



First Year M. Sc. Biotechnology

BIOPHYSICS IBT: 101

Unit No.	Topic
1	<p>1.1 Interference: Interference, coherence and coherent sources, interference by division of wavefront, interference by division of amplitude</p> <p>1.2 Diffraction: Fresnel and Fraunhofer diffraction, Fraunhofer diffraction due to (i) single slit (ii) double slit (iii) circular aperture, resolving power or optical instruments, dispersive power</p> <p>1.3 Polarization: Production of polarized light, Malus law, analysis of polarized light, optical activity</p>
2	<p>2.1 Lasers: Introduction, spontaneous and stimulated emission, main components of Laser, The ruby laser, He-Ne laser, Einstein's coefficients and optical amplification.</p> <p>2.2 Fiber optics: Introduction, total internal reflection, step and graded index fibers, fiber optic sensors.</p> <p>2.3 Nature of light and matter: Particle nature of radiation - The photoelectric effect, Compton effect, X-ray diffraction - Bragg's law</p> <p>2.4 The origin of quantum theory – Planck's hypothesis, the wave function, basic postulates of quantum mechanics</p>
3	<p>3.1 Spectroscopy : Infrared spectroscopy, and its applications, Ultraviolet and Visible spectroscopy.</p> <p>3.2 Biomechanics : Biostatics, biophysics of bones, strength of bones, biodynamics.</p> <p>3.3 Biophysics and Fluid flow : Steady laminar flow, Poiseuille's formula, energetics of fluid flow, turbulence, hemodynamics, fluid flow in plants.</p> <p>3.4 Biophysics and gas transport : The ideal gas, convective transport of gases, diffusion of gases: Fick's laws, physiology of respiration.</p> <p>3.5 Physics of audition : Transverse and longitudinal waves, physiological characteristics of sound, human ear, phase sensitivity and determination of direction, Doppler effect.</p> <p>3.6 Physics of vision : Wave nature of light, geometrical optics, refractive power, retina and photoreceptors, photoreceptors and fiber optics, resolving power of eye, polarization and vision</p>

BIOCHEMISTRY – I
BT: 102

Unit No.	Topic
1	<p>1.1. Chemical Bonding</p> <p>1.1.1 Ionic bond – lattice energy – Born Haber cycle –</p> <p>1.1.2 Covalent - bond energy changes during bond - formation</p> <p>1.1.3 Potential energy diagram of H₂ & He₂</p> <p>1.1.4 Coordinate bond - Vander wall forces</p> <p>1.1.5 Hydrogen bond and its effect on properties of compounds</p> <p>1.1.6 Hybridization sp³, sp², sp - VSEPR principle as applied to NH₃, H₂O, molecules – molecular orbital theory – LCAO method - structure of diatomic molecules N₂, O₂, F₂.</p>
	<p>1.2. Wemer's theory of complex salt</p> <p>1.2.1 Primary and secondary valencies – Tetrahedral, Ocathedral, Square planar complexes</p> <p>1.2.2 Naturally occurring chelates</p> <p>1.2.3 Isomerism in Complexes</p>
	<p>1.3 Oxidation Reduction –</p> <p>1.3.1 Oxidising agents like Kmno₄, K₂Cr₂O₇, I₂,</p> <p>1.3.2 Reducing agents - oxalate - thirosulphate - Arsenite.</p> <p>1.3.3 Applications of redox Tirations – Iodometry and lodimetry - (i) Estimation of Vitamin- C. (ii) Reducing and non – reducing sugars.</p>
2	<p>2.1 Thermodynamics</p> <p>2.1.1 Zeroth, First law and second law</p> <p>2.1.2 Enthalpy - Entropy</p> <p>2.1.3 Hess law - Heat of reaction - Heat of combustion –</p> <p>2.1.4 Entropy as criteria for spontaneity – Gibbs free energy - As criteria of spontaneity - Numericals.</p>
	<p>2.2. Chemical kinetics –</p> <p>2.2.1 1st order - Second order rate laws</p> <p>2.2.2 Parallel reactions</p> <p>2.2.3 Determination of order of reactions</p> <p>2.2.4 Steady and non-steady state approach.</p>
	<p>2.3. Theories of acid - base</p> <p>2.3.1 Ionisation constant of acid & base</p> <p>2.3.2 Ionic product of water</p> <p>2.3.3 PH scale</p> <p>2.3.4 Buffer solutions – buffer capacity Handerson equation - Preparation of buffer solutions –</p> <p>2.3.5 Acid base Indicators & its theory.</p>
3	<p>3.1. Colloids –</p> <p>3.1.1 Preparation of colloids and their purification</p> <p>3.1.2 Types of colloids - multimolecular, macromolecular and associated colloids</p> <p>3.1.3 Brownian movement</p> <p>3.1.4 Determination of molecular weight by ultracentrifuge and Donan equilibrium method</p> <p>3.1.5 Emulsions - Emulsifiers.</p>
	<p>3.2. Surface chemistry –</p> <p>3.2.1 Adsorption – Physical & Chemical</p> <p>3.2.2 Adsorption isotherms. (Freundlich & Langnuir –</p> <p>3.2.3 Catalysis - Theory of catalysis Homogeneous, Heterogeneous & enzyme catalysis</p>

