

K.K. UNIVERSITY

NALANDA, BIHAR - 803115



SCHOOL OF APPLIED SCIENCES

Bachelor of Science (B.Sc.)

(Three Year Full
Programme)

2022-2023

PROGRAMME STRUCTURE & SYLLABUS B.SC. BOTANY



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KK University

Berauti, Nepura, Bihar Sharif
Nalanda - 803115 (Bihar)

B.Sc. BOTANY (Hons.) - Program Structure - Total Credit - 118						
B.Sc. BOTANY (Hons.)						
Semester : I						
S.No.	Subject Code	Subject Name	L	T	P	Total Credit
1	BSBT 1101	NON - VASCULAR PLANTS-I	3	1	0	4
2	BSZG-S- 1101	ZOOLOGY -I	3	0	0	3
3	BSCH-S- 1101	CHEMISTRY -I	3	0	0	3
4	HNL - 1101	HINDI-I	2	0	0	2
5	BSBT 1101(P)	NON-VASCULAR PLANTS-I LAB	0	0	6	3
6	BSZG-S-1101(P)	ZOOLOGY- I LAB	0	0	4	2
7	BSCH-S-1101(P)	CHEMISTRY- I LAB	0	0	4	2
						19
semester : II						
S.No.	Subject Code	Subject Name	L	T	P	Total Credit
1	BSBT 1201	NON- VASCULAR PLANTS-II	3	1	0	4
2	BSZG -S- 1201	ZOOLOGY -II	3	0	0	3
3	BSCH-S- 1201	CHEMISTRY-II	3	0	0	3
4	ENG 1201	ENGLISH-II	2	0	0	2
5	BSBT 1201 (P)	PRACTICAL : NON-VASCULAR PLANTS-II	0	0	6	3
6	BSZG-S- 1201(P)	PRACTICAL : ZOOLOGY -II	0	0	4	2
7	BSCH-S- 1201 (P)	PRACTICAL : CHEMISTRY -II	0	0	4	2
						19
semester : III						
S.No.	Subject Code	Subject Name	L	T	P	Total Credit
1	BSBT 2101	VASCULAR PLANTS	3	1	0	4
2	BSZG-S- 2101	ZOOLOGY-III	3	0	0	3
3	BSCH-S- 2101	CHEMISTRY-III	3	0	0	3
4	HNL 2101	HINDI-II	2	0	0	2
5	BSBT 2101 (P)	VASCULAR PLANTS LAB	0	0	6	3
6	BSZG-S- 2101 (P)	PRACTICAL : ZOOLOGY - III	0	0	4	2
7	BSCH-S- 2101 (P)	PRACTICAL : CHEMISTRY -III	0	0	4	2
						19
B.Sc. BOTANY (Hons.) - Program Structure - Total Credit - 118						
B.Sc. BOTANY (Hons.)						
Semester : IV						
S.No.	Subject Code	Subject Name	L	T	P	Total Credit
1	BSBT 2201	MICRO BIOLOGY & PLANT PATHOLOGY	3	1	0	4



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2	BSZG-S- 2201	ZOOLOGY -IV	3	0	0	3
3	BSCH-S- 2201	CHEMISTRY- IV	3	0	0	3
4	ENL -2201	ENGLISH-II	2	0	0	2
5	BSBT 2201 (P)	PRACTICAL : MICRO BIOLOGY & PLANT PATHOLOGY	0	0	6	3
6	BSZG-S- 2201 (P)	PRACTICAL: ZOOLOGY- IV	0	0	4	2
7	BSCH-S- 2201 (P)	PRACTICAL: CHEMISTRY -IV	0	0	4	2
						19

semester : V

S.No.	Subject Code	Subject Name	L	T	P	Total Credit
1	BSBT 3101	PLANT PHYSIOLOGY	3	1	0	4
2	BSBT 3102	CYTOGENETICS & PLANT BREEDING	3	1	0	4
3	BSBT 3103	PLANT BIOTECHNOLOGY & TISSUE CULTURE	3	1	0	4
4	BSBT 3101 (P)	PRACTICAL : PLANT PHYSIOLOGY	0	0	6	3
5	BSBT 3102 (P)	PRACTICAL: CYTOGENETICS & PLANT BREEDING	0	0	6	3
6	BSBT 3013 (P)	PRACTICAL : PLANT BIOTECHNOLOGY & TISSUE CULTURE	0	0	6	3
						21

semester : VI

S.No.	Subject Code	Subject Name	L	T	P	Total Credit
1	BSBT 3201	BIO- CHEMISTRY & MOLECULAR BIOLOGY	3	1	0	4
2	BSBT 3202	PLANT ECOLOGY & ENVIRONMENTAL BIOLOGY	3	1	0	4
3	BSBT 3203	PLANT ANATOMY AND EMBRYOLOGY	3	1	0	4
4	BSBT 3201 (P)	PRACTICAL: BIO- CHEMISTRY & MOLECULAR BIOLOGY	0	0	6	3
5	BSBT 3202(P)	PRACTICAL: PLANT ECOLOGY & ENVIRONMENTAL BIOLOGY	0	0	6	3
6	BSBT 3203 (P)	PRACTICAL : PLANT ANATOMY AND EMBRYOLOGY	0	0	6	3
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B.Sc. Botany (Hons.)

Semester : I

BSBT 1101 : NON- VASCULAR PLANTS –I

Algae: General character and classification of algae, General characteristics of Cyanophyceae with reference to Oscillatoria and Rivularia. Algae in relation to human welfare.

Fungi: Occurrence, Cell wall composition, Modern concepts in classification of Fungi, Nutrition, Role of Fungi in human welfare. Typical life history of : Pythium, Phytophthora, Mucor, Saccharomyces, Eurotium, Peziza, Puccinia, Agaricus, Alternaria, Cladobotryum. General account of Lichen.

General characters and classification of Bryophytes. Structure and life history of the following genera with reference to comparative studies of gametophytes and sporophytes: Marchantia, Pellia, Anthoceros, Sphagnum and Polytrichum. Fossils: Rhynchonella, Lepidodendron and Calamites.

