

CHOICE BASED CREDIT SYSTEM SCHEME & SYLLABUS

B.Sc. Medical



Department of Life Sciences
University Institute of Science & Humanities (UIISH)

Sant Baba Bhag Singh University
2018

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4.	ENG101-18	General English-I	1	5-6
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7.	BOT103-18	Plant Biodiversity Practical	1	8-9
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9.	ZOO103-18	Animal Biodiversity Practical	1	10-11
10.	BOT102-18	Plant Ecology and Taxonomy	2	12-13
11.	CHM102-18	Chemical Energetics, Equilibria & Functional Groups Organic Chemistry-I	2	13-14
12.	ZOO102-18	Comparative Anatomy and Developmental Biology of Vertebrates	2	15-16
13.	ENG102-18	General English-II	2	16-17
14.	PBI102-18	General Punjabi-II	2	17-18
15.	HCP102-18	History and Culture of Punjab-II	2	18
16.	BOT104-18	Plant Ecology and Taxonomy Practical	2	19-20
17.	CHM104-18	Chemical Energetics, Equilibrium & Functional Group Organic Chemistry-I Lab	2	20-21
18.	ZOO104-18	Comparative Anatomy and Developmental Biology of Vertebrates Practical	2	21-22
19.	BOT201-18	Anatomy and Embryology of Angiosperms	3	23-24
20.	CHM201-18	Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II	3	24-26
21.	ZOO201 -18	Animal Physiology and Biochemistry	3	26-27
22.	EVS101-18	Environmental Science	3	27-28
23.	BOT203-18	Anatomy and Embryology of	3	28-29

		Angiosperms Practical		
24.	CHM203-18	Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic y-II Lab	3	29-30
25.	ZOO203-18	Animal Physiology and Biochemistry Practical	3	30-31
26.	BOT202-18	Plant Physiology and Metabolism	4	32-33
27.	CHM202-18	Coordination Chemistry, States of Matter & Chemical Kinetics	4	33-35
28.	ZOO202-18	Genetics and Evolutionary Biology	4	35-36
29.	BOT204-18	Plant Physiology and Metabolism Practical	4	36-37
30.	CHM204-18	Coordination Chemistry, States of Matter & Chemical Kinetics Lab	4	37-38
31.	ZOO204-18	Genetics and Evolutionary Biology Practical	4	38-39

Skill Enhancement Courses

S.N.	Subject Name	Subject Code	Semester	Page Num.
1.	Medicinal Botany	BOT 205-18	Semester-III	40
2.	Medical Diagnostics	ZOO205-18	Semester-III	41
3.	Basic Analytical Chemistry	CHM 209-18	Semester-III	42-43
4.	Floriculture	BOT 206-18	Semester-IV	43-44
5.	Green Methods in Chemistry	CHM 210-18	Semester-IV	44-45
6.	Ethnobotany	BOT 206-18	Semester-IV	45-46
7.	Apiculture & Sericulture	ZOO315-18	Semester-V	46-47
8.	Aquatic Biology	ZOO 317-18	Semester-V	47-48
9.	Fuel Chemistry	CHM 313-18	Semester-V	48-49
10.	Mushroom Culture Technology	BOT 310-18	Semester-VI	49-50

11.	Aquarium Fish Keeping	ZOO 314-18	Semester-VI	50-51
12.	Pharmaceutical Chemistry	CHM 318-18	Semester-VI	51-52

Discipline Elective Courses (Semester- V-VI) Any two of each subject in both semesters

S.N.	Subject Name	Subject Code	Semester	Page Num.
1.	Cell and Molecular Biology	BOT301-18	Semester-V	53
2.	Cell and Molecular Biology Practical	BOT303-18	Semester-V	54
3.	Analytical Techniques in Plant Sciences	BOT305-18	Semester-V	54-55
4.	Analytical Techniques in Plant Sciences Practical	BOT307-18	Semester-V	55-56
5.	Cell Biology, Biotechnology, and Reproductive Biology	ZOO301-18	Semester-V	56-57
6.	Cell Biology, Biotechnology, and Reproductive Biology Practical	ZOO303-18	Semester-V	57-58
7.	Applied Zoology	ZOO305-18	Semester-V	58-59
8.	Applied Zoology Practical	ZOO307-18	Semester-V	59-60
9.	Aquatic Biology	ZOO309-18	Semester-V	60-61
10.	Aquatic Biology Practical	ZOO311-18	Semester-V	61-62
11.	Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy	CHM305-18	Semester-V	62-64
12.	Organometallics, Bioinorganic Chemistry, Polynuclear Hydrocarbons and UV, IR Spectroscopy Practical	CHM307-18	Semester-V	64-65
13.	Industrial chemical and	CHM309-18	Semester-V	65-66

	environment67-			
14.	Industrial chemical and environment practical	CHM311-18	Semester-V	67-68
15.	Green Chemistry	CHM310-18	Semester-VI	69-70
16.	Green Chemistry Practical	CHM312-18	Semester-VI	70-72
17.	Analytical Methods in Chemistry	CHM314-18	Semester-VI	72-74
18.	Analytical Methods in Chemistry Practical	CHM316-18	Semester-VI	74-75
19.	Chemistry of main group element, theories of acids and bases	CHM306-18	Semester-VI	76-77
20.	Chemistry of main group element, theories of acids and bases practical	CHM308-18	Semester-VI	77-78
21.	Economic Botany and Biotechnology	BOT302-18	Semester-VI	78-79
22.	Economic Botany and Biotechnology Practical	BOT304-18	Semester-VI	79-80
23.	Bioinformatics	BOT 306-18	Semester-VI	80-81
24.	Bioinformatics Practical	BOT 308-18	Semester-VI	81
25.	Immunology and Biostatistics	ZOO302-18	Semester-VI	82
26.	Immunology and Biostatistics practical	ZOO304-18	Semester-VI	83
27.	Reproductive Biology	ZOO306-18	Semester-VI	83-84
28.	Reproductive Biology Practical	ZOO308-18	Semester-VI	84-85
29.	Insect, Vector and Diseases	ZOO310-18	Semester-VI	85-86
30.	Insect, Vector and Diseases Practical	ZOO312-18	Semester-VI	86-87

31.	Instrumental methods of chemical analysis	CHM326-18	Semester-VI	87-88
32.	Instrumental methods of chemical analysis practical	CHM328-26	Semester-VI	88-89



Course Scheme, B.Sc Life Sciences

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	BOT101-18	Plant Biodiversity	4:0:0	4:0:0	4	4	CC
2	CHM101-18	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons	4:0:0	4:0:0	4	4	CC
3	ZOO101-18	Animal Biodiversity	4:0:0	4:0:0	4	4	CC
4	ENG101-18	General English-I	3:0:0	3:0:0	3	3	AECC
5	PBI101/ HCP101-18	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	BOT103-18	Plant Biodiversity Practical	0:0:4	0:0:2	4	2	CC
2	CHM103-18	Atomic Structure, Bonding, General Organic Chemistry & Aliphatic Hydrocarbons Lab	0:0:4	0:0:2	4	2	CC
3	ZOO103-18	Animal Biodiversity Practical	0:0:4	0:0:2	4	2	CC
4	PT101/PT103/PT105-18	Physical Training (NSO/NCC/NSS)	0:0:2	Non-credit	2	NC	