	3.2.5 Inhibitors and Poisoning of catalyst.
	3.3 Radioactivity – 3.3.1 Detection and measurement of radio activity 3.3.2 One method Artificial nuclear reactions 3.3.3 Induced radio - activity – 3.3.4 Tracers and their applications 3.3.5 Radioimmunoassay 3.3.6 Isotope dilution analysis.
	Section2
4	4.1.1. IUPAC Nomenclature of organic compounds 4.1.2 Properties of Alcohols, Aldehydes, Ketone, amines, phenols, esters, ethers, 4.1.3 Preparation and synthetic uses of Acetoacetic ester, malonic ester 4.1.4 Grignard Reagent 4.2. Homolytic & Heterolytic fission of bond - Inductive, mesomeric effect - Resonance - Tautomerism - Hyper conjugation - Electrophilic and nucleophilic substitution 4.3. Stereochemistry - Diastereoisomers – Enantiomers - Chirality - absolute configuration - R and S - E and Z – Stereochemistry of biphenyl & spiro compounds - Resolution – Asymmetric synthesis – conformational analysis in Cyclonexane & its derivatives.
5	5.1. Carbohydrates - Their classification-structure of glucose,(Bimolecular) Fructose and maltose - Inversion of sugars-Mutarotation - Ring structure Of glucose & fructose - starch and cellulose (No structures) Vitamin C. 5.2. Proteins and amino acids - Hydrolysis of proteins - methods of synthesis of α - amino acids (3 methods) – synthesis of polypeptide (3 methods) structure of proteins. - Tests for proteins - Protein hormones thyroxine. 5.3. Chemistry of Hemoglobin and chlorophyll- Role of chlorophyll in photosynthesis - Role of Hemoglobin in human body.
6	6.1. Polymers - classification according to effect of heat, structure and repeat unit - Molecular weight of polymers, Number average and weight, average molecular weight - Determination of molecular weight (only two methods) - Stereo specific polymers - Zeigler - Natta catalyst, Biodegradability of polymers 6.2. Important polymers & their applications - polyethylene, Polypropylene, PVC, Polystyrene, Nylon, Polyester, Synthetic rubber, Teflon, Polyethylene terephthalate. 6.3. Chemotherapeutic agents – sulphonamides - Antibiotics – Antimalarial - Anti TB drugs – Polypeptide antibiotics - Anti- inflammatory drugs.