A general account of thallus and ultra-structure of Cyanobacterial cell, Photosynthesis and Reproduction. Economic importance as biofertilizer and as food (Single Cell Protein – SCP). Type study of Scytonema, Oscillatoria, Gloeotrichia.

A general account of habitat, thallus structure, pigments, plastids, (including pyrenoids) reproduction, life cycle pattern and classification (based on Fritsch).

Study of Structure, Reproduction and Lifecycles of Oedogonium, Chara, Chara, Caucheria, Diatoms (Pinnularia), Sargassum, Polysiphonia. Economic importance of Algae, Algal blooms (Diatomaceous earth)

Suggested Readings:

1. V. Singh Pandey and Jain, A textbook of Botany (Algae, Fungi, Virus, Microbiology, Plant Pathology, Bryophytes, Pteridophytes and Gymnosperms) Rastogi Publications, Shivaji Road, Meerut.
2. Webster, J. and Weber, R. (2007) Introduction to Fungi. 3rd Edition, Cambridge University Press, Cambridge.
3. Raven, P.H., Johnson, G.B., Losos, J.B. and Singer, S.R. (2005) Biology. Tata MC Graw Hill.
4. Richardson, D.H.S. (1981) The Biology of Mosses. John Willey and Sons, New York.
5. Sambamurthy (2008) A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. IK International Publishers.
6. Shaw, A.J. and Goffinet, B. (2000) Bryophyte Biology. Cambridge University Press.



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BSZG-S- 1101 : ZOOLOGY –I
BIODIVERSITY-I : NON-CHORDATA

Protozoa: General Characters and Reproduction in Protozoa.

Metazoa : Origin of metazoan,

Porifera: General Characters and Structural organization of Sycon.

Cnidaria: General characters and Polymorphism in Cnidarians.

Platyhelminthes: General characters and Fasciola: Structure and life history

Aschelminthes : General characters and Life history of Ascaris and its parasitic adaptations.

Annelida : Gneral Characters and Adaptive radiations in Polychaeta.

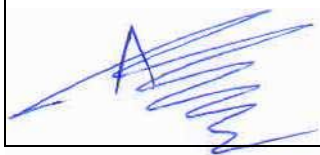
Arthropoda: General Characters and Larval forms of crustacean; metamorphosis in Insecta

Mollusca : General characters and Torsion and detorsion

Echinodermata : General Characters and Water – vascular system and larval forms.

Suggested Readings:

1. Barnes, R.D. Invertebrate Zoology (1982) VI Edition. Holt Saunders International Edition.
2. Barnes, R.S.K., Calow, P., Olive, P.J. W., Golding, D.W. & J.I., Spicer (2002) The Invertebrates: a New Synthesis. III Edition. Blackwell Science.
3. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson
4. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.



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BSCH-S- 1101: CHEMISTRY –I

UNITS	CONTENTS	Contact Hrs.
1	Physical Chemistry Gaseous State (a) Kinetic Theory of gases, Derivation of kinetic gas equation, deduction of gas law, calculation of gas constants and kinetic theory. (b) Types of solids, crystal forces, law of constancy of angles, seven crystal systems, law of rational indices, Bragg's Law, Lattice energy, Born-Haber cycle	
	Thermochemistry (a) Heat in chemical reactions, Reaction enthalpy, standard enthalpy changes. (b) Hess Law, Kirchoff Law (c) Bond energy and determination	
	Ionic Equilibrium (a) Ionic Product of water, pH, pK_a , pK_b , pK_w (b) Buffer solution, Idea of buffer solution in everyday life. (c) Solubility product and its application in salt analysis. (d) Specific conductance, Molar conductance, Equivalent conductance.	
II	Inorganic Chemistry Atomic Structure and Bonding (a) Features of H-spectra and Bohr's theory. (b) Shapes of orbitals and their labeling, idea of quantum number (c) Pauli's Exclusion Principle, Hund's rule, Aufbau Principle (d) Electronic configuration of elements (e) Idea of ionic and covalent bonds, Ionization potential, Electro negativity, Electron affinity, Fajan's rule Chemistry of the following elements Li, Sn, Fluorine, Chlorine, Iodine	
III	Organic Chemistry Structure and Mechanism (a) Hybridization, bond angle, bond length, idea of bonds. (b) Inductive effect, electrometric effect, mesomeric effect (c) Bond fission and products.	



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HNL 1101 : HINDI – I

- Hindi Bhasha ke Vibhinna Roop – Rashtra Bhasha, Rajbhasha, Janbhasha.
- Tippan, Aalekhan, Sankshepan, Sarkari Patra ke Prakar, Paribhashik Shabdawali.
- Anuvaad ki Paribhasha, Prakar, Upyogita aur Mahatva, Achhe Anuvaad ke Gun, Anuvaad Prayog (Hindi se Englishme Anuvaad).
- Sambhashan Kala ka Artha, Sambhashan Ke Vibhinn Roop – Vaartalap, Vyakhyan, Vaad-Vivaad, Ekaalap, Avaachik Abhivyakti, Jan Sambodhan, Sambhashan kala ke Upadaan – Bhasha Gyan, Antaraal Dhawani (Volume), Lahaja (Accent).
- Sambhashan kala ke vibhinn Roop – Udghoshna, Sanchalan, Aankho Dekha Haal, vaachan Kala, Vaad-Vivaad Pratiyogita, Samuh Samvaad.

Suggested Readings:

1. Karayalayeeya Hindi – Dr. Kailashnath Pandey – Prabhat Prakashan, New Delhi.
2. Prayojanmulak Hindi – Prayukti aur Anuvaad – Madhav Sontakke
3. Anuvaad Vigyan – Bholanath Tiwari
4. Bhashan aur Sambhashan ki Divya shakti – shri ram Acharya – Yug Nirman Yojana Press, Mathura
5. Bhashan Kala – Dr. Mahesh Shama – GyanGanga Delhi.