CC: Core courses

AECC: Ability Enhancement Core Course

Total Contact hrs: 32

Total Credit Hours: 24

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	BOT102-18	Plant Ecology and Taxonomy	4:0:0	4:0:0	4	4	CC
2	CHM102-18	Chemical Energetics, Equilibria & Functional Groups Organic Chemistry-I	4:0:0	4:0:0	4	4	CC
3	ZOO102-18	Comparative Anatomy and Developmental Biology of Vertebrates	4:0:0	4:0:0	4	4	CC
4	ENG102-18	General English-II	3:0:0	3:0:0	3	3	AECC
5	PBI102/HC P102-18	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	BOT104-18	Plant Ecology and Taxonomy Practical	0:0:4	0:0:2	4	2	CC
2	CHM104-18	Chemical Energetics, Equilibrium & Functional Group Organic Chemistry-I Lab	0:0:4	0:0:2	4	2	CC
3	ZOO104-18	Comparative Anatomy and Dev. Bio of Vertebrates Practical	0:0:4	0:0:2	4	2	CC
4	PT102/PT104/PT106-18	Physical Training (NSO/NCC/NSS)	0:0:2	Non-credit	2	NC	AECC

CC: Core courses

AECC: Ability Enhancement Core Course

Total Contact hrs: 32
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	BOT201-18	Anatomy and Embryology of Angiosperms	4:0:0	4:0:0	4	4	CC
2	CHM201-18	Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic Chemistry-II	4:0:0	4:0:0	4	4	CC
3	ZOO201-18	Animal Physiology and Biochemistry	4:0:0	4:0:0	4	4	CC
4	EVS101-18	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	BOT203-18	Anatomy and Embryology of Angiosperms Practical	0:0:4	0:0:2	4	2	CC
2	CHM203-18	Solutions, Phase equilibrium, Conductance, Electrochemistry & Functional Group Organic y-II Lab	0:0:4	0:0:2	4	2	CC
3	ZOO203-18	Animal Physiology and Biochemistry Practical	0:0:4	0:0:2	4	2	CC

CC: Core courses

Total Contact hrs: 29

AECC: Ability Enhancement Core Course

Total Credit Hours: 23

SEC: Skill Enhancement Course

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	BOT202-18	Plant Physiology and Metabolism	4:0:0	4:0:0	4	4	CC
2	CHM202-18	Coordination Chemistry, States of Matter & Chemical Kinetics	4:0:0	4:0:0	4	4	CC
3	ZOO202-18	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

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	BOT204-18	Plant Physiology and Metabolism Practical	0:0:4	0:0:2	4	2	CC
2	CHM204-18	Coordination Chemistry, States of Matter & Chemical Kinetics Lab	0:0:4	0:0:2	4	2	CC
3	ZOO204-18	Genetics and Evolutionary Biology Practical	0:0:4	0:0:2	4	2	CC

CC: Core courses

AECC: Ability Enhancement Core Course

SEC: Skill Enhancement Course

Total Credit Hours: 20

Total Contact hrs: 26

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

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)Lab-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

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: Discipline Specific Elective

SEC: Skill Enhancement Courses

Total Contact hrs: 26

Total Credit Hours: 20

Course Scheme Summary

Sem	L	T	P	Contact hrs/wk	Credits	CC	AEC	SEC	DSE
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	14	0	12	26	20	18		2	
5	14	0	12	26	20			2	18
6	14	0	12	26	20			2	18
Total	95	0	76	171	131	72	15	8	36



Core Courses (Semester I)

PLANT BIODIVERSITY

Course Code	BOT101-18
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, characteristic features of each group and to give preliminary knowledge of microbes

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	CHM101-18
Course Title	Atomic structures , bonding , general organic and chemistry and aliphatic hydrocarbons
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Non Medical or Medical
Course Objective	The aim of the subject is to enhance the knowledge of students about Stereochemistry of organic compounds, basic concepts and reactions of organic chemistry.

Unit-I

Atomic Structure: Review of: Bohr's theory and its limitations, dual behavior of matter 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 hydrogenic 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 m_l and m_s . Shapes of s, p and d atomic orbitals, nodal planes. Discovery of spin, spin quantum number (s) and magnetic spin quantum number (m_s). 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. Concept of resonance and resonating structures in various inorganic and organic compounds.

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. KMnO₄) and trans-addition (bromine), Addition of HX (Markownikoff's and anti-Markownikoff's addition), Hydration, Ozonolysis, oxymercuration-demercuration, Hydroboration-oxidation Alkynes: (Upto 5 Carbons) Preparation: Acetylene from CaC₂ 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. KMnO₄.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	I.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	ZOO101-18
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 acellular to multicellular animals. Classification and general characters of the following phyla up to 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 Nematelminthes:General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its 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 in Insects

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, Biting mechanism 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	A Text 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	ENG101-18
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)	<ol style="list-style-type: none"> 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.

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

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	PBI101-18
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. ivaAwrQI AwDuink pMjwbl kvIAW dI jlvnI qoN jwxU hoxgy[2. ivaAwrQIAW nUM AwDuink pMjwbl kivqw dI ivSYgq jwxkwrI ho jwvygI[3. ivaAwrQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[

iekweI- a

- AwDuink pMjwbl kivqw:** BweI vIr isMG (rauN ru^, smW, ie`Cw bl qy fUMGIAW SwmW), DnI rwm cwiqRk(rwDw sMdyS, isdkW vwilAW dy byVy pwr ny), pRo. pUm isMG(purwxy pMjwb nUM AwvwzW), &Irozdn Sr&(kurbwnI, ^Yr pMjwbl dI), pRo. mohn isMG(Awau n`cley, nvW kOqk), nMd lwl nUrpurI(cuMm cuMm r`Ko, mzdUr), AMimRqw pRIqm(bwrW mwh, sMXog ivXog), fw. hrBjn isMG(qryy hzUr myrI hwizrI dI dwsqW), iSv kumwr btwlvI(ibrhoN dI rVhk, z^m), surjIq pwqr(cONk ShIdW `c ausdw Awi^ri BwSx, Zzl)
- pMjwb dy mhwn klwkr(lyK):** ky. AY~l. sihgl, bVy gulwm AII KW, soBw isMG, ipRQvIrwj kpUr, BweI smuMd isMG[

iekweI- A

- pMjwbl DunI ivauNq : aucwrn AMg, aucwrn sQwn qy ivDIAW, svr, ivAMjn[
- BwSw vMngIAW: BwSw dw tkswli rUp, BwSw Aqy aup- BwSw dw AMqr, pMjwbl aupBwSwvW dy pCwx icMnH[

pusqk sUcI

pwT- pusqkW

lyKk	swl	Pusqk	pbilSr
sMpwdk, iF`loN; h.s. Aqy srgoDIAw; p.s.	2014	do rMg	pblIkySn ibaUro, gurUu nwnk dyv XUnIvrstI, AMimRqsr

gwrGI; b.	1995	pMjwb dy mhwn klwkwr	pblIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr
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sMbMiDq pusqkW

lyKk	swl	Pusqk	pbilSr
isMG; h.	1966	pMjwbI bwry	pMjwbI XUnIvristI, pitAwlw
isMG; qIrQ (fw.)	2014	pMjwbI AiDAwpn	AY~s. jI. pbilSrZ, jIMDr
syKoN; suKivMdr isMG (fw.) Aqy syKoN; mndIp kOr	2015	pMjwbI BwSw dw AiDAwpn	kilAwxI pbilSrZ, luiDAwxw

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

LIST OF EXPERIMENTS

Volumetric Analysis

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

Course Code	CHM 103-18
Course Title	Atomic structures , bonding , general organic and chemistry and aliphatic hydrocarbons
Type of course	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.

mixture.

