SCHEME & SYLLABUS

B.Sc. Medical

Department of Natural Sciences

UISH

University Institute of Science & Humanities

Sant Baba Bhag Singh University

2015

INDEX

37	BOT303	Botany Lab-V	**59**	**5**
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40	BOT302	Botany-VI	**62**	**6**
41	CHM302	Chemistry-VI	**63**	**6**
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43	ZOO306	Mushroom Cultivation Technology	**67**	**6**
44	BOT304	Botany Lab-VI	**68**	**6**
45	CHM304	Chemistry Lab-VI	**69**	**6**
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Course Scheme, B.Sc Medical

SEMESTER I

I. Theory Subjects

S. No.	Subject Code	Subject Name	Contact Hours (L:T:P)	Credits (L:T:P)	Total Contact Hours	Total Credit Hours
1	BOT101	Botany-I	5:0:0	5:0:0	5	5
2	CHM101	Chemistry-I	5:0:0	5:0:0	5	5
3	ZOO101	Zoology-I	5:0:0	5:0:0	5	5
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	Botany Lab-I	0:0:4	0:0:2	4	2
2	CHM103	Chemistry Lab-I	0:0:4	0:0:2	4	2
3	ZOO103	Zoology Lab-I	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: 35
Total Credit Hours: 27

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	Botany-II	5:0:0	5:0:0	5	5
2	CHM102	Chemistry-II	5:0:0	5:0:0	5	5
3	ZOO102	Zoology-II	5:0:0	5:0:0	5	5
4	ENG102	General English-II	3:0:0	3:0:0	3	3
5	PBI102/HCP102	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	Botany Lab-II	0:0:4	0:0:2	4	2
2	CHM104	Chemistry Lab-II	0:0:4	0:0:2	4	2
3	ZOO104	Zoology Lab-II	0:0:4	0:0:2	4	2
4	PT102/PT104/PT106	Physical Training (NSO/NCC/NSS)	0:0:2	Non-credit	2	NC

Total Contact hrs: 35
Total Credit Hours: 27

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	Botany-III	6:0:0	6:0:0	6	6
2	CHM201	Chemistry-III	6:0:0	6:0:0	6	6
3	ZOO201	Zoology-III	6:0:0	6:0:0	6	6
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	Botany Lab-III	0:0:4	0:0:2	4	2
2	CHM203	Chemistry Lab-III	0:0:4	0:0:2	4	2
3	ZOO203	Zoology Lab-III	0:0:4	0:0:2	4	2

Total Contact hrs: 35
Total Credit Hours: 29

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	Botany-IV	6:0:0	6:0:0	6	6
2	CHM202	Chemistry-IV	6:0:0	6:0:0	6	6
3	ZOO202	Zoology-IV	6:0:0	6:0:0	6	6
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	Botany Lab-IV	0:0:4	0:0:2	4	2
2	CHM204	Chemistry Lab-IV	0:0:4	0:0:2	4	2
3	ZOO204	Zoology Lab-IV	0:0:4	0:0:2	4	2
4	CSE220	Computational Skills Lab	0:0:2	0:0:1	2	1

Total Contact hrs: 34
Total Credit Hours: 27

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	BOT301	Botany-V	6:0:0	6:0:0	6	6
2	CHM301	Chemistry-V	6:0:0	6:0:0	6	6
3	ZOO301	Zoology-V	6:0:0	6:0:0	6	6
4	BOT305	Floriculture	2:0:0	2:0:0	2	2
5	ZOO305	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	BOT303	Botany Lab-V	0:0:4	0:0:2	4	2
2	CHM303	Chemistry Lab-V	0:0:4	0:0:2	4	2
3	ZOO303	Zoology Lab-V	0:0:4	0:0:2	4	2

Total Contact hrs: 34
Total Credit Hours: 28

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	BOT302	Botany-VI	6:0:0	6:0:0	6	6
2	CHM302	Chemistry-VI	6:0:0	6:0:0	6	6
3	ZOO302	Zoology-VI	6:0:0	6:0:0	6	6
4	BOT306	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	BOT304	Botany Lab-VI	0:0:4	0:0:2	4	2
2	CHM304	Chemistry Lab-VI	0:0:4	0:0:2	4	2
3	ZOO304	Zoology Lab-VI	0:0:4	0:0:2	4	2

Total Contact hrs: 32
Total Credit Hours: 26

Course Scheme Summary

Sem	L	T	P	Contact hrs/wk	Credits	CC	AEC	SEC	DSE
1	21	0	12	33	27	21	6		
2	21	0	12	33	27	21	6		
3	23	0	12	35	29	24	3	2	
4	20	0	14	34	27	24		3	
5	22	0	12	34	28			4	24
6	20	0	12	32	26			2	24
Total	**127**	**0**	**74**	**201**	**164**	**90**	**15**	**11**	**48**

BOTANY-I

Course Code	BOT101
Course Title	Botany-I (Diversity of Cryptogams and Phanerogams)
Type of course	Theory
L T P	5 0 0
Credits	5
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; Classification of algae; Ecology; Range of thallus organization, reproduction and economic importance. Morphology, reproduction and life-cycles of the following genera:

a) Chlorophyta–*Volvox, Chlamydomonas,Oedogonium*
b) Xanthophyta–*Vaucheria*
c) Phaeophyta–*Sargassum*
d) Rhodophyta–*Polysiphonia*

UNIT-II

Fungi: General characteristics, ecology and significance, range of thallus organization, cell wall composition, nutrition, reproduction, classification and economic importance.
Morphology, reproduction and life-cycles of the following genera:

a) Mastigomycotina- *Phytophthora*
b) Zygomycotina– *Rhizopus*
c) Ascomycotina– *Penicillium*
d) Basidiomycotina– *Agaricus*
e) Deuteromycotina–*Cercospora, Colletotrichum*

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 economic 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.

Angiosperms: General characteristics, 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	The Fungi	P.D. Sharma	Rastogi Publisher
5	Cryptogamic Botany, Vol. II, Bryophytes & Pteridophytes	G.M Smith	Tata McGraw Publisher
6	Botany for degree students B.Sc 1st Year	V K Aggarwal	S.Chand Publishing
7	A Text book of Botany-I	S.P. Jain	Rastogi Publishers
8	University Botany-I, Algae, Fungi, Bryophyta & Pteridophyta	S.M.Reddy	New Age International Publisher

CHEMISTRY-I

Course Code	CHM101
Course Title	Chemistry-I
Type of course	Theory
L T P	5 0 0
Credits	5
Course prerequisite	10+2 Non Medical or Medical
Course Objective	The aim of the subject is to enhance the knowledge of students in Atomic Structure, Chemistry of Noble gases and Stereochemistry of Organic Compounds.

Inorganic Chemistry

UNIT-I

Atomic Structure: Idea of de Broglie matter waves, Heisenberg uncertainty principle

along with its significance, Schrodinger wave equation, significance of, Ψ and Ψ^2, Quantum numbers, radial and angular wave functions, Radial probability distribution curve, shapes of s, p, d orbitals. Aufbau and Pauli exclusion principles, Hund's multiplicity rule. Electronic configuration of the elements and ions.

UNIT-II

Chemistry of Noble gases : Physical and Chemical properties of noble gases, chemistry of xenon compounds including their preparation, properties, structure and bonding.

S-block elements: Trends in physical and chemical properties of alkali metals and alkaline earth metals, Diagonal relationship, Anomalous behaviour of Lithium and Beryllium.

UNIT-III

Covalent Bonding: Covalent compounds and their characteristics, factors favoring formation of covalent compounds, Valence bond theory and its limitations, Application of Valence Bond Theory in formation of hydrogen molecule, Hybridization and its types, Shapes of simple inorganic molecules and ions on the basis of hybridization (BeF_2 , BF_3 , CH_4, PF_5, SF_6, IF_7, $Sncl_2$, XeF_4, $Sncl_6^{2-}$) **,** Valence shell electron pair repulsion (VSEPR) theory and shapes of molecules (NH_3, SF_4, ClF_3, ICl_2^-, H_2O, H_3O^+, MO theory, Molecular orbitals in homonuclear diatomic molecules and heteronuclear diatomic molecules (NO, CO, CO^+, CN, CN^-, BO), multicenter bonding in electron deficient molecule (Boranes) , Percentage ionic character from dipole moment and electronegativity difference.

UNIT-IV

Ionic Solids: Ionic compounds and their characteristics, Factors favoring the formation of ionic compounds, Concept of close packing, Coordination Number and radius ratio, Ionic structures, (NaCl , CsCl, Zinc blende, Wurtzite, CaF_2), Lattice defects, Lattice energy and Born-Haber cycle, Covalent character in Ionic compounds—Fajan's rule, solvation energy and solubility of ionic solids, Conductors, Non-Conductors, and Semi conductors.