BSBT 1101 (P) : NON – VASCULAR PLANTS –I LAB

1. Mounting Technique : Mounting of Algae in Glycerine.
2. Study of Cyanobacteria – Myrocystis, Oscillatoria, Scytonema, Gloeotrichia.
3. Morphology, Structure and Reproductive parts of Algae (based on theory syllabus).
4. Study of plant materials as prescribed in Algae, Fungi, Bryophyta.



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BSZG –S- 1101 (P) : ZOOLOGY –I LAB

Protozoa:

1. Examination of Amoeba, Euglena, Paramecium, Noctiluca, and Vorticella.
Porifera.
2. Study of Sycon (including T.S. and L.S.)
Euplectella:
3. Temporary mounts of spicules, gemmules and sponging fibres.
Cnidaria:
4. Study of Obelia, Sertularia, Millepora, Aurelia, and Metridium (including T.S. and L.S.).
Platyhelminthes:
5. Study of Fasciola, Taenia,, Echinococcus: life history and sections of Fasciola and Taenia
Aschelminthes:
6. Study of male and female Ascaris (including sections).
Annelida:
7. Demonstration through CD/charts etc: digestive and nervous systems of earthworm.
8. Temporary mounts: Ovary, pharyngeal and septal nephridia of earthworm.
9. Slides: T.S. through pharynx, gizzard, and typhlosolar intestine of earthworm.
10. Specimens : Aphrodite, Heteronereis, Chaetopterus, Pheretima, Tubifex, Hirudinaria.
Arthropoda:
11. Demonstration through CD/charts etc: digestive and nervous systems of cockroach.
12. Specimens/Slides: Limulus, spider, crustacean larvae, Daphnia, Balanus, Saculina, Cancer, Eupagurus, Scolopendra, Julus, termite, louse, wasp, honeybee, silkworm and peripatus.
Mollusca:
13. Demonstrations through CD/charts etc: digestive system of Pila: Temporary mounts radula and gill of Pilla.
14. Specimens: Chiton, Dentalium Unio, Ostrea, Teredo, Loligo, Sepia, octopus and nautilus.
Echinodermata:
15. Slides : T.S. arm of Pentaceros, Echinoderm larvae.
16. Specimens: Pentaceros, Ophiura, Echinus, Cucumaria and Antedon.

BSCH-S-1101 P : PRACTICAL : CHEMISTRY – I

PRACTICAL	
1.	Inorganic chemistry Volumetric Analysis (a) Acidimetric and alkalimetry (b) Use of Potassium permanganate and potassium dichromate (c) Iodometry
2.	Note book and Viva voce.




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Semester : II

BSBT 1201 : NON- VASCULAR PLANTS –II

Recent trends and criteria used in the classification of Fungi (C.J. Alexopoulos)

Structure and reproduction: Albugo, Aspergillus, Pencillium, and Ceercospora.

Cultivation methods of Mushroom: Mushrooms production: spawn and paddy straw polythene method of cultivation.

General characteristics, classification of Bryophytes. Structure and Reproduction of Marchantia, Anthoceros, Funaria. Economic importance of Bryophytes. Evolution – Gametophytes and Sporophytes.

Systems and classification of – Bentham and Hooker, Engler and Prantl and Takhtajan's systems. Modern taxonomy – supporting evidence taxonomy in relation to embryology, Palynology, Cytology, Secondary metabolites (Chemotaxonomy).

Phylogeny of Angiosperm – A general account of Origin and Evolution Angiosperm (Special reference to bennettitalean. Gnetalean and Herbaceous, Origin theories). Important characters of the following Angiosperm families – Ranunculaceae, Euphorbiaceae, Acanthaceae, Amaranthaceae, Asclepiadaceae, Cucurbitaceae, Poaceae and Cyperaceae.

Suggested Readings:

1. Vasishtha B.R. and others, Bryophytes S.Chand an Co New Delhi.
2. S.C. Dey "Mushroom Growing" Agro Bios Jodhpur.



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BSZG-S- 1201 : ZOOLOGY – II
**BIODIVERSITY- II : CHORDATA **

Chordates: Introduction and origin.

Protochordates: General features and Phylogeny of Hemichordates, Urochordates and Cephalochordates. Retrogressive metamorphosis.

Agnatha: General features of living Agnatha.

Pisces: Osmoregulation, Migration and parental care.

Amphibia: Origin, Poisonous and non-poisonous snakes in India, Biting mechanism in snakes, Affinities of Sphenodon.

Aves: Origin, Flight adaptations, Mechanism of flight and Migration.

Mammals : Origin of Mammals. Origin and evolution of human.

Suggested Readings:

1. Kardong, K.V. (2005) Vertebrates Comparative Anatomy, Function and evolution. IV Edition. McGraw –Hill Higher Education.
2. Kent, G.C. and Carr R.K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
3. Young, J.Z. (2004). The life of vertebrates. III Edition. Oxford university press.
4. Hall B.K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Barlett Publishers.



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BSCH-S- 1201: CHEMISTRY –II

UNITS	CONTENTS	Contact Hrs.
1	Physical Chemistry Chemical Kinetics (a) Rate of reaction, order and molecularity. (b) Expression for specific rate constant of first order reaction. (c) Half-life period and Units	
	Colligative Properties (a) Osmosis and its determination. (b) Vapour Pressure (c) Raoult's law of lowering vapour pressure (d) Relation between osmotic pressure and lowering of vapour pressure.	
II	Inorganic Chemistry Principles involved in the volumetric and gravimetric estimation of Cu and Fe. Isotopes: Brief idea of detection and separation, Radiocarbon dating .	
III	Organic Chemistry Nomenclature (a) IUPAC Nomenclature of aliphatic and aromatic compounds Chemistry of monohydric alcohol and Grignard reagent Idea of purification of compounds, Chromatography	



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ENG 1201 : ENGLISH –I

I. Prose:

1. The Bet - Anton Chekov
2. Socrates and the Schoolmaster – F.L. Brayne
3. An Astrologer's Day – R.K. Narayan
4. The Gift of the Magi – O' Henry
5. With the Photographer – Stephen Leacock

II. Spoken Communication:

1. Meeting People, Exchanging Greetings and Taking Leave
2. Introducing Yourself
3. Introducing People to Others
4. Answering the Telephone and Asking for Someone
5. Dealing with a Wrong Number
6. Taking and Leaving Messages
7. Making Inquiries on the Phone
8. Calling for Help in an Emergency

III. Grammar and Vocabulary : Articles, prepositions, modal auxiliaries, antonyms, synonyms, one-word substitutes.

IV. Written Communication : Summarizing



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BSBT 1201 (P) : PRACTICAL : NON – VASCULAR PLANTS – II

1. Study of structure and reproductive parts (External and Internal) of Marchantia, Anthoceros and Funaria.
2. Practical records, Herbarius field report.