2. Estimation of oxalic acid by titrating it with KMnO_4 .
3. Estimation of water of crystallization in Mohr's salt by titrating with KMnO_4 .
4. Estimation of Fe (II) ions by titrating it with $\text{K}_2\text{Cr}_2\text{O}_7$ using internal indicator.
5. Estimation of Cu (II) ions iodometrically using $\text{Na}_2\text{S}_2\text{O}_3$.

Organic Chemistry Detection of extra elements (N, S, Cl, Br, I) in organic compounds

(containing upto two extra elements)

1. Separation of mixtures by Chromatography: Measure the R_f value in each case (combination of two compounds to be given)
 - (a) 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
 - (b) Identify and separate the sugars present in the given mixture by paper chromatography.

Text and Reference 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
6	Advanced Practical Physical Chemistry	J.B. Yadav	KRISHNA Prakashan Media (P) Ltd,

HISTORY AND CULTURE OF PUNJAB -I

Course code	HCP101-18
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 10/12 th class
Course objectives (CO)	<ol style="list-style-type: none"> 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	BOT103-18
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

LIST OF EXPERIMENTS

- EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
- Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
- Gram staining
- 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)
- Rhizopus* and *Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
- Alternaria*: Specimens; photographs and tease mounts.
- 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.
- Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
- Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
- Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
- 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).
- 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	ZOO103-18
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

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:

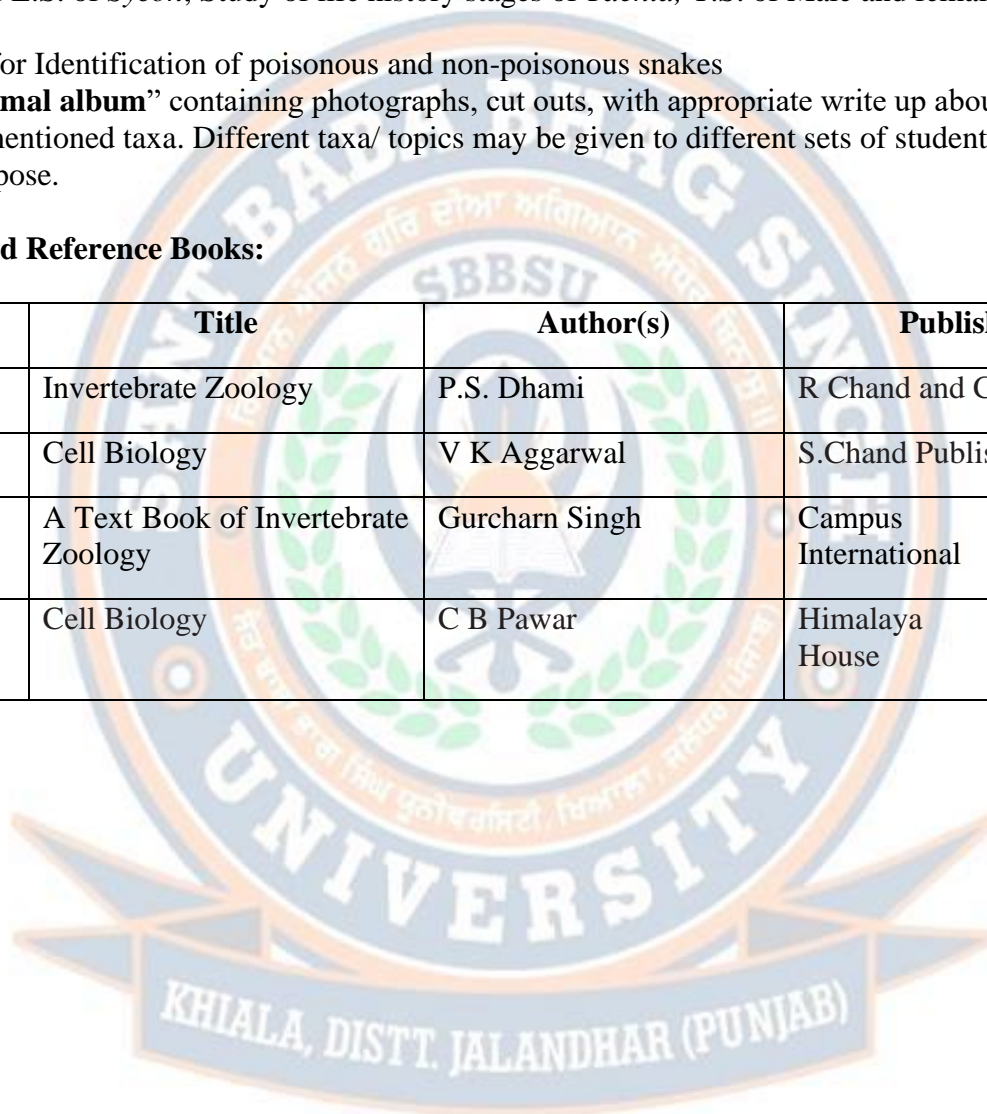
T.S. and L.S. of *Sycon*, Study of life history stages of *Taenia*, T.S. of Male and female *Ascaris*

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





Core Courses (Semester II)

PLANT ECOLOGY AND TAXONOMY

Course Code	BOT102-18
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.

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 law of 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 pyramids production and productivity; Biogeochemical cycling; Cycling of carbon, nitrogen and phosphorous.

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 molecular data

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, Rosaceae Umbelliferae, 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	CHM102-18
Course Title	Chemical Energetic, Equilibrium and Functional Group Organic chemistry – I
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	The aim of this course is to impart basic knowledge about properties and importance of natural bio-macromolecules .

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° , Le Chatelier's principle. Relationships between K_p , K_c and K_x 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. Solubility and solubility product of sparingly soluble salts – applications of solubility product principle.

Unit-III

Functional group approach for the following reactions (preparations & reactions) to be studied in context to their structure. 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: KNH₂/NH₃ (or NaNH₂/NH₃). 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 1^o, 2^o and 3^o 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. KMnO₄, acidic dichromate, conc. HNO₃). 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-Ponndorf Verley reduction.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Organic reaction mechanism, 3 rd 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	ZOO102-18
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

UNIT-I

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

Skeletal System: Evolution of visceral arches

UNIT-II

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 and aortic arches

Urinogenital System: Succession of kidney, Evolution of urinogenital ducts

UNIT-III

Nervous System: Comparative account of brain

Sense Organs: Types of receptors

UNIT-IV

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-V

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.

UNIT-IV

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	ENG102-18
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.