ORGANIC CHEMISTRY

UNIT-I

Structure and Bonding: Hybridization, bond lengths and bond angles, bond energy and bond order, localized and delocalized chemical bond, Van der Wall's interactions, resonance, hyperconjugation, aromaticity, inductive and field effects, hydrogen bonding

UNIT-II

Mechanism of Organic Reactions: Curved arrow notation, drawing electron movements with half- headed (Fish Hook) and double headed arrows, homolytic and heterolytic bond cleavages. Types of organic reactions, reagents and Energy considerations. Reactive intermediates-carbocations, carbanions,

free radicals, carbenes, arynes and nitrenes (with examples). Assignment of formal charges for intermediates and other ionic species. Methods to determine reaction mechanism (product analysis, intermediates, isotope effect, kinetic and stereo-chemical studies)

UNIT-III

Alkanes: Isomerism in alkanes, sources, methods of preparation (with special reference to Wurtz reaction, Kolbe reaction, Corey-House reaction and decarboxylation of carboxylic acids), physical properties and Mechanism of free radical halogenation of alkanes: orientation, reactivity and selectivity.

Cycloalkanes: Cycloalkanes; nomenclature, chemical reactions, Baeyer's strain theory and its limitations. Ring strain in small rings (cyclopropane and cyclobutane), theory of strain less rings. The case of cyclopropane ring: banana bonds.

UNIT-IV

Stereochemistry of Organic Compounds: Concept of isomerism. Types of isomerism Optical-isomerisim-elements of symmetry, molecular chirality, enantiomers, stereogenic centre, optical activity, properties of enantiomers, chiral and achiral molecules with two stereogenic centres, diastereomers, threo and erythro diastereomers, meso compounds, resolution of enantiomers, inversion, retention and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. Geometric isomerism-determination of configuration of geometric isomers, E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds.Conformational isomerism-conformational analysis of ethane and n-butane; conformations of cyclohexane, axial and equatorial bonds, conformation of mono substituted cyclohexane derivatives. Newman projection and Sawhorse formulae, Fischer and flying wedge formulae.Difference between configuration and conformation.

PHYSICAL CHEMISTRY

UNIT-I

Mathematical Concepts: Logarithmic relations. curve sketching, linear graphs and calculation of slopes, differentiation of functions like kx, e^x, x^n, sin x, log x, maxima and minima, partial differentiation and reciprocity relations. Integration of some useful/relevant functions permutations and combinations. Factorials and Probability .

UNIT-II

Evaluation of Analytical Data: Terms of mean and median, precision and accuracy in chemical analysis, determining accuracy of methods, improving accuracy of analysis, data treatment for series involving relatively few measurements, linear least squares curve fitting, types of errors, standard deviation, confidence limits, rejection of measurements (F-test and Q-test) numerical problems related to evaluation of analytical data.

UNIT-III

Liquid State: A qualitative description of intermolecular forces, structure of liquids Structural differences between solids, liquids and gases. Liquid crystals: Difference between liquid crystal, solid and liquid. Classification and structure of nematic and eholestric phases.Thermography and seven segment cell.

Gaseous State: Postulates of kinetic theory of gases, deviation from ideal behaviour, van der Waals equation of states, the isotherms of van der Waals equation, relationship between critical constants and van der Waals constants, the law of corresponding states, reduced equation of state. Molecular velocities: Root mean square, average and most probable velocities. Qualitative discussion of the Maxwell's distribution of molecular velocities, collision number, means free path and collision diameter, Liquefaction of gases (based on Joule-Thomson effect).

UNIT-IV

Physical Properties and Molecular Structure: Optical activity, polarization- (Clausius-Mossotti equation), orientation of dipoles in an electric field, dipole moment. Induced dipole moment, measurement of dipole moment temperature method and refractivity method.Dipole moment and structure of molecules, magnetic properties-paramagnetism, diamagnetism and ferromagnetism.

Text and Reference Books:

S. No	Title	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd

ZOOLOGY-I

Course Code	ZOO101
Course Title	Zoology-I (Biodiversity)
Type of course	Theory
L T P	5 0 0
Credits	5
Course prerequisite	10+2 Medical
Course Objective (CO)	1. To enable the students to develop an appreciation for the biodiversity of invertebrate species and to impart knowledge about co-existence of different forms of living organisms ranging from acelluar to multicellular animals. 2. Studies on this group of animals bring to light knowledge of basic functions of life viz., nutrition, respiration, excretion, reproduction etc. and how the organisms of various phyla structurally and functionally adapt themselves for surviving in different ecological conditions. 3. 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

UNIT-II

Phylum Platyhelminthes: General characters and classification up to classes; Life history of *Taenia solium,* Phylum Nemathelminthes: General characters and classification up to classes; Life history of *Ascaris lumbricoides* and its parasitic adaptations,

UNIT-III

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

UNIT-IV

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,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	**NA**
Course Objective (CO)	1. The students will critically read and analyze the prescribed texts. 2. The students will demonstrate effective word choice, vocabulary, idioms, grammar and sentence structure allowing accurate communication of meaning in written work. 3. The students will recognize the correct usage of present/past/future tenses in contextualized speech.

UNIT I

Tales of Life :

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

Prose for Young Learners:

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

Exploring Tenses in English:

a. Present and Past
b. Present Perfect and Past

UNIT II

Tales of Life:

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

Prose for Young Learners:

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

Exploring Tenses in English:

a. Future

Text and Reference Books:

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

GENERAL PUNJABI-I

Course Code	PBI101
Course Title	General Punjabi-I
Type of Course	Theory
L T P	3 0 0
Credits	3
Course Prerequisite	NA
Course Objectives	1. ividAwrQI AwDuink pMjwbI kvIAW dI jIvnI qoN jwxU hoxgy[2. ividAwrQIAW nUM AwDuink pMjwbI kivqw dI ivSYgq jwxkwrI ho jwvygI[3. ividAwrQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[4. ividAwrQIAW nUM pMjwbI DunIN ivauNqbMdI sMbMDI igAwn hwisl ho jwvygw[5. ividAwrQI pMjwbI aup- BwSwvW nUM pCwnxXog ho jwxgy[

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

iekweI- A

1. pMjwbI DunI ivauNq : aucwrn AMg, aucwrn sQwn qy ivDIAW, svr, ivAMjn[
2. BwSw vMnglAW: BwSw dw tkswlI rUp, BwSw Aqy aup- BwSw dw AMqr, pMjwbI aupBwSwvW dy pCwx icMnH[

pusqk sUcI

pwT- pusqkW

lyKk	swl	Pusqk	pbilSr
sMpwdk, iF`loN; h.s. Aqy srgoDIAw; p.s.	2014	do rMg	pbllkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr
gwrgI; b.	1995	pMjwb dy mhwn klwkwr	pbllkySn ibaUro, gurUu nwnk dyv XUnIvristI, AMimRqsr

sMbMiDq pusqkW

lyKk	swl	Pusqk	pbilSr

isMG; h.	1966	pMjwbI bwry	pMjwbI XUnIvristI, pitAwlw
isMG; qIrQ (fw.)	2014	pMjwbI AiDAwpn	AY~s. jI. pbilSrz, jlMDr
syKoN; suKivMdr isMG (fw.) Aqy syKoN; mndIp kOr	2015	pMjwbI BwSw dw AiDAwpn	kilAwxI pbilSrz, luiDAwxw

BOTANY LAB-I

Course Code	BOT103
Course Title	Botany Lab-I
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course Objective	To learn about morphology and reproductive bodies of microbes and plants by studying plant specimens and permanent slides

List of experiments:

Plants/material available in locality/institution can be selected.

1. Study of the genera included under algae through museum specimens and permanent slides (classification, vegetative thallus and reproductive organs) - *Volvox, Chlamydomonas,Oedogonium. Vaucheria*. *Ectocarpus, Sargassum and Polysiphonia*.
2. Study of the genera included under fungi through museum specimens and permanent slides (classification, vegetative thallus and reproductive organs) – *Mucor, Penicillium, Rhizopus, Agaricus.*
3. Study of diseased plant material, disease symptoms and their causal organism- vein mosaic disease of Bhindi, Tobacco Mosaic disease, Damping off of Tomato/Capsicum seedlings, Late blight of Potato, Yellow rust of Wheat, Black rust of Wheat, Loose smut of Wheat, Covered smut of Barley, Tikka disease of Groundnut and Red rot of Sugarcane.
4. Study of lichen morphology through museum specimens- crustose, foliose and fruticose lichens.
5. Study of morphology, reproductive structures and anatomy of the Bryophytes through museum specimens and permanent slides- *Marchantia and Funaria*
6. Study of morphology, reproductive structures and anatomy of the Pteridophytes through museum specimens and permanent slides- *Selaginella, Equisetum* and *Pteris.*
7. Study of morphology, reproductive structures and anatomy of Gymnosperms through museum specimens and permanent slides- Cycas and Pinus.
8. Gram staining of bacteria.