BSZG –S- 1201 (P) : PRACTICAL : ZOOLOGY –II

1. Protochordata : Study of Balanoglossus, Herdmania, Branchiostoma Balanoglossus sections through Probosis, Collar, branchiogenital & hepatic region. Amphioxus – oral hood, Whole Mount sections through pharyngeal, intestinal & caudal regions
2. Fishes: Study of Petromyzon, Scoliodon, Sphyrna, Pristis, Trygon, Torpedo, Chimaera, Notopterus, Labeo, Catla, Cirrihina, Heteroneustes, Mystus, Exocoetus. Demonstrations through CD/charts etc: Cranial nerves of Scoliodon. Temporary unstained preparation of placoid, Cycloid and Ctenoid scales.
3. Amphibia: Study of Necturus, Salamander, Bufo, Hyla, Rhacophorus.
4. Reptiles: Study of Chelone, Testuda, Kachuga, Hemidactytus, Varanus, Uromastix, Chameoleon, Draco, Hydrophis, Bungarus, Viper, Krait, Coral snakes, Crocodiles.
5. Aves : Study of dozen Birds of local place/district/ Zoo/ National park.
6. Mammals: Study of Sorex/Hedgehog, Bat (Insectivorous & frugivorous).

BSCH-S- 1201P : PRACTICAL : CHEMISTRY –II

PRACTICAL	
1.	Organic chemistry Detection of nitrogen sulphur and halogen in organic compouns Detection of following functional group of organic compounds (a) OH (Phenolic) (b) CHO(c) = O (d) COOH (e) NH ₃ and NO ₂



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3.	Note book and Viva voce.
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Semester : III

BSBT 2101: VASCULAR PLANTS

Classification, comparative study of morphology, anatomy and reproduction in : Psilotum, Lycopodium, Selaginella, Equisetum, Marsilea, Pteris. Stellar organization. A general account of Rhynia, Sigillaria and Clamites. General distribution and Economic Importance.

Occurrence and functions and types of root system – Modification for storage, support and vital functions – (Respiratory, Photosynthetic, Haustorial and Epiphytic). Stem – Characteristics and functions, types of underground, Aerial and Sub-Aerial modifications. Leaf – Structure and functions , types of phyllotaxy, venation, types of leaves (simple and compound), modifications (stipule and leaf), insectivorous plants (Drosera, Utricularia and compound), modifications (stipule and leaf) , insectivorous plants (Drosera, utricularia and nepenthes). Inflorescence- Types of inflorescence (Racemose, Cymose and special type- Cyathium, Hypanthodium and Verticillaster.) Flowers – bract, Calyx (variations), Corolla- (variations and aestivation), Androecium – (variations), Gynoecium (variations), Placentation and types of flowers (Technical terms used to describe a flower). Fruits- Classification and types (Simple, aggregate and composite).

Suggested Readings:

1. Singh, Pandey and Jain, Pteridophyta, Gymnosperm and Paleobotany, Rastogi Publication, Meerut.
2. S. Sundarajan, College Botany, Vol II, Himalya publishing House, New Delhi.
3. AC Datta College Botany (For degree students), Manzar Khan Oxford University, Press Kolkata.
4. Gangulee Das and Dutta – College Botany Vol – I, New central Book Agency, Kolkatta.
5. Pandey and Ajanta Chaddna A. Text Book of Botany Vol II, Vikas Publication Pvt. Ltd, New Delhi.



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BSZG-S- 2101 : ZOOLOGY –III
ANIMAL PHYSIOLOGY AND FUNCTIONAL HISTORY

1. Digestive system: Structure and types of mode of digestive system and its glands; process of digestion, assimilation and various disorders.
2. Respiratory System : Structure and functions of respiratory system; Control and coordination of respiration.
3. General organization: Neuron resting membrane potential and its basis; Origin of action potential.
4. Nervous System: Its propagation in myelinated and unmyelinated nerve fibers; Synaptic transmission and types of synapses, Neuro- muscular junction; Physiology of hearing and vision.
5. Muscle: Histology of different types of muscle; Ultra structure of skeletal muscle; Molecular and chemical basis of muscle contraction; Characteristics of muscle twitch; Motor unit.
6. Reproductive System: Histology of male and female reproductive systems, puberty, physiology of male and female reproduction; Methods of contraception (depicted through flow chart); Disorders of reproductive system.
7. Endocrine System: Histology and functions of endocrine glands; Nature of hormones; Mode of action of hormones; Hypothalamus – principal nuclei involved in control of endocrine system, control of anterior pituitary hormones by hypothalamic releasing hormones (neuroendocrine mechanisms)

Suggested Readings:

1. Guyton, A.C. & Hall, J.E. (2006). Textbook of Medical Physiology. XI Edition. Herecourt Asia PTE Ltd./ W.B. Saunders Company.
2. Tortora, G.J. & Grabowski, S. (2006). Principles of Anatomy & Physiology. XI Edition. John wiley & sons, Inc.
3. Victor P. Eroschenko. (2008). diFiore's Atlas of Histology with Functional Correlations. XII Edition. Lippincott W. & Wilkins.
4. Arey, L.B. (1974). Human Histology. IV Edition. W.B. Saunders.




