

**DEPARTMENT OF BOTANY**  
**NORTH LAKHIMPUR COLLEGE (autonomous)**  
**OUTLINE OF THE BOTANY CORE SYLLABUS**  
**TOTAL (MARKS – 1400) CREDIT -70**

<b>SEMESTER I</b>	<b>CREDIT 5</b>			<b>L- T -P</b>
	CT-3-BOT-101	Algae, Fungi, Lichen	Cr. 3	L-2, T-1, P-0
	CP-2-BOT-102	Practical based on CT-3-BOT-101	Cr. 2	L-0, T-0, P-2
<b>SEMESTER II</b>	<b>CREDIT 5</b>			<b>L- T -P</b>
	CT-3-BOT-201	Bryophytes and Pteridophytes	Cr. 3	L-2, T-1, P-0
	CP-2-BOT-202	Practical based on CT-3-BOT-201	Cr. 2	L-0, T-0, P-2
<b>SEMESTER III</b>	<b>CREDIT 8</b>			<b>L- T -P</b>
	CT-3-BOT-301	Gymnosperms, Paleobotany , Evolution	Cr. 3	L-2, T-1, P-0
	CT-3-BOT-302	Microbiology, Plant Pathology	Cr. 3	L-2, T-1, P-0
	CP-2-BOT-303	Practical based on CT-3-BOT-301 and 302	Cr. 2	L-0, T-0, P-2
<b>SEMESTER IV</b>	<b>CREDIT 10</b>			<b>L- T -P</b>
	CT-3-BOT-401	Embryology and Anatomy of Angiosperm	Cr. 3	L-2, T-1, P-0
	CP-2-BOT-402	Practical based on CT-3-BOT-401	Cr. 2	L-0, T-0, P-2
	CT-3-BOT-403	Morphology and Taxonomy of Angiosperms	Cr. 3	L-2, T-1, P-0
	CP-2-BOT-404	Practical based on CT-3-BOT-403 + <b>Field Study Report</b>	Cr. 2	L-0, T-0, P-2
<b>SEMESTER V</b>	<b>CREDIT 21</b>			<b>L- T -P</b>
	CT-4-BOT-501	Cell and Molecular Biology	Cr. 4	L-3, T-1, P-0
	CP-2-BOT-502	Practical based on CT-4-BOT-501	Cr. 2	L-0, T-0, P-2
	CT-4-BOT-503	Biochemistry and Economic Botany	Cr. 4	L-3, T-1, P-0
	CP-2-BOT-504	Practical based on CT-4-BOT-503	Cr. 2	L-0, T-0, P-2
	CT-3-BOT-505	Modern Laboratory Techniques and Biophysics	Cr.3	L-4, T-1, P-0
	CT-3-BOT-506	Genetics and Plant Breeding	Cr. 3	L-3, T-1, P-0
	CP-3-BOT-507	Practical based on CT-3-BOT-505 and 506	Cr. 3	L-0, T-0, P-3
<b>SEMESTER VI</b>	<b>CREDIT 21</b>			<b>L- T -P</b>
	CT-3-BOT-601	Plant Physiology	Cr. 3	L-2, T-1, P-0
	CP-2-BOT-602	Practical based on CT-3-BOT-601	Cr. 2	L-0, T-0, P-2
	CT-3-BOT-603	Biotechnology and Biostatistics	Cr. 3	L-2, T-1, P-0
	CT-3-BOT-604	Bioinformatics, Functional and Chemical Biology	Cr. 3	L-2, T-1, P-0
	CP-2-BOT-605	Practical based on CT-4-BOT-603 and 604	Cr. 2	L-0, T-0, P-2
	CT-4-BOT-606	Ecology, and Plant Geography	Cr. 4	L-3, T-1, P-0
	CP-2-BOT-607	Practical based on CT-4-BOT-606	Cr. 2	L-0, T-0, P-2
	PR-2-BOT-608	Project Report	Cr. 2	L-0, T-0, P-2

**Botany**  
**Core (Major)**  
**SEMESTER-I**  
**Total Marks :60**

Code (Paper) : CT-3-BOT-101	Title : Algae, Fungi, Lichen	Credit : 3	L-2, T-1, P-0
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**Algae ( Marks: 25 )**

**Total Class: 30**

Unit –1. General characters, classification and economic importance of algae; its phylogeny and distribution in India.

Unit –2. Vegetative structure: cell and thallus structure; algal chromatophores and pigments; range of thallus structure.

Unit –3. Reproduction: vegetative, asexual, sexual and pattern of life cycles.

Unit –4. A comprehensive knowledge of the following classes with special reference to the structure and life histories of the genera mentioned below:

- a) Myxophyceae: *Nostoc* and *Anabaena*
- b) Chlorophyceae: *Chlorella*, *Volvox*, *Oedogonium*, *Coleochaete* and *Chara*
- c) Xanthophyceae: *Vaucheria*
- d) Bacillariophyceae: A general account
- e) Phaeophyceae: *Ectocarpus* and *Fucus*
- f) Rhodophyceae: *Polysiphonia* and *Batrachospermum*

**Fungi ( Marks: 25 )**

**Total Class :30**

Unit –1. Salient features of fungi, fungal cell structure and nutrition.

Unit –2. Classification of fungi (Alexopolus) and their distribution in India, Economic importance of fungi.

Unit –3. Comparative account of structure, method of reproduction and mode of spore dispersal of fungi.

Unit –4. Comprehensive knowledge of the following groups with special reference to the structure and life histories of the genera mentioned below from an evolutionary point of view.