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	The Fungi	P.D. Sharma	Rastogi Publisher
5	Cryptogamic Botany, Vol. II, Bryophytes & Pteridophytes	G.M Smith	Tata McGraw Publisher
6	Botany for degree students B.Sc 1st Year	V K Aggarwal	S.Chand Publishing
7	A Text book of Botany-I	S.P. Jain	Rastogi Publishers

8	University Botany-I,Algae, Fungi, Bryophyta & Pteridophyta	S.M.Reddy	New Age International Publisher

CHEMISTRY LAB-I

Course Code	**CHM103**
Course Title	Chemistry Lab-I
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Non Medical or Medical
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students about the separation and identification of ions, Determination of melting and boiling point of organic compounds and liquids.

List of Experiments:

1. **Determination of one cation and anion in given salts**.
   Separation and identification of
   ions from groups I, II, III, IV, V, and VI. Anionic analysis. Four ions with
   no interference
2. **Crystallization involving impure sample of any one of the following alum, $CuSO_4$.**
3. **Determination of melting point**
   Naphthalene 80–82^oC
   Benzoic acid 121.–122^0C
   Urea 132.5–133^oC
   Succinic Acid 184.5–185^oC
   P–dichlorobenzene 52^oC
   Cinnamic acid 132.5–133^oC
   Salicylic acid 157.5–158^oC
   Acetanilide 113.5–114^oC
   Aspirin 135^oC
4. **Determination of Boiling point**
   Ethanol 78^oC
   Benzene–80^oC
   Cyclohexane 81.4^oC
   Toluene 110°C
5. **Simple Organic Preparations**
6. **Quantitative Analysis**
   Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide), in simple organic compounds
7. **Gravimetric Analysis**
   Analysis of Cu as CuSCN and Ni as Ni (dimethylgyoxime)$_2$
8. **Volumetric Analysis**
   (a) Estimation of calcium content in chalk as calcium oxalate by permanganometry.
   (b) Estimation of hardness of water by EDTA.
   (c) Estimation of ferrous and ferric by dichromate method.

(d) Estimation of copper using sodium thiosulphate.

Text and Reference Books:

S. No	Name	Author(S)	Publisher
1	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham,	ELBS
2	Laboratory Manual in Organic Chemistry	R.K. Bansal,	Wiley Eastern
3	Advanced Experimental Chemistry. Vol. I	J.N. Gurtu and R. Kapoor	S. Chand & CO.

ZOOLOGY LAB-I

Course Code	ZOO103
Course Title	Zoology Lab-I
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+2 Medical
Course objective	To make the students aware about different organisms pertaining to different phylum by studying their habits, habitat, morphology and characteristics.

List of experiments:

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, Columba, Eudynamis,Tyto alba, Corvus spledens,Macropus gigantus,Macaca mulatta Funambulus palmarum,Panthera leo*
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
4.An "animal album" containing followings:
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,* VIII Edition	Ruppert and Barnes, R.D.	Holt Saunders International Edition.
2	*The Invertebrates: A New Synthesis*, III Edition(2002)	Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. and Spicer	Blackwell Science
3	*The Life of Vertebrates*. III Edition	Young, J. Z.	Oxford university press
4	*Vertebrate life* VIII Edition,	Pough H.	Pearson International
5	*Strickberger's Evolution*. IV Edition	Hall B.K. and Hallgrimsson B.	Jones and Bartlett Publishers Inc.

BOTANY-II

Course Code	BOT102
Course Title	Botany-II (Plant Physiology and Biochemistry)
Type of course	Theory
L T P	5 0 0
Credits	5
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

CHEMISTRY-II

Course Code	CHM102
Course Title	Chemistry-II
Type of course	Theory
L T P	5 0 0
Credits	5
Course prerequisite	10+-Non Medical or Medical
Course Objective	The aim of the subject is to enhance the knowledge of students regarding the element of periodic table, General organic chemistry, behavior of Ideal and non-ideal solutions and Chemical kinetics.

INORGANIC CHEMISTRY

UNIT-I

Periodic Properties, s-Block and Group no. 13 Elements: Position of elements in the periodic table, effective nuclear charge and its calculations. Atomic and ionic radii, ionization energy, electron affinity and electronegativity-definition.methods of determination or evaluation, trends in periodic table and applications in predicting and explaining the chemical behavior.

UNIT-II

S-block: elements comparative study, diagonal relationships, salient features of hydrides, solvation and complexation tendencies including their function in biosystems, an introduction to alkyls and aryls. Comparative study (including diagonal relationship) of groups 13 elements, compounds like hydrides, oxides, oxyacids and halides of groups 13; hydrides of boron-diborane and higher boranes, borazine, borohydrides.

UNIT-III

p - Block Elements: Comparative study (including diagonal relationship) of groups 14-l7 elements, compounds like hydrides, oxides, oxyacids and halides of groups 14-17;

UNIT-IV

Fullerenes, carbides, fluorocarbons, silicates (structural principle), tetrasulphur tetranitride systems, basic properties of halogens, interhalogens and polyhalides.

ORGANIC CHEMISTRY

UNIT-I

Alkenes, Cycloalkenes: Nomenclature of alkenes-methods of formation, mechanisms and dehydration of alcohols and dehydrohalogenation of alkyl halides regioselectivity in alcohol dehydration. The Saytzeff rule, Hofmann elimination, physical properties and relative stabilities of alkenes. Chemical reactions of alkenes-mechanisms involved in hydrogenation, electrophilic and free radical additions Markownikoff's rule, hydroboration-oxidation, oxymercuration reduction. Epoxidation, ozonolysis, hydration, hydroxylation and oxidation with $KMnO_4$.Polymerization of alkenes.Substitution and the allylic and vinylic positions of alkenes.Industrial application of ethylene and propene.Methods or formation, conformation and chemical reactions of Cycloalkenes.

UNIT-II

Nomenclature and classification of dienes: isolated, conjugated and cumulated dienes. Structure of allenes and butadiene, methods of formation, polymerization. Chemical reactions-I,2 and l,4 additions, Diels-Alder reaction. Nomenclature, structure and bonding in alkynes. Methods of formation.Chemical reactions of alkynes, acidity of alkynes.Mechanism of electrophilic and nucleophilic addition reactions hydroboration-oxidation.metal-ammonia reductions, oxidation and polymerization.

UNIT-IV

Alkyl and aryl halides: Nomenclature and classes of alkyl halides, methods of formation chemical reactions. Mechanisms of nucleophilic substitution reactions of alkyl halides, $S_N2$and S_N1 reactions with energy profile diagrams. Methods of formation of aryl halides, nuclear and side chain reactions.The addition elimination and the elimination-additional mechanisms of nucleophilic aromatic substitution reactions.Relative reactivities of alkyl halides vs allyl, vinyl and aryl halides.

PHYSICAL CHEMISTRY

UNIT-I

Ideal and non-ideal solutions, methods of expressing concentration of solutions, activity and activity coefficients. Dilute solution, colligative properties, Raoult's law, relative lowering of vapour pressure, molecular weight determination. Osmosis, law of osmotic pressure and its measurement, determination molecular weight from osmotic pressure, Elevation of boiling point and depression of freezing point, Thermodynamic derivation of relation between molecular weight and elevation in boiling point and depression in freezing point. Experimental methods for determining various colligative properties.Abnormal molar mass, degree of dissociation and association of solutes.

UNIT-II

Definition of colloids, classification of colloids Solids in liquids (sols): properties-kinetic, optical and electrical; stability of colloids protective action, Hardy-Schulze law, gold number. Liquids in liquids (emulsions) types of emulsions, preparation, Emulsifiers.Liquids in solids, (gels) classification, preparation and properties inhibition.General applications of colloids.

UNIT-III

Chemical Kinetics and catalysis: Chemical kinetics and its scope, rate of a reaction, factors influencing the rate of a reaction- concentration, temperature, pressure, solvent, light, catalyst. Concentration dependence of rates, mathematical characteristics of simple chemical reactions-zero order, first order, second order, pseudo order, half life and mean life. Determination of the order of reaction-s-differential method, method of integration, method of half life period and isolation method.Radioactive decay as a first order phenomenon.

UNIT-IV

Theories of chemical kinetics, effect of temperature on rate of reaction. Arrhenius equation, concept of activation energy.Simple collision theory based on hard sphere model, transition state theory (equilibrium hypothesis).Expression for the rate constant based on equilibrium constant and thermodynamic aspects.Catalysis and general characteristics of catalytic reactions. Homogeneous catalysis, acid base catalysis and enzyme catalysis including their mechanisms, Michaelis Menten equation for enzyme catalysis and its mechanism.