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BSCH-S- 2101: CHEMISTRY – III

UNITS	CONTENTS	Contact Hrs.
1	Physical Chemistry States of Matter (a) Van der Waals equation, critical constants, collision frequency, mean free path. (b) Idea of lattice planes, stoichiometric and non-stoichiometric defects in simple ionic solid	4
	Thermodynamics (a) Extensive and Intensive system. (b) First and second law of thermodynamics (c) Carnot cycle	4
II	Inorganic Chemistry Atomic structure and bonding Atomic structure and bonding (a) De Broglie waves (b) Schrodinger wave equation (c) Idea of overlap and hybridization (d) Metallic bonding (e) Double salts and complex salts (f) Werner's theory	4
	Introduction to the transition metal complex Variable oxidation states, magnetism	
III	Organic Chemistry Structure and Mechanism (a) Different types of isomerism (b) Elementary and nucleophilic substitution at saturated carbon	4
	Natural Products (a) Carbohydrates (b) Elementary idea of Alkaloids and Terpenoids	

HNL 2101: HINDI –II



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BSBT 2101 (P) : VASCULAR PLANTS LAB

1. Study of morphological, anatomical and reproductive structures in Lycopodium, Selaginell, Marsilea, Equisetum.
2. Study of fossils – Rhynia, Lepidodendron, Calamities (slides or materials).
3. Study of morphological, anatomical and reproductive features of Cycas, Pinus and Gnetum.
4. A. project report on morphological (Angiosperm or Gymnosperms as herbarium of photographs) peculiarities, like calyx forms, corolla forms, stamens, Cycas male or female cones, leaves and stipule modifications.

BSZG-S- 2101 (P) : PRACTICAL : ZOOLOGY –III

1. Recording of simple muscle twitch with electrical stimulation.
2. Demonstration of the knee jerk reflex.
3. Preparation of temporary mounts: Squamous epithelium, Ciliated epithelium, Striated muscle fibres and nerve cells.
4. Examination of sections of Mammalian skin, Cartilage, Bone, pancreas, Testis, Ovary, pituitary, Adrenal, Thyroid, Parathyroid.
5. Preparation of permanent slide of any five mammalian tissues- Microtomy.

BSCH-S- 2101P : PRACTICAL : CHEMISTRY –III

PRACTICAL	
2.	Inorganic chemistry Qualitative inorganic analysis of mixtures containing Acid and Basic radicals Basic radicals : Pb²⁺, Cu²⁺, Fe²⁺, Fe³⁺, Cr³⁺, Ni²⁺, Co²⁺, Zn²⁺, Mg²⁺, Na⁺, K⁺ Acid radicals: CO₃²⁻, SO₃²⁻, S²⁻, SO₄²⁻, NO₂⁻, NO₃⁻
4.	Note book and Viva voce.



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Semester : IV
BSBT 2201: MICRO BIOLOGY & PLANT PATHOLOGY

Aim and scope of Microbiology: A general account of microbes from soil, air and water.

History of Microbiology, Classification of Microorganisms and Characteristics of different groups.

Methods in Microbiology: Basic principles of micrometry, Staining, Sterilization methods, Culture Media, Population estimation and growth determination.

Structure: Ultrastructure of prokaryotic microorganisms.

Viruses: Properties and Classification host- Virus interaction, Bacteriophage, TMV.

Bacteria: Structure, genetic recombination, Mycoplasma and Actinomycetes – General Account. Role of Micro- organisms in biogeochemical cycling of nitrogen and Carbon, Biological nitrogen fixation.

Industrial application of micro-organisms: organic acids, alcohol, food processing, milk products, antibiotics and bio pesticide.

Historical development of Plant pathology.

Pathogen attract and defense mechanisms: Physical, Physiological, Biochemical.

Plant disease epidemiology: Transmission and spread of pathogens Disease cycles.

Plant disease management, Chemical, Biological, Development of transgenic.

Genetics of resistance and susceptibility. General account of some diseases of crop plants:

- | | | | |
|-------------------|--------------------------|-------------------------|------------------|
| a. Tobacco mosaic | b. Citrus canker | C. Red rot of sugarcane | d. Rust of wheat |
| e. Smut of Barley | f. Late blight of Potato | g. Ergot of Rye. | |

Suggested Readings:

1. Hans G. (1993) General Microbiology Volume – I Cambridge University, press Cambridge.
2. C.L. Mandar (1978) Introduction to plant Viruses.
3. Mathews (1981) Plant Viruses.
4. K.M. Smith (1977) Plant Viruses.



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**BSZG-S- 2201 : ZOOLOGY –IV
ECOLOGY I**

Introduction to the Biosphere : Inter – relationships between the living world and the environment, the components and dynamism, homeostasis.

Soil: Importance, origin, formation, composition; physical, chemical and biological components; soil profile; role of climate in soil development.

Water : Importance; role of climate in soil development. Atmospheric moisture; precipitation types ; water in soil, water table, water bodies;; aquifers, water shed.

The Atmosphere: Composition and stratification; radiation flux; role of electromagnetic radiations, UV, visible spectrum; variations in temperature; wind as a factor.

The Living World : Biotic component of environment; types of biotic interactions.

Fire: As an ecological factor.

Levels or Organization: Individual, population, community; concepts of autecology, synecology; concept of biological diversity; habitat and ecological niche.

Population Ecology : Distribution and characteristics of population; population dynamics; Ecological Speciation.

Suggested Readings

1. Singh, J.S., Singh, S.P. and Gupta, S. (2006) Ecology Environment and Resource Conservation. Anamaya Publication, New Delhi.
2. Wilkinson, D.M. (2007). Fundamental processes in Ecology. An Earth Approach. Oxford.
3. Daubenmier, R.F. (1970). Plant Communities, Willey Eastern Private Limited
4. Odum, E. (2008) Ecology. Oxford and IBH Publisher.
5. Sharma, P.D. (2010) Ecology and Environment, (8th Ed.) Rastogi Publications, Meerut.