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	PBI102-18
Course Title	General Punjabi-II
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	10+2
Course Objective	<ol style="list-style-type: none"> 1. ividAwRQI AwDuink pMjwbI khwxIkwrW dI jIvnl qoN jwxU hoxgy[2. ividAwRQIAW nUM AwDuink pMjwbI khwxI dI ivSYgq jwxkwrI ho jwvvygI[3. ividAwRQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[4. ividAwRQI muhwvry, AKwxW dI Fu`kvIN vrqoN krnW is`K jwxgy

iekweI- a

1. **pMjwbI in`kI khwxI:** BUAw (nwnk isMG), bwZI dI DI (gurmuK isMG muswi&r), pymI dy inAwxy(sMq isMG syKoN), bwgW dw rwKw(sujwn isMG), qYN kI drd nw AwieAw(krqwr isMG du`gl), DrqI hyTlw bOID(kulvMq isMG ivrk), dUjI vwr jyb k`tI gel(nvqyj isMG), ICmI(pRym pRkWS), bu`q iSkN(AjIq kOr), b`s kMfktr(dIip kOr itvwxw)[
2. **pMjwb dy mhwn klwkwr (lyK):** sqIS gujrwI, gurcrn isMG, Twkur isMG,blrwj swhnI, suurMdr kOr[

iekweI- A

1. Sbd bxqr Aqy Sbd rcnw: pirBwSw Aqy mu`Fly sMklp
2. (a) pYrHw rcnw, muhwvry Aqy AKwx[
(A) pYrHw pVH ky pRSnW dy au~qr dyxw[

pusqk sUcI

pwt- pusqkW

LyKk	swl	pusqk	pbiI Sr
sMpwdk, iF`loN; h.s. Aqy srgoDIAw, p.s+.	2014	do rMg	pbiIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr
gwrGI, b.	1995	pMjwb dy mhwn klwkwr	pbiIkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr

sMbMiDq pusqkW

LyKk	swl	psqk	pbiSr
isMG, h.	1966	pMjwbl bwry	pMjwbl XUnIvristI, pitAwlw
isMG, q.	2014	pMjwbl AiDAwpn	AY~s. jI. pbiSr, jIMDr
syKoN, s.s. Aqy syKoN, m.k.	2015	pMjwbl BwSw dw AiDAwpn	kilAwXI pbiSr, luiDAwxw

HISTORY AND CULTURE OF PUNJAB -II

Course ode	HCP102-18
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)	<ol style="list-style-type: none"> 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	BOT104-18
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.

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 (Orobanchae), 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 – Tagetes erecta/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	<i>Plant Systematics</i>	Simpson, M.G.	Academic Press, San Diego, CA, U.S.A.
4	<i>Plant Systematics: Theory and Practice.</i>	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	CHM104-18
Course Title	Chemical energetic, Chemical Equilibrium and Functional Group organic chemistry-I
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective (CO)	To enable the students practical knowledge about separation, purification, extraction of natural products and biomolecules.

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 (KNO₃, NH₄Cl).
5. Determination of enthalpy of hydration of copper sulphate.

Ionic equilibria

- a) Measurement of pH of different solutions like aerated drinks, fruit juices, shampoos and soaps (use dilute solutions of soaps and shampoos to prevent damage to the glass electrode) using pH-meter.
- b) Preparation of buffer solutions:

- (i) Sodium acetate-acetic acid
- (ii) Ammonium chloride-ammonium hydroxide

Measurement of the pH of buffer solutions and comparison of the values with theoretical values.

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.

- (a) Bromination of Phenol/Aniline

(b) Benzoylation of amines/phenols

(c) Oxime and 2,4-dinitrophenylhydrazone of aldehyde/ketone

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 Limited.
3	Vogel's Textbook of Practical Organic Chemistry (5th Edition) 2003	A.I. Vogel , A.R. Tatchell , B.S. Furnis , A.J. Hannaford , P.W.G. Smith	Pearson

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES PRACTICAL

Course Code	ZOO104-18
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.

LIST OF EXPERIMENTS

1. Osteology:

- Disarticulated skeleton of fowl and rabbit
- Carapace and plastron of turtle /tortoise
- Mammalian skulls: One herbivorous and one carnivorous animal.

2. Study of developmental stages of frogs, metamorphosis from tadpole to adult through 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	K.V Kardong	McGraw-Hill

	Anatomy, Function and Evolution. IV Edition.		
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
5	Developmental Biology, VIII Edition	S.F. Gilbert	Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.
6	An introduction to Embryology	B.I. Balinsky	International Thomson Computer Press
7	Patten's Foundations of Embryology	Carlson, Bruce M	McGraw Hill, Inc





Core Courses (Semester III)

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Course Code	BOT201-18
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.

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 S Bhojwani 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 201-18
Course Title	Solutions , Phase Equilibrium, conductance, electrochemistry and functional group organic chemistry-II
Type of course	CORE
L T P	4:0:0
Credits	4
Course prerequisite	BSc. 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 equilibria, Electrochemistry and organic chemistry and natural polymers.

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, solvent extraction.

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, FeCl₃-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. Conductometric titrations (only acid-base).

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. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. pH determination using hydrogen electrode and quinhydrone electrode. Potentiometric titrations -qualitative treatment (acid-base and oxidation-reduction only).

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 HNO₂, Schotten – Baumann Reaction. Electrophilic substitution (case aniline): nitration, bromination, sulphonation. Diazonium salts: Preparation: from aromatic amines. Reactions: conversion to benzene, phenol, dyes.

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 Cu²⁺ 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. Structure of disaccharides (sucrose, cellobiose, maltose, lactose) and polysaccharides (starch and cellulose) excluding their structure elucidation.

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, 3 rd 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	Eliezer Gileadi,	Wiley-VCH

Applications		
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ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

Type of course	CORE
L T P	4:0:0
Credits	4
Course prerequisite	BSc. 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 equilibria, Electrochemistry and organic chemistry and natural polymers.

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

Lipid Metabolism: Biosynthesis and β oxidation of palmitic acid

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 8 th edition	Tortora, G.J. and Derrickson, B.H.	John Wiley & Sons
2	Vander's Human Physiology, 11 th edition	Widmaier, E.P., Raff, H. and Strang, K.T.	McGraw Hill
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	EVS101-18
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.

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 environemntal assetsriver/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	Erach Bharucha	
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	BOT203-18
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.

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 (*Revenala madagascariensis*) 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.

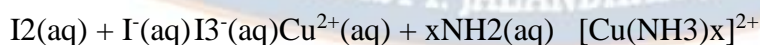
Text and reference books:

Sr No.	Title	Author	Publisher
1	The Embryology of Angiosperms	S S Bhojwani 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
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-II PRACTICAL

Course Code	CHM 203-18
Course Title	Solutions , phase equilibrium, conductance, electrochemistry and functional organic chemistry-II
Type of course	Practical
L T P	0:0:4
Credits	2
Course prerequisite	10+2 with chemistry as core subject
Course Objective	To provide practical knowledge about conductometry , potentiometry and qualitative organic analysis.

Distribution: Study of the equilibrium of one of the following reactions by the distribution method:



Phase equilibria

Construction of the phase diagram of a binary system (simple eutectic) using cooling curves.

Determination of the critical solution temperature and composition of the phenol water system and study of the effect of impurities on it.

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
Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.

Perform the following conductometric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base

Potentiometry

Perform the following potentiometric titrations:

- i. Strong acid vs. strong base
- ii. Weak acid vs. strong base
- iii. Potassium dichromate vs. Mohr's salt

Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Separation of amino acids by paper chromatography.

Determination of the concentration of glycine solution by formylation method.

1. Titration curve of glycine
2. Action of salivary amylase on starch
3. Effect of temperature on the action of salivary amylase on starch.
4. Differentiation between a reducing and a non reducing sugar.

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	ZOO203-18
Course Title	Physiology and Biochemistry 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.