Text and Reference Books:

S. no.	Title	Author(s)	Publishers
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd

ZOOLOGY-II

Course Code	ZOO102
Course Title	Zoology-II (Comparative Anatomy and Developmental Biology)
Type of course	Theory
L T P	5 0 0
Credits	5
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

Digestive System: Brief account of alimentary canal and digestive glands

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

UNIT-II

Circulatory System: Evolution of heart and aortic arches

Urinogenital System: Succession of kidney, Evolution of urinogenital ducts

Nervous System: Comparative account of brain

Sense Organs: Types of receptors

UNIT-III

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

UNIT-IV

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

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

Text and Reference Books:

Sr No.	Title	Author(s)	Publisher
1	Vertebrates' Comparative Anatomy, Function and Evolution. IV Edition.	K.V Kardong	McGraw-Hill

2	Comparative Anatomy of the Vertebrates. IX Edition	G.C. Kent and R.K Carr	McGraw-Hill
3	Analysis of Vertebrate Structure	M. Hilderbrand and G.E. Gaslow	John Wiley and Sons
4	Biology of Vertebrates	H.E. Walter and L.P. Sayles	Khosla Publishing House
5	Developmental Biology, VIII Edition	S.F. Gilbert	Sinauer Associates, Inc., Publishers, Sunderland, Massachusetts, USA.

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	NA
Course Objectives	1. ividAwrQI AwDuink pMjwbI khwxIkwrW dI jIvnI qoN jwxU hoxgy[2. ividAwrQIAW nUM AwDuink pMjwbI khwxI dI ivSYgq jwxkwrI ho jwvygI[3. ividAwrQIAW iv`c ryKw ic`qrW dw Alocnwqmk AiDAYn krn dw hunr auqpMn hovygw[4. ividAwrQI muhwvry, AKwxW dI Fu`kvIN vrqoN krnW is`K jwxgy

iekweI- a

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

iekweI- A

1. Sbd bxqr Aqy Sbd rcnw: pirBwSw Aqy mu`Fly sMklp

2. (a) pYrHw rcnw, muhwvry Aqy AKwx[

(A) pYrHw pVH ky pRSnW dy au~qr dyxw[

pusqk sUcI

pwT- pusqkW

LyKk	swl	pusqk	pbilSr
sMpwdk, iF`loN; h.s. Aqy srgoDlAw, p.s.	2014	do rMg	pbllkySn ibaUro, gurUu nwnk dyv XUnlvristl, AMimRqsr
gwrgl, b.	1995	pMjwb dy mhwn klwkwr	pbllkySn ibaUro, gurUu nwnk dyv XUnlvristl, AMimRqsr

sMbMiDq pusqkW

LyKk	swl	psqk	pbilSr
isMG, h.	1966	pMjwbl bwry	pMjwbl XUnlvristl, pitAwlw
isMG, q.	2014	pMjwbl AiDAwpn	AY~s. jl. pbilSrz, jlMDr
syKoN, s.s. Aqy syKoN, m.k.	2015	pMjwbl BwSw dw AiDAwpn	kilAwxl pbilSrz, luiDAwxw

BOTANY LAB-II

Course Code	**BOT104**
Course Title	Botany Lab-II
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 Grissem and Russell L Jones	Wiley International
6	Experiments in Plant Physiology- A Laboratory Manual.	D Bajracharya	Narosa Publishing House

CHEMISTRY LAB-II

Course Code	CHM104
Course Title	Chemistry Lab-II
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	10+-Non Medical or Medical

Course Objective (CO)	The aim of this course is to impart practical knowledge to the students about the preparation of organic compounds, Chemical Kinetics and boiling point of organic liquids.

List of Experiments:

Naphthalene, 80-82^{0}C. Benzoic acid, 121.5-122^{0}C

Urea, 132.5-133^{0}C, Succinic acid, 184.5-185^{0}C.

Cinnamic acid, 132.5-133^{0}C, Salicylic acid, 157.5-158^{0}C.

Acetanilide, 113.5-114^{0}C, m-Dinitrobenzene, 90^{0}C.

ρ-Dichlorobenzene, 52^{0}C, Asprin, 135^{0}C.

Determination of boiling points

Ethanol, 78^{0}C, Cyclohexane, 81.4^{0}C. Toluene, 110.6^{0}C, Benzene, 80^{0}C

Crystallization

Concept of induction of crystallization
Phthalic acid from hot water (using fluted filter paper and seamless funnel)
Acetanilide from boiling water
Naphthalene from ethanol
Benzoic acid from water

Physical Chemistry Experiment: Chemical Kinetics

1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by hydrogen ions at room temperature.
2. To study the effect of acid strength on the hydrolysis of an ester.
3. Viscosity & Surface Tension of pure liquids.
   To determine the viscosity and surface tension of C2H5oH and glycerin solution in water
4. Molecular weight determined by Part method.

Text and reference books:

S. No	Name	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
2	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham	ELBS
3	Handbook of Preparative Inorganic Chemistry. Vol. I & II	Brauer	Academic Press

ZOOLOGY LAB-II

Course Code	ZOO104
Course Title	Zoology Lab-II

Type of course	Practical

S.No	Title	Author(s)	Publisher
1	*Vertebrates' Comparative Anatomy, Function and Evolution*. IV Edition	Kardong, K.V.	McGraw-Hill Higher Education
2	*Comparative Anatomy of the Vertebrates*. IX Edition	G.C. and Carr R.K.	The McGraw-Hill Companies
3	*Analysis of Vertebrate Structure*,	Hilderbrand, M and Gaslow G.E.	John Wiley and Sons

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 though permanent slides.
3. **Study of the different types of placenta-**
   Histological sections through permanent slides or photomicrographs.
4. Study of placental development in humans by ultrasound scans.
5. **Examination of gametes - frog/rat** Sperm and ova through permanent slides or photomicrographs.
6. Study of histological section of testis and ovary through permanent slides.

Text and reference books:

BOTANY-III

Course Code	BOT201
Course Title	Botany-III (Plant Ecology and Taxonomy)
Type of course	Theory
L T P	6 0 0
Credits	6
Course Prerequisite	B.Sc Ist Year
Course Objective (CO)	To make students aware about concepts in plant ecology, environment and its components, structure and function of ecosystems and applications of ecology. To study general characters of spermatophytes viz. Angiosperms and Gymnosperms, details of representative plants of both groups, taxonomic classification, systems, branches and applications of taxonomy.

UNIT-I

Introduction: 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.

UNIT-II

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

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

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.

UNIT-IV

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.

CHEMISTRY-III

Course Code	**CHM201**
Course Title	Chemistry-III
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc Ist year
Course Objective (CO)	The aim of the subject is to enhance the knowledge of students regarding the chemistry of transition elements, Phenols, alcohols and aldehydes and thermodynamics.

INORGANIC CHEMISTRY

UNIT-I

Chemistry of Elements of First Transition Series: Characteristic properties of d-block elements. Properties of the elements of the first transition series, their simple compounds and complexes illustrating relative stability of their oxidation states, coordination number and geometry.

UNIT-II

Chemistry of Lanthanide Elements: Electronic structure, oxidation states and ionic radii and lanthanide contraction, complex formation, occurrence and isolation of lanthanide compounds.

UNIT-II

Chemistry of Elements of Second and Third Transition Series: General characteristics, comparative treatment with their 3d-analogues in respect of ionic radii, oxidation states.Magnetic behaviour, spectral properties & stereochemistry

UNIT-IV

Chemistry of Actinides Elements: General features and chemistry of actinides, chemistry of separation of Np, Pu and Am from U, similarities between the later actinides and the later lanthanides.

ORGANIC CHEMISTRY

UNIT-I

Alcohols Classification and nomenclature.Monohydric Alcohols-nomenclature, methods of formation by reduction of aldehydes, ketone, carboxylic acids and esters.Hydrogen bonding, Acidic nature, Reactions of alcohols.Dihydric alcohols-nomenclature, methods of formation, chemical reactions of vicinal glycols-nomenclature, methods of formation chemical reaction of vicinal glycols, oxidative cleavage with [Pb (OAc) and HIO_4] and Pinacol-Pinacolone rearrangement.Trihydric alcohol-nomenclature, methods off formation and chemical reactions of glycerol.

UNIT-II

Phenols Nomenclature, structure and bonding.Preparation of Phenols, physical properties and acidic character.Comperative acidic strengths of alcohols and phenols, resonanace stabilization of phenoxide ion.Reaction of phcnols-electrophilic aromatic subsititution, acylation and carboxylation Mechanisms of Fries rearrangement.Gatterman synthesis, Hauben.Heesch reaction.Lederer-Mianasse reaction and Reimer-Tiemann reaction.