BOTANY – I
IBT: 103

Unit No.	Topic
1	1.1 Morphology and Systematics of plants – I
	Plant Nomenclature – Significance, Binomial system of Classification, Effective and valid publication, Author citation, type concept, Types of names.
	1.2 Morphological aspects of root, stem and leaf
	1.2.1 Root – Types of roots, Modifications of root. Special examples such as runner and stolons (rhizome & underground parts), Pneumatophores in <i>Avicennia</i> and coralloid roots in <i>Cycas</i> . Differentiation of root, Regions of root growth and functions of root. 1.2.2 Shoot/Stem forms of stem, modifications of stem, branching patterns, specialized stem – phylloclade, cladode and phyllode, functions of stem. 1.2.3 Leaf – Types of leaf, shape, margin, apex, base and petiole phyllotaxy and venation. Specialized leaf like Leaf Mosaic, Heterophylly.
2	Morphology of Plants – II
	2.1 Bud – Types and modifications 2.2 Flower Types, parts accessory and essential floral parts such as bracts, bracteoles, thalamus, pedicel, calyx, corolla. Androecium and gynoecium, Flower as modified shoot. Floral diagram and floral formula, aestivation. 2.3 Flower as a reproductive element. Typical flower – <i>Passiflora</i> , <i>Datura</i> , <i>Hibiscus rosa – sinensis</i> . 2.4 Inflorescence types, special inflorescence like Cyathium, Thyrsus, Verticillaster and Hypanthodium.
3	Morphology Plants – III
	1.1 Ovule – Types, arrangement of ovules (placentation), functions. 1.2 Fruit – Types, edible parts of some common Indian fruits, specialized fruit development like parthenocarpy. 1.3 Pollination – Types of pollination agents, mode of pollination, fertilization. 1.4 Seed – Types germination pattern hypogeal and epigeal germination. Study of common seed parts and functions e.g. <i>Abrus</i> , Coconut, pomegranate, <i>Pithecellobium</i> , Beans and Mango. 1.5 Functions, dehiscence and dispersal of seeds mode of dispersal, seed dormancy and factors affecting seed dormancy.
4	Biology and systematics of lower plants (non vascular plants)
	4.1 Algae 4.1.1 General characters of algae including cell structure and thellus. 4.1.2 Classification as per G. M. Smith up to class level With respect to pigment-ation and reserved food materials. 4.1.3 Life cycle (general), morphology and reproduction in : 4.1.3.1 Cyanophyta - Nostoc, Oscillatoria, Anabaena 4.1.3.2 Chlorophyta – Volvox and Spirogyra 4.1.3.3 Bacillariophyta – Diatoms 4.1.3.4 Phyeophyta – Sargassum, Ectocarpus 4.1.3.5 Rhodophyta – Batrachospermum and polysiphonia 4.1.4 Economic importance of Algae.
	4.2 Fungi 4.2.1 General characters including cell structure 4.2.2 Classification of Fungi upto class level as per G. M. Smith.

	<p>4.2.3 Life history (general), morphology and reproduction in :</p> <p>4.2.3.1 Phycomycetes – <i>Rhizopus and mucor</i></p> <p>4.2.3.2 Ascomycetes – Yeast and <i>Aspergillus</i></p> <p>4.2.3.3 Basidiomycetes – <i>Agricus</i></p> <p>4.2.3.4 Deuteromycetes – <i>Fusarium</i></p> <p>4.2.4 Economic importance of Fungi.</p> <p>4.2.5 Lichens – Classification, general characters & economic.</p>
	<p>4.3 Bryophytes</p> <p>4.3.1 General characters of Bryophytes.</p> <p>4.3.2 Classification of Bryophytes up to class level.</p> <p>4.3.3 Life cycle (general), morphology and reproduction in :</p> <p>4.3.3.1 Hepaticopsida – <i>Riccia</i> and <i>Marchantia</i></p> <p>4.3.3.2 Anthocerotopsida – <i>Anthoceros</i></p> <p>4.3.3.3 Bryopsida – <i>Funaria</i></p> <p>4.3.4 Economic importance of Bryophytes.</p>
5	Biology and systematics of higher plants (vascular and seed plants)
	<p>5.1 Pteridophytes</p> <p>5.1.1 General characters of pteridophytes (Heterospory, Apogamy & Apospory).</p> <p>5.1.2 Classification of pteridophytes up to class level.</p> <p>5.1.3 Life cycle (general), morphology and reproduction in :</p> <p>5.1.3.1 <i>Nephrolepis</i>, <i>Selaginella</i>, <i>Equisetum</i>, <i>Marsilea</i>.</p> <p>5.1.4 Stele – types in pteridophytes.</p>
	<p>5.2 Gymnosperms</p> <p>5.2.1 General characters of gymnosperms.</p> <p>5.2.2 Classification up to level.</p> <p>5.2.3 Life cycle (general), morphology and reproduction in :</p> <p>5.2.3.1 <i>Cycas</i> and <i>Pinus</i></p>
	<p>5.3 Angiosperms</p> <p>5.3.1 General characters of Angiosperms including Dicot & Monocot (Difference between them)</p> <p>5.3.2 Study of following angiosperms families as per Bentham and Hooker's system of classification. Malvaceae, cucurbitaceae, Ceasalpiniaceae or Papilionaceae, Apocynaceae, Rubiaceae, Solanaceae, Nyctaginaceae, Amaryllidaceae and Liliaceae</p> <p>5.3.3 Know how of Botanical Institution BSI (Kolkatta) & NBRI (Lakhnow), botanical gardens NBI Kolkatta, Waghai and Ghandhinagar.</p> <p>5.3.4 Study of important medical plants :</p> <p>5.3.4.1 <i>Azadirachta indica</i> (Neem)</p> <p>5.3.4.2 <i>Adhatoda vesica</i> (Ardusi)</p> <p>5.3.4.3 <i>Ocimum Spp.</i> (Tulsi)</p> <p>5.3.4.4 <i>Aloe vera</i> (Kuwarpathu)</p> <p>5.3.4.5 <i>Commiphora wightii</i> (Guggal)</p> <p>5.3.4.6 <i>Rauwolfia Serpentina</i> Sarpaghandha</p> <p>5.3.4.7 <i>Withania somnifera</i> (Ashwagandha)</p> <p>5.3.4.8 <i>Papaver somniferum</i></p> <p>5.3.4.9 <i>Tinospora</i></p> <p>5.3.4.10 <i>Catharanthus Roseus</i> (Barmasi)</p> <p>5.3.4.11 <i>Chlorophytum borivilianum</i> (Safed Musli)</p> <p>5.3.4.12 <i>Asparagus racemosus</i> subsp. <i>javanicus</i> (Shatavari)</p>
6	Basics of plant anatomy and plant pathology
	<p>6.1 Plant tissue – types: simple, complex, mechanical and structural tissues, Function.</p> <p>6.2 Cambium – Types, location and function.</p> <p>6.3 Vascular tissues – types of vascular bundles.</p>

