographs:
Aedes, *Culex*, *Anopheles*, *Pediculus humanus capitis*, *Pediculus humanus corporis*, *Phithirus pubis*, *Xenopsyllacheopis*, *Cimexlectularius*, *Phlebotomusargentipes*, *Musca domestica*, through permanent slides/ photographs
3. Study of different diseases transmitted by above insect vectors
Submission of a project report on any one of the insect vectors and disease transmitted

Text and reference books:

S. no.	Title	Author	Publisher
1	A General Text Book of Entomology	Imms, A.D	Chapman & Hall
2	The Insects: Structure and Function	Chapman, R.F	Cambridge University Press
3	Entomology and Pest Management	PedigoL.P	Prentice Hall Publication
4	Integrated Vector Management	Mathews, G.	Wiley-Blackwell

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Course Code	**CHM326**
Course Title	**Instrumental Methods Chemical of Analysis**
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	The aim of this course is to impart theoretical knowledge to the students about various spectroscopic methods, chromatographic methods for analysis.

UNIT-I

Introduction to spectroscopic methods of analysis: Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: Treatmentof analytical data, including error analysis. Classification of analytical methods and the types ofinstrumental methods. Consideration of electromagnetic radiation.

Infrared spectroscopy: Interactions with molecules: absorption and scattering. Means of excitation (light sources),separation of spectrum (wavelength dispersion, time resolution), detection of the signal (heat,differential detection), interpretation of spectrum (qualitative, mixtures, resolution), advantagesof Fourier Transform (FTIR). Samples and results expected. Applications: Issues of qualityassurance and quality control, Special problems for portable instrumentation and rapiddetection.

UNIT-II

UV-Visible/ Near IR – emission, absorption, fluorescence and photoaccoustic. Excitation sources (lasers, time resolution), wavelength dispersion (gratings, prisms, interference filters, laser, placement of sample relative to dispersion, resolution), Detection of signal (photocells, photomultipliers, diode arrays, sensitivity and S/N), Single and Double Beam instruments, Interpretation (quantification, mixtures, absorption vs. fluorescence and the use of time, photoaccoustic, fluorescent tags).

UNIT-III

Separation techniques *Chromatography:* Gas chromatography, liquid chromatography, supercritical fluids, Importanceof column technology (packing, capillaries), Separation based on increasing number of factors(volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simplevs. specific (gas and liquid), Detection as a means of further analysis (use of tags and couplingto IR and MS), Electrophoresis (plates and capillary) and use with DNA analysis.

Immunoassays and DNA techniques

Mass spectroscopy: Making the gaseous molecule into an ion (electron impact, chemical ionization), Making liquids and solids into ions (electrospray, electrical discharge, laser desorption, fast atom bombardment), Separation of ions on basis of mass to charge ratio, Magnetic, Time of flight, Electric quadrupole. Resolution, time and multiple separations,
Detection and interpretation (how this is linked to excitation).

UNIT-IV

Elemental analysis: Mass spectrometry (electrical discharges).
Atomic spectroscopy: Atomic absorption, Atomic emission, and Atomic fluorescence.

Excitation and getting sample into gas phase (flames, electrical discharges, plasmas), Wavelength separation and resolution (dependence on technique), Detection of radiation (simultaneous/scanning, signal noise), Interpretation (errors due to molecular and ionic species, matrix effects, other interferences).

NMR spectroscopy: Principle, Instrumentation, Factors affecting chemical shift, Spincoupling, Applications.

Electroanalytical Methods: Potentiometry & Voltammetry

Radiochemical Methods

X-ray analysis and electron spectroscopy (surface analysis)

Text and reference books:

S. no.	Title	Author	Publisher
1	Principles of Instrumental Analysis	Skoog, D.A. Holler F.J. & Nieman, T.A	Cengage Learning India Ed
2	Instrumental Methods of Analysis, 7^{th}Ed	Willard, H.H., Merritt, L.L., Dean, J. &Settoe, F.A	Wadsworth Publishing Company Ltd.
3	Physical Chemistry	P.W. Atkins	
4	Fundamentals of Molecular Spectroscopy	C.N. Banwell	
5	Infrared Spectral Interpretations: A Systematic Approach	Brian Smith	

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS PRACTICAL

Course Code	**CHM328**
Course Title	**Instrumental Methods of Chemical Analysis Practical**
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	The aim of this course is to impart practical knowledge to the students about various spectroscopic methods, chromatographic methods for analysis.