UNIT-III

Aldehydes and Ketones Nomenclature and structure of the carbonyl group, Synthesis of aldehydes and ketones with particular reference to the synthesis of aldehydes from acid chlorides, synthesis of aldehyes and ketones using 1,3- dithianes, synthesis of ketones from nitrites and from carboxylic acids. Physical properties and Mechanism of nucleophillic addition to carbonyl group with particular emphasis ofBenzoin, Aldol, Perkin and Knoevenagel condensations,

Condensation with ammonia and its derivatives, Wittig reaction, and Mannich reaction.

UNIT-IV

Use of acetals as protecting group.Oxidation of aldehydes, Baeyer-Villiger oxidation of ketones, Cannizzaro reaction, MPV, Clemmensen, Wolff-Kishner, $LiAlH_4$ and $NaBH_4$ reductions.Halogenation of enolizable ketones.An Introduction to , unsaturated aldehydes and ketones, Michael addition.

PHYSICAL CHEMISTRY

UNIT-I

Thermodynamics: Definition of thermodynamics terms: system, surroundings etc. Types of systems, intensive and extensive properties.State and path functions and their differentials, Thermodynamic processes, Concept of heat and work, elementry idea of thermochemistry.

First Law of Thermodynimcs : statement, definition of internal energy and enthalpy. Heat capacity, heat capacities at constant volume and pressure and their relationship.Joule's law. Joule Thomson coefficient and inversion temperature, Calculation of w, q, dU &dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

UNIT-II

Thermodynamic-II: Second law of thermodynamics: need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem.Themodynamic scale of temperature. Concept of entropy as a state function, entropy as a function of V &T, entropy as a function of P &T, entropy change in physical change, Clausius inequality, entropy as a criterion of spontaneity and equilibrium. Entropy change in ideal gases mixing of gases.

UNIT-III

Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data, Gibbs and Helmholtz functions; Gibbs function (G) and Helmhotz function (A) as thermodynamic quantities. A & G as criteria for thermodynamic equilibrium and spontaneity, their advantage over entropy change. Variation of G and A with P, V and T.

UNIT-IV

Chemical Equilibrium: Equilibrium constant and free energy, Thermodynamic derivation of law of mass action.Le Chatelier's principle.Reaction isotherm and reaction isochore-Clapeyron equation and Clausius-Claperyron equation, applications.

Text and Reference Books

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

4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd

ZOOLOGY-III

Course Code	**ZOO201**
Course Title	Zoology-III (Animal Physiology and Biochemistry)
Type of course	Theory
L T P	6 0 0
Credits	6
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 8th edition	Tortora, G.J. and Derrickson, B.H.	John Wiley & Sons
2	Vander's Human Physiology,11th edition	Widmaier, E.P., Raff, H. and Strang, K.T.	McGraw Hill
3	Textbook of Medical Physiology, 12th edition	Guyton, A.C. and Hall, J.E	Harcourt Asia Pvt. Ltd/ W.B. Saunders Company
4	Biochemistry, 6th edition	Berg, J. M., Tymoczko, J. L. and Stryer, L	W.H Freeman and Co.
5	Principles of Biochemistry, 6th edition	Nelson, D. L., Cox, M. M. and Lehninger, A.L	W.H. Freeman and Co.
6	Harper's Illustrated Biochemistry, 28th edition	Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W.	Lange Medical Books/Mc Graw Hill

ENVIRONMENTAL SCIENCE

Course Code	**EVS101**
Course Title	Environmental Science
Type of course	Theory
L T P	3 0 0
Credits	3
Course prerequisite	NA
Course Objective (CO)	To make students aware about environment and need of maintaining it with best possible knowledge.

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

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

Text and reference books:

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

MEDICAL DIAGNOSTICS

Course Code	ZOO205
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, VIIIEdition	Robbins and Cortan	Saunders
6	Lab Manual on Blood Analysis and Medical Diagnostics	Prakash, G	S.Chand

BOTANY LAB-III

List of experiments:

Course Code	BOT 203
Course Title	Botany Lab-III (Plant Ecology and Taxonomy Lab)
Type of course	Theory
L T P	0 0 4
Credits	2
Course Objective	To learn about ecology of plants, determination of ecological components and study of some angiosperm families.

1. Study of instruments used to measure microclimatic variables: Soil thermometer, maximum and minimum thermometer, anemometer, psychrometer/hygrometer, rain gauge and lux meter.
2. Determination of pH, and analysis of two soil samples for carbonates, chlorides, nitrates, sulphates, organic matter and base deficiency by rapid field test.
3. Comparison of bulk density, porosity and rate of infiltration of water in soil of three habitats.
4. (a) Study of morphological adaptations of hydrophytes and xerophytes (four each). (b)Study of biotic interactions of the following: Stem parasite (*Cuscuta)*, Root parasite (Orobanche), Epiphytes, Predation (Insectivorous plants)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method. (species to be listed)
6. Quantitative analysis of herbaceous vegetation in the college campus for frequency and comparison with Raunkiaer's frequency distribution law
7. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):
Brassicaceae –*Brassica/Alyssum / Iberis*
Asteraceae –*Tagetes erecta/Ageratum conyzoides*
Solanaceae –*Solanum tuberosum, Withania*
Fabaceae-*Pisum sativum/Cassia fistula/Acacia nilotica*
Lamiaceae -*Salvia, Ocimum*
Liliaceae - *Asphodelus / Lilium / Allium.*
Gramineae-*Triticum*
Rosaceae-*Rosa indica*
Malvaceae-*Hibiscus Rosa sinensis*
Umbelliferae- *Coriandrum*
Asclepiadaceae- *Calotropis*
Euphorbiaceae- *Euphorbia*
8. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Concepts of Ecology	Kormondy, E.J	Prentice Hall, U.S.A. 4th edition.
2	Ecology and Environment	Sharma, P.D	Rastogi Publications, Meerut, India. 8thed

3	*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.

CHEMISTRY LAB-III

Course Code	**CHM 203**
Course Title	Chemistry Lab-III
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course Objective	The aim of the subject is to improve the knowledge of students about the preparation, Volumetric Analysis and identification of compound by TLC

List of experiments:

Volumetric Analysis

(a)Determination of acetic acid in commercial vinegar using NaOH, Arkalimity of water sample.

(b) Determination of alkali content of antacid.

(c) Estimation of calcium content in chalk as calcium oxalate by permanganometry .

(d) Estimation of hardness of water by EDT A.

(e) Estimation of ferrous and ferric by dichromate method.

(f) Estimation of copper using sodium thiosulphate.

Laboratory Techniques

(a)Thin Layer Chromatography

(b) Determination of R, values and identification of organic compounds.

(c) Separation of green leaf pigments (spinach leaves may be used)

(d) Preparation and separation of 2, 4-dinitrophenylhydrazones of acetone, benzophenone cyclohexanone using toluene and light petroleum (40 : 60).

(e) Separation of a mixture of dyes

Text and reference books:

S. No	**Name**	**Author(S)**	**Publisher**
01	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
02	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J. Mendham	ELBS
03	Handbook of Preparative Inorganic	Brauer	Academic Press

	Chemistry. Vol. I & II		
04	Inorganic Synthesis		McGraw Hill

ZOOLOGY LAB-III

Course Code	ZOO203
Course Title	Zoology Lab-III
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course objective	Study of histological sections of different glands, metabolic constituents' estimations and haematological tests.

List of experiments:

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

Text and reference books:

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

BOTANY-IV

Course Code	BOT202

Course Title	Botany-IV (Plant Anatomy and Embryology)
Type of course	Theory
L T P	6 0 0
Credits	6
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; types of inflorescences; 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	Title	Author	Publisher

No.			
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

CHEMISTRY-IV

Course Code	CHM202
Course Title	Chemistry-IV
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc Ist year
Course Objective (CO)	The aim of the subject is to enhance the knowledge of students about the Coordination Compounds, Carboxylic Acid and its Derivatives, Detergents and Electrochemistry.

INORGANIC CHEMISTRY

UNIT-I

Coordination Compounds: Werner's coordination theory and its experimental verification, effective atomic number concept, chelates, nomenclature of coordination compounds, isomerism in coordination compounds, valence bond theory of transition metal complees.

UNIT-II

Oxidation and Reduction: Use of redox potential data-analysis of redox cycle, redox stabilityto water-Frost, Latimer and Pourbaix diagrams. Principles involved in the extraction of the elements.

UNIT-III

Acids and Bases: Arrhenius, Bronsted-Lowry, the Lux-Flood solvent system and Lewis concepts of acids and bases.