	<p>6.4 Plant pathology – Importance of pathology. Reputed agricultural institutes like IARI, ICRISAT and NPPRI.</p> <p>6.5 Brief study of following plant diseases with respect to symptoms, causal organism and disease cycle and control measures.</p> <ul style="list-style-type: none">6.5.1 Mycoplasma – Little leaf of Brinjal.6.5.2 Bacteria – Citrus cancer.6.5.3 Fungus – Red Rot of Sugarcane.6.5.4 Grain smut and Head smut of jowar6.5.5 Leaf wart of Papaya
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ZOOLOGY – I
IBT: 104

Unit No.	Topic
1	Significance of Animal classification. History and Development of classification, Principles of classification, International rules for Zoological nomenclature
2	Classification and characters of non- chordates 2.1 Protozoa 2.2 Porifera 2.3 Coelenterata 2.4 Platyhelminthis 2.5 Nemathelmenthis 2.6 Annelida 2.7 Arthropoda 2.8 Mollusca 2.9 Echinodermata
3	Classification and characters of Chordates 3.1 Cyclostomata 3.2 Osteichthyes 3.3 Amphibia 3.4 Reptilia 3.5 Aves 3.6 Mammals
4	Comparative Anatomy of Digestive and reproductive systems of amphibian, reptiles, avia and mammalia.
5	Comparative Hemopoietic systems of amphibian, reptile, avia and mammalian. Including structure and function of blood.
6	Economic importance of animals 6.1 Wild animals (Terrestrial and aquatic) 6.2 Pet animals (Aquaculture, Pisciculture, Apiculture, Sericulture, Poultry and Dairy. 6.3 Use of animal models in bio- medical research Bioethics, merits and demerits of the system.