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BSCH-S- 2201 : CHEMISTRY –IV

UNITS	CONTENTS	Contact Hrs.
1	Physical Chemistry Ionic Equilibrium (a) Oswald's dilution law (b) Salt Hydrolysis (c) Theory of acid – base indicator	4
	Chemical Kinetics (a) Second order reaction, expression of rate constant. (b) Effect of temperature on reaction rate (c) Arrhenius equation	4
II	Inorganic Chemistry (a) Chemistry of Group 4 elements (b) Idea of Major pollutants in environments	4
	Chemistry of Fe, Cr, Ni compounds	
III	Organic Chemistry Structure of Benzene and benzene Diazonium chloride	4
	Brief idea of Polymers, resins, drugs	



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ENL 2201 : ENGLISH –II

I. Short Stories

1. Maupassant – The Necklace
2. O. Henry – The Last Leaf
3. Catherine Mansfield – A Cup of Tea
4. R.K. Narayan – Selvi
5. M.R. Anand – The Lost Child
6. Jhumpa Lahiri – The Interpreter of Maladies
7. Shashi Deshpande – Hear Me Sanjaya!

II. Piece of Prose

1. James Bryce- Some hints of Public Speaking
2. C.E.M. Toad- A Dialogue on Civilization
3. Hill- Principles of good writing.
4. Bapsi Sidhwa – Why do I write ?
5. Jawahar Lal Nehru – The Reawakening of India
6. Subhash Chandra Bose – to Delhi, to Delhi
7. Dr. Rukhmabai – Purdah – The Need for its abolition

III. Novel: Lord of the Flies – William Golding

BSBT 2201 (P): PRACTICAL : MICRO BIOLOGY & PLANT PATHOLOGY

1. Study of viral diseases of plants using local available specimens – Tobacco mosaic, Red rot of sugarcane, Rust of wheat.
2. Study of plant disease mentioned in the syllabus.
3. Study of plant diseases caused by Bacteria: (Locally available specimens) Citrus canker.

BSZG-S- 2201 (P) : PRACTICAL : ZOOLOGY –IV

1. Study of following microclimatic variables in different habitats: soil and air temperature, wind velocity, relative humidity, rainfall and light intensity.
2. Permeability (percolation; total capacity as well as rate of movement) of different soil samples.
3. Saturation capacity and field capacity of different soil samples and rapid test texture of soils.
4. Density and porosity and rate of infiltration of water in undisturbed soils.
5. Soil organic matter in different soil samples by titration method.



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BSCH-S- 2201P : PRACTICAL : CHEMISTRY –IV

PRACTICAL	
1	Organic chemistry Preparation of Organic compounds by using following reactions: (a) Acetylation of Aniline (b) Oxidation of benzaldehyde (c) Hydrolysis of esters
2	Note book and Viva voce.

Semester : V

BSBT 3101 : PLANT PHYSIOLOGY

Introduction to plant physiology.

Plant water relation – Importance of water of plant life, diffusion, Osmosis, Ascent of sap and Transpiration.

Mineral nutrition – Role of micro and macro elements.

Photosynthesis – Historical aspect, photosynthetic pigments, mechanisms, C₃ and C₄ cycles photospiration.

Repiration – Glycolysis, Kreb's cycle, Pentose phosphate pathway.

Growth and movement- Phases of growth and evelopment, Kinetics and growth, Phototropism, Geotropism, Seismonasty, Auxins, Gibberellins, Cytokinins.

Ennzymes – Nomenclature, classification and mode of action.

Photosynthesis – Introduction, significance, Structure and function of chloroplast.

Quantosomes, Solar spectrum and its importance.

Mechanism of photosynthesis – Light reaction, cyclic and non-cyclic photo photosphorylation

Mineral absorption – passive absorption, ion exchange, Donnan's equilibrium.

Active absorption – carrier concept, Landgrath's theory, Protien Leacithin theory.

Transpiration – definition, types, structure of stomatal apparatus.

Mechanism of opening and closing of stomata.

Suggested Readings

1. Hopkins, W.G. and Huner, P.A. (2008) Introduction to Plant Physiology. John wiley & Sons.
2. Nelson, D.L., Cox, M.M. (2004) Lehninger Principle of Biochemistry, 4th Edition, W.H. Freeman and Company, New York, USA.
3. Salisbury, F.B. and Ross, C.W. (1991) Plant Physiology, Wadsworth Publishing Co. Ltd.
4. Taiz, L. and Zeiger, E. (2006) Plant Physiology, 4th Edition, Sinauer Associates Inc. MA, USA.



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BSBT 3102 : CYTOGENETICS & PLANT BREEDING

Cell division – Mitosis and Meiosis.

Cell Cycle and regulation – Apoptosis.

Prokaryotic and Eukaryotic chromosome structure, Lampbrush and Polythene chromosome.

Mendel's experiment and principles of inheritance. Gene interaction and modified dihybrid ratios (Epistatic, Complimentary, Supplementary and Duplicate factors).

Linkage and crossing over.

Sex-linked inheritance in Drosophila and Man, Mechanism of sex determination.

Chromosomal aberration. Mutation – Spontaneous and Induced.

Polyploidy- Types and effects of auto and allopolyploidy, origin and meiosis in Nullisomics, Monosomics, Trisomics.

Methods of plant improvement – Hybridization, Hybrid vigour.

Standard error, Standard deviation and Chi- square test. Linkage and crossing over mechanism in maize. (coupling and repulsion)

Nucleic acids:

(a) Structure, chemical composition and function of DNA and RNA.

(b) DNA replication, semiconservative.

Genetic Code – meaning and properties, protein synthesis.

Introduction, objectives.

Methods in plant breeding.

(a) Mass selection

(b) Pure line selection

(c) Clonal selection

Hybridization and somatic hybridization.

Hetrosys and its significance.

Suggested Readings

1. Genetics – P.K. Gupta, Rastogi Publications, Meerut.
2. College Botany Vol 04 – S. Sudarajan, Himalaya Publishing House, Mumbai.
3. Cytogenetics – P.K. Gupta, Rastogi Publications, Meerut.