UNIT-IV

Non-aqueous Solvents: Physical properties of a solvent, types of solvents and their general characteristics, reaction in non-aqueous solvents with reference to liquid NH_3 and liquid SO_2

ORGANIC CHEMISTRY

UNIT-I

Carboxylic Acids: Nomenclature, structure and bonding.physical properties, acidity of carboxylic acids, effects of substituents on acid strength. Preparation of carboxylic acids, Reactions of amides, Reactions of carboxylic acids, Mechanism of decarboxylation.Methods of formition and chemical reactions of halo acids. Hydroxyacids, maleic and tartaric acid, citric acids. (Structural Formula only), Methods of formation and chemical reaction of unsaturated nonocarboxylic acids.Dicaboxylic acids, methods of formation and effect of heat and dehydrating agents.

Carboxylic Acid Derivatives: Structure and nomenclature of acid chlorides, esters.amides and cid anhydrides. Relative stability and reactivity of acyl derivatives.

Physical properties, interconversion of acid derivatives by nucleophillic acyl substitution.

Preparation of carboxylic derivatives, chemical reactions, Mechanism of esterfication and hydrolysis (acidic and Basic).

UNIT-II

Ethers and Epoxides: Nomenclature of ethers and methods of their formation, physical properties, Chemical reactions-cleavage and autooxidation, Ziesel' s Method.

Synthesis of epoxide, add and base catalysed ring opening of epoxide, orientation of ring opening reactions ofGringard and organolithium reagents with epoxide.

UNIT-III

Fats, Oils and Detergents: Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerides, hydrogenation of unsaturated oils.Saponification value, iodine value, acid value.Soaps, synthetic detergents, alkyl and aryl sulphonates.

UNIT-IV

Preparation of nitroalkanes and nitroarenes.Chemical reactions of nitroalkanes.Mechanism of nucleophilic substitution in nitroarenes and their reactions in acidic, neutral and alkaline media, Picric acid.

Reactivity, structure and nomenclature of amines, physical properties. Stereochemistry of

amines Separation of a mixture secondary and tertiary amines. Structural features effecting the basicity of amines. Amine salts as phase-transfer catalyst and preparation of alkyl and aryl amines

PHYSICAL CHEMISTRY

UNIT-IV

Phase Equilibrium: Statement and meaning of the tems-phase, component and degree of freedom, derivation of Gibbs phase rule; phase equilibria of one component system-water and S systems. Phase equilibria of two component systems-solid-liquid equilibria, simple eutectic Pb-Ag sytems, desilverisation of lead.

Solid Solutions-compound formation with congruent melting point (Mg-Zn) and incongruent melting point, (NaCI-Hp), ($FeCI\text{-}_3H_2O$) systems.Freezing mixtures, acetone-dry ice. Liquid-Liquid mixtures-ideal liquid mixtures, Raoult's and Henry's law.

UNIT-II

Electrochemistry-I: Electrical transport-conduction in metals and in electrolyte solutions, specific conductance and equivalent conductance with dilution.

Migration of ions and Kohlrausch law.Arrhenius theory of electrolyte dissociation and its limitations, weak and strong electrolytes, Ostwald's dilution law, its uses and limitations.Debye-Huckel-Onsagar's equation for strong electrolytes (elementa treatment only).

UNIT-III

Electrochemistry-II: Transport number, definition and deterriilfiafion by Hittorf method and moving boundary method. Applications of conductance measurements: determination of degree of dissociation, determination of K. of acids, determination of solubility product of a sparingly soluble salts, conductometric titrations.

UNIT-IV

Electrochemistry-III: Types of reversible electrodes--gas-metal ion, metal-metal ion, metal-insoluble salt-anion and redox electrodes.Electrode reactions, Nernst equation, derivation of cell E.M.F. and single electrode potential, standard hydrogen electrode-reference electrodes-standard electrode.potential, sign conventions, electrochemical series and its significance.

Electrolyte and Galvanic cells-reversible and irreversible cells, conventional representation of electrochemical cells.

EMF of a cell and its measurements, Computation of cell EMF.Calculation of thermodynamic quantities of cell reaction (G, H and K), polarization, over potential and hydrogen over voltage. Concentration cell with and without transport, liquid junction potential, application of concentration cells, valency of ions, solubility product and activity coefficient potentiometric titrations. Definition of pH and pK., determination of pH using hydrogen, quinhydrone and glass electrodes, by potentiomentric methods

Text and Reference Books

S. No	Name	Author(S)	Publisher

1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd

ZOOLOGY-IV

Course Code	**ZOO202**
Course Title	Zoology-IV (Genetics and Evolutionary Biology)
Type of course	Theory
L T P	6 0 0
Credits	6
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, 8th edition	Gardner, E.J., Simmons, M.J., Snustad, D.P.	Wiley India
2	Principles of Genetics, 5th edition	Snustad, D.P., Simmons, M.J	John Wiley and Sons Inc.
3	Concepts of Genetics, 10th edition	Klug, W.S., Cummings, M.R., Spencer, C.A	Benjamin Cummings
4	Genetics- A Molecular Approach, 3rd edition	Russell, P. J.	Benjamin Cummings.
5	Introduction to Genetic Analysis, 9th edition	Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B.	W. H. Freeman and Co.
6	Evolution, 3rd edition	Ridley, M.	Blackwell Publishing
7	Evolutionary Biology	Douglas, J. Futuyma	Sinauer Associates.

BOTANY LAB-IV

Course Code	BOT204
Course Title	Botany Lab-IV
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course Objective	To study plant anatomy and embryology through slides and specimens.

List of Experiments:

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

Text and reference books:

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

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

CHEMISTRY LAB-IV

Course Code	**CHM204**
Course Title	Chemistry Lab-IV
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course Objective	The aim of the subject is to improve the knowledge of students about qualitative analysis and enthalpy of acids and bases.

Qualitative Analysis

Detection of elements (N, S and halogens) and functional groups (phenolic, carboxylic, carbonyl, esters, carbohydrates, amines, amides, nitro and anilide) in simple organic compounds.

Physical Chemistry

1. To determine the solubility of benzoic acid at different temperatures and to determine H of the dissolution process.
2. To determine the enthalpy of neutralisation of a weak acid/weak base versus strong base/strong acid and determine the enthalpy of ionisation of the weak acid/weak base.
3. To determine the enthalpy of solution of solid calcium chloride.

Text and reference books:

S. No	**Name**	**Author(S)**	**Publisher**
1	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
2	Vogel's Textbook of Quantitative Inorganic Analysis (revised),	J. Basseff, R.C. Dennery, G.H. Jeffery and J.	ELBS

		Mendham	
3	Handbook of Preparative Inorganic Chemistry. Vol. I & II	Brauer	Academic Press
4	Inorganic Synthesis		McGraw Hill

ZOOLOGY LAB-IV

Course Code	**ZOO204**
Course Title	Zoology Lab-IV
Type of course	Practical
LTP	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course objective	Study of Mendelian genetical laws , evolution , fossils study and phylogeny of mammals and birds

List of practical:

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, 8th edition	Gardner, E.J., Simmons, M.J., Snustad, D.P.	Wiley India
2	Principles of Genetics, 5th edition	Snustad, D.P., Simmons, M.J	John Wiley and Sons Inc.
3	Concepts of Genetics, 10th edition	Klug, W.S., Cummings, M.R., Spencer, C.A	Benjamin Cummings
4	Genetics- A Molecular Approach, 3rd edition	Russell, P. J.	Benjamin Cummings.

BOTANY-V

Course Code	BOT301
Course Title	Botany-V (Cell and Molecular Biology)
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc IInd year
Course Objective	To learn about structure and function of cell and its various components. To impart fundamental knowledge regarding structure, function and expression 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.

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

Cell Organelles: Mitochondria: Structure, marker enzymes, composition; Semiautonomous nature; Symbiont hypothesis; Proteins synthesized within mitochondria; mitochondrial DNA. 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-II

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 Cycle : Overview of Cell cycle, Mitosis and Meiosis; Molecular controls.

UNIT-III

Genetic material: DNA: Miescher to Watson and Crick- historic perspective, Griffith's and Avery's transformation experiments, Hershey-Chase bacteriophage experiment, DNA structure, types of DNA, types of genetic material. DNA replication (Prokaryotes and eukaryotes): bidirectional replication, semi–conservative, semi discontinuous RNA priming, Ǿ (theta) mode of replication, replication of linear, ds-DNA, replicating the 5 end of linear chromosome including replication enzymes.

Transcription (Prokaryotes and Eukaryotes): Types of structures of RNA (mRNA, tRNA, rRNA), RNA polymerase- various types; Translation (Prokaryotes and eukaryotes), genetic code.

UNIT-IV

Regulation of gene expression: Prokaryotes:Lac operon and Tryptophan operon ; and in Eukaryotes.

Genetic Inheritance: Mendelism; laws of segregation and independent assortment; linkage analysis; allelic and non–allelic interactions.

Genetic Variations: Mutations, spontaneous and induced; transposable genetic elements; DNA, damage and repair.