- (a) Mastigomycotina: *Albugo*, *Pythium*.
- (b) Zygomycotina: *Rhizopus*.
- (c) Ascomycotina: *Peziza*
- (d) Basidiomycotina: *Puccinia*, *Polyporus*, *Cyathus*, *Agaricus*
- (e) Deuteromycotina: *Aspergillus*, *Alternaria*, *Penicillium*

Unit -5. Myxomycetes: a general account

**Lichen (Marks: 10 )**

**Total Class : 7**

Unit –1. A general account with particular reference to types and their detail cell structure.

Unit -2. Mode of reproduction, symbiotic association, nutrition and economic importance.

**Botany**  
**Core (Major)**  
**SEMESTER-I**  
**Total Marks :40**

Code (Paper) : CP-2-BOT-102	Title : Practical based on CT-3-BOT-101	Credit : 2	L-0, T-0, P-2
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Preparation, drawing, description and identification of the types prescribed for study in theory syllabus (Algae and Fungi).

Microscopic measurements and camera lucida drawing of fungal types.

**SCHEME OF THE PRACTICAL EXAMINATION:**

**Time: 4 hrs.**

**Marks: 40**

1. Slide preparation (algae)	10
2. Drawing labelling and description (with Camera-lucida drawing and spore measurement of fungi)	10
3. Identification (Lichen)	5
4. Collection of specimen	5
5. Practical record book	5
6. Viva voce	5

**Books recommended :**

- 1 A Text Book of Algae: Kumar, H.D, & Singh, H.N; Affiliated East West Press Pvt. Ltd., New Delhi.
- 2 A Text Book of Botany – Algae: Pandey, B.B; S. Chand & Co. (P) Ltd, New Delhi.
- 3 Botany for Degree students : Dutta, A.C.
- 4 An introduction of Fungi: Srivastava, J.P. ; Central Book Depot,Allahabad.
- 5 An Introduction to Mycology: Mehrotra R.S. and Aneja K.R; Wiley, Eastern Limited, New Delhi..
- 6 Botany for degree students –Algae: Vashishta, B.R; S. Chand & Co. Ltd., New Delhi.

- 7 Botany for Degree students. Part II. Fungi.: Vashista, B.R. S.Chand and Co. New Delhi
- 8 Cryptogamic Botany (Vol. I-Algae, Fungi & Lichens): Smith, G.M. ;Mc Graw Hill Book Co, New York.
- 9 Introductory Mycology: Alexopoulos C.J., Mims, C.W. and Blackwell, M. John Wiley and Sons, New York.
- 10 Introductory Phycology: Kumar, H.D ; Affiliated East West Press (P) Ltd., New Delhi.
- 11 Studies in Botany: J.N. Mitra
- 12 Text Book of Algae: Sharma. O.P, Tata Mc Graw Hill Publishing Co, Ltd., New Delhi.
- 13 Text Book of Fungi: Sharma, O.P. Tata McGraw Hill Publishing Co.,New Delhi.

**Botany**  
**Core (Major)**  
**SEMESTER-II**  
**Total Marks :60**

Code (Paper) : CT-3-BOT-201	Title : Bryophytes and Pteridophytes	Credit: 3	L-2, T-1, P-0
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**Bryophytes (Marks: 25)**

**Total Classes:22**

Unit \_1. General account, classification and distribution in India

Unit \_2. Comparative account of the gametophyte

Unit –3. Evolution of saprophytes and spore dispersal mechanism

Unit –4. A comparative knowledge of the structure and life history of the following types from the evolutionary point of view , their ecology and economic importance.

*Riccia, Marchantia, Anthoceros, Sphagnum, Polytrichum*

**Pteridophytes (Marks: 35)**

**Total Classes : 32**

Unit –1. General classification, organisation and affinities, distribution in India and economic importance, basic idea on fern genetics.

Unit –2. Stellar organisation in Pteridophytes. Homospory and Heterospory and its importance in evolution of seed habit

Unit –3. Evolution of sporophytes and sporophylls in pteridophytes.

Unit –4. Comparative study of morphology and life history of-

*Psilotum, Lycopodium, Selaginella, Equisetum, Marsilea.*

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**Botany**  
**Core (Major) Practical**  
**SEMESTER-II**  
**Total Marks :40**

Code (Paper) : CP-2-BOT-202	Title : Practical based on CT-3-BOT-201	Credit: 2	L-0, T-0, P-2
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Preparation of slides by cutting section, drawing, labelling, description and identification of the types, prescribed in the theory syllabus.

**SCHEME OF THE PRACTICAL EXAMINATION:**

**Time: 4 hrs.      Marks : 40**

1. Slide preparation (Bryophyte)	10
2. Slide preparation (Pteridophyte)	10
3. Identification	4
4. Slide and Herbarium submission	6
5. Practical record book	5
6. Viva voce	5