MATHEMATICS AND BIOSTATISTICS
IBT: 105

Unit No.	Topic
	Section – I – Mathematics
1	Surds and Quadratic Equations. 1.1 Definition and examples of surds. 1.2 Monomial and binomial surds. 1.3 Some theorems on surds. 1.4 Simplification of surds. 1.5 Definition and examples of linear equation. 1.6 Method of solution of simultaneous linear equations. 1.7 Definition and examples of quadratic equation. 1.8 Method of solution of quadratic equations.
2	Set Theory 2.1 Introduction 2.2 Representation 2.3 Operations and its properties 2.4 Cartesian product
3	Functions 3.1 Definition 3.2 Types. Domain and Range 3.3 Construction and Functions
4	Elements of Differential Calculus 4.1 Real Numbers and Functions 4.2 Limits and continuity 4.3 Differentiation 4.4 Derivatives of trigonometric function
5	Matrices 5.1 Matrices of Order $m \times n$ 5.2 Row and column Transformation 5.3 Addition, Subtraction and Multiplication of Matrices 5.4 computation of Determinants 5.5 Concepts of Determinants 5.6 Cramer's Rule 5.7 applications of Matrices
	Section – II : Biostatistics
1	1.1 Introduction to Statistics 1.1.1 History and Applications (scope) & uses of statistics in Bio – Science. 1.2 Sources and Presentation of Data 2.1.1 Methods of obtaining data 2.1.2 Types of data 2.1.3 Methods of presentation of Data – Charts, Graphs, Tables. 2.1.4 Presentation frequency distributions for each of data.
2	2.1 Measures of central tendency & Location measures of central tendency 2.1.1. Measures of central tendency : Mean, Median, Mode – definitions, uses and applications of these measures to biological data.

	<p>2.2 Measures of Location : Quartiles, Deciles and Percentiles – Graphical method, Arithmetical method, also Their applications.</p>
	<p>Measures of Dispersion :</p> <p>2.3.1 Types of variability : Biological, Real, Experimental.</p> <p>2.3.2 Measures of Variability :</p> <p>2.3.2.1 Range 2.3.2.2 Semi quartile range 2.3.2.3 Mean deviation 2.3.2.4 Standard deviation Coefficient of variation application in Bio – Science.</p>
3	<p>Correlation and Regression (Linear only)</p> <p>3.1 Correlation : Definition & types of correlation, methods to correlation. [1] Graphical, [2] Spearman’s Rank correlation and [3] Karl person’s method.</p> <p>3.2 Regression : Definition and interpretation of regression coefficient and regression line (Without proof) and their applications in Bio-Science.</p>
4	<p>4.1 Probability : Probability Theory : Definitions of population space, Sample space, Events, Favorable events Mutually Exclusive events, Independent events, Exhaustive events, equally likely events. Mathematical definition of probability, Additive and multiplicative rules of probability. concept of Conditional probability. (Without proof).</p>
	<p>4.2 Probability Distribution & Sampling : Binomial distribution, Poisson and Normal distribution. Their properties (without proof) and applications in Bio-Science.</p>
5	<p>5.1 Sampling : Definition of Population, Representative sample, sampling frame, sampling scheme Different sampling techniques :</p> <p>5.1 Simple random sampling 5.2 stratifies random sampling 5.3 Systematic sampling 5.4 Cluster sampling 5.5 Two stage sampling 5.6 Double sampling 5.7 Multi sampling 5.8 Multi phone sampling Explain the procedures of all these sampling schemes and use of Particular scheme according to the need of the study and data.</p>
6	<p>Statistical Software : SPSS For all the topics covered in the earlier topics. Practical use of this software be taught as practical training.</p>

COMMUNICATION SKILLS – 103
IBT: 106

Unit No.	Topic
1	Reading Skill : 1.1 Reading tactics and strategies 1.2 Reading purpose and meaning 1.3 Reading outcomes, structure of meaning, technique.
2	Writing Skill : 2.1 Guidelines for effective writing 2.2 Writing styles for application with personal resume 2.3 Business letter and memo including requests, complains 2.4 Technical report writing 2.5 Development of Paragraph 2.6 Development of story.
3	Listening Skill : 3.1 Barriers to listening 3.2 Effective listening skills 3.3 Attending telephone - calls 3.4 Note – taking.
4	Speaking and discussion Skill : 4.1 Component of effective talk / presentation 4.2 Effective speaking skills 4.3 Discussion skills
5	Text – Book : A Rama Krishna Rao. Learning English – A Communicative Approach. Orient Longman. 5.1 Astronomy 5.2 Information Technology 5.3 Travel and Transport 5.4 Humour 5.5 Health and Medicine 5.6 Environment 5.7 Inspiration 5.8 Human Interest 5.9 Media