Text and Reference books:

S. No.	Title	Author	Publisher
1	Cell and Molecular Biology: Concepts and Experiments 6th edition	Gerald Karp	John Wiley and Sons
2	Cell and Molecular Biology	EDP De Robertis and EMF De Robertis	Lippincott Williams and Wilkins, Philadelphia
3	The Cell: A Molecular Approach 5th Edition	G M Cooper and Hausman	ASM Press and Sunderland
4	The world of The Cell, 7th Edition	W M Becker, L J Hardin and G P Bertoni	Pearson Benjamin Cummings Publishing, San Francisco

CHEMISTRY-V

Course Code	**CHM301**
Course Title	Chemistry-V
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc IInd year
Course Objective (CO)	The syllabus is designed to enhance the scientific knowledge of students about the Transition metal Complexes, spectroscopic techniques, and Quantum Mechanics.

INORGANIC CHEMISTRY

UNIT-I

Metal-ligand Bonding in Transition Metal Complexes: Limitations of valence bond theory, an elementary idea of crystal- field theory, crystal field splitting in octahedral, tetrahedral and square planar complexes, factors affecting the crystal-field parameters.

UNIT-II

Thermodynamic and Kinetic Aspects of Metal Complexes : A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution

reactions of square planar complexes.

UNIT-III

Magnetic Properties of Transition Metal Complexes: Types of magnetic behaviour, methods of determining magnetic susceptibility, spin-only formula, L-S coupling, Correlation of μ_s and μ_{eff} values, orbital contribution to magnetic moment, application of magnetic moment data for 3d-metal complexes.

UNIT-IV

Electronic Spectra of Transition Metal Complexes: Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectrochemical series. Orgel-energy level diagram for $d^1$and d^9 states, discussion of electronic spectrum of $[Ti(H_2O)_6]^{3+}$ complexion.

ORGANIC CHEMISTRY

UNIT-I

Nuclear magnetic resonance (NMR) spectroscopy: Proton magnetic resonance (^{1}H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2 tribromoethane, ethyl acetate, toluene and acetophenone.

Ultraviolet (UV) absorption spectroscopy-absorption laws (Beer-Lambert's law, Molar absorptivity, presentation and analysis ofUV Spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated enes and enones.

UNIT-II

Infrared (IR) absorption spectroscopy-molecular vibrations, Hooke's law, Selection rules, intensity and position of IR bands, measurement of lR spectrum, fingerprint region, characteristic absorption of various functional groups and Interpretation of IR spectra of simple organic compounds. Problems pertaining to the structure elucidation of simple organic compounds using IR spectroscopic techniques.

UNIT-III

Organomagnesium Compounds The Grignard reagents formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions.

UNIT-IV

Organosulphur Compounds: Nomenclature, structural features, methods of formation and chemical reactions of thiols, thioethers, sulphonic acids, and sulphonamides.

PHYSICAL CHEMISTRY

UNIT-I

Elementary Quantum Mechanics: Black-body radiations, Planck's radiation law, photoelectric effect, heat capacity of solids.

Sinusoidal wave equation Hamiltonian operator, Schrodingcr wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box.

Sehrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

UNIT-II

Introduction : Electromagnetic radiation, regions of spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degrees of freedom.

UNIT-III

Rotational Spectrum: Diatomic molecules. Energy levels of a rigid rotor (semi-classical principles), selection rules, spectral intensity, determination of bond length, qualitative description of non-rigid rotor, isotope effect.

UNIT-IV

Vibrational Spectrum: Infrared spectrum: Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, intensity, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion and isotope on the spectrum, idea of vibrational frequencies of different functional groups.

Text and Reference Books:

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford

ZOOLOGY-V

Course Code	ZOO301
Course Title	Zoology-V (Cell Biology, Biotechnology and Reproductive biology)
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc IInd year
Course Objective (CO)	1. To enable the students to learn various aspects of cell biology and techniques of biotechnology. 2. To aware the students about various reproductive processes and the modern techniques to assist these processes.

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 , 8th Edn 1995.
5.	Albert	Essential Cell Biology	, New York , 3rd Edn , 1997
6.	Guyton and Hall	Text book of Medical Physiology 7th Edn	WB Saunders, Company
7.	Degroot, L.J. and Jameson, J.L.	Endocrinology	W.B. Saunders and Company
8.	Prakas, G.	Lab Manual of Blood analysis and medical diagonostics	S. chand Publications
9.	T.A. Brown	Gene cloning	Nelson Thornes Ltd.

FLORICULTURE

Course Code	**BOT305**
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	ZOO305
Course title	Apiculture and Sericulture
Type of course	Theory
LTP	2 0 0
Credits	2
Course objective	To impart basic knowledge about reaing of honey bess and silkworms for commercial production of honey and silk.

UNIT-I

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

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

UNIT-II

Introduction and Biology of Silkworm: Sericulture: Definition, history and present status Mulberry and non-mulberry Sericulture; Life cycle of *Bombyx mori*

UNIT-III

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

UNIT-IV

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

Text and reference books:

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

BOTANY LAB-V

Course Code	**BOT303**
Course Title	Botany Lab-V
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc IInd year
Course Objective	To learn about structure of cell, organelles and genetic material through photographs, charts, slides and models

List of practicals:

1. Study of the photomicrographs of cell organelles
2. To study the structure of plant cell through temporary mounts.
3. Study of mitosis and meiosis (temporary mounts and permanent slides).
4. Study the effect of temperature, organic solvent on semi permeable membrane.
5. Study the structure of nuclear pore complex by photograph (from Gerald Karp)
6. Study of special chromosomes (polytene & lampbrush) either by slides or photographs.
7. Study of DNA and RNA structure through models.
8. Study DNA packaging by micrographs.
9. Preparation of the karyotype and ideogram from given photograph of somatic metaphase chromosome.
10. Demonstration of Mendel's Laws through capsules or colored beads.
11. Chi-square test for goodness of fit. Simple numerical problems based on genetic laws.

Text and Reference books:

S. No.	Title	Author	Publisher
1	Cell and Molecular Biology: Concepts and Experiments 6th edition	Gerald Karp	John Wiley and Sons

2	Cell and Molecular Biology	EDP De Robertis and EMF De Robertis	Lippincott Williams and Wilkins, Philadelphia
3	The Cell: A Molecular Approach 5th Edition	G M Cooper and Hausman	ASM Press and Sunderland
4	The world of The Cell, 7th Edition	W M Becker, L J Hardin and G P Bertoni	Pearson Benjamin Cummings Publishing, San Francisco

CHEMISTRY LAB-V

Course Code	**CHM 303**
Course Title	Chemistry Lab-V
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc Ist year
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students about the inorganic preparation and synthesis of organic compounds.

Synthesis and Analysis

(a) Preparation of sodium trioxalatoferrate(III), Na_3 $[Fe(C_2O_4)_3]$ and determination of its composition by permagnometry.

(b) Preparation of Ni-DMG complex, $[Ni(DMG)_2]^{2+}$

(c) Preparation of copper tetra-ammine complex. $[Cu(NH_3)_4]SO_4$.

(d) Preparation of cis-and trans-bis(oxalato)diaquachromate(III) ion.

Synthesis or Organic Compounds

(a) Iodoform from ethanol and acetone

(b) Aromatic electrophlic substitution

1. m-dinitrobenzene
2. p-nitroacetanilide
3. p-bromoacetanilide
   2,4,6-tribromophenol
   Diazotization/Coupling
4. Preparation of methyl orange and methyl red
5. Preparation of benzoic acid from toluene
6. Reduction

(c) Preparation of aniline from nitrobenzene

(d)Preparation of m-nitroaniline from m-dinitrobenzene

Text and reference books:

S. No	Title	Author(S)	Publisher
1	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
2	Handbook of Preparative Inorganic Chemistry. Vol. I & II	Brauer	Academic Press
3	Inorganic Synthesis		McGraw Hill
4	Laboratory Manual in Organic Chemistry	R.K. Bansal	Wiley Eastern

ZOOLOGY LAB-V

Course Code	ZOO 303
Course Title	Zoology Lab-V
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
3.	Animal Physiology	Mohan P. Arora	Himalyan Publishing, House
4.	G Karp, EDP & De Robertis	Cell and Molecular Biology	EMF , WB Saunders, Co Philadelphia , 8th Edn 1995.
5.	Albert	Essential Cell Biology	, New York , 3rd Edn , 1997

BOTANY-VI

UNIT-I

Introduction to biotechnology

Course Code	BOT 302
Course Title	Botany-VI (Plant Biotechnology and Economic Botany)
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc IInd year
Course Objective (CO)	To provide fundamental knowledge regarding current plant molecular biology techniques, basic concepts and their applications. To learn about various plants of commercial importance, their groeth requirements, cultivation, harvesting and uses.

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

UNIT-II

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.