**Books Recommended:**

- 1 An Introduction Embryophyta, Vol I – Bryophyta : Parihar, N.S. , Central Book Depot, Allahabad.
- 2 A Text Book of Bryophyta, Pteridophyta and Gymnosperms.: Pandey. B.P.; K.Nath and Co., Meerut.
- 3 An Introduction to Bryophyta: Parihar, N.S., Central Book Depot, Allahabad,
- 4 An Introduction to Pteridophyta : Rashid, A., Vikas publ. Co. New Delhi.
- 5 Botany for degree student –Bryophyta:Vashishta, B.R.; S. Chand & Co, New Delhi.
- 6 Botany for Degree Students, Vol IV – Vascular Cryptogams (Pteridophyta): Vashishta. P.C. ; S.Chand & Co.
- 7 Bryophyta : Vasishta B.R. S. Chand and Co. New Delhi.
- 8 College Botany Vol.1 : Gangulee Das and Dutta., Central Book Dept. Calcutta.
- 9 College Botany Vol.II : Gangulee, H.C. and Kar A.K. , New Central Book Agency
- 10 Cryptogamic Botany Vol. .II. Bryophytes and Pteridophytes : Smith G.M.; McGraw
- 11 Cryptogamic Botany. Vol-III: Smith, G.M.; Tata McGraw HillPublishing Co.
- 12 Morphology of Pteridophytes : Sporne, K.R. , Hutchi University Library, London.
- 13 Morphology of Vascular Plants, lower group: Eames, A.J. ; Wiley International edition,
- 14 Pteridophyta : Vasishta B.R. ; S. Chand and Co., New Delhi

**Botany**  
**Core (Major)**  
**SEMESTER-III**  
**Total Marks :60**

Code (Paper) : CT-3-BOT-301	Title : Gymnosperms, Paleobotany , Evolution	Credit : 3	L-2, T-1, P-0
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**Gymnosperms (Marks: 25)**

**Total Classes :13**

Unit –1. Classification, distribution and economic importance.

Unit –2. Comparative and evolutionary study of morphology, anatomy and reproduction of *Cycas*, *Pinus*, *Ginkgo*, *Gnetum*.

**Palaeobotany (Marks: 20 )**

**Total Classes :10**

Unit –1. An elementary knowledge of paleobotany – process and the theory of fossilization, geological periods and importance of paleobotany.

Unit –2. General account of anatomy and reproduction of the following types:

(a) Pteridophytes – *Rhynia*, *Hornea*, *Psilophyton*, *Sphenophyllum*

(b)Gymnosperms– Cycadofilicales (*Lyginopteris*), Bennettitales (*Williamsonia*) and Cordaitales (*Cordaites*).

**Evolution Marks 15**

**Total class 5**

Unit –1. Organic evolution: evidences, theories, and mechanism of organic evolution.

Unit –2. Modern concept of evolution and origin of life in the light of chemical evolution.

**Botany**  
**Core (Major)**  
**SEMESTER-III**  
**Total Marks :60**

Code (Paper) : CT-3-BOT-302	Title : Microbiology, Plant Pathology	Credit : 3	L-2, T-1, P-0
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**Microbiology ( Marks: 30 )**

**Total Classes :27**

Unit –1. Contribution of scientists for development of microbiology.

Unit –2. Classification of micro-organisms and characteristic features of different groups of micro-organisms, brief knowledge of bacteria, cyanobacteria, virus, bacteriophage, mycoplasma (Structure, reproduction and importance).

Unit –3. Elementary principles of isolation, and cultivation of micro-organisms and pure culture concept.

Unit –4. General ecology of soil microflora, mycorrhiza and bacteriorrhiza.

Unit –5. Microbiology of food, milk and water.

Unit –6. Importance of micro-organisms for human welfare, elementary knowledge of disease caused by microbes to man, and plants (only two diseases from each group, mentioning causal organism, symptoms and control measures).

**Plant Pathology (Marks: 30)**

**Total Classes :28**

Unit –1. Principles of plant pathology with special reference to systemic and localised diseases and symptoms.

Unit –2. Host parasite interaction, role of toxins and enzymes in pathogenesis.

Unit –3. Plant disease management through physical, chemical, biological, regulatory and cultural methods, and post harvest management.

Unit –4. Study of the following diseases and their methods of control:

Late blight of potato, ergot of rye, loose smut of wheat,  
red rot of sugarcane, grey blight of tea, citrus canker  
and Tobacco mosaic virus.



**Botany**  
**Core (Major)**  
**SEMESTER-III**  
**Total Marks :40**

Code(Paper):CP-2-BOT-303	Title Practical based on CT-3-BOT-301 and 302	Credit: 2	L-0, T-0, P-2
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**Gymnosperm:** Preparation of slides by cutting section drawing, labelling, description and identification of the types, prescribed in the theory syllabus.

**Paleobotany:** Study of specimen and slide of paleo-botanical importance.

**Pathology:** Study on disease symptoms, preparation of slide by cutting section, drawing, labelling, description and identification of the types prescribed in the theory syllabus of plant pathology

**Microbiology:** Use of the microbiological apparatus - Hot air oven, autoclave, incubator, sterilization techniques/ methods, preparation of different types of media and cultures, dilution plate technique, staining of bacteria, slide preparations

**SCHEME OF THE PRACTICAL EXAMINATION:**

**Time: 4 hrs.      Marks: 40**

1. Slide Preparation (Microbiological)	4
2. Demonstration (Microbiological instruments)	
3. Plant Pathology	8
4. Gymnosperm	8
5. Paleobotany	5
6. Practical record book	5
7. Viva voce	6

