

SCHEME & SYLLABUS
B.Sc. Life Sciences



Department of Natural Sciences

UISH

University Institute of Science & Humanities

Sant Baba Bhag Singh University

2017

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14	ENG102	General English-II	25	2
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17	BOT104	Plant Ecology and Taxonomy Practical	28	2
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20	BOT201	Anatomy and Embryology of Angiosperms	33	3
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25	BOT203	Anatomy and Embryology of Angiosperms Practical	39	3
26	CHM203	Chemical Bonding Transition Metal and Coordination Chemistry Practical	40	3
27	ZOO203	Animal Physiology and Biochemistry Practical	41	3
28	BOT202	Plant Physiology and Metabolism	43	4
29	CHM202	Physical Chemistry for the Biosciences	44	4
30	ZOO202	Genetics and Evolutionary Biology	46	4

31	BOT204	Plant Physiology and Metabolism Practical	47	4
32	CHM204	Physical Chemistry for the Biosciences Practical	48	4
33	ZOO204	Genetics and Evolutionary Biology Practical	49	4
34	BOT301	Cell and Molecular Biology <i>DSE</i>	51	5 4
35	BOT303	Cell and Molecular Biology Practical	52	5 4
36	BOT305	Analytical Techniques in Plant Sciences <i>DSE</i>	53	5 4
37	BOT307	Analytical Techniques in Plant Sciences Practical	54	5 5
38	CHM301	Analytical Methods in Chemistry <i>DSE</i>	55	5
39	CHM303	Analytical Methods in Chemistry Practical	56	5
40	CHM305	Molecular Modelling & Drug Design <i>DSE</i>	57	5
41	CHM307	Molecular Modelling & Drug Design Practical	58	5
42	CHM309	Research Methodology for Chemistry <i>DSE</i>	59	5
44	ZOO301	Cell Biology, Biotechnology and Reproductive Biology	61	5
45	ZOO303	Cell Biology, Biotechnology and Reproductive Biology Practical	62	5
46	ZOO305	Applied Zoology <i>DSE</i>	63	5
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53	BOT306	Bioinformatics <i>DSE</i>	70	6

54	BOT308	Bioinformatics Practical DSE	71	6
55	CHM302	Green Chemistry DSE	71	6
56	CHM304	Green Chemistry Practical DSE	72	6
57	CHM306	Bio-inorganic & Environmental Chemistry DSE	74	6
58	CHM308	Bio-inorganic & Environmental Chemistry Practical DSE	75	6
59	CHM326	Instrumental Methods of Analysis DSE	76	6
60	CHM328	Instrumental Methods of Analysis Practical DSE	78	6
61	ZOO302	Immunology and Biostatistics DSE	79	6
62	ZOO304	Immunology and Biostatistics Practical DSE	80	6
63	ZOO306	Reproductive Biology DSE	81	6
64	ZOO308	Reproductive Biology Practical DSE	82	6
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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
1	BOT101	Plant Biodiversity	4:0:0	4:0:0	4	4
2	CHM101	Conceptual Organic Chemistry	4:0:0	4:0:0	4	4
3	ZOO101	Animal Biodiversity	4:0:0	4:0:0	4	4
4	ENG101	General English-I	3:0:0	3:0:0	3	3
5	PBI101/ HCP101	General Punjabi-I/History and Culture of Punjab	3:0:0	3:0:0	3	3

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	BOT103	Plant Biodiversity Practical	0:0:4	0:0:2	4	2
2	CHM103	Conceptual Organic Chemistry Practical	0:0:4	0:0:2	4	2
3	ZOO103	Animal Biodiversity Practical	0:0:4	0:0:2	4	2
4	PT101/PT103/PT105	Physical Training (NSO/NCC/NSS)	0:0:2	Non-credit	2	NC

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
1	BOT102	Plant Ecology and Taxonomy	4:0:0	4:0:0	4	4
2	CHM102	Molecules of Life	4:0:0	4:0:0	4	4
3	ZOO102	Comparative Anatomy and Developmental Biology of Vertebrates	4:0:0	4:0:0	4	4
4	ENG102	General English-II	3:0:0	3:0:0	3	3
5	PBI102/H CP102	General Punjabi-II/History and Culture of Punjab	3:0:0	3:0:0	3	3

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	BOT104	Plant Ecology and Taxonomy Practical	0:0:4	0:0:2	4	2
2	CHM104	Molecules of Life Practical	0:0:4	0:0:2	4	2
3	ZOO104	Comparative Anatomy and Developmental Biology of Vertebrates Practical	0:0:4	0:0:2	4	2
4	PT102/PT 104/PT106	Physical Training (NSO/NCC/NSS)	0:0:2	Non-credit	2	NC

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
1	BOT201	Anatomy and Embryology of Angiosperms	4:0:0	4:0:0	4	4
2	CHM201	Chemical Bonding Transition Metal & Coordination Chemistry	4:0:0	4:0:0	4	4
3	ZOO201	Physiology and Biochemistry	4:0:0	4:0:0	4	4
4	ZOO205	Medical Diagnostics	2:0:0	2:0:0	2	2
5	EVS101	Environmental Science	3:0:0	3:0:0	3	3

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	BOT203	Anatomy and Embryology of Angiosperms Practical	0:0:4	0:0:2	4	2
2	CHM203	Chemical Bonding Transition Metal & Coordination Chemistry Practical	0:0:4	0:0:2	4	2
3	ZOO203	Physiology and Biochemistry Practical	0:0:4	0:0:2	4	2

Total Contact hrs: 29

Total Credit Hours: 23

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
1	BOT202	Plant Physiology and Metabolism	4:0:0	4:0:0	4	4
2	CHM202	Physical Chemistry for the Biosciences	4:0:0	4:0:0	4	4
3	ZOO202	Genetics and Evolutionary Biology	4:0:0	4:0:0	4	4
4	CSE218	Computational Skills	2:0:0	2:0:0	2	2

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	BOT204	Plant Physiology and Metabolism Practical	0:0:4	0:0:2	4	2
2	CHM204	Physical Chemistry for the Biosciences Practical	0:0:4	0:0:2	4	2
3	ZOO204	Genetics and Evolutionary Biology Practical	0:0:4	0:0:2	4	2
4	CSE220	Computational Skills Lab	0:0:2	0:0:1	2	1

Total Contact hrs: 28
Total Credit Hours: 21

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
1		Discipline Specific Elective-I	4:0:0	4:0:0	4	4
2		Discipline Specific Elective-I	4:0:0	4:0:0	4	4
3		Discipline Specific Elective-I	4:0:0	4:0:0	4	4
4	BOT309	Floriculture	2:0:0	2:0:0	2	2
5	ZOO315	Apiculture and Sericulture	2:0:0	2:0:0	2	2

II. Practical Subjects

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

List of Electives

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	BOT301	Cell and Molecular Biology	4:0:0	4:0:0	4	4
2	BOT303	Cell and Molecular Biology Practical	0:0:4	0:0:2	4	2
3	BOT305	Analytical Techniques in Plant Sciences	4:0:0	4:0:0	4	4

4	BOT307	Analytical Techniques in Plant Sciences Practical	0:0:4	0:0:2	4	2
5	CHM301	Analytical Methods in Chemistry	4:0:0	4:0:0	4	4
6	CHM303	Analytical Methods in Chemistry Practical	0:0:4	0:0:2	4	2
7	CHM305	Molecular Modelling & Drug Design	4:0:0	4:0:0	4	4
8	CHM307	Molecular Modelling & Drug Design Practical	0:0:4	0:0:2	4	2
9	CHM309	Research Methodology for Chemistry	5:1:0	5:1:0	6	6
10	CHM311	Research Methodology for Chemistry Practical	0:0:4	0:0:2	4	2
11	ZOO301	Cell Biology, Biotechnology and Reproductive Biology	4:0:0	4:0:0	4	4
12	ZOO303	Cell Biology, Biotechnology and Reproductive Biology Practical	0:0:4	0:0:2	4	2
13	ZOO305	Animal Biotechnology	4:0:0	4:0:0	4	4
14	ZOO307	Animal Biotechnology Practical	0:0:4	0:0:2	4	2
15	ZOO309	Aquatic Biology	4:0:0	4:0:0	4	4
16	ZOO311	Aquatic Biology Practical	0:0:4	0:0:2	4	2

Total Contact hrs: 28
Total Credit Hours: 22

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
1		Discipline Specific Elective-II	4:0:0	4:0:0	4	4
2		Discipline Specific Elective-II	4:0:0	4:0:0	4	4
3		Discipline Specific Elective-II	4:0:0	4:0:0	4	4
4	BOT310	Mushroom Culture Technology	2:0:0	2:0:0	2	2