LIST OF EXPERIMENTS

1. Safety Practices in the Chemistry Laboratory
2. Determination of the isoelectric pH of a protein.
3. Titration curve of an amino acid.
4. Determination of the void volume of a gel filtration column.
5. Determination of a Mixture of Cobalt and Nickel (UV/Vis spec.)
6. Study of Electronic Transitions in Organic Molecules (i.e., acetone in water)
7. IR Absorption Spectra (Study of Aldehydes and Ketones)
8. Determination of Calcium, Iron, and Copper in Food by Atomic Absorption
9. Quantitative Analysis of Mixtures by Gas Chromatography (i.e., chloroform and carbon tetrachloride)
10. Separation of Carbohydrates by HPLC
11. Determination of Caffeine in Beverages by HPLC
12. Potentiometric Titration of a Chloride-Iodide Mixture
13. Cyclic Voltammetry of the Ferrocyanide/Ferricyanide Couple
14. Nuclear Magnetic Resonance
15. Use of fluorescence to do “presumptive tests” to identify blood or other body fluids.
16. Use of “presumptive tests” for anthrax or cocaine
17. Collection, preservation, and control of blood evidence being used for DNA testing
18. Use of capillary electrophoresis with laser fluorescence detection for nuclear DNA (Y chromosome only or multiple chromosome)
19. Use of sequencing for the analysis of mitochondrial DNA
20. Laboratory analysis to confirm anthrax or cocaine
21. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
22. Detection of illegal drugs or steroids in athletes
23. Detection of pollutants or illegal dumping
24. Fibre analysis

At least 10 experiments to be performed.

Text and reference books:

S. no.	Title	Author	Publisher
1	Principles of Instrumental Analysis	Skoog, D.A. Holler F.J. & Nieman, T.A	Cengage Learning India Ed
2	Instrumental Methods of Analysis, 7th Ed	Willard, H.H., Merritt, L.L., Dean, J. &Settoe, F.A	Wadsworth Publishing Company Ltd.
3	Physical Chemistry	P.W. Atkins	
4	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.

Communication Skills and Personality Development

Course Code	**ENG004**
Course Title	**Communication Skills and Personality Development**
Type of course	**ID**
L T P	2 0 2
Credits	3 0 0
Course prerequisite	10+2 (Non Medical or Medical) or Equivalent
Course objective	Main objective of the extension subject is to introduce the students to communication skills and personality development.
Course Outcome	Students will use their communication skills and personality effectively.

Theory

UNIT-1 Communication Skills: Structural and functional grammar; meaning and process ofcommunication, verbal and nonverbal communication.

UNIT-1I

Listening and note taking, writing skills, oral presentation skills; field diary and lab record; indexing,footnote and bibliographic procedures.

UNIT-III

Reading and comprehension of general and technical articles, precise writing, summarizing,abstracting.

UNIT-1V

Individual and group presentations, impromptu presentation, public speaking; Group discussion.Organizing seminars and conferences.

Practical

1. Listening and note taking, writing skills, oral presentation skills.
2. Field diary and lab record; indexing, footnote and bibliographic procedures.
3. Reading and comprehension of general and technical articles, precise writing, summarizing,abstracting; individual and group presentations.

Recommended Books:

S. No	Name	Author(S)	Publisher
1	Agriculture Demonstration and Extension Communication	Ram Krishan	P S Jayasinghe AsiaPublishing House
2	Communication Skills and Personality Development		Kalyani Publishers.Ludhiana,
3	Communication Skills and Personality Development		Nirali Prakashan