BIOPHYSICS PRACTICALS**IBT: 107**

Unit No.	Topic
	<u>Section – I – Mathematics</u>
	LIST OF EXPERIMENTS :
1	To determine Young's modulus "Y" of the material of a beam by the method of bending of beam.
2	To determine the modulus of rigidity 'η' of the material of a thin rod by static method
3	To determine the frequency of tuning fork using sonometer.
4	To determine viscosity of liquid by log decrement method.
5	To determine Planck's constant "h" by photocell.
6	To verify Stefan's fourth power law.
7	To verify Malus law.
8	To determine resolving power of telescope.
9	To determine dispersive power of the material of the prism using spectrometer.
10	To determine the wavelength of light using plane diffraction grating (Normal incidence method)
11	To determine specific rotation of sugar solution using Laurent's half shade polarimeter
12	To determine cardinal points of a lens system using pins and plane mirror.
13	To study spherical aberration.
14	To determine the wavelength of monochromatic light by Newton's rings.
15	To determine wavelength of light using cylindrical obstacle.
16	To determine wavelength of light using biprism.
17	To determine angular magnification of simple and compound microscope.
18	To determine temperature coefficient of resistance by post office box method.
19	To determine wavelength of a Laser beam using diffraction.
20	To plot the characteristic curves of a Geiger Counter and to determine resolving time of the counter.
21	To simulate interference, diffraction and polarization on PC[D]

BIOCHEMISTRY PRACTICALS
IBT: 108

Unit No.	Topic
1	Preparation and standardization of NaOH solution, HCl solution, Na ₂ S ₂ O ₃ solution, EDTA solution.
2	Titrimetric Analysis : 2.1 Determination of total hardness of water 2.2 Percentage purity of Vitamin C. 2.3 Estimation of glucose. 2.4 Saponification value of an oil sample. 2.5 Determination of H ₂ O ₂ content in sample. 2.6 Estimation of Cu ⁺² by iodometric method. 2.7 Determination of Zn ⁺² by EDTA titration. 2.8 Determination of phenol / aniline by bromination method. 2.9 Determination of total alkalinity of given water sample. 2.10 Determination of culozide using mohr's method.
3	Use of pH - meter - Calibration of pH meter - Preparation of buffer of pH 5.0 and 10.0 and measuring its pH - Preparing 0.01 M acetic acid and measuring their pH.
4	To study the use of colorimeter - verification of Beer's kw with K ₂ Cr ₂ O ₇ solution
5	To study the adsorption isotherm.
6	Chemical kinetics. 6.1 Acid hydrolysis of methyl acetate 6.2 Reaction between H ₂ O ₂ I KI.
7	Viscosity measurement -
	To find mol.wt. of polymer
8	Surface Tension measurement : To determine parachor values of organic liquids and determine. Percentage composition of mixture.
9	Polarimeter : To measure the angle of rotation of Sugar, glucose solution.
10	To determine Ka of a weak acid using pH - metric titration.
11	Qualitative Analysis : 1.1 Test for Urea (Binret test) 1.2 Test for earbohydrates. 1.3 Test for proteins.
12	Paper chromatographic separation of amino acids.