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BSBT 3103 : PLANT BIOTECHNOLOGY & TISSUE CULTURE

Plant Tissue Culture : Historical Perspective; Composition of media; Nutrient and hormone requirements (role of vitamins and hormones); Totipotency; Organogenesis; Ebryogenesis (somatic and zygotic); Protoplast isolation, culture and fusion; Tissue culture applications (micropropagation, androgenesis, virus elimination, secondary metabolite production, haploids, triploids and hybrids; Cryopreservation; Germplasm Conservation).

Recombinant DNA technology: Restriction Endonucleases (History, Types I-IV, biological role and application); Restriction Mapping (Linear and Circular); Cloning Vectors: Prokaryotic (pUC 18 and pUC 19, pBR322, Ti plasmid, BAC); Lambda phage, M13 phagemid, Cosmid, Shuttle vector; Eukaryotic Vectors (YAC).

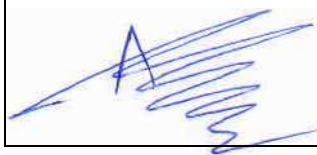
Gene Cloning : Recombinant DNA, Bacterial Transformation and selection of genomic and eDNA clones, PCR mediated gene cloning; Gene Construct; construction of genomic and cDNA libraries, screening. DNA libraries to obtain gene of interest by genetic selection; complementation, colony hybridization; PCR.

Methods of gene transfer: Agrobacterium-mediated, Direct gene transfer by Electroporation, Microinjection, Micro projectile bombardment; Selection of transgenics- selectable marker and reporter genes (Luciferase, GUS, GFP).

Applications of Biotechnology: Pest resistant (Bt-cotton); herbicide resistant plants (RoundUp Ready soybean); Transgenic crops with improved quality traits (Flavr Savr tomato, Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation (Superbug); edible vaccines; Industrial enzymes (Aspergillase, Protease, Lipase); Genetically Engineered Products – Human Growth Hormone; Humulin; Biosafety concerns.

Suggested Readings

1. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
2. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
3. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
4. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.



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BSBT 3101 (P) : PRACTICAL : PLANT PHYSIOLOGY

1. Diffusion – Diffusion of solid into liquid (minor)
2. Osmosis – Physical and physiological – Endosmosis and Exosmosis (minor).
3. Ascent of Sap:
 - (a) To show ascent of Sap by Balsan plant and in a fresh plant twig (minor).
 - (b) To show root pressure.
 - (c) To show suction due to transpiration.
4. Photosynthesis:
 - (a) Evolution of oxygen (minor).
 - (b) Effect of quality of light on photosynthesis.
 - (c) Effect of CO₂ concentration on photosynthesis.
 - (d) Light is essential for photosynthesis (minor).
 - (e) CO₂ is essential for photosynthesis.
 - (f) Chlorophyll separation by paper chromatography method.
 - (g) Chlorophyll is necessary for photosynthesis (minor). (With starch test).

BSBT 3102 (P): PRACTICAL : CYTOGENETICS & PLANT BREEDING

1. Cytological technique of making (Mitosis and Meiosis) permanent slides.
2. Observation of polytene and lamp brush chromosomes (Permanent slides).
3. Genetics problems based on theory syllabus – monohybrid, dihybrid, test cross and interaction of factors.
4. Practice of hybridization techniques in a self pollinated and cross pollinated plants (any available plant).
5. Visit to agricultural research centre for observation and record of inter variety, inter specified integration plants.

BSBT 3103 (P) : PRACTICAL : PLANT BIOTECHNOLOGY & TISSUE CULTURE

1. (a) Preparation of MS medium.
(b) Demonstration of in vitro sterilization and inoculation methods using leaf and nodal explants of tobacco, Datura, Brassica etc.
2. Study of anther, embryo and endosperm culture, micropropagation, somatic embryogenesis & artificial seeds through photographs.
3. Isolation of protoplasts.
4. Construction of restriction map of circular and linear DNA from the data provided.
5. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct.
6. Study of steps of genetic engineering for production of Bt cotton, Golden rice, Flavr Savr tomato through photographs.
7. Isolation of plasmid DNA.
8. Restriction digestion and gel electrophoresis of plasmid DNA.



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Semester : VI
BSBT 3201: BIO-CHEMISTRY & MOLECULAR BIOLOGY

Enzyme – Discovery, nomenclature, characteristic and mode of action, factors affecting enzyme activity.

Amino acids and Proteins – Types and structure, Biosynthesis of amino acids and proteins.

Lipid – Structure and function of lipid, oxidation, Classification, Biosynthesis of lipids.

Physico – Chemical organization and role of Mitochondria, Chloroplasts, Ribosomes and Glyxisomes in metabolic pathways in plants. Outline of the secondary plant metabolites and their role. Carbohydrates and their structure and classification.

Nucleic acids: Carrier of genetic information – Historical perspective; DNA as the carrier of genetic information (Griffith's, Hershey & Chase, Avery, McLeod & McCarty experiment).

The Structure of DNA and RNA/ Genetic Material – DNA Structure: Miescher to Watson and Crick – historic perspective, DNA structure, Salient features of double helix, Types of DNA, Types of genetic material, denaturation and renaturation.

The replication of DNA – General principles – bidirectional, semiconservative and semi discontinuous replication, RNA Priming; Various models of DNA replication, Enzymes involved in DNA replication.

Central dogma and genetic code Transcription - Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; Prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in E. coli. Eukaryotes; transcription factors, heat shock proteins, steroids and peptide hormones; Gene silencing.

Central dogma genetic code Transcription – Transcription in prokaryotes and eukaryotes. Principles of transcriptional regulation; prokaryotes: Regulation of lactose metabolism and tryptophan synthesis in E.coli. Eukaryotes; transcription factors, hear shock proteins, steroids and peptide hormones; Gene silencing.

Translation – Ribosome structure and assembly, mRNA; Charging of tRNA, Various steps in protein synthesis, elongation and termination of proteins.

Suggested Readings.