## **Books Recommended :**

### **Gymnosperms, Paleobotany and Evolution –**

- 1 Gymnosperms: Vashista. P.C. ; S.Chand & Co Pvt. Ltd., 1976.
- 2 A Text Book of Bryophyta, Pteridophyta and Gymnosperms: Pandey. B.P.; K.Nath and Co.,
- 3 A Text Book of Gymnosperms: Sreevastava H.N. ; S. Chand and Co. Ltd., New Delhi.
- 4 An introduction to Embryology. Vol-II.Pteridophyta and Gymnosperms: Parihar. N.S.; K.Nath and Co,
- 5 An Introduction to paleobaotany: Arnolds, C.A. McGraw Hill Book Co., New York.
- 6 Essentials Palaeobotany: Shukla.A.C. and Mistra S.P; Vikas Publishing House Pvt. Ltd.,
- 7 Gymnosperms – Structure and Evolution : Chamberlain C.J.; Chicago University Press.
- 8 Gymnosperms: Vasishta P.C. S. Chand and Co., Ltd., New Delhi.
- 9 Morphology of Gymnosperms: Sporne K.R. ;Hutchinson and Co. Ltd. London.
- 10 Palaeootany : Sreevastava H.N., Pradeep Publishing Company, Jalandhar.
- 11 The Morphology of Gymnosperms: Sporne K.R.; Hutchinson and Co. Ltd. London.

### **Microbiology and Plant Pathology-**

- 1 A Textbook of Microbiology: Dubay R.C. & D.K. Maheswari; Chand & Co, New Delhi.
- 2 A textbook of Modern Plant Pathology: Bilgrami K.H. & H.C. Dube. International Book Distributing Co. Lucknow.
- 3 Microbiology : Sharma P.D., Rastogi Publication.
- 4 Microbiology: Subbarao, N.S. – Oxford & IBH Publishing Co., (P) Ltd.,
- 5 Modern Concepts of Microbiology : Kumar H.D. & S. Kumar Tata McGraw Hill,Delhi.
- 6 Plant Pathology (Pathogens & Plant disease) : Pandey B.P. ; S. Chand & Co., New Delhi.
- 7 Plant Pathology: Mehrotra, R.S. ;TMH, New Delhi.

## **SEMESTER-IV**

**Course : CT-3-BOT-401**

**Embryology and Anatomy of Angiosperms**

**Total Marks -60, Credit 3, 5 Classes/Week**

**Embryology (Marks: 30)**

**Total Classes : 27**

Unit –1. Microsporangium, microsporogenesis and development of male gametophyte; Megasporangium, mega-sporogenesis and development of female gametophyte of angiosperm (monosporic, biosporic and tetrasporic).

Unit - 2. A brief account on pollination, fertilization and double fertilization.

Unit –3. Development of embryo; apomixis, polyembryony.

Unit –4. Development of endosperm – nuclear, cellular, helobial; houstorial structures, xenia and metaxenia

**Anatomy (Marks: 30 )**

**Total Classes : 29**

Unit –1. Organisation of tissues: types of tissues, meristematic and permanent, their structure, distribution and function; theories of differentiation of root and shoot.

Unit –2. Root–stem transition, leaf traces and leaf gaps, branch gaps, abscission layer, pit.

Unit –3. Cambium and its activities, Secondary growth in thickness- normal and anomalous.

Unit –4. Anatomical and physiological consideration of dermal, mechanical, conducting and photosynthetic system of tissues; anatomy of C<sub>3</sub> and C<sub>4</sub> plants.

## SEMESTER-IV

Course : CP-2-BOT-402

Based on Course : CT-3-BOT-401

Total Marks -40, Credit 2, 4 Classes/Week

**Anatomy:** Study of primary, secondary and anomalous structures of stem and roots; Knowledge of single and double staining methods; preparation of temporary and permanent slides.

**Embryology:** Study of permanent slides of embryological importance and preparation of temporary slides of placenta and pollen grains (germinating).

### SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs. Marks: 40

1. Double staining slide (anatomy) drawing, labelling, description	15
2. Workout and study of permanent slide (embryological)	10
3. Practical record book	5
4. Viva voce	10

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### Books Recommended :

- 1 A text Book of plant Anatomy: Vashista, P.C.
- 2 An Introduction to Plant Anatomy: Eames, A. J. & L H Mac Daniels; Tata Mac Grow Hill Publishing company Ltd. New Delhi.
- 3 Embryology of Angiosperms: Dwivedi. J.N, Rastogi and Co. Meerut.
- 4 Introduction to Embryology of Angiosperms : Maheswari P. ; Mac Graw Hill, New York.
- 5 Morphology of Angiosperms: Eames M.S; Mc Graw Hill New York.
- 6 Plant Anatomy: Esau, K. ; Wiley Eastern Private Limited. New Delhi.
- 7 Plant Anatomy: Pandey B.P S. Chand & Co. Delhi.
- 8 Plant Anatomy: Vasishta P.C. ; Pradeep Publication, Jalandhar
- 9 The Embryology of Angiosperms: Bhojwani, S..S and Bhatnagar, S.P.; Vikas Publishing

**Morphology and Taxonomy of Angiosperms**

**Total Marks -60, Credit 3, 5 Classes/Week**

**Morphology of Angiosperms (Marks: 20)**

**Total classes :10**

Unit –1. Detail study of (i) origin of angiosperms, (ii) inflorescence – types and evolution, (iii) carpel polymorphism (iv) role of morphology in the classification of the flowering plants, (v) Phyllode theory,

**Taxonomy of Angiosperms (Marks: 40 )**

**Total Classes :40**

Unit –1. History of plant classification, its aims and objectives, outline of the main classifications (systems of classification) – artificial, natural, phylogenetic and modern with special reference to Linnaeus, Bentham and Hooker, Engler and Prantl, Hutchinson and Takhtajan's classification, a brief knowledge on Angiosperm Phylogeny Group (APG) classification.