BOTANY PRACTICALS
IBT: 109

Unit No.	Topic
1	To Study Morphology and modification of Root.
2	To Study Morphology and modification of Stem.
3	To Study Morphology and modification of Leaves.
4	To Study essential and accessory floral egs. <i>Datura</i> , <i>Vinca</i> , <i>Hibiscus rosa - Sinensis</i> .
5	Study of Phyllotaxy and Venation. 5.1 Typical Alternate – <i>Ipomoea fistulosa</i> . 5.2 1/2 two ranked – <i>Typha angustata</i> or any Poaceae member. 5.3 1/3 Three ranked – Durva or Darbh (<i>Cyanodon Dactylon</i>) 5.4 2/5 ranked – China rose (<i>Hibiscus rosa – Sinensis</i>) 5.5 3/8 ranked – Papaya (<i>Carica Papaya</i>) 5.6 Typical opposite – <i>Psidium guajava</i> (Jamphal) 5.7 Opposite Decussate – <i>Calotropis procera</i> & <i>Ocimum sanctum</i> . 5.8 Opposite Superposed – <i>Quisqualis indica</i> & <i>Vinea rosea</i> . 5.9 Spiral – <i>Nerium indicum</i> 5.10 Whorled – <i>alstonia Scholaris</i> 5.11 Leaf mosaic – <i>Acalypha indica</i> 5.12 Parallel venation – any monocot member (Banana, Bamboo) 5.13 Reticulate venation – any dicot member (<i>Ficus</i>) 5.14 Unicostate – <i>Ficus religiosa</i> 5.15 Multicostate convergent – wheat of Smilax 5.16 multicostate Divergent – Fan palm or <i>Cucurbita</i> .
6	Study of Inflorescence : 6.1 Receme or racemose – <i>Caesalpinia pulcherrima</i> 6.2 Compound resame or panicle – <i>Delonix Regia</i> 6.3 Spikelet – Any member of poaceae (<i>Sugarcane</i>) 6.4 Umbel – Any member of Apiaceae (<i>Foeniculum vulgare</i>) 6.5 Spedix – Kewdo (<i>Pandanus</i>) 6.6 Compound umbel – Dhana or Carrot 6.7 Capitata – Bottle brush or any member of mimosaceae 6.8 Capitulum – Sunflower or Marygold 6.9 Dichasial cyme – <i>Ixora</i> or <i>Bougainvillea spectabilis</i> 6.10 Polychasial cyme – <i>Calotropis procera</i> 6.11 Verticillaster – <i>ocimum sanctum</i>
7	Study of Placentation : (Fresh Specimens and slides) 7.1 Axile – <i>Datura</i> , <i>Habiscus rosa – sinensis</i> or Tomato 7.2 Parietal – Any member of Cruciferae 7.3 Superficial – water lily (<i>Crinum</i>) 7.4 Marginal – any member of Leguminosea 7.5 Basal – Marygold or Sunflower
8	Study of lower group of plants algae, fungi and bryophytes – examples as mentioned in theory. (Through preserved material and permanent slides).
9	Study of Pteidophytes and Gymnosperms. 9.1 Examples as mentioned in Theory. 9.2 T. S. of <i>Nephrolepis</i> leaflet passing through sori. 9.3 T. S. of <i>Nephrolepis</i> leaflet without sori. 9.4 T. S. of Fern rachis. 9.5 T. S. of <i>Cycas</i> leaflet.

	9.6 T. S. of <i>Pinus</i> needle. 9.7 Preserved laboratory specimens of <i>Cycas</i> & <i>Pinus</i> – Male & Female cone
10	Study of Angiosperm families with respect to floral diagram, floral formula, general and diagnostic characters. 10.1 Malvaceae – <i>Hibiscus rosa Sinensis</i> 10.2 Cucurbitaceae – <i>Coccinia indica</i> or any available species 10.3 Caesalpiniaceae – <i>Caesalpinia pulcherrima</i> 10.4 Apocynaceae – <i>Vinea rosea</i> , <i>Thevetia</i> or <i>Nerium indicum</i> 10.5 Solanaceae – <i>Datura metal</i> or <i>Solanum xanthocarpum</i> 10.6 Rubiaceae – <i>Ixora</i> spp. 10.7 Nyctaginaceae – <i>Bougainvillea spectabilis</i> 10.8 Amaryllidaceae – <i>Crinum</i> or <i>Paneratium</i> 10.9 Liliaceae – <i>Asparagas</i> spp.
11	Study of Plant tissues : 11.1 Permanent slides of tissues. 11.2 T.S. of Dicot root, stem and leaf. 11.3 T. S. of Monocot root, stem and leaf. 11.4 Root apex and shoot apex. Types of Vascular bundles & stale (Permanent slides)
12	Study of plant diseases as mentioned in theory.
13	Morphology and Micro chemical test for stored food material egs. Wheat, rice, maize, chickpea, potato with respect to glucose, starch, lignin & fats.
14	Morphology and Microscopic structure of the oil yielding tissues, tests for oil and Iodine number egs. Mustard, Groundnut, Soybean, Coconut, Sunflower and Castor.