1. Conn, E.E., Stumpf, P.K. and Bruening, G. (2006) Outlines of Biochemistry, 4th Edition, John Wiley and Sons Inc.
2. Buchanan, B., Gruissem, W. and Jones, R. (2000) Biochemistry and Molecular Biology of Plants. American Society of Plant Biologists.
3. Elliot (2009) Biochemistry and Molecular Biology. Oxford Publishers.
4. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John wiley & Sons. Inc.
5. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology. VIII Edition. Lippincott Williams.



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BSBT 3202: PLANT ECOLOGY & ENVIRONMENTAL BIOLOGY

Plants and environment – Edaphic Climatic and biotic factors. Interrelationship between the living world and the environment.

Earth as a system: The biosphere, the hydrosphere, the lithosphere, atmosphere, components within biosphere.

Population: Basic concept, interaction and regulation.

Community : Characteristics and their measurement, species diversity, ecological niche.

Anatomical and Physiological responses of plants to water – Hydrophytes, Xerophytes, ligh-heriophytes, sciopmytes.

Ecosystem : Types, structure and functions.

Food Chain : Food web, trophic levels, ecological pyramids, Bio-geochemical cycles.

Productivity : Concepts and types.

Ecological Succession : Hydrosere and Xerosere.

Plant indicators and their role in environment monitoring.

Soil conservation : Principles and management. Renewable and non-renewable natural resource and their management. Conservation of endangered species, wild life management. Forestation, Social and agro forestry. Major sources of environmental pollution and their control. Major vegetation belts in India.

Environmental education and organizations.

Suggested Reading:

1. Odum, E.P. (2005). Fundamentals of ecology. Cenagage Learning India Pvt. Ltd., New Delhi. 5th editin.
2. Singh, J.S., Singh, S.P., Gupta, S. (2006). Ecology Environment and Resource Conversation. Anamaya Publicaions, New Delhi, India.
3. Sharma, P.D. (2010). Ecology and Environment. Rastogi Publications, Meerut, India. 8th edition.
4. Wilkinson, D.M. (2007). Fundamental Processes in Ecology. An Earth Systems Approach. Oxford University Press. U.S.A.
5. Kormondy, E.J. (1996). Concepts of ecology. PHI Learning Pvt. Ltd., Delhi, India. 4th edition.



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BSBT 3203 : PLANT ANATOMY AND EMBRYOLOGY

Meristematic and permanent tissues. Root and shoot apical meristems: Simple and complex tissues.

Internal organization of plant body. The three tissue systems, types of cells and tissues. Evolution of concept of organization of shoot apex (Apical cell theory, Histogen theory, Tunica corpus theory, continuing meristematic residue). Types of vascular bundles.

Organization of tissue in relation to environment, (Ecological and Anatomy).

Anamolous secondary growth in – Bignonia, Nyctanthes, Achyranthes, Boerhaavia, Tecoma, Dracaena. Root – Stem transition.

Various development processes in Microsporo genesis, male gametophyte megaspore genesis in female gametophyte, Endosperm, Embryogenesis. Importance of anther and embryo culture.

Pollination and Fertilization (outlines) Endosperm development and types.

Development of Dicot and Monocot embryos, Polyembryony. Ovule structure and types; Megasporogenesis, development of Monosporic, Bisporic and Tetrasporic types (Pepromia, Drusa, Adoxa) of embryo sacs.

BSBT 3201 (P) : PRACTICAL : BIO-CHEMISTRY & MOLECULAR BIOLOGY

1. Detection of organic acids: citric, tartaric, oxalic and malic from laboratory samples.
2. Detection of carbohydrate and protein from plant samples.
3. Detection of the nature of carbohydrate – glucose, fructose, sucrose and starch from laboratory samples.
4. Detection of Ca, Mg, Fe, S from plant ash sample.
5. Preparation of solutions and buffers.
6. Estimation of glucose by Benedicts quantitative reagent.

BSBT 3202 (P) : PRACTICAL : PLANT ECOLOGY & ENVIRONMENTAL BIOLOGY

1. Minimum size of the quadrat by species area curve method.
2. Measurement of frequency and density in a grassland.
3. Water holding capacity of soil.





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BSBT 3203 (P) : PRACTICAL : PLANT ANATOMY ANDEMBRYOLOGY

1. Study of meristems (permanent slides/photographs).
2. Study of simple tissues – parenchyma, chlorenchyma, collenchymas and sclerenchyma (fresh specimens/ permanent slides.)
3. Primary Structure.
 - (a) Stems of Helianthus annus / Eupatorium odorum and Oryza sativa / Zea mays.
 - (b) Roots of Helianthus annus / Eupatorium odorum and Oryza / Zea mays.
 - (c) Leaves of Helianthus annus / Eupatorium odorum or any other suitable dicot plant.
 - (d) Leaves of Oryza sativa or Zea mays.
4. Maceration of wood, structure of xylem & phloem (permanent slides, photographs).
5. Structure of perineum (permanent slide).
6. T.S. of stems of Boerhaaia, Bignonia and Dracaena showing anomalous secondary growth (fresh or preserved specimens).
7. Epidermal appendages and stomata types (fresh/permanent slides).
8. Anatomical adaptations: Xerophytes (Opuntia); Hydrophytes (any hydrophytes – anatomy of stem/root/leaf), Halophyte (leaf and pneumatophore of Avicennia), Epiphyte (aerial root of any epiphyte).
9. Structure of anther (young and mature); tapetum – amoeboid and secretory (Permanent slides / pictures / photographs).
10. Types of ovules: anatropous, orthotropous, circinotropous, amphitropous/campylotropous (permanent slides/pictures/photographs).
11. Female gametophyte: Polygonal (monosporic), Alliums (bischopric) and Fritillaria or peperomia (tetrasporic) types of embryo sac development (permanent slides/ photographs).
12. Pollution types and dispersal mechanisms of fruits/seeds (any 4types – live/preserved/photographs and/specimens).
13. Demonstration of polyembryony using Citrus seeds.




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