Unit –2. Generic names, specific epithets, citation and authority, binomial nomenclature, taxonomic keys; typification and priority; importance of herbarium specimens and their preparations; role of herbaria and botanical gardens; documentation (floras, monographs, manuals, journals, abstracts, indices and dictionaries).

Unit –3. Taxonomy in relation to cytology (cytotaxonomy), chemistry (chemotaxonomy) numerical taxonomy and biosystematics.

Unit –4. A detailed knowledge of the following families, their phylogenetic affinities and economically important plants:

Dicotyledons: Ranunculaceae, Malvaceae, Rubiaceae, Fabaceae, Rosaceae,  
Solanaceae, Cucurbitaceae, Apiaceae, Asteraceae, Lamiaceae,  
Acanthaceae, Apocynaceae and Euphorbiaceae

Monocotyledons : Orchidaceae, Musaceae, Zingiberaceae, Arecaceae, Poaceae,  
Araceae, Cyperaceae

## SEMESTER-IV

Course : CP-2-BOT-404

Based on Course : CT-3-BOT-403

**Morphology and Taxonomy of Angiosperms**

**Total Marks -40, Credit 2, 4 Classes/Week**

Candidates will be asked to dissect, draw and describe the plants in simple technical language and identify upto genera with the help of identifying keys. **Students have to perform a field study, submission of herbarium sheets and field study report.**

### SCHEME OF THE PRACTICAL EXAMINATION:

**Time: 4 hrs.**

**Marks: 40**

1. Dissection, drawing, labelling, description	14
2. Herbarium	6
3. Field Study Report	8
4. Practical record book	5
5. Viva voce	7

### Books Recommended :

- 1 College Botany : Gangulee, H.C., J.S. Das & C. Dutta ; New Central Book Agency.
- 2 College Botany –Vol. I : Gangulee, H.C., Das, K.S & Datta, C.T ;Basant Panchami, Calcultta.
- 3 Introductory Botany Vol. IV- Taxonomy, Embryology and Economic Botany: Gupta, S.K; Kedar Nath Ram Nath, Meerut.
- 4 Taxonomy of angiosperms (Systematic Botany): Pandey, P.B, S.Chand & Co. Ltd.,
- 5 Taxonomy of Angiosperms : Naik, V.N , Tata McGraw Hill Publishing Co., (P) Ltd.,
- 6 Taxonomy of Angiosperms: Singh, V. & Singh, D.K, Rastogi Publication, Meerut.
- 7 Taxonomy of Angiosperms: Vashista, P.C, S. Chand & Co., New Delhi.

## **SEMESTER -V**

**Course : CT-4-BOT-501**

**Cell and Molecular Biology**

**Total Marks -80, Credit 4, 7 Classes/Week**

The main objective of this course is to introduce the students with the fundamentals of Cell and molecular biology.

**CELL BIOLOGY: Marks: 40**

**Total class : 30**

Unit –1. Cell theory and its exceptions, prokaryotic and eukaryotic cells.

Unit –2. Cell organisation: cell wall, its formation and growth, plasma membrane, chemical organisation and function; protoplast, cell-sap, plasmodesmata, ergastic substance, cell organelles, structure, origin and function of mitochondria, nucleus, plastids with reference to chloroplast, golgi bodies, endoplasmic reticulum, ribosome and lysosome.

Unit- 3. Chromosomes- morphology, chemical composition, ultrastructure (nucleosome model), chromosome banding (C-banding, G-banding). Special types of chromosomes – polytene chromosome and lampbrush chromosome.

Unit-4. Cell division - cell cycle, mitosis , meiosis and their significance.

Unit- 5 : Signal Transduction, G- Protein

**Molecular Biology Marks: 40**

**Total class : 28**

Unit- 1. Nucleic Acids: DNA as genetic material, structure and functions of DNA and RNA, Watson and Crick Model of DNA, other forms of DNA (A and Z). Replication of DNA- prokaryotes and eukaryotes.

Unit- 2. Features of genetic code, wobble hypothesis, protein biosynthesis in prokaryotes and eukaryotes.

Unit- 3. Recombination in prokaryotes; transformation, conjunction and transduction; genome organization in prokaryotes and eukaryotes, concept of transposons and plasmids.

Unit- 4. Gene regulation in prokaryotes - Operon concept (Lac Operon, Trp. Operon).

Unit-5. Plant genome sequencing - brief account, Human Genome Project – brief account.

**SEMESTER -V**

**Course : CP-2-BOT-502**

**Based on Course : CT-4- BOT-501**

**Total Marks -40, Credit 2, 4 Classes/Week**

**Cell biology:** Microtomy : Preparation of paraffin blocks, trimming. fixing; staining techniques used in differentiation of different types of cells.