LIST OF SLIDES

1. Spirogyra Whole Mount
2. Scalariform conjugation
3. Lateral Conjugation
4. Volvox Antheridial colony
5. Volvox Oogonial colony
6. Nostoc in Root
7. Oscillatoria entire filament
8. Anabaena whole mount
9. Yeast cells whole mount
10. Yeast cells budding
11. Aspergillus whole mount
12. Rhizopus whole mount
13. Agaricus stipe T. S.
14. Agaricus stipe and Pileus V. S.
15. Agaricus Pileus V. S.
16. Mucor Zygosporangium
17. Mucor vegetative whole mount
18. Mucor sporangia whole mount
19. Moss antheridia
20. Moss plant with capsule
21. Moss capsule L. S. and T. S.
22. Moss archegonia
23. Funaria antheridia
24. Funaria capsule L. S.
25. Riccia thallus
26. Riccia sporophyte
27. Fern sorus whole mount
28. Fern leaf T. S.
29. Fern rhizome T. S.
30. Fern rachis T. S.
31. Fern leaf with sori V. S.
32. Fern prothallus archegonia
33. Fern prothallus sporophyte
34. Fern prothallus antheridia
35. T. S. of Cycas rachis
36. T. S. of Cycas leaflet
37. Cycas megasporophyll V. S.
38. Cycas Microsporophyll T. S.
39. Pinus needle T. S.
40. Pinus ovule V. S.
41. Pinus male cone
42. Pinus female cone
43. Axile placentation
44. Parietal placentation
45. Marginal placentation
46. Basal placentation
47. T. S. of parenchyma tissue
48. T. S. of aerenchyma tissue
49. T. S. of collenchyma tissue
50. T. S. of sclerenchyma tissue
51. T. S. of chlorenchyma tissue
52. Sclerenchyma fiber macerated
53. Sclerenchyma cell macerated
54. Xylem elements bordered pits
55. Xylem elements macerated spiral and annular vessels
56. Phloem elements macerated
57. T. S. of monocot root
58. Stone cells macerated
59. T. S. of monocot leaf
60. L. S. of apical meristem
61. T. S. of monocot leaf
62. T. S. of dicot leaf
63. Sclereids in section
64. sieve tube elements
65. V. S. of monocot and dicot leaf
66. T. S. of old dicot root
67. T. S. of old dicot stem
68. Actinostele
69. Plectostele
70. Siphonostele
71. Dictyostele
72. Actinostele
73. Polystele
74. Solenostele
75. Vascular bundle conjoint, collateral
76. Vascular bundle Radial
77. Vascular bundle concentric amphivasal
78. Vascular bundle concentric amphicribal
79. Vascular bundle – conjoint, collateral and closed

ZOOLOGY PRACTICALS
IBT: 110

Unit No.	Topic
1	<p>Study of external characters and classification of representative genera of each phylum.</p> <p>1.1 PROTOZOA : noctiluca, euglena, volvox, leishmania, trichomonas, opalina, monocystis, plasmodium (signet ring), paramecium, vorticella, ceratium.</p> <p>1.2 PORIFERA : Leucosolania, sycon, euplectella, hylonema, cliona, spongilla, chalina, euspogia.</p> <p>1.3 COELENTERATA : porpita, rhizostoma, gorgonoan, praynatula, adamsia, fungia, madrwpora, astrea.</p> <p>1.4 PLATYHELMINTHES : Liver fluke, tapeworm.</p> <p>1.5 NEMATHELMINTHES : ascaris, wuchereria,</p> <p>1.6 ANNELID : earthworm, neris, leeh, sabella, terbella, arnicola.</p> <p>1.7 MOLLUSCA : pila, chiton, neopilina, halitis, patella, aplysia or doris, dentalium, mytilus, pecten, teredo, solen, sepia, loligo, octopus.</p> <p>1.8 ARTHROPODA : trilobite, limulus, aranea, ticks, apus, daphnia, Cyclops, lepus, saculina, aquilla, crab, julus, centipede, scolopendra, lepisma, cockroach, locust, mantis, stick insects, forficulla, dragon fly, belostoma, butterfly, moth, honey bees.</p> <p>1.9 ECHINODERMATA : feather star, holothurians, echinus, and dollar, astro pecten, brittle star, sea urchin, asteria.</p> <p>1.10 CHORDATA : Amphixus, lamprey, hagfish, shark, labeo, salamander, frog, tortoise, calottes, any snake, pigeon, rat.</p>
2	Dissection of earthworm (digestive, nervous, reproductive) Mounting of spermatheca, blood glands, nephridia.
3	Dissection of Rat (digestive, reproductive) Fish - Bony fish - N. S.
4	To study metachromatia from rat bone marrow.
5	Estimation of hemoglobin content of blood.
6	To study haemin crystals.
7	Differential staining and counting of RBC & WBC.
8	To study ionic effects on erythrocytes.
9	To study life cycle of honey bees, silk moth.