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), amino acids 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 8 th edition	Tortora, G.J. and Derrickson, B.H.	John Wiley & Sons
2	Vander's Human Physiology, 11 th edition	Widmaier, E.P., Raff, H. and Strang, K.T.	McGraw Hill
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.



**Core Courses
(Semester IV)**

KHIALA, DISTT. JALANDHAR (PUNJAB)

PLANT PHYSIOLOGY AND METABOLISM

Course Code	BOT202-18
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.

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 and unloading.

Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photosystem I and II, reaction center, antenna molecules; z-scheme, photophosphorylation, Electron transport and mechanism of ATP synthesis; C₃, C₄ and CAM 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), red and 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 Grisse 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 202-18
Course Title	Coordination chemistry, states of matter and chemical kinetics
Type of course	CORE
L T P	4:0:0
Credits	4
Course prerequisite	BSc. 1 st 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.

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.

Unit-III

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 (derivation not required).

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	I.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 202-18
Course Title	Genetics and Evolutionary Biology
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Ist 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.

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, 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.
3	Concepts of Genetics, 10 th edition	Klug, W.S., Cummings, M.R., Spencer, C.A	Benjamin Cummings
4	Genetics- A Molecular Approach, 3 rd edition	Russell, P. J.	Benjamin Cummings.
5	Introduction to Genetic Analysis, 9 th edition	Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.	W. H. Freeman and Co.
6	Evolution, 3 rd edition	Ridley, M.	Blackwell Publishing
7	Evolutionary Biology	Douglas, J. Futuyma	Sinauer Associates.

PLANT PHYSIOLOGY AND METABOLISM PRACTICAL

Course Code	BOT204-18
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

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 KINETICS PRACTICAL

Course Code	CHM 204-18
Course Title	Coordination chemistry, states of matter and chemical kinetics
Type of course	practical
L T P	0:0:4
Credits	2
Course prerequisite	BSc. 1st 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.

LIST OF EXPERIMENTS

Semi-micro qualitative analysis (using H₂S or other methods) of mixtures - not more than four ionic species (two anions and two cations, excluding insoluble salts) out of the following: Cations : NH₄⁺, Pb²⁺, Bi³⁺, Cu²⁺, Cd²⁺, Fe³⁺, Al³⁺, Co²⁺, Ni²⁺, Mn²⁺, Zn²⁺, Ba²⁺, Sr²⁺, Ca²⁺, K⁺ Anions : CO₃²⁻, S²⁻, SO₃²⁻, S₂O₃²⁻, NO₃⁻, CH₃COO⁻, Cl⁻, Br⁻, I⁻, NO₃⁻, SO₄²⁻, PO₄³⁻, BO₃³⁻, C₂O₄²⁻, F⁻ (*Spot tests should be carried out wherever feasible*)

1. Estimate the amount of nickel present in a given solution as bis(dimethylglyoximate) nickel(II) or aluminium as oximate in a given solution gravimetrically.

2. Estimation of (i) Mg^{2+} or (ii) Zn^{2+} by complexometric titrations using EDTA.
3. Estimation of total hardness of a given sample of water by complexometric titration.

(I) Surface tension measurement (use of organic solvents excluded).

- a) Determination of the surface tension of a liquid or a dilute solution using a stalagmometer.
- b) Study of the variation of surface tension of a detergent solution with concentration.

(II) Viscosity measurement (use of organic solvents excluded).

- a) Determination of the relative and absolute viscosity of a liquid or dilute solution using an Ostwald's viscometer.
- b) Study of the variation of viscosity of an aqueous solution with concentration of solute.

(III) Chemical Kinetics

Study the kinetics of the following reactions.

1. Initial rate method: Iodide-persulphate reaction
2. Integrated rate method:
 - a. Acid hydrolysis of methyl acetate with hydrochloric acid.
 - b. Saponification of ethyl acetate.
 - c. Compare the strengths of HCl and H_2SO_4 by studying kinetics of hydrolysis of methyl acetate

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	ZOO204-18
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

LIST OF EXPERIMENTS

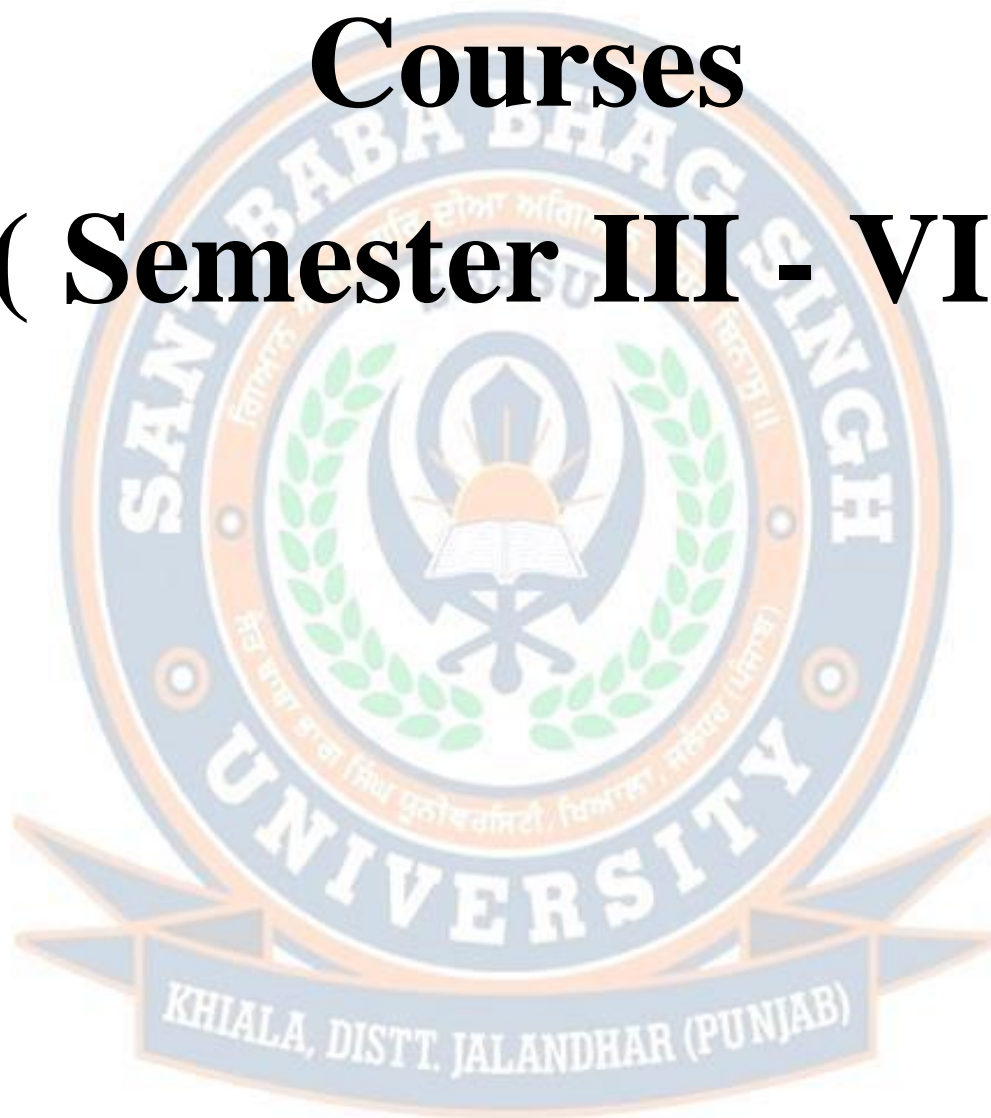
1. Study of Mendelian Inheritance and gene interactions (Non Mendelian Inheritance) using suitable examples. Verify the results using Chi-square test.
2. Study of Linkage, recombination, gene mapping using the data.
3. Study of Human Karyotypes (normal and abnormal).
4. Study of fossil evidences from 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.



Skill Enhancement Courses (Semester III - VI)



Medicinal Botany

Course Code	BOT 205-18
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.

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

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

Unit 3: Ethnobotany and Folk medicines. Definition; Ethnobotany in India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases. **(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: A Scientific Approach, 2 nd edn. Agrobios, India.	Purohit and Vyas	Oxford University Press, New York

MEDICAL DIAGNOSTICS

Course Code	ZOO 205-18
Course Title	Medical Diagnostics
Type of course	Skill Enhancement Courses
L T P	2 0 0
Credits	2
Course prerequisite	B.Sc Ist year
Course Objective	To make students familiar with latest techniques available to diagnose different diseases, their preventive measures and treatments.

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, Erythrocyte Sedimentary 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 I and Type II), Hypertension (Primary and secondary), Testing of blood glucose using Glucometer/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 Edition	Godkar P.B. and Godkar D.P.	Bhalani Publishing 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
5	Pathologic Basis of Disease, VIII Edition	Robbins and Cortan	Saunders

BASIC ANALYTICAL CHEMISTRY

Course Code	CHM 209-18
Course Title	Basic analytical chemistry
Type of course	Skill Enhancement Courses
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 to the students about analytical methods of chemical analysis .

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:

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, asafoetida, chilli powder, turmeric powder, coriander powder and pulses, etc.

b. Analysis of preservatives and colouring matter.

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.

UNIT III:

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).

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 trase 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	Concise Inorganic Chemistry	I.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Vogel's Qualitative Inorganic Analysis (7 th Edition). ISBN-13:978-0582218666,	G Svehla	Prentice Hall
4	Vogel's Quantitative Chemical Analysis (6 th Edition), ISBN-13:978-0582226289,	J. Mendham, R.C. Denney, J.D. Barnes, M.J.K. Thomas	Prentice Hall
5	Instrumental Analysis	G.D. Christian and J.E.G. Reily	Allegn Becon, Latest edition
6	Instrumental Methods of Chemical Analysis	G.W.Ewing,	McGraw Hill Pub, 1975.

FLORICULTURE

Course Code	BOT206-18
Course Title	Floriculture
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	B.Sc IInd 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

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 210-18
Course Title	GREEN METHOD IN CHEMISTRY
Type of course	SAC (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 theoretical knowledge to the students Green chemistry and applications of green chemistry in organic synthesis.

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 CO₂ 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

Preparation and characterization of biodiesel from vegetable oil. Extraction of D-limonene from orange peel using liquid CO₂ 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	BOT204-18
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

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

a) 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) *Azadirachta indica* b) *Ocimum sanctum* c) *Vitex negundo*. d) *Gloriosa superba* e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauwolfia serpentina*, *Trichopus zeylanicus*, *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 Book for references:

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) S.K. Jain (ed.) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981
- 3) Lone et al., Palaeoethnobotany
- 4) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
- 5) S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
- 6) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
- 7) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra 92 Pradesh, India. Botanical Survey of India. Howrah. 8) Rajiv K. Sinha – Ethnobotany The Renaissance of Traditional Herbal Medicine – INA –SHREE Publishers, Jaipur-1996 9)

Apiculture and Sericulture

Course code	ZOO315-18
Course title	Apiculture and Sericulture
Type of course	Theory
LTP	2 0 0
Credits	2

Course objective	To impart basic knowledge about rearing of honey bees and silkworms for commercial production of honey and silk.
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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	ZOO317-18
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	

FUEL CHEMISTRY

Course Code	CHM 313-18
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 aim of this course is to impart theoretical knowledge to the students in petroleum and fuel chemistry.

UNIT I:

Review of energy sources (renewable and non-renewable). Classification of fuels and their calorific value.

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 catalytic cracking)

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	Saunders 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	BOT310-18
Course Title	Mushroom Culture Technology
Type of course	Theory
L T P	2 0 0
Credits	2

Course prerequisite	B.Sc IInd 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

UNIT-I

Introduction, history: Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms. Types of edible mushrooms available in India - *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Agaricus bisporus*.

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, pickles, papads), drying, storage in salt solutions. 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	ZOO314-18
Course Title	AQUARIUM FISH KEEPING
Type of course	Theory
L T P	2 0 0
Credits	2

Course prerequisite	B.Sc IInd 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

Unit1: Introduction to Aquarium Fish Keeping

The potential scope of Aquarium Fish Industry as a Cottage Industry, Exotic and Endemic species of Aquarium Fishes

Unit 2: Biology of Aquarium Fishes

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

Unit 3: Food and feeding of Aquarium fishes

Use of live fish feed organisms. Preparation and composition of formulated fish feeds

Unit 4: Fish Transportation

Live fish transport - Fish handling, packing and forwarding techniques.

Unit 5: Maintenance of Aquarium

General Aquarium maintenance – budget for setting up an Aquarium Fish Farm as a Cottage Industry

PHARMACEUTICAL CHEMISTRY

Course Code	CHM 318-18
Course Title	PHARMACEUTICAL CHEMISTRY
Type of course	SKILL ENHANCEMENT COURSE
L T P	2:0:0
Credits	2
Course prerequisite	Bsc.
Course Objective (CO)	The aim of this course is to impart theoretical knowledge to the students in Drugs & Pharmaceuticals

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, Ibuprofen);

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.

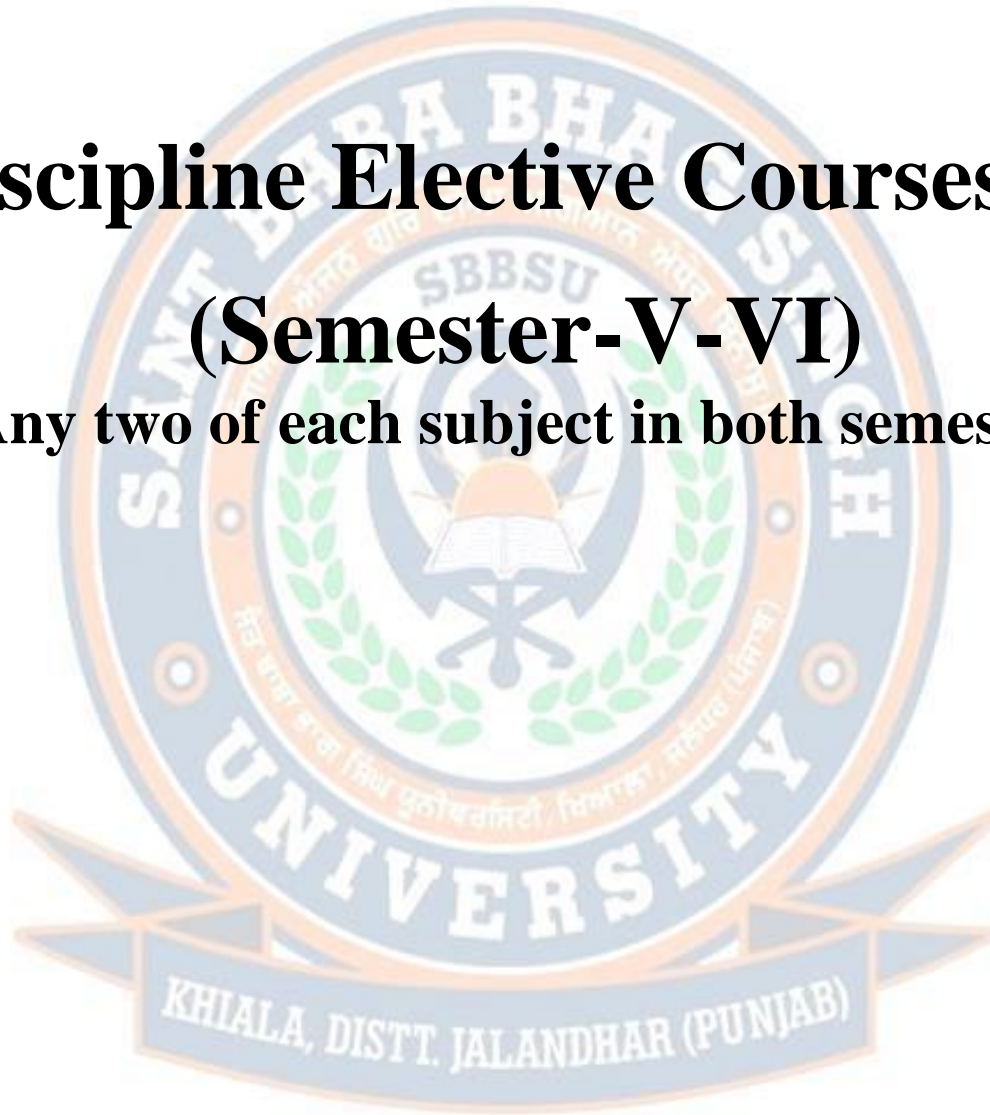
Text and Reference Books

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



CELL AND MOLECULAR BIOLOGY

Course Code	BOT301-18
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

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; molecular organization, 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, θ (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	BOT303-18
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

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

ANALYTICAL TECHNIQUES IN PLANT SCIENCES

Course Code	BOT305-18
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

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	BOT307-18
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

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

Course Code	ZOO301-18
Course Title	Cell Biology, Biotechnology and Reproductive Biology
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc IInd year
Course Objective (CO)	<ol style="list-style-type: none"> 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.

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 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 , 8 th Edn 1995.
5.	Albert	Essential Cell Biology	, New York , 3 rd Edn , 1997

CELL BIOLOGY, BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY PRACTICAL

Course Code	ZOO 303-18
Course Title	Cell Biology, Biotechnology and Reproductive Biology Practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc IInd year
Course Objective	To impart practical knowledge about basic animal cell structure and cytological details of reproductive cells and organs

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. Examination of vaginal smear of rats from live animals.
5. Blood clotting and bleeding time
6. Erythrocyte sedimentation rate
7. 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	ZOO305-18
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 fatal 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 Wuchereria bancrofti; Insects of Economic Importance: Biology, Control and damage caused by Helicoverpa armigera, Pyrrilla perpusilla and Papilio demoleus, Callosobruchus chinensis, Sitophilus oryzae and Tribolium castaneum; Insects of Medical Importance: Medical importance and control of Pediculus humanus corporis, Anopheles, Culex, Aedes, Xenopsylla cheopis

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, 16 th Edition	Park, K.	B.B Publishers
2	Medical Parasitology, 2 nd 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	ZOO307-18
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 Wuchereria bancrofti 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, Papilio demoleus, Pyrrilla perpusilla, Callosobruchus chinensis, Sitophilus oryzae and Tribolium castaneum
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, 2 nd Edition	Arora, D. R and Arora, B	CBS Publications
2	Agricultural Entomology	Dennis, H	Timber Press

AQUATIC BIOLOGY

Course Code	ZOO309-18
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	ZOO311-18
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(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 theoretical knowledge to the students about organometallic chemistry and organic spectroscopy.

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 – II

Bio-Inorganic Chemistry: A brief introduction to bio-inorganic chemistry. Role of metal ions present in biological systems with special reference to Na^+ , K^+ , Mg^{2+} ions, Na/K pump; Role of Mg^{2+} ions in energy production and chlorophyll. Role of Ca^{2+} 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-heteromolecules having

UNIT IV

Application of Spectroscopy to Simple Organic Molecules Application of visible, ultraviolet and Infrared spectroscopy in organic molecules. Electromagnetic radiations, electronic transitions, λ_{max} & ϵ_{max} , chromophore, auxochrome, bathochromic and hypsochromic shifts. Application of electronic spectroscopy and Woodward rules for calculating λ_{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 $>\text{C}=\text{O}$ stretching absorptions).

Text and Reference Books

S. No	Name	Author(S)	Publisher
1.	Concise Inorganic Chemistry	I.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
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.

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

Paper chromatographic separation of Fe³⁺, Al³⁺ and Cr³⁺

Or

Paper chromatographic separation of Ni²⁺, Co²⁺, Mn²⁺ and Zn²⁺.

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

(i) tetraamminecarbonatocobalt (III) nitrate

(ii) tetraamminecopper (II) sulphate

(iii) potassium trioxalato ferrate (III) trihydrate

Compare the conductance of the complexes with that of M/1000 solution of NaCl, MgCl₂ and LiCl₃
Systematic Qualitative Organic Analysis of Organic Compounds possessing monofunctional groups (-COOH, phenolic, aldehydic, ketonic, amide, nitro, amines) and preparation of one derivative.

Text and Reference Books

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis (7 th Edition).	A.I. Vogel, G Svehla	Prentice Hall

2	Vogel's Quantitative Chemical Analysis (6 th 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 aim of this course is to impart theoretical knowledge to the students in Industrial processes and environmental chemistry.

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 SO₂, CO₂, CO, NO_x, H₂S and other foul smelling gases. Methods of estimation of CO, NO_x, SO_x 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	Environmental Pollution Analysis, 1995	S. M. Khopkar,	Wiley Eastern Ltd.,
4	Physical Electrochemistry- Fundamentals, Techniques and Applications	Eliezer Gileadi,	Wiley-VCH 2011.
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
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.

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 (CO₃²⁻, HCO₃⁻) using double titration method.
7. Measurement of dissolved CO₂.
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	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 Pollution Analysis, 1995	S. M. Khopkar,	Wiley Eastern Ltd.,
3	Physical Electrochemistry- Fundamentals, Techniques and Applications	Eliezer Gileadi,	Wiley-VCH 2011.
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	Chemical and Biological methods for water pollution studies, 1986.	R. K. Trivedy, and P. K. Goel,	Environmental publications
7	Principles of Instrumental Methods of analysis	D. A. Skoog and D.M.West	Saunder's College Publ. Latest edition.



GREEN CHEMISTRY

Course Code	CHM 310
Course Title	GREEN CHEMISTRY
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 (CO)	The aim of this course is to impart theoretical knowledge to the students Green chemistry and applications of green chemistry in organic synthesis.

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. $\text{risk} = (\text{function}) \text{hazard} \times \text{exposure}$; waste or pollution prevention hierarchy.

UNIT II

Green solvents– supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluorinated 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. Use of catalytic reagents (wherever possible) in preference to stoichiometric reagents; 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 I

Examples of Green Synthesis/ Reactions and some real world cases

1. Green Synthesis of the following compounds: adipic acid, catechol, disodium iminodiacetate (alternative to Strecker synthesis)
2. 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

3. Ultrasound assisted reactions: Sono chemical Simmons-Smith Reaction
(Ultrasonic alternative to Iodine)
- 4 Surfactants for carbon dioxide – replacing smog producing and ozone depleting solvents with CO₂ for precision cleaning and dry cleaning of garments.
- 5 Designing of Environmentally safe marine antifoulant.
- 6 Rightfit pigment: synthetic azopigments to replace toxic organic and inorganic pigments.

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 (C²S³); 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.

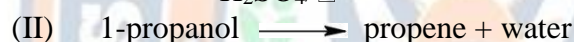
GREEN CHEMISTRY PRACTICAL

Course Code	CHM 312
Course Title	GREEN CHEMISTRY
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 to the students green methods of synthesis.

1. Safer starting materials: Preparation and characterization of nanoparticles of gold using tea leaves.
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



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 from 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.

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 (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 theoretical knowledge to the students in analytical methods in chemistry.

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. Role of computers in instrumental methods of analysis.

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	Saunders's College Publ. Latest edition.
4	Vogel's Qualitative Inorganic Analysis (7 th Edition).	G Svehla	Prentice Hall
5	Vogel's Quantitative Chemical Analysis (6 th 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	Allegn Becon, 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
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 to the students about analytical methods of chemical analysis .

I. Separation Techniques

Chromatography:

- (i) Separation of mixtures : Paper chromatographic separation of Fe^{3+} , Al^{3+} , and Cr^{3+} .
- (ii) Separation and identification of the monosaccharides present in the given mixture (glucose & fructose) by paper chromatography. Reporting the R_f values.
- (iii) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.
- (iv) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

II. Solvent Extractions:

- (i) 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.
- (ii) Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.
- (iii) Determination of Na, Ca, Li in cola drinks and fruit juices using flame photometric techniques.

Analysis of soil:

- (i) Determination of pH of soil.
- (ii) Total soluble salt
- (iii) Estimation of calcium, magnesium, phosphate, nitrate

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.

III Spectro-photometry

- (i) Determination of pKa values of indicator using spectrophotometry.
- (ii) Structural characterization of compounds by infrared spectroscopy.
- (iii) Determination of dissolved oxygen in water.
- (iv) Determination of chemical oxygen demand (COD).
- (v) Determination of Biological oxygen demand (BOD).

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	Saunders's College Publ. Latest edition.
4	Vogel's Qualitative Inorganic Analysis (7 th Edition).	G Svehla	Prentice Hall
5	Vogel's Quantitative Chemical Analysis (6 th 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	Allegn Becon, 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(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 theoretical knowledge to the students in Main group elements.

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

UNIT IV

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. 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 (NPCl₂)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	I.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. Girdlomi; 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
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 to the students in qualitative and quantitative inorganic analysis..

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. Estimation of iodine in iodized salts.
5. Iodimetric estimation of ascorbic acid in fruit juices.
6. Estimation of dissolved oxygen in water samples.
7. Gravimetric estimation of sulphate as barium sulphate.
8. Gravimetric estimation of aluminium as oximato complex
9. Preparation of the following :potash alum, chrome alum, 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 (7 th Edition). ISBN-13:978-0582218666,	G Svehla	Prentice Hall
2	Vogel's Quantitative Chemical Analysis (6 th 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	BOT302-18
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.
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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 of embryo & endosperm culture with their applications

UNIT-IV

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

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	BOT304-18
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.

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	BOT306-18
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.

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	BOT308-18
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.

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 AND BIOSTATISTICS

Course Code	ZOO302-18
Course Title	Immunology and Biostatistics
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. To aware students about statistical methods used in biology.

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, Complement system: Components and pathways. Vaccines: General introduction to vaccines, various types of vaccines

UNIT-IV

Biostatistics: Measures of central tendency (mean, mode and median), Measures of Dispersion (range, mean deviation, standard deviation), Correlation and regression, Chi square test

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 of Immunology	Dr. P. Madhavee Latha	S. Chand publications
4.	<i>Cellular and Molecular Immunology</i> . V Edition	Abbas, K. Abul and Lechtman H. Andrew (2003.)	Saunders Publication.
5.	Biostatistics	P. Ramakrishnan	Saras Publications

IMMUNOLOGY AND BIOSTATICS PRACTICAL

Course Code	ZOO304-18
Course Title	Immunology and Biostatistics Practical
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

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. Cell counting and viability test from splenocytes of farm bred animals/cell lines.
6. Demonstration of ELISA
7. Chromatography (Paper and TLC).
8. Graphical representation of data

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	ZOO306-18
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, and prostaglandins, hypothalamo – hypophyseal – gonadal axis, regulation of gonadotrophin secretion in male and female; Reproductive System: Development and differentiation of gonads, genital ducts, external genitalia, mechanism of sex differentiation.

UNIT-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 and secretion of ovarian hormones; Reproductive cycles (rat and human) and their regulation, changes in the female tract; Ovum transport in the fallopian tubes; Sperm transport in the female tract, fertilization; Hormonal control of implantation; Hormonal regulation of gestation, pregnancy diagnosis, foeto – maternal relationship; Mechanism of parturition and its hormonal regulation; Lactation and its regulation

UNIT-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	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	ZOO308-18
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, hysterectomy, 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	ZOO310-18
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 as vectors – 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 of louse-borne diseases –Typhus fever, Relapsing fever, Trench fever, Vagabond's disease, Phthiriasis; Control of human louse

UNIT-IV

Hemiptera as Disease Vectors: Bugs as insect vectors; Blood-sucking bugs; Chagas disease, Bed bugs as mechanical 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	Pedigo L.P	Prentice Hall Publication
4	Integrated Vector Management	Mathews, G.	Wiley-Blackwell

INSECT VECTORS AND DISEASES PRACTICAL

Course Code	ZOO312-18
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, Phthirus pubis, Xenopsylla cheopis, Cimex lectularius, Phlebotomus argentipes, 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	Pedigo L.P	Prentice Hall Publication
4	Integrated Vector Management	Mathews, G.	Wiley-Blackwell

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

Course Code	CHM326-18
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: Treatment of analytical data, including error analysis. Classification of analytical methods and the types of instrumental 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), advantages of Fourier Transform (FTIR). Samples and results expected. Applications: Issues of quality assurance and quality control, Special problems for portable instrumentation and rapid detection.

UNIT-II

UV-Visible/ Near IR – emission, absorption, fluorescence and photoacoustic. 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, photoacoustic, fluorescent tags).

UNIT-III

Separation techniques Chromatography: Gas chromatography, liquid chromatography, supercritical fluids, Importance of column technology (packing, capillaries), Separation based on increasing number of factors (volatility, solubility, interactions with stationary phase, size, electrical field), Detection: simple vs. specific (gas and liquid), Detection as a means of further analysis (use of tags and coupling to 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	CHM328-18
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, 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	Electrochemical methods, Fundamentals and Methods	A.J. Bard, L.R. Faulkner,	Wiley, 1980.