**Molecular Biology :** DNA Model/Chart Preparation, DNA/RNA estimations

**SCHEME OF THE PRACTICAL EXAMINATION:**

<b>Time: 4 hrs.</b>	<b>Marks: 40</b>
1. Cell Biology	12
2. DNA Model/Charts	(3+3) 6
3. DNA/RNA estimations	12
4. Practical record book	5
5. Viva voce	5

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**Books Recommended :**

**Cell and Molecular Biology-**

1. Cell biology : Rastogi, S.C. ; TATA McGraw Hill publishing Co, New Delhi.
2. Cell biology : Singh S.P& Tomar B.S; Rastogi Publication, Meerut.
3. A Text book of Cell Biology : Nair, P.G.K & Prabhakara Achar, K.; Konark publishers, New Delhi.
4. Fundamentals of Molecular Biology: Rastogi V.B. ; Ane Books, India.
5. Molecular Biology: Arora, M.P. and Chandrakanta
6. Cell biology, Genetics and Molecular Biology: Kar, D.K., S. Haldar



**SEMESTER -V**

**Course : CT-4-BOT-503**

**Biochemistry and Economic Botany**

**Total Marks -80, Credit 4, 7 Classes/Week**

**Biochemistry Marks 40**

**Total class :30**

Unit -1. Basic principles of biological chemistry-acid, base, pH and buffer

Unit -2. Carbohydrates. - classification, structure and functions, lipid and its metabolism

Unit - 3. Amino acids and its synthesis, protein - structure (primary, secondary, tertiary and quaternary), basic aspects of protein conformation, post-translational modification of proteins.

Unit-4 . Enzymes: mechanism of enzyme action, coenzymes, allosteric enzyme and isozymes.

Unit-5. Vitamins : definition, types, physiological functions and deficiency symptoms.

**Economic Botany: Marks :40**

**Total Class 30**

Unit -1: Origin of cultivated plants, Vavilov's centre of origin of crop plants, ethnobotany and its importance in Indian context, Indigenous Knowledge System (IKS).

Unit – 2: Agrotechnology of rice, mustard, sugarcane and tea and their economic utilization.

Unit – 3:Study on following plant with special reference to their scientific name, family, parts used and economic utilization –

chilli, turmeric, zinger, cardamom, black pepper, cotton, ramie, bamboo, teak, sal, sisoo, nahar , mustard, ground nut, coconut, sunflower.

Unit–4: Medicinal importance of sarpagandha, ashwagandha, cinchona, aloe vera, neem, tulshi and arjun .

Unit – 5: Aromatic and petro-crops(cultivation and economic utilization) of patchouli, citronella, vitivar, sasi, jatropha and castor.

Unit – 6: In-situ and ex-situ conservation of economically important plants.

**SEMESTER -V**

**Course : CP-2-BOT-504**

**Based on Course : CT-4- BOT- 503**

**Total Marks -40, Credit 2, 4 Classes/Week**

**Biochemistry:** Qualitative test for reducing and non-reducing sugars, carbohydrates, protein and fats.

**Economic Botany:** Submission and identification of economically important plants and its parts.

**SCHEME OF THE PRACTICAL EXAMINATION:**

<b>Time: 4 hrs.</b>	<b>Marks: 40</b>
1. Biochemical tests	12
2. Economic Botany	
a. Submission	6
b. Identification	5
c. Chart preparation	5
4. Practical record book	5
5. Viva voce	7

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**Books Recommended :**

**Biochemistry and Economic Botany-**

- 1 Economic Botany: Hill, A.W ; McGraw Hill Book Co., New York.
- 2 Economic Botany: Pandey, B.P. ; S.Chand and Co., New Delhi.
- 3 Economic Botany: Sen, S. ; New Central Book Agency, Calcutta.
- 4 Fundamentals of Biochemistry: Jain,J.L.; S.Chand and Co., New Delhi.
- 5 Introduction to Plant Biochemistry : Goodwin Y.W., and Mercer E.I. ; CBS Publishers
- 6 Lehninger- Principles of Biochemistry : David L; Nelson and Michael M Cox ; Macmillan,
- 7 Text Book of Economic Botany: Varma, V. ; Ane Books India, New Delhi.

**SEMESTER -V**

**Course : CT-3-BOT-505**

**Modern Laboratory Technique and Biophysics**

**Total Marks -60, Credit 3, 6 Classes/Week**

**Modern Laboratory Technique :Marks: 30,**

**Total class : 25**

Unit –1: Working principles, operations and application of the following in biological sciences: Microscopy: compound, phase contrast, dark field and Electron microscopes.

Unit-2. Chromatography : Introduction, definition and concept of partition coefficient, principle, method and advantages of Paper, TLC and Column Chromatography and HPLC , Gel-eletrophoresis.

Unit- 3. Spectrophotometry- working principle of spectrophotometer and colorimeter.

Unit-4. Principles and applications of P<sup>H</sup> meter, incubator, autoclave, Hot air oven, laminar air flow chamber, centrifuge.

**Biophysics : Marks: 30**

**Total class : 25**

Unit – 1. Introduction – i) Application of Biophysics in Biological Science

ii) Division of Biophysics

Unit- 2. True solution and its biological importance, colloids and colloidal solution; comparison of true solution and colloidal solution.

Unit - 3. Isotopes, types, their importance in biological studies and autoradiography.

Unit-4. Biophysics of the membrane- nuclear membrane, cell membrane, mitochondrial membrane and thylakoid membrane.

Unit-5: Computer in Biology and medicine

Unit- 6 : Laws of Thermodynamics and living Organisms

Unit- 7 : Basic idea on Nanotechnology

## **SEMESTER -V**

**Course : CT-3-BOT-506**

**Genetics and Plant Breeding**

**Total Marks -60, Credit 3, 5 Classes/Week**

**Genetics Marks: 40**

**Total Classes : 25**

Unit –1. Mendel’s Laws, their critical appreciation, gene interactions and modified monohybrid and dihybrid ratios; concept of alleles, multiple alleles and multiple genes.

Unit – 2.. Linkage, crossing over and basic knowledge of gene mapping.

Unit – 3. Determination of sex, sex linked and sex limited traits.

Unit – 4. Cytoplasmic inheritance with reference to plastid inheritance and kappa particle inheritance.

Unit –5. Chromosomal (numerical and structural) and gene mutation, concept of biochemical mutation.

Unit – 6. Basic ideas of gene and its fine structure, transposons and plasmids.

Unit – 7. Human genetics: karyotype, important syndromes and disorders.

**Plant Breeding Marks: 20**

**Total Class :15**

Unit – 1. Methods of reproduction: vegetative, asexual and sexual.

Unit – 2. Principles and methods of plant breeding: introduction, selection, hybridization, heterosis breeding and concept of mutation breeding.

Unit – 3. In vitro culture: requirements, techniques and application in crop improvement.

Unit-4. Breeding for crop improvement with reference to paddy, wheat, sugarcane.

## SEMESTER -V

Course : CP-3-BOT-507

Based on Course : CT-3-BOT-505 and - 506

Total Marks -60, Credit 3, 6 Classes/Week

**Genetics:** Temporary aceto-carmin and aceto-orcin preparations of root tips (onion/lily) and flower buds (onion/tradescantia); drawing, description of the mitotic and meiotic stages. Simple calculation of Mendelian ratios including ratios due to gene interaction .

**Plant breeding:** Study of floral biology and techniques of plant breeding emasculation, bagging, tagging and labelling.

**Modern laboratory methodology:** separation of plant pigments/ amino acids by paper chromatography/ TLC. Demonstration of modern biological tools as per theory syllabus mentioning their principle, function and uses in biological science.

### SCHEME OF THE PRACTICAL EXAMINATION:

Time: 4 hrs.

Marks: 40

1. Genetics	10
2. Plant breeding	10
3. Modern laboratory methodology	
(a) Chromatography	15
(b) Principles & Diagram	5
(c) Demonstration	8
4. Practical record book	5
5. Viva voce	7

### Books recommended :

#### Modern Laboratory Technique and Biophysics-

1. A Text book of Biophysics: Roy, R.N. ; New Central Book Agency Pvt. Ltd.,
2. Biophysics : Hoppe, W. (edt). ; Springer Verlag.

3. Selected Topics of Biophysics: Sasidharan, A. ; Frontier Area Publishers.
4. Techniques of Autoradiography: Rogers,A.W. ; Elsevier Pub.Company.
5. Biological instrumentation and Methodology: Bajpai,P.K.
6. Biotechniques- theory and practice : Rana,S.V.S.

### **Genetics and Plant Breeding-**

- 1 Elementary Principles of Plant Breeding: Chauduri, H.K. ; Oxford and IBH Co., New Delhi.
- 2 Plant Breeding: Singh, B.D. Kalyani Publishers, Ludhiana.
- 3 Plant Breeding: Singh, S.P. Laxmi Ram Singh, Srivastava, J.P.; Aman Publishing House,.
- 4 Principles of Plant Breeding : Allard, R.W. ; John Willey and Sons, Inc.
- 5 Text Book of Genetics: Gupta, P.K. ; Rastogi Publications, Meerut.
- 6 Text book of Genetics: Verma, P.S. & Agarwal S. Chand & Co., New Delhi.

**SEMESTER – VI**  
**Course : CT-3-BOT-601**  
**Plant Physiology**  
**Total Marks -60, Credit 3, 7 Classes/Week**

**Plant Physiology 60**

**Total Classes : 50**

Unit –1. Plant water relationships: diffusion, imbibition and osmosis; water potential and chemical potential; absorption of water; mechanism of active and passive absorption; water holding capacity of soil and wilting co-efficient.

Unit –2. Ascent of sap: definition; different theories related to ascent of sap; transpiration, its mechanism and its significance; physiological effects of water deficit and stress physiology.

Unit –3. Mineral nutrition in plants: role of micro and macro elements; mineral deficiency and symptoms in plant growth.

Unit –4. Nitrogen metabolism: nitrogen fixation (symbiotic and non-symbiotic), *nif*-gene and nitrification.

Unit –5. Photosynthesis: historical background and significance; mechanism

(a) Light reaction – Red drop, Emerson effect, photosynthetic pigments; two pigment systems; cyclic and non-cyclic electron transport; photophosphorylation and production of assimilatory power

(b) Dark reaction: Calvin cycle (C<sub>3</sub> pathway), Hatch-Slack pathway (C<sub>4</sub> pathway); differences between C<sub>3</sub> and C<sub>4</sub> cycle; photorespiration, Crassulacian Acid Metabolism (CAM) and chemosynthesis; factors affecting photosynthesis.

Unit –6. Translocation of organic solutes: Transport of photosynthates; the mechanisms of translocation in phloem, source sink-relationships.

Unit –7. Respiration: Glycolysis and TCA cycle, pentose phosphate pathway; oxidative phosphorylation, Electron Transport System (ETS).

Unit –8. Growth and Development: Definitions; phases of growth; kinetics of growth; physiology of seed dormancy and germination; photoperiodism and vernalisation; movements –tropic and nastic.

**Course : CP-2-BOT-602**

**Based on Course : CT-3-BOT-601**

**Total Marks -40, Credit 2, 4 Classes/Week**

Experiments should be related to imbibitions, absorption, osmosis, transpiration, photosynthesis, respiration, test for plant pigments and ash analysis.

**SCHEME OF THE PRACTICAL EXAMINATION:**

**Time: 4 hrs.      Marks: 40**

1. Experiment	
a)Major	16
b)Minor	10
2. Practical record book	7
3. Viva voce	7

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**Books recommended :**

- 1 A Text Book of Plant Physiology: Verma, V., Emkay Publications, NewDelhi.
- 2 Introductory Plant Physiology: Nogle, G.R., and Fritz, G.J.;Prentice Hall of India Private Ltd.
- 3 Plant Physiology: Devlin, K.M. ; Reinehart and Winston and Affiliated East West Press (P) Ltd.
- 4 Plant Physiology: Gill, D.S.; S.Chand and co., New Delhi.
- 5 Plant Physiology: Malik, C.P. ;Kalyani Publishers, Ludhiyana.
- 6 Plant Physiology: Pandy,. S.N. ; Tata McGraw Hill Publishers (P)Ltd., New Delhi.
- 7 Plant Physiology: Salisbury, F.B. and Ross, C.W. ; CBS Publishers and Printers, New Delhi.



**Course : CT-3-BOT-603**  
**Biotechnology and Biostatistics**  
**Total Marks -60, Credit 3, 7 Classes/Week**

**Biotechnology Marks: 30**

**Total Classes :30**

Unit – 1. Introduction, scope of biotechnology, recent advances in biotechnology, application of biotechnology in agriculture and industry, concepts pertaining to biofertilizers.

Unit – 2. Genetic Engineering and its merits and demerits, techniques of gene manipulation. Recombinant DNA technology, outline of cloning - plasmid, cosmid, vectors

Unit – 3. Tissue culture: basic principle, medium, protoplast fusion and somatic hybridization.

**Biostatistics (Marks:30)**

**Total Classes:25**

Unit –1. Application of statistics in Biological Science, collection and classification of data for frequency distribution.

Unit –2. Measurement of central tendency; mean, median , mode,

Unit 3: Measurement of dispersion- range, deviation, mean deviation, standard deviation, variance and standard error.

Unit –4. Test of significance –t-test, f-test, test for goodness of fit - chi-square test

Unit-5: Test for probability.

**Course : CT-3-BOT-604**  
**Bioinformatics, Functional and Chemical Biology**  
**Total Marks -60, Credit 3, 7 Classes/Week**

**Bioinformatics Marks: 30**

**Total class: 26**

Unit-1. Basics of computer application, fundamentals of bioinformatics: introduction, history and scope of bioinformatics; sources of information, internet and bioinformatics.

Unit- 2. Introduction to genomics and proteomics.

Unit-3. Bioinformatics databases: basic concepts of primary and secondary databases;  
Nucleic acid databases –NCBI, EMBL, GENBANK.

Protein Databases – SwissProt, TrEMBL./ Data mining and data mining tools  
(ENTREZ)

Unit 4. Database search and sequence alignment, Tools of bioinformatics/sequence alignment – FASTA and BLAST; methods of sequence alignment.

Unit 5. Phylogenetic analysis: basic concept, steps in evaluation of phylogeny and constructing phylogenetic trees.

**Functional and Chemical Biology: Marks 30**

**Total Class :30**

Unit –1: Concept of biomolecules, polymeric substances in plants- A brief study of polysaccharides, lipids, proteins, nucleic acids, chlorophylls with special reference to their functions.

Unit –2: Concept of metabolic pathway- anabolism and catabolism,

Unit– 3: Secondary plant products- terpenoids, phenols, flavonoids, anthocyanins, alkaloids, non-protein amino acids.

Unit-4 Phytohormones- auxin, gibberellins and cytokinin, ethylene and ABA along with their physiological role.

**Course : CP-2-BOT-605**

**Based on Course : CT-3-BOT-603 and 604**

**Total Marks -40, Credit 2, 4 Classes/Week**

**Functional and chemical biology:** Qualitative analysis and estimation of secondary metabolites in different plant samples.

Qualitative and quantitative estimation of different photosynthetic pigments.

**Bioinformatics:** Different e-resources and database search, Similarity search in sequence such as BLAST / FASTA, submission of charts and models etc.

**Biotechnology:** Demonstration of apparatus for plant tissue culture techniques.

**Biostatistics:** Computation of central tendency and deviation, t-test, chi-square test

**SCHEME OF THE PRACTICAL EXAMINATION:**

**Time: 4 hrs.      Marks:40**

1. Biostatistics	8
2. Tissue culture( demonstration)	5
3. Functional and chemical biology	8
4. Bioinformatics	8
5. Practical record book	5
6. Viva - Voce	6

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**Books Recommended :**

**Biotechnology and Biostatistics-**

- 1 A text book of Biotechnology: Dubey R.C; S. Chand & Co., Ltd., New Delhi.
- 2 An Introduction to plant tissue culture: Kalyan Kumar.D. ; New Central Book Agency, Calcutta.
- 3 Basic biotechnology: Ignachimuthu, S. ; Tata McGraw Hill Publishing Company Ltd.
- 4 Elements of Biostatistics: Prasad, S. Rastogi Publ.
- 5 Fundamentals of Biostatistics: Rastogi, V.B.; Ane Book India.
- 6 Fundamentals of Biostatistics: T.J. Bailey; Wraaz Publ. Hyderabad.

**Bioinformatics, Functional and Chemical Biology-**

- 1 Basic Bioinformatics : Ignacimuthu S; Narosa Publishing House.
- 2 Bioinformatics – sequence and Genome analysis : David W. Mount; CBS Publishers.
- 3 Basic Bioinformatics: Bansal,M.
- 4 Bioinformatics- Concepts, Skill and Application: Rastogi SC, Namita Mendiratta and Rastogi P; CBS publishers and distributes
- 5 