II. Practical Subjects

S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1		Discipline Specific Elective-II Practical	0:0:4	0:0:2	4	2
2		Discipline Specific Elective-II Practical	0:0:4	0:0:2	4	2
3		Discipline Specific Elective-II Practical	0:0:4	0:0:2	4	2

List of Electives


S. No	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	BOT302	Economic Botany and Biotechnology	4:0:0	4:0:0	4	4
2	BOT304	Economic Botany and Biotechnology Practical	0:0:4	0:0:2	4	2
3	BOT306	Bioinformatics	4:0:0	4:0:0	4	4

4	BOT308	Bioinformatics Practical	0:0:4	0:0:2	4	2
5	CHM302	Green Chemistry	4:0:0	4:0:0	4	4
6	CHM304	Green Chemistry Practical	0:0:4	0:0:2	4	2
7	CHM306	Bio-inorganic & Environmental Chemistry	4:0:0	4:0:0	4	4
8	CHM308	Bio-inorganic & Environmental Chemistry Practical	0:0:4	0:0:2	4	2
9	CHM326	Instrumental Methods of Analysis	4:0:0	4:0:0	4	4
10	CHM328	Instrumental Methods of Analysis Practical	0:0:4	0:0:2	4	2
11	ZOO302	Immunology and Biostatistics	4:0:0	4:0:0	4	4
12	ZOO304	Immunology and Biostatistics Practical	0:0:4	0:0:2	4	2
13	ZOO306	Reproductive Biology	4:0:0	4:0:0	4	4
14	ZOO308	Reproductive Biology Practical	0:0:4	0:0:2	4	2
15	ZOO310	Insect, Vector and Diseases	4:0:0	4:0:0	4	4
16	ZOO312	Insect, Vector and Diseases Practical	0:0:4	0:0:2	4	2

Total Contact hrs: 26
Total Credit Hours: 14

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	14	28	21	18	3		
5	16	0	12	28	22			4	18
6	14	0	12	26	20			2	18
Total	97	0	78	175	134	72	18	8	36



First Semester

PLANT BIODIVERSITY

Course Code	BOT101
Course Title	Plant Biodiversity
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	To make students aware about biodiversity among different groups of plants, 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

CONCEPTUAL ORGANIC CHEMISTRY*Chemistry Same*

Course Code	CHM101
Course Title	Conceptual Organic Chemistry
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**Stereochemistry**

Writing of Fischer projection, Newmann and Sawhorse projection and Wedge formulae. Interconversion of one type of structural representation into another type. Conformations: Various conformations of ethane, butane, ethane-1,2-diol and cyclohexane. Relative stability of different conformations in terms of energy difference is to be discussed for all these compounds.

Geometrical Isomerism: Requirements for a molecule to show geometrical isomerism, Cis-Trans and E/ Z notation along with CIP rules for geometrical isomers. Optical Isomerism: Optical activity, specific and molar rotation, chirality, enantiomerism, diastereoisomerism,

racemic mixtures. Relative and absolute configuration: D / L nomenclature system for configuration of carbohydrates. Threo and Erythro designation. Rand S- configuration (upto two chiral centres).

UNIT-II

Addition Reactions

Alkenes and Alkynes: Hydrogenation, addition of halogens, Hydrohalogenation (Markovnikov's and anti-Markovnikov's addition), hydration, hydroxylation (cis and trans), oxymercuration-demercuration, hydroboration-oxidation, ozonolysis. Reactivity of alkenes vs alkynes.

Aldehydes and ketones: (formaldehyde, acetaldehyde, benzaldehyde, acetone) Addition of sodium bisulphite, hydrogen cyanide and alcohols. Addition- elimination reactions with ammonia and its derivatives

Name reactions: Aldol, cross Aldol, Claisen, Knoevenagel, Cannizzaro, cross Cannizzaro

UNIT-III

Substitution Reactions

Free radical substitution reactions: Halogenation of alkanes, Nucleophilic substitution reactions: Alkyl, allyl and benzyl halides – substitution of halogen by some common nucleophiles. Mechanism of S_N1 and S_N2 reactions (stereochemistry, nature of substrate, nucleophile and leaving group) Alcohols, amines and phenols: Substitution of active hydrogen, replacement of hydroxyl group in alcohols (using PCl₅, SOCl₂ and HI)

Ethers: Cleavage by HI

Electrophilic Substitution Reactions (aromatic compounds): General mechanism of electrophilic substitution reactions (nitration, halogenation, sulphonation, Friedel Crafts alkylation and acylation), directive influence of substituents.

UNIT-IV

Elimination Reactions

Alkyl halides (dehydrohalogenation, Saytzeff's rule), vicinal dihalides (dehalogenation), alcohols (dehydration), Quaternary ammonium salts (Hofmann's elimination). Mechanism of E₁ and E₂ reactions (nature of substrate and base), elimination vs substitution

Aldehydes and Ketones: Oxidation with potassium permanganate, chromic acid and Tollen's reagent Catalytic hydrogenation, reduction with sodium borohydride, lithium aluminium hydride, Clemmensen, Wolff-Kishner

Ketones: Oxidation with potassium permanganate, sodium hypiodite (iodoform reaction) and Baeyer-Villiger oxidation

Text and Reference Books:

Sr No.	Book Title	Author	Publisher
1	Organic Chemistry	I.L. Finar	ELBS
2	Organic Chemistry	R T Morrison R N Boyd	Pearson Education
3	Advanced Organic Chemistry	Arun Bahl and B S Bahl	S. Chand

5	Organic Chemistry	T W Graham Solomon	John Wiley and Sons
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ANIMAL BIODIVERSITY

Course Code	ZOO101
Course Title	Animal Biodiversity
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	1.To enable the students to develop an appreciation for the biodiversity of invertebrate species and to impart knowledge about co-existence of different forms of living organisms ranging from 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
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. Gardiner)
- 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
Course Title	General Punjabi-I
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	10+2 in any stream
ਫੋਰਸਟ ਬਜਟਰਵਿਸ	1. ਵਿਦਿਆਰਥੀ ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਵੀਆਂ ਦੀ ਜੀਵਨੀ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ। 2. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਵਿਤਾ ਦੀ ਵਿਸ਼ੇਸ਼ਤਾ ਜਾਣਕਾਰੀ ਹੋ ਜਾਵੇਗੀ। 3. ਵਿਦਿਆਰਥੀਆਂ ਵਿੱਚ ਰੇਖਾ ਚਿੱਤਰਾਂ ਦਾ ਅਲੋਚਨਾਤਮਕ ਅਧਿਐਨ ਕਰਨ ਦਾ ਹੁਨਰ ਉਤਪੰਨ ਹੋਵੇਗਾ।

ਇਕਾਈ- ੳ

1. ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਵਿਤਾ: ਭਾਈ ਵੀਰ ਸਿੰਘ (ਰਉਂ ਰੁਖ, ਸਮਾਂ, ਇੱਛਾ ਬਲ ਤੇ ਡੂੰਘੀਆਂ ਸ਼ਾਮਾਂ), ਧਨੀ ਰਾਮ ਚਾੜ੍ਹਕ(ਰਾਧਾ ਸੰਦੇਸ਼, ਸਿਦਕਾਂ ਵਾਲਿਆਂ ਦੇ ਬੇਤੇ ਪਾਰ ਨੇ), ਪ੍ਰੋ. ਪੂਰਨ ਸਿੰਘ(ਪੁਰਾਣੇ ਪੰਜਾਬ ਨੂੰ ਆਵਾਜ਼ਾਂ), ਫੀਰੋਜ਼ਦੀਨ ਸ਼ਰਫ਼(ਕੁਰਬਾਨੀ, ਬੈਰ ਪੰਜਾਬੀ ਦੀ), ਪ੍ਰੋ. ਮੋਹਨ ਸਿੰਘ ਆਉ ਨਚੀਏ, ਨਵਾਂ ਕੋਤਕ), ਨੰਦ ਲਾਲ ਨੂਰਪੁਰੀ(ਚੁੰਮ ਚੁੰਮ ਰੱਖ, ਮਜ਼ਦੂਰ), ਅੰਮ੍ਰਿਤਾ ਪ੍ਰੀਤਮ(ਬਾਰਾਂ ਮਾਹ, ਸਯੋਗ ਵਿਯੋਗ), ਡਾ. ਹਰਭਜਨ ਸਿੰਘ(ਤੇਰੇ ਹਜ਼ੂਰ ਮੇਰੀ ਹਾਜ਼ਿਰੀ ਦੀ ਦਾਸਤਾਂ), ਸ਼ਿਵ ਕੁਮਾਰ ਬਟਾਲਵੀ(ਬਿਰਹੇ ਦੀ ਰੜਕ, ਜ਼ਖ਼ਮ), ਸੁਰਜੀਤ ਪਾਤਰ(ਚੌਂਕ ਸ਼ਹੀਦਾਂ 'ਚ ਉਸਦਾ ਆਖਿਰੀ ਭਾਸ਼ਣ, ਗ਼ਜ਼ਲ)
2. ਪੰਜਾਬ ਦੇ ਮਹਾਨ ਕਲਾਕਾਰ(ਲੇਖ): ਕੇ. ਐੱਲ. ਸਹਿਗਲ, ਬੜੇ ਗੁਲਾਮ ਅਲੀ ਖਾਂ, ਸੋਭਾ ਸਿੰਘ, ਪ੍ਰਿਥਵੀਰਾਜ ਕਪੂਰ, ਭਾਈ ਸਮੁੰਦ ਸਿੰਘ।

ਇਕਾਈ- ਅ

1. ਪੰਜਾਬੀ ਧੁਨੀ ਵਿਉਂਤ : ਉਚਾਰਨ ਅੰਗ, ਉਚਾਰਨ ਸਥਾਨ ਤੇ ਵਿਧੀਆਂ, ਸਵਰ, ਵਿਅੰਜਨ।
2. ਭਾਸ਼ਾ ਵੰਨਗੀਆਂ: ਭਾਸ਼ਾ ਦਾ ਟਕਸਾਲੀ ਰੂਪ, ਭਾਸ਼ਾ ਅਤੇ ਉਪ- ਭਾਸ਼ਾ ਦਾ ਅੰਤਰ, ਪੰਜਾਬੀ ਉਪਭਾਸ਼ਾਵਾਂ ਦੇ ਪਛਾਣ ਚਿੰਨ੍ਹ।

ਪਾਠ- ਪੁਸਤਕਾਂ

ਪੁਸਤਕ ਸੂਚੀ

ਲੇਖਕ	ਸਾਲ	ਫੁਸਤਕ	ਪਬਲਿਸ਼ਰ
ਸੰਪਾਦਕ, ਢਿੱਲੋਂ; ਹ.ਸ. ਅਤੇ ਸਰਗੋਧੀਆ; ਪ.ਸ. ਗਾਰਗੀ; ਬ.	2014	ਦੋ ਰੰਗ	ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ
	1995	ਪੰਜਾਬ ਦੇ ਮਹਾਨ ਕਲਾਕਾਰ	ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ

ਸੰਬੰਧਿਤ ਪੁਸਤਕਾਂ

ਲੇਖਕ	ਸਾਲ	ਫੁਸਤਕ	ਪਬਲਿਸ਼ਰ
ਸਿੰਘ; ਹ.	1966	ਪੰਜਾਬੀ ਬਾਰੇ	ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ
ਸਿੰਘ; ਤੀਰਥ (ਡਾ.)	2014	ਪੰਜਾਬੀ ਅਧਿਆਪਨ	ਐੱਸ. ਜੀ. ਪਬਲਿਸ਼ਰਜ਼, ਜਲੰਧਰ
ਸੇਖੋਂ; ਸੁਖਵਿੰਦਰ ਸਿੰਘ (ਡਾ.) ਅਤੇ ਸੇਖੋਂ; ਮਨਦੀਪ ਕੌਰ	2015	ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਅਧਿਆਪਨ	ਕਲਿਆਣੀ ਪਬਲਿਸ਼ਰਜ਼, ਲੁਧਿਆਣਾ

HISTORY AND CULTURE OF PUNJAB -I

Course code	HCP101
Course title	History and Culture of Punjab -I
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	Students who have not studied Punjabi in 10/12 th class
Course objectives	1. The Student will acquire the knowledge about Punjab and its

(CO)	Historical Resources.
	2. The Student will understand the Harppan Culture and different Vedic Periods.
	3. The Students will analyze the Alexander's invasions.

UNIT I

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

UNIT II

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

UNIT III

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

UNIT IV

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

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

Text and References Books:

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

PLANT BIODIVERSITY PRACTICAL

Course Code	BOT103
Course Title	Plant Biodiversity Practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective (CO)	To make students aware about biodiversity among different groups of plants, characteristic features of each group and to give preliminary knowledge of microbes

LIST OF EXPERIMENTS

1. EMs/Models of viruses – T-Phage and TMV, Line drawing/Photograph of Lytic and Lysogenic Cycle.
2. Types of Bacteria from temporary/permanent slides/photographs; EM bacterium; Binary Fission; Conjugation; Structure of root nodule.
3. Gram staining
4. Study of vegetative and reproductive structures of *Nostoc*, *Chlamydomonas* (electron micrographs), *Oedogonium*, *Vaucheria*, *Fucus** and *Polysiphonia* through temporary preparations and permanent slides. (* *Fucus* - Specimen and permanent slides)
5. *Rhizopus* and *Penicillium*: Asexual stage from temporary mounts and sexual structures through permanent slides.
6. *Alternaria*: Specimens; photographs and tease mounts.
7. *Puccinia*: Herbarium specimens of Black Stem Rust of Wheat and infected Barberry leaves; section/tease mounts of spores on Wheat and permanent slides of both the hosts.
8. *Agaricus*: Specimens of button stage and full grown mushroom; Sectioning of gills of *Agaricus*.
9. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose)
10. Mycorrhiza: ecto mycorrhiza and endo mycorrhiza (Photographs)
11. *Marchantia*- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, l.s. sporophyte (all permanent slides).
12. *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, l.s. capsule and protonema. *Selaginella*- morphology, w.m. leaf with ligule, t.s. stem, w.m. strobilus, w.m. microsporophyll and megasporophyll (temporary slides), l.s. strobilus (permanent slide).
13. *Equisetum*- morphology, t.s. internode, l.s. strobilus, t.s. strobilus, w.m. sporangiophore, w.m. spores (wet and dry)(temporary slides); t.s rhizome (permanent slide).
14. *Pteris*- morphology, t.s. rachis, v.s. sporophyll, w.m. sporangium, w.m. spores (temporary slides), t.s. rhizome, w.m. prothallus with sex organs and young sporophyte (permanent slide).
15. *Cycas*- morphology (coralloid roots, bulbil, leaf), t.s. coralloid root, t.s. rachis, v.s. leaflet, v.s. microsporophyll, w.m. spores (temporary slides), l.s. ovule, t.s. root (permanent slide).
16. *Pinus*- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female), w.m. dwarf shoot, t.s. needle, t.s. stem, , l.s./t.s. male cone, w.m. microsporophyll, w.m. microspores (temporary slides), l.s. female cone, t.l.s. & r.l.s. stem (permanent slide).

Text and Reference Books:

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

3	Text Book of Pteridophyta	O.P.Sharma	McMillan India Ltd
4	The Fungi	P.D. Sharma	Rastogi Publisher
5	Cryptogamic Botany, Vol. II, Bryophytes & Pteridophytes	G.M Smith	Tata McGraw Hill
6	Biology	P H Raven, G B Johnson, SIR R Singer	Tata McGraw Hill
7	Gymnosperms	SP Bhatnagar and A Moitra	S Chand

CONCEPTUAL ORGANIC CHEMISTRY PRACTICAL

Course Code	CHM103
Course Title	Conceptual Organic Chemistry Practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students about organic preparation and determination of basic physical properties of organic compounds.

LIST OF EXPERIMENTS

- Purification of organic compounds by crystallization using the following solvents:
 - Water
 - Alcohol
 - Determination of the melting points of organic compounds (by Kjeldahl method and electrically heated melting point apparatus).
- Organic preparations:** Carry out the following preparations using 0.5 - 1 g of starting compound. Recrystallize the product and determine the melting point of the recrystallized sample.
- To prepare acetanilide by the acetylation of aniline.
 - To prepare p-bromoacetanilide.
 - Benzoylation of aniline or β -naphthol by Schotten-Baumann reaction
 - Hydrolysis of benzamide or ethyl benzoate.
 - Semicarbazone derivative of one the following compounds: acetone, diethylketone, , benzaldehyde.
 - Nitration of nitrobenzene.
 - Oxidation of benzaldehyde by using alkaline potassium permanganate.

Text and Reference Books:

Sr No.	Book Title	Author	Publisher
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	(5th Edition) 2003	A.J. Hannaford P.W.G. Smith	
2	Laboratory Experiments on Organic Chemistry	R. Edemas, J.R. Johnson and C.F. Wilcox	The Macmillan Limited, London, 1970.

ANIMAL BIODIVERSITY PRACTICAL

Course Code	ZOO103
Course Title	Animal Biodiversity Practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	Classification up to orders and study of the specimens mentioned against each phylum with ecological note

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. Dharmi	R Chand and Company
2	Cell Biology	V K Aggarwal	S.Chand Publishing

Second Semester



PLANT ECOLOGY AND TAXONOMY

Course Code	BOT102
Course Title	Plant Ecology and Taxonomy
Type of course	Theory
L T P	4 0 0
Credits	2
Course prerequisite	10+2 Medical
Course Objective (CO)	To make student understand basics of ecosystem, its working and components also diversity in angiosperm families.

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,

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.

MOLECULES OF LIFE

Course Code	CHM102
Course Title	Molecules of Life
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

Carbohydrates: Classification of carbohydrates, reducing and non-reducing sugars, General properties of Glucose and Fructose, their open chain structure. Epimers, mutarotation and anomers. Determination of configuration of glucose (Fischer proof). Cyclic structure of glucose. Haworth projections. Cyclic structure of fructose. Linkage between monosachharides, structure of disachharides (sucrose, maltose, lactose) and c (starch and cellulose) excluding their structure elucidation.

UNIT-II

Amino Acids, Peptides and Proteins: Classification of Amino Acids, Zwitterion structure and Isoelectric point. Overview of Primary, Secondary, Tertiary and Quaternary structure of proteins. Determination of primary structure of peptides, determination of N-terminal amino acid (by DNFB and Edman method) and C-terminal amino acid (by thiohydantoin and with carboxypeptidase enzyme Merrifield solid phase synthesis.

UNIT-III

Nucleic Acids: Components of Nucleic acids: Adenine, guanine, thymine and cytosine (structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA (types of RNA), Genetic code, Biological roles of DNA and RNA. ATP hydrolysis and free energy change. Conversion of food into energy.

Lipids: Introduction to lipids, classification. Oils and fats: Common fatty acids present in oils and fats, Omega fatty acids, Trans fats, Hydrogenation, Saponification value, Iodine number. Biological importance of triglycerides, phospholipids, glycolipids, and steroids (cholesterol)

UNIT-IV

Enzymes and correlation with drug action: Mechanism of enzyme action, factors affecting enzyme action, Coenzymes and cofactors and their role in biological reactions, Specificity of enzyme action (including stereospecificity), Enzyme inhibitors and their importance, phenomenon of inhibition (competitive and noncompetitive inhibition including allosteric inhibition). Drug action - receptor theory. Structure - activity relationships of drug molecules

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Organic Chemistry	R T Morrison and R N Boyd	Dorling Kindersley
2	Organic Chemistry (Volume 1)	I.L Finar	Dorling Kindersley
3	Organic Chemistry (Volume 2)	I.L Finar	Dorling Kindersley
4	Lehninger's Principles of Biochemistry	DL Nelson and M M Cox	W H Freeman
5	Biochemistry	J M Berg, J L Tymoczko and L Stryer	W H Freeman

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES

Course Code	ZOO102
Course Title	Comparative Anatomy and Developmental Biology of Vertebrates
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	To enable the students to draw a comparative account of the morphology, general anatomy and physiology of the vertebrates

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
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

GENERAL ENGLISH-II

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

Texts Prescribed:

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)	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-II

Course Code	PBI102
Course Title	General Punjabi-II
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	10+2
Course Objective	1. ਵਿਦਿਆਰਥੀ ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਹਾਣੀਕਾਰਾਂ ਦੀ ਜੀਵਨੀ ਤੋਂ ਜਾਣੂ ਹੋਣਗੇ। 2. ਵਿਦਿਆਰਥੀਆਂ ਨੂੰ ਆਧੁਨਿਕ ਪੰਜਾਬੀ ਕਹਾਣੀ ਦੀ ਵਿਸ਼ੇਸ਼ਤਾ ਜਾਣਕਾਰੀ ਹੋ ਜਾਵੇਗੀ। 3. ਵਿਦਿਆਰਥੀਆਂ ਵਿੱਚ ਰੇਖਾ ਚਿੱਤਰਾਂ ਦਾ ਅਲੋਚਨਾਤਮਕ ਅਧਿਐਨ ਕਰਨ ਦਾ ਹੁਨਰ ਉਤਪੰਨ ਹੋਵੇਗਾ। 4. ਵਿਦਿਆਰਥੀ ਮੁਹਾਵਰੇ, ਅਖਾਣਾਂ ਦੀ ਢੁੱਕਵੀਂ ਵਰਤੋਂ ਕਰਨਾਂ ਸਿੱਖ ਜਾਣਗੇ

ਇਕਾਈ- ਓ

1. ਪੰਜਾਬੀ ਨਿੱਕੀ ਕਹਾਣੀ: ਭੂਆ (ਨਾਨਕ ਸਿੰਘ), ਬਾਗੀ ਦੀ ਧੀ (ਗੁਰਮੁਖ ਸਿੰਘ ਮੁਸਾਫ਼ਿਰ), ਪੇਮੀ ਦੇ ਨਿਆਏ(ਸੰਤ ਸਿੰਘ ਸੇਖੋਂ), ਬਾਗਾਂ ਦਾ ਰਾਖਾ(ਸੁਜਾਨ ਸਿੰਘ), ਤੈਂ ਕੀ ਦਰਦ ਨਾ ਮਾਇਆ(ਕਰਤਾਰ ਸਿੰਘ ਦੁੱਗਲ), ਧਰਤੀ ਹੇਠਲਾ ਬੋਲਪ(ਕੁਲਵੰਤ ਸਿੰਘ ਵਿਰਕ), ਦੂਜੀ ਵਾਰ ਜੇਬ ਕੱਟੀ ਗਈ(ਨਵਤੇਜ ਸਿੰਘ), ਲਛਮੀ(ਪ੍ਰੇਮ ਪ੍ਰਕਾਸ਼), ਬੁੱਤ ਸ਼ਿਕਨ(ਅਜੀਤ ਕੌਰ), ਬੱਸ ਕੰਡਕਟਰ(ਦਲੀਪ ਕੌਰ ਟਿਵਾਣਾ)।
2. ਪੰਜਾਬ ਦੇ ਮਹਾਨ ਕਲਾਕਾਰ (ਲੇਖ): ਸਤੀਸ਼ ਗੁਜਰਾਲ, ਗੁਰਚਰਨ ਸਿੰਘ, ਠਾਕੁਰ ਸਿੰਘ, ਬਲਰਾਜ ਸਾਹਨੀ, ਸੁਰਿੰਦਰ ਕੌਰ।

ਇਕਾਈ- ਅ

1. ਸ਼ਬਦ ਬਣਤਰ ਅਤੇ ਸ਼ਬਦ ਰਚਨਾ: ਪਰਿਭਾਸ਼ਾ ਅਤੇ ਮੁੱਢਲੇ ਸੰਕਲਪ
2. (ੳ) ਪੈਰਾ ਰਚਨਾ, ਮੁਹਾਵਰੇ ਅਤੇ ਅਖਾਣ।
(ਅ) ਪੈਰਾ ਪੜ੍ਹ ਕੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਉੱਤਰ ਦੇਣਾ।

ਪੁਸਤਕ ਸੂਚੀ

ਪਾਠ- ਪੁਸਤਕਾਂ

ਲੇਖਕ	ਸਾਲ	ਪੁਸਤਕ	ਪਬਲਿਸ਼ਰ
ਸੰਪਾਦਕ, ਢਿੱਲੋਂ; ਹ.ਸ. ਅਤੇ ਸਰਗੋਧੀਆ, ਪ.ਸ., ਗਾਰਗੀ, ਬ.	2014	ਦੋ ਰੰਗ	ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ
	1995	ਪੰਜਾਬ ਦੇ ਮਹਾਨ ਕਲਾਕਾਰ	ਪਬਲੀਕੇਸ਼ਨ ਬਿਊਰੋ, ਗੁਰੂ ਨਾਨਕ ਦੇਵ ਯੂਨੀਵਰਸਿਟੀ, ਅੰਮ੍ਰਿਤਸਰ

ਸੰਬੰਧਿਤ ਪੁਸਤਕਾਂ

ਲੇਖਕ	ਸਾਲ	ਪੁਸਤਕ	ਪਬਲਿਸ਼ਰ
ਸਿੰਘ, ਹ.	1966	ਪੰਜਾਬੀ ਬਾਰੇ	ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ
ਸਿੰਘ, ਤ.	2014	ਪੰਜਾਬੀ ਅਧਿਆਪਨ	ਐੱਸ. ਜੀ. ਪਬਲਿਸ਼ਰਜ਼, ਜਲੰਧਰ
ਸੇਖੋਂ, ਸ.ਸ. ਅਤੇ ਸੇਖੋਂ, ਮ.ਕ.	2015	ਪੰਜਾਬੀ ਭਾਸ਼ਾ ਦਾ ਅਧਿਆਪਨ	ਕਲਿਆਣੀ ਪਬਲਿਸ਼ਰਜ਼, ਲੁਧਿਆਣਾ

HISTORY AND CULTURE OF PUNJAB -II

Course ode	HCP102
Course title	History And Culture Of Punjab –II
Type of course	Theory
L T P	3:0:0
Credits	3
Course prerequisite	Students who have not studied Punjabi in 10/12 th class
Course objectives (CO)	<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
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 (*Orobancha*), 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. 8th ed
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.

MOLECULES OF LIFE PRACTICAL

Course Code	CHM104
Course Title	Molecules of Life Practical
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.

LIST OF EXPERIMENTS

1. Separation of amino acids by paper chromatography
2. Separation of sugars by paper chromatography
3. To determine the concentration of glycine solution by formylation method.
4. Study of titration curve of glycine
5. To determine the saponification value of an oil/fat.
6. To determine the iodine value of an oil/fat
7. Differentiate between a reducing/nonreducing sugar.
8. To synthesize aspirin by acetylation of salicylic acid and compare it with the ingredient of an aspirin tablet by TLC.

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Organic Chemistry	R T Morrison and R N Boyd	Dorling Kindersley
2	Organic Chemistry (Volume 1)	I.L Finar	Dorling Kindersley
3	Organic Chemistry (Volume 2)	I.L Finar	Dorling Kindersley
4	Lehninger's Principles of Biochemistry	DL Nelson and M M Cox	W H Freeman
5	Biochemistry	J M Berg, J L Tymoczko and L Stryer	W H Freeman
6	Laboratory Experiments on Organic Chemistry	R. Edemas, J.R. Johnson and C.F. Wilcox	The Macmillan Limited, London, 1970.
7	Laboratory Manual in Organic Chemistry	R.K. Bansal,	Wiley Eastern

COMPARATIVE ANATOMY AND DEVELOPMENTAL BIOLOGY OF VERTEBRATES PRACTICAL

Course Code	ZOO104
Course Title	Comparative anatomy and developmental biology of vertebrates practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	Study of skeletons of different vertebrates, different types of developmental stages of frog and reproductive organs of mammals.

LIST OF EXPERIMENTS

1. Osteology:

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

2. Study of developmental stages of frogs, metamorphosis from tadpole to adult 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 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

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



Third Semester



ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Course Code	BOT201
Course Title	Anatomy and Embryology of Angiosperms
Type of course	Theory
L T P	4 0 0
Credits	4
Course Objective	i. To study basic body plan of flowering plant, various tissue systems in higher plants, their structure, development and function. ii. To study structure, development and function of reproductive structures in flowering plants.

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

CHEMICAL BONDING TRANSITION METAL & COORDINATION CHEMISTRY

Course Code	CHM201
Course Title	Chemical Bonding Transition Metal & Coordination Chemistry
Type of course	Theory
L T P	4 0 0
Credits	4
Course Prerequisite	B.Sc Ist Year
Course Objective (CO)	The aim of this course is to impart knowledge to the students about basic concepts their bonding of transition elements and coordination compounds.

UNIT-I

The covalent bond and the structure of molecules :Valence bond approach, Concept of resonance in various organic and inorganic compounds, Hybridization and structure, equivalent and non-equivalent hybrid orbitals, Bent's rule and its applications, VSEPR model for predicting shapes of molecules and ions containing lone pairs, sigma and pi bonds.

UNIT-II

Molecular Orbital Approach: LCAO method, symmetry and overlap for s-s, s-p and p-p combinations, MO treatment of homonuclear diatomic molecules of 2nd period (B₂, C₂, N₂, O₂, F₂) and heteronuclear di-atomic molecules (CO, NO) and their ions.

Intermolecular forces: van der Waals forces, Hydrogen bonding and its applications, effects of these forces on melting point, boiling point and solubility.

UNIT-III

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).

UNIT-IV

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. Coordination compounds in biological systems: Fe, Cu, Co, Mn, Ni, Zn and heavy metal ions.

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 O_h and T_d complexes, Tetragonal distortion of octahedral geometry. Jahn-Teller distortion, Square planar coordination.

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Inorganic Chemistry: Principles of structure and reactivity, 4 th Edition	James E. Huheey	Prentice Hall
2	Inorganic Chemistry, 4 th Edition	D. S. Shriver and P.A. Atkins	Oxford University Press
3	Inorganic Chemistry, 3 rd Edition	Alan G. Sharpe	University of Cambridge
4	A New Concise Inorganic Chemistry, 4 th Edition	J. D. Lee,	ELBS
5	Inorganic Chemistry, 3 rd Edition	Grey L. Miessler and Donald A. Tarr	Prentice Hall

ANIMAL PHYSIOLOGY AND BIOCHEMISTRY

Course Code	ZOO201
Course Title	Animal Physiology and Biochemistry
Type of course	Theory
L T P	4 0 0
Credits	4
Course Prerequisite	B.Sc Ist Year
Course Objective (CO)	To make student's aware about physiological systems and biochemical pathways of mammals.

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
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 resources 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 environmental assets river/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

MEDICAL DIAGNOSTICS

Course Code	ZOO 205
Course Title	Medical Diagnostics
Type of course	Theory
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

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS PRACTICAL

Course Code	BOT203
Course Title	Anatomy and Embryology of Angiosperms Practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course Objective	To study plant anatomy and embryology through slides and specimens.

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 origin 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, microsporogenesis (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

CHEMICAL BONDING TRANSITION METAL & COORDINATION CHEMISTRY PRACTICAL

Course Code	CHM203
Course Title	Chemical Bonding Transition Metal & Coordination Chemistry Practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course Objective	The aim of this course is to impart practical knowledge to the students about analysis through titrimetric and complexometric titration.

LIST OF EXPERIMENTS

Titrimetric Analysis:

Preparations of standard solutions (concept of primary and secondary standards), Different units of concentration (molarity, molality, normality and formality)

(A) Titrations involving Acids-Bases:

Principles of acid-base titrations, Principle behind selection of an appropriate indicator.

1. Standardization of NaOH solution (standard solution of oxalic acid to be prepared).
2. Determination of concentration of carbonate and bicarbonate present in a mixture.
3. Determination of concentration of free alkali present in soaps/detergents/shampoos.

(B) Titrations involving redox reactions:

Concept of electrode potential, principle behind selection of an appropriate indicator.

4. Standardization of KMnO₄ solution (standard solution of Mohr's salt to be prepared).
5. Determination of concentration of Fe(II) in Mohr's salt and/or K₂Cr₂O₇ using diphenylamine/N-phenylanthranilic acid as internal indicator (standard solution of K₂Cr₂O₇ and /or Mohr's salt

to be prepared).

(C) Complexometric Titrations

Principles of complexometric titrations

6. Determination of concentration of Mg (II) & Zn (II) by titrimetric method using EDTA.

7. Determination of concentration of Ca/Mg in water sample using EDTA.

8. Determination of concentration of total hardness of a given sample of water by complexometric titration.

(At least 2 experiments from each set.)

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Inorganic Chemistry: Principles of structure and reactivity, 4 th Edition	James E. Huheey	Prentice Hall
2	Inorganic Chemistry, 4 th Edition	D. S. Shriver and P.A. Atkins	Oxford University Press
3	Inorganic Chemistry, 3 rd Edition	Alan G. Sharpe	University of Cambridge
4	Advanced Practical Inorganic Chemistry	Ayodha Singh	Campus Books 2002

PHYSIOLOGY AND BIOCHEMISTRY PRACTICAL

Course Code	ZOO203
Course Title	Physiology and Biochemistry Practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.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.



Fourth Semester

PLANT PHYSIOLOGY AND METABOLISM

Course Code	BOT202
Course Title	Plant Physiology and Metabolism
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	10+2 Medical
Course Objective (CO)	To study underlying mechanism of basic plant metabolic and physiological processes. To study concepts behind working of plant body.

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 Grissem and Russell L Jones	Wiley International
6	Experiments in Plant Physiology- A Laboratory Manual.	D Bajracharya	Narosa Publishing House

PHYSICAL CHEMISTRY FOR THE BIOSCIENCES

Course Code	CHM202
Course Title	Physical Chemistry for the Biosciences
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 knowledge to the students about basic concepts of chemical energetic, chemical equilibrium chemical kinetics and spectroscopic methods of analysis.

UNIT-I

Chemical Energetics: Review of the Laws of Thermodynamics. Important principles and definitions of thermochemistry. Concept of standard state and standard enthalpies of formation, 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.

Chemical Equilibrium Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Distinction between ΔG and ΔG° , Le Chatelier's principle. Relationships between K_p , K_c and K_x for reactions involving ideal gases.

Photochemistry: Laws of photochemistry. Fluorescence and phosphorescence. Quantum efficiency and reasons for high and low quantum yields. Primary and secondary processes in photochemical reactions. Photochemical and thermal reactions.

UNIT-II

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.

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 and first order reactions. Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Enzyme kinetics.

UNIT-III

Spectroscopy: Introduction to spectroscopy: Electromagnetic radiation, fundamental definitions, electromagnetic spectrum, introduction to concepts of absorption and emission spectroscopy, Beer-Lambert law. IR Spectroscopy: Fundamental and non-fundamental molecular vibrations, IR spectrum, fingerprint and group frequency regions and their significance, Hooke's law and vibrational frequency. Factors affecting vibrational frequency.

Characterization of functional groups: alkanes, alkenes, alkynes (only alicyclic systems), aldehydes, ketones, carboxylic acids and their derivatives, hydroxy compounds and amines. Study of hydrogen bonding. Electronic Spectroscopy: Electronic transitions, singlet and triplet states, dissociation and predissociation.

UNIT-IV

UV spectroscopy: Types of electronic transitions, UV spectrum, λ_{\max} , ϵ_{\max} , chromophores, auxochromes, bathochromic shift, hypsochromic shift (definitions and elementary examples) and solvent effect. Characteristic UV transitions in common functional groups. General applications of UV spectroscopy.

Woodward rules for calculating λ_{\max} in the following systems:

□ □ Conjugated dienes: alicyclic, homoannular, heteroannular.

PMR spectroscopy: Basic principles of NMR spectroscopy, PMR scale, chemical shifts (concept of shielding and deshielding), factors influencing chemical shifts, simple spin-spin couplings, coupling constant, chemical shift equivalence, anisotropic effects in alkenes, alkynes, aldehydes and aromatics. Interpretation of PMR spectra of simple compounds. Application of UV, IR and PMR in solving structures of simple molecules.

Text and reference books:

S. No.	Title	Author	Publisher
1	Physical Chemistry	Ball, D. W.	Thomson Press

2	J. de Atkin's Physical Chemistry, 9 th Edition	Atkins, P. W. & Paula	Oxford University
3	Physical Chemistry, 3 rd Edition	Castellan, G. W	Narosa
4	Physical Chemistry, 3 rd Edition	Mortimer, R. G.	Elsevier
5	Physical Chemistry for the Biosciences	Chang, R.	University Science Books
6	Applications of Absorption Spectroscopy of Organic Compounds,	John R. Dyer:	Prentice Hall.
7	Spectroscopic Identification of Organic Compounds	R.M. Silverstein, G.C. Bassler & T.C. Morrill	John Wiley & Sons

GENETICS AND EVOLUTIONARY BIOLOGY

Course Code	ZOO 202
Course Title	Genetics and Evolutionary Biology
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.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
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
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

PHYSICAL CHEMISTRY FOR THE BIOSCIENCES PRACTICAL

Course Code	CHM204
Course Title	Physical Chemistry for the Biosciences Practical
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	To impart practical knowledge thermochemistry, pH and potentiometric measurements and colourimetric experiments

LIST OF EXPERIMENTS

Thermochemistry

1. Determination of heat capacity of a calorimeter for different volumes.
2. Determination of the enthalpy of neutralization of hydrochloric acid with sodium hydroxide.

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3. Determination of integral enthalpy of solution of salts (endothermic and exothermic).

(III) pH-metric and potentiometric measurements

4. Preparation of sodium acetate-acetic acid buffer solutions and measurement of their pH.
5. Potentiometric titrations of (i) strong acid vs strong base (ii) weak acid vs strong base

6. Determination of dissociation constant of a weak acid.

(IV) Study the kinetics of the following reactions:

7. Acid hydrolysis of methyl acetate with hydrochloric acid.
8. Saponification of ethyl acetate

(V) Colorimetry

9. Verification of Lambert-Beer's Law for potassium dichromate/ potassium permanganate solution.

10. Determination of pK (indicator) for phenolphthalein.

Text and reference books:

S. No.	Title	Author	Publisher
1	Senior Practical Physical Chemistry	Khosla, B.D.; Garg, V.C.; Gulati, A. & Chand, R.	New Delhi.
2	Advanced Practical Physical Chemistry	J.B. Yadav	KRISHNA Prakashan Media (P) Ltd, 2012
3	Experimental Physical Chemistry	C. Das, B. Behera	Tata McGraw Hill Publishing Company Limited.
4	Experimental Physical Chemistry	Matthews, G. Peter	1st edition, Oxford University Press, 1985.

GENETICS AND EVOLUTIONARY BIOLOGY PRACTICAL

Course Code	ZOO204
Course Title	Genetics and Evolutionary Biology Practical
Type of course	Practical
L T P	0 0 4
Credits	2

Course prerequisite	10+2 Medical
Course Objective	To impart knowledge about plant functions through simple physiological experiments

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.
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.

Fifth Semester



CELL AND MOLECULAR BIOLOGY

Course Code	BOT301
Course Title	Cell and Molecular Biology
Type of course	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
Course Title	Cell and Molecular Biology 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 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
Course Title	Analytical Techniques in Plant Sciences
Type of course	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
Course Title	Analytical Techniques in Plant Sciences Practical
Type of course	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

ANALYTICAL METHODS IN CHEMISTRY

Course Code	CHM301
Course Title	Analytical Methods in Chemistry
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 knowledge to the students about qualitative, quantitative analysis and various physical methods of analysis.

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.

UNIT-II

Basic principles of quantitative analysis: estimation of metal ions from aqueous solution, geometrical isomers, keto-enol tautomers.

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator & detector) for single and double beam instrument; sampling techniques.

Structural illustration through interpretation of data, Effect and importance of isotope substitution.

UNIT-III

Flame Atomic Absorption and Emission Spectrometry: Basic principles of instrumentation (choice of source, monochromator, 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.

Electroanalytical methods: Classification of electroanalytical methods, basic principle of pH metric, potentiometric and conductometric 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 nonaqueous media.

Chromatography: Classification, principle and efficiency of the technique.

Mechanism of separation: adsorption, partition & ion exchange.

Development of chromatograms: frontal, elution and displacement methods.

Qualitative and quantitative aspects of chromatographic methods of analysis: IC, GLC, GPC,

TLC and HPLC.

Text and Reference Books:

S. No	Title	Author(s)	Publisher
1	Vogel's Textbook of Quantitative Chemical Analysis	Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C	John Wiley & Sons
2	Instrumental Methods of Analysis, 7th Edition	Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A	Wadsworth Publishing Company Ltd
3	Analytical Chemistry, 6th Edition	Christian, G.D	John Wiley & Sons
4	Basic Concepts of Analytical Chemistry	Khopkar, S.M	New Age, International Publisher
5	Exploring Chemical Analysis	Harris, D. C	W.H. Freeman
6	Principles of Instrumental Analysis	Skoog, D.A. Holler F.J. & Nieman, T.A.	Cengage Learning
7	Laboratory Hand Book of Chromatographic & Allied Methods	Mikes, O	John Wiley & Sons

ANALYTICAL METHODS IN CHEMISTRY PRACTICAL

Course Code	CHM303
Course Title	Analytical Methods in Chemistry 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 qualitative, quantitative analysis and various physical/ spectroscopic methods of analysis.

LIST OF EXPERIMENTS

1. Separation Techniques

I. Chromatography:

(a) Separation of mixtures

(i) 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.

(b) Separate a mixture of Sudan yellow and Sudan Red by TLC technique and identify them on the basis of their R_f values.

(c) Chromatographic separation of the active ingredients of plants, flowers and juices by TLC

3. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

5. Analysis of soil:

- (i) Determination of pH of soil.
- (ii) Total soluble salt
- (iii) Estimation of calcium, magnesium, phosphate, nitrate
- 6. Spectrophotometry
 - 1. Determination of dissolved oxygen in water.
 - 2. Determination of chemical oxygen demand (COD).
 - 3. Determination of Biological oxygen demand (BOD).

Text and Reference Books:

S. No	Title	Author(s)	Publisher
1	Vogel's Textbook of Quantitative Chemical Analysis	Jeffery, G.H., Bassett, J., Mendham, J. & Denney, R.C	John Wiley & Sons
2	Instrumental Methods of Analysis, 7th Edition	Willard, H.H., Merritt, L.L., Dean, J. & Settoe, F.A	Wadsworth Publishing Company Ltd
3	Analytical Chemistry, 6th Edition	Christian, G.D	John Wiley & Sons
4	Basic Concepts of Analytical Chemistry	Khopkar, S.M	New Age, International Publisher
5	Exploring Chemical Analysis	Harris, D. C	W.H. Freeman
6	Principles of Instrumental Analysis	Skoog, D.A. Holler F.J. & Nieman, T.A.	Cengage Learning
7	Laboratory Hand Book of Chromatographic & Allied Methods	Mikes, O	John Wiley & Sons

MOLECULAR MODELLING & DRUG DESIGN

Course Code	CHM305
Course Title	Molecular Modelling & Drug Design
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To impart theoretical knowledge about molecular modeling used in drug design.

UNIT-I

Introduction. Useful Concepts in Molecular Modelling: Coordinate Systems. Potential Energy Surfaces. Molecular Graphics. Surfaces. Computer Hardware and Software. The Molecular Modelling Literature. Force Fields: Fields. Bond Stretching. Angle Bending. Introduction to nonbonded interactions. Electrostatic interactions. van der Waals Interactions. Hydrogen bonding in Molecular Mechanics. Force Field Models for the Simulation of Liquid Water.

UNIT-II

Energy Minimization and Computer Simulation: Minimization and related methods for exploring the energy surface. Non-derivative method, First and second order minimization methods. Computer simulation methods. Simple thermodynamic properties and Phase Space. Boundaries. Analyzing the results of a simulation and estimating Errors.

UNIT-III

Molecular Dynamics & Monte Carlo Simulation: Molecular Dynamics Simulation Methods. Molecular Dynamics using simple models. Molecular Dynamics with continuous potentials. Molecular Dynamics at constant temperature and pressure. Metropolis method. Monte Carlo simulation of molecules. Models used in Monte Carlo simulations of polymers.

UNIT-IV

Structure Prediction and Drug Design: Structure prediction - Introduction to comparative Modeling. Sequence alignment. Constructing and evaluating a comparative model. Predicting protein structures by 'Threading', Molecular docking. Structure based de novo ligand design, Drug Discovery - Chemoinformatics - QSAR.

Text and Reference Books:

S. No	Title	Author(s)	Publisher
1	Molecular Modelling Principles and Application	Leach, A.R	Longman
2	Molecular Dynamics Simulation Elementary Methods	Haile, J.M	John Wiley and Sons
3	QSAR and Molecular Modeling	Gupta, S.P.	Anamaya Publishers

MOLECULAR MODELLING & DRUG DESIGN PRACTICAL

Course Code	CHM307
Course Title	Molecular Modelling & Drug Design 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 molecular modeling used in drug design.

LIST OF EXPERIMENTS

1. Compare the optimized C-C bond lengths in ethane, ethene, ethyne and benzene. Visualize the molecular orbitals of the ethane σ bonds and ethene, ethyne, benzene and pyridine π bonds.
2. (a) Perform a conformational analysis of butane. (b) Determine the enthalpy of isomerization of cis and trans 2-butene.
3. Visualize the electron density and electrostatic potential maps for LiH, HF, N₂, NO and CO and comment. Relate to the dipole moments. Animate the vibrations of these molecules.
4. (a) Relate the charge on the hydrogen atom in hydrogen halides with their acid

character. (b) Compare the basicities of the nitrogen atoms in ammonia, methylamine, dimethylamine and trimethylamine.

5. (a) Compare the shapes of the molecules: 1-butanol, 2-butanol, 2-methyl-1-propanol, and 2-methyl-2-propanol. Note the dipole moment of each molecule. (b) Show how the shapes affect the trend in boiling points: (118 °C, 100 °C, 108 °C, 82 °C, respectively).

6. Build and minimize organic compounds of your choice containing the following functional groups. Note the dipole moment of each compound: (a) alkyl halide (b) aldehyde (c) ketone (d) amine (e) ether (f) nitrile (g) thiol (h) carboxylic acid (i) ester (j) amide.

7. (a) Determine the heat of hydration of ethylene. (b) Compute the resonance energy of benzene by comparison of its enthalpy of hydrogenation with that of cyclohexene.

8. Arrange 1-hexene, 2-methyl-2-pentene, (E)-3-methyl-2-pentene, (Z)-3-methyl-2-pentene, and 2,3-dimethyl-2-butene in order of increasing stability.

9. (a) Compare the optimized bond angles H₂O, H₂S, H₂Se. (b) Compare the HAH bond angles for the second row dihydrides and compare with the results from qualitative MO theory.

Note: Software: ChemSketch, ArgusLab (www.planaria-software.com), TINKER 6.2 (dasher.wustl.edu/ffe), WebLab Viewer, Hyperchem, or any similar software.

Text and Reference Books:

S. No	Title	Author(s)	Publisher
1	Molecular Modelling Principles and Application	Leach, A.R	Longman
2	Molecular Dynamics Simulation Elementary Methods	Haile, J.M	John Wiley and Sons
3	QSAR and Molecular Modeling	Gupta, S.P.	Anamaya Publishers

RESEARCH METHODOLOGY FOR CHEMISTRY

Course Code	CHM309
Course Title	Research Methodology For Chemistry
Type of course	Theory
L T P	5 1 0
Credits	6
Course prerequisite	B.Sc Medical II year
Course Objective	To impart theoretical knowledge about various research methodology used in chemistry viz. Chemical safety, data handling.

UNIT-I

Literature Survey: Print: Sources of information: Primary, secondary, tertiary sources; Journals: Journal abbreviations, abstracts, current titles, reviews, monographs, dictionaries, textbooks, current contents, Introduction to Chemical Abstracts and Beilstein, Subject Index, Substance Index, Author Index, Formula Index, and other Indices with examples.

Digital: Web resources, E-journals, Journal access, TOC alerts, Hot articles, Citation index, Impact factor, H-index, E-consortium, UGC infonet, E-books, Internet discussion groups and communities, Blogs, Preprint servers, Search engines, Scirus, Google Scholar, ChemIndustry, Wiki- Databases, ChemSpider, Science Direct, SciFinder, Scopus.

UNIT-II

Information Technology and Library Resources: The Internet and World Wide Web. Internet resources for chemistry. Finding and citing published information. Methods of Scientific Research and Writing Scientific Papers: Reporting practical and project work. Writing literature surveys and reviews. Organizing a poster display. Giving an oral presentation. Writing scientific papers – justification for scientific contributions, bibliography, description of methods, conclusions, the need for illustration, style, publications of scientific work. Writing ethics. Avoiding plagiarism.

UNIT-III

Chemical Safety and Ethical Handling of Chemicals: Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratory ventilation. Safe storage and use of hazardous chemicals, procedure for working with substances that pose hazards, flammable or explosive hazards, procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratory chemicals, procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system, incineration and transportation of hazardous chemicals.

UNIT-IV

Data Analysis: *The Investigative Approach*: Making and Recording Measurements. SI Units and their use. Scientific method and design of experiments. *Analysis and Presentation of Data*: Descriptive statistics. Choosing and using statistical tests. Chemometrics. Analysis of variance (ANOVA), Correlation and regression, Curve fitting, fitting of linear equations, simple linear cases, weighted linear case, analysis of residuals, General polynomial fitting, linearizing transformations, exponential function fit, r and its abuse. Basic aspects of multiple linear regression analysis. Electronics: Basic fundamentals of electronic circuits and their components used in circuits of common instruments like spectrophotometers, typical circuits involving operational amplifiers for electrochemical instruments. Elementary aspects of digital electronics.

Text and Reference Books:

S. No	Title	Author(s)	Publisher
1	Practical skills in chemistry. 2nd Ed	Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones, A.	Prentice Hall
2	Data analysis for chemistry	Hibbert, D. B. & Gooding, J. J	Oxford University Press
3	Quantitative chemical analysis. 6th Ed	Harris, D. C	Freeman

4	How to use Excel in analytical chemistry and in general scientific data analysis	Levie, R. de	Cambridge University Press
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CELL BIOLOGY, BIOTECHNOLOGY AND REPRODUCTIVE BIOLOGY

Course Code	ZOO301
Course Title	Cell Biology, Biotechnology and Reproductive Biology
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc IIInd 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
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
Course Title	Applied Zoology
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To aware students about the various types of parasites and their relationship with their hosts. To find out some organisms which are fetal to animals and try for the control measures against them.

UNIT-I

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

UNIT-II

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

UNIT-III

Parasitic Helminthes: Life history and pathogenicity of Ancylostoma duodenale and 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	Arora, D. R and	CBS Publications

	Edition	Arora, B	
3	Agricultural Pests of India and South East Asia	Atwal, A.S	Kalyani Publishers
4	Agricultural Entomology	Dennis, H	Timber Press
5	Reproduction in Farm Animals	Hafez, E. S. E	Lea & Fabiger Publisher

APPLIED ZOOLOGY PRACTICAL

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

LIST OF EXPERIMENTS

1. Study of Plasmodium vivax, Entamoeba histolytica, Trypanosoma gambiense, Ancylostoma duodenale and 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
3	Reproduction in Farm Animals	Hafez, E. S. E	Lea & Fabiger Publisher
4	Aquaculture and Fisheries Biotechnology Genetic Approaches	Dunham R.A.	CABI publications

AQUATIC BIOLOGY

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

UNIT-I

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

UNIT-II

Freshwater Biology: Lakes: Origin and classification, Lake as an Ecosystem, Lake morphometry,

Physico-chemical Characteristics: Light, Temperature, Thermal stratification, Dissolved Solids, Carbonate, Bicarbonates, Phosphates and Nitrates, Turbidity; dissolved gases (Oxygen, Carbon dioxide).

UNIT-III

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

UNIT-IV

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

Text and Reference Books:

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

AQUATIC BIOLOGY PRACTICAL

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

LIST OF EXPERIMENTS

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

Text and Reference Books:

S. No	Title	Author(s)	Publisher
1	Bioresources Ecology 3rd Edition	Anathakrishnan	
2	Limnology, 2nd Edition	Goldman	
3	Physicochemical Methods for Water and Wastewater Treatment, 1 st Edition	Pawlowski	

FLORICULTURE

Course Code	BOT309
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.

Apiculture and Sericulture

Course code	ZOO315
Course title	Apiculture and Sericulture
Type of course	Theory
LTP	2 0 0
Credits	2
Course objective	To impart basic knowledge about rearing of honey bees and silkworms for commercial production of honey and silk.

UNIT-I

Sixth Semester



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

ECONOMIC BOTANY AND BIOTECHNOLOGY

Course Code	BOT302
Course Title	Economic Botany and Biotechnology
Type of course	Theory
L T P	4 0 0
Credits	4
Course prerequisite	B.Sc Medical II year
Course Objective	To study economically important plants and recombinant DNA techniques.

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
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
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
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

GREEN CHEMISTRY

Course Code	CHM302
Course Title	Green Chemistry

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 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.
- Green solvents— supercritical fluids, water as a solvent for organic reactions, ionic liquids, fluoruous biphasic solvent, PEG, solventless 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.
- Prevention of chemical accidents designing greener processes, inherent safer design, principle of ISD “What you don’t have cannot harm you”, greener alternative to Bhopal Gas Tragedy (safer route to carbaryl) and Flixborough accident (safer route to cyclohexanol) subdivision of ISD, minimization, simplification, substitution, moderation and limitation.
- Strengthening/ development of analytical techniques to prevent and minimize the generation of hazardous substances in chemical processes.

UNIT-II

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: sonochemical 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.

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

8 Healthier fats and oil by Green Chemistry: Enzymatic interesterification for production of no Trans-Fats and Oils

UNIT-III

Future Trends in Green Chemistry: Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C₂S₃); Green chemistry in sustainable development.

Text and reference books:

S. no.	Title	Author	Publisher
1	New Trends in Green Chemistry	Ahluwalia, V.K. & Kidwai, M.R	Anamalaya Publishers
2	Green Chemistry - Theory and Practical	Anastas, P.T. & Warner, J.K	Oxford University Press
3	Introduction to Green Chemistry	Matlack, A.S	Marcel Dekker
4	Real-World cases in Green Chemistry	Cann, M.C. & Connely, M.E.	American Chemical Society, Washington
5	Introduction to Green Chemistry	Ryan, M.A. & Tinnesand, M	American Chemical Society, Washington
6	Green Chemistry: An Introductory Text	Lancaster, M.	RSC Publishing

GREEN CHEMISTRY PRACTICAL

Course Code	CHM304
Course Title	Green Chemistry 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 Green chemistry and use of green chemistry in organic synthesis.

LIST OF EXPERIMENTS

1. 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

(I) Triethylamine ion + OH⁻ → propene + trimethylpropene + water

(II) 1-propanol H₂SO₄/□□ propene + water

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

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

Text and reference books:

S. no.	Title	Author	Publisher
1	New Trends in Green Chemistry	Ahluwalia, V.K. & Kidwai, M.R	Anamalaya Publishers
2	Green Chemistry - Theory and Practical	Anastas, P.T. & Warner, J.K	Oxford University Press
3	Introduction to Green Chemistry	Matlack, A.S	Marcel Dekker
4	Real-World cases in Green Chemistry	Cann, M.C. & Connely, M.E.	American Chemical Society, Washington

BIOINORGANIC AND ENVIRONMENTAL CHEMISTRY

Course Code	CHM306
Course Title	Bioinorganic and Environmental Chemistry
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 bioinorganic and environmental chemistry.

UNIT-I

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

UNIT-II

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.	Title	Author	Publisher
1	Industrial Chemistry	E. Stocchi	Ellis Horwood Ltd.
2	Elementary Principles of Chemical Processes	R.M. Felder, R.W. Rousseau	Wiley Publishers
3	Riegel's Handbook of Industrial Chemistry	J. A. Kent	CBS Publishers
4	Environmental Chemistry	S. S. Dara	S. Chand & Company Ltd.
5	Environmental Pollution Analysis	S. M. Khopkar	Wiley Eastern Ltd
6	Environmental Studies	A. Mishra	Selective and Scientific Books

BIO-INORGANIC & ENVIRONMENTAL CHEMISTRY PRACTICAL

Course Code	CHM308
Course Title	Bioinorganic and Environmental Chemistry 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 water analysis and environmental pollution analysis.

LIST OF EXPERIMENTS

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 (AgNO_3 and potassium chromate).
 6. Estimation of total alkalinity of water samples (CO_3^{2-} , HCO_3^-) using double titration method.
 7. Measurement of dissolved CO_2 .
 8. Study of some of the common bio-indicators of pollution.
 9. Estimation of SPM in air samples.
 10. Preparation of borax/ boric acid.
- Separation of mixtures by chromatography: Measure the R_f value in each case. (Combination of two ions to be given)
11. Paper chromatographic separation of Fe^{3+} , Al^{3+} and Cr^{3+} or paper chromatographic separation of Ni^{2+} , Co^{2+} , Mn^{2+} and Zn^{2+}

Text and reference books:

S. no.	Title	Author	Publisher
1	Industrial Chemistry	E. Stocchi	Ellis Horwood Ltd.
2	Elementary Principles of Chemical Processes	R.M. Felder, R.W. Rousseau	Wiley Publishers
3	Riegel's Handbook of Industrial Chemistry	J. A. Kent	CBS Publishers
4	Environmental Chemistry	S. S. Dara	S. Chand & Company Ltd.
5	Environmental Pollution Analysis	S. M. Khopkar	Wiley Eastern Ltd

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS

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

UNIT-I

Introduction to spectroscopic methods of analysis: Recap of the spectroscopic methods covered in detail in the core chemistry syllabus: 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,	Wadsworth Publishing Company Ltd.

3	Physical Chemistry	J. & Settoe, F.A	
4	Fundamentals of Molecular Spectroscopy	P.W. Atkins C.N. Banwell	
5	Infrared Spectral Interpretations: A Systematic Approach	Brian Smith	

INSTRUMENTAL METHODS OF CHEMICAL ANALYSIS PRACTICAL

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

LIST OF EXPERIMENTS

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

21. Detection in the field and confirmation in the laboratory of flammable accelerants or explosives
22. Detection of illegal drugs or steroids in athletes
23. Detection of pollutants or illegal dumping
24. Fibre analysis

At least 10 experiments to be performed.

Text and reference books:

S. no.	Title	Author	Publisher
1	Principles of Instrumental Analysis	Skoog, D.A. Holler F.J. & Nieman, T.A	Cengage Learning India Ed
2	Instrumental Methods of Analysis, 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.

IMMUNOLOGY AND BIOSTATISTICS

Course Code	ZOO302
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 Lichtman H. Andrew (2003.)	Saunders Publication.
5.	Biostatistics	P. Ramakrishnan	Saras Publications
6.	Biostatistics: A foundation for analysis in the health sciences	W.W. Daniel	John Wiley and Sons

IMMUNOLOGY AND BIOSTATISTICS PRACTICAL

Course Code	ZOO304
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
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
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. Ovaryectomy, 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
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
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

MUSHROOM CULTURE TECHNOLOGY

Course Code	BOT310
Course Title	Mushroom Culture Technology
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	B.Sc Medical II year
Course Objective	To learn about mushroom production at commercial scale

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	Oyster Mushrooms	Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R	
2	Food and Nutrition	Swaminathan, M	
3	Mushroom cultivation	Tewari, Pankaj Kapoor, S.C	Mittal Publications
4	Hand book of Mushrooms	Nita Bahl	