UNIT-III

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

Cereals: Wheat -Origin, morphology, uses

Legumes: General account with special reference to Gram and soybean

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

UNIT-IV

Beverages: Tea (morphology, processing, uses)

Oils and Fats: General description with special reference to groundnut

Fibre Yielding Plants: General description with special reference to Cotton (Botanical name, family, part used, morphology and uses)

Text and reference books:

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

CHEMISTRY-VI

Course Code	CHM302
Course Title	Chemistry-VI
Type of course	Theory
L T P	6 0 0
Credits	6
Course prerequisite	B.Sc IInd year
Course Objective (CO)	The syllabus is designed to enhance the scientific knowledge of students about the Bioinorganic Chemistry, Heterocyclic Compounds, spectroscopic techniques, Photochemistry and advanced spectroscopy techniques.

INORGANIC CHEMISTRY

UNIT-I

Hard and Soft acids and Bases (HSAB): Classification of acids and bases as a hard and soft, Pearson's HSAB concept, acid-base strength and hardness and softness.Symbiosis, theoretical basis of hardness and softness, electronegativity and hardness and softness.

UNIT-II

Bioinorganic Chemistry: Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin.Biological role of alkali and alkaline earth metal ions with special reference to Ca^{+2}, Nitrogen fixation.

UNIT-III

Silicones and Phosphazene: Silicones and Phosphazenes as examples of inorganic polymers,nature of bonding in triphosphazenes.

UNIT-IV

Organometallic Chemistry: Definition, Nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls,of' Li, Al, Hg, Sn and Ti, a brief account of metal-ethylene complexes and homogeneous hydrogenation, mononuclear carbonyls and the nature of bonding in metal carbonyls.

ORGANIC CHEMISTRY

UNIT-I

Heterocyclic Compounds: Introduction: Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on mechanism of electrophlic substitution.Mechanism of nucleophlic substitution reaction in pyridine derivatives.Comparison of basicity of pyridine,

piperidine and pyrrole.

Introduction to condensed five and six membered heterocycles.Preparation and reactions of indole, quinoline and isoquinoline wi th special reference to Fischer indole synthesis, Skraup synthesis and Bischler- Napieralski synthesis. Mechanism of electrophlic substitution reactions of indole, quinoline and isoquinoline.

UNIT-II

Synthesis of Polymers: Ziegler-Natta polymerziation and vinyl polymers. Condensation or step growth polymerziation. Urea formaldhehyde resins, epoxy resins and polyurethanes. Natural and synthetic rubbers.

Organic Synthesis Via Enolatcs

Acidity of α-hydrogens, alkylation of diethyl malonate and ethyl acetoacetate. Synthesis of ethyl acetoacetate: the Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate.Alkylation and acylation of enamines.

UNIT-III

Carbohydrates: Classification and nomenclature, Monosaccharides, mechanism of osazone formation, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses.

Configuration of monosaccharides. Erythro and threodiastereomers.Conversion of glucose into mannose. Formation of glycosides, ethers, and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+)-glucose. Mechanism of mutarotation.

Structures of ribose and deoxyribose.

An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharide starch an cellulose without involving structure determination.

UNIT-IV

Amino Acids, Pcptidcs, Proteins and Nucleic Acids: Classification, structure and stereochemistry of amino acids.Acid base behaviour, isoelectric point and electrophoresis.Preparation and reactions of α-amino acids.

Structure and nomenclature of peptides and proteins.Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical levels of protein structure. Protein denaturation/renaturation.

Nucleic acids: Introduction, Constituents of nucleic acids Ribonucleosides and ribonucleotides. The double helical structure of DNA.

PHYSICAL CHEMISTRY

UNIT-I

Raman Spectrum: Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

UNIT-II

Electronic Spectrum: Concept of potential energy curves for bonding and antibonding molecular orbitals, qualitative description of selection rules and Franck-Condon principle. Qualitative description of σ, π and n M.O. their energy levels and their respective transitions.

UNIT-III

Photochemistry: Interaction of radiation with matter, difference between thermal and photochemical process. Laws of photochemistry: Grothus-Drapperlaw, Stark-Einstein law, Jablonski diagram depiciting various processes occurring in the excited state, qualitative description of fluorescence, non- radiative processes (internal conversion, intersystem crossing), quantumyield, photosensitized reactions- energy transfer processes (simple examples).

UNIT-IV

Solid State: Definition of space lattice and unit cell. Laws of crystallography-(i) Law of constancy of interfacial angles. (ii) Law of rationality of indices (iii) Law of symmetry elements in crystals.

X-ray diffraction by crystals.Derivation of Bragg's equation.Determination of crystal structure ofNaCI, KCI and CsCI (Laue's method and powder method).

Text and Reference Books:

S. No	Name	Author(S)	Publisher
1	Concise Inorganic Chemistry	1.D. Lee	ELBS
2	Inorganic Chemistry	A.G. Sharpe	ELBS
3	Organic Chemistry	Morrison and Boyd	Prentice Hall
4	Fundamentals of Organic Chemistry	Solomons	John Wiley
5	The Elements of Physical Chemistry	P.w. Aikins	Oxford
6	Physical Chemistry	R.A. Alberty	Wiley Eastern Ltd

ZOOLOGY-VI

Course Code	ZOO302
Course Title	Zoology-VI(Immunology and Biostatistics)
Type of course	Theory
L T P	6 0 0
Credits	6
Course Objective (CO)	1. To make students aware about the immunological reaction taking place in your body. 2. 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.	*Cellular and Molecular Immunology.* V Edition	Abbas, K. Abul and Lechtman 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

MUSHROOM CULTURE TECHNOLOGY

Course Code	**BOT306**
Course Title	Mushroom Culture Technology
Type of course	Theory
L T P	2 0 0
Credits	2
Course prerequisite	B.Sc IInd year
Course Objective	To provide knowledge about commercial aspect of mushroom cultivation in India which may motivate students to take up it as professional occupation

UNIT-I

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

UNIT-II

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

UNIT-III

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

UNIT-IV

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

Text and Reference Books:

S. No.	Title	Author	Publisher
1	Mushroom Cultivation	S C Tewari and Pankaj Kapoor	Mittal Publications
2	Mushroom Production and Processing Technology	V N Pathak	Agrobios India
3	Mushroom Cultivation and Uses	Suman and B C Sharma	Agrobios India
4	Food and Nutrition	M Swaminathan	Bangalore Printing and Publishing Co.

BOTANY LAB-VI

Course Code	**BOT 304**
Course Title	Botany Lab-VI
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc IInd year
Course Objective	To familiarize students with current techniques in plant biotechnology through demonstrations.

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.
5. Demonstration of ELISA.
6. Demonstration of SDS-PAGE.
7. Demonstration of Agarose Gel Electrophoresis.
8. Isolation of Plant Genomic DNA.

Text and reference books:

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

CHEMISTRY LAB-VI

Course Code	**CHM304**
Course Title	Chemistry Lab-VI
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc IInd year
Course Objective (CO)	The aim of this course is to impart practical knowledge to the students about conductometry titration, Column Chromatography and pH-metrically by using standard alkali solution.

List of experiments:

1. Column Chromatography
2. Separation of fluorescein and methylene blue.
3. Separation of leaf pigments from spinach leaves.
4. Models

Stereochemical Study of Organic Compounds via Models

Rand S configuration of optical isomers.

E, Z configuration of geometrical isomers.

Conformational analysis of cyclohexanes and substituted cyclohexanes.

5. Physical Experiments

(a) To determine the strength of the given acid conductometrically using standard alkali solution.

(b) To determine the solubility and solubility product of a given sparingly soluble electrolyte conductometrically.

(c) To study the saponification of ethyl acetate conductometrically.

(d) To determine the ionisation constant of a weak acid conductometrically.

(e) To determine the strength of the given acid solution pH- metrically by using standard alkali solution.

(f) To determine the molar refraction of methanol, ethanol and propanol.

(g) To study the distribution of iodine between water and $CC1_4$.

(h) To study the distribution of benzoic acid between benzene and water.

Text and reference books:

S. No	**Title**	**Author(S)**	**Publisher**
1	Vogel's Qualitative Inorganic Analysis	Svehla	Orient Longman
2	Handbook of Preparative Inorganic Chemistry. Vol. I & II	Brauer	Academic Press
3	Laboratory Manual in Organic Chemistry	R.K. Bansal	Wiley Eastern

ZOOLOGY LAB-VI

Course Code	**ZOO304**
Course Title	Zoology Lab-VI
Type of course	Practical
L T P	0 0 4
Credits	2
Course prerequisite	B.Sc IInd 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, VI Edition	Kindt, T. J., Goldsby, R.A., Osborne, B. A. and Kuby, J (2006)	W.H. Freeman and Company
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5.	Biostatistics	P. Ramakrishnan	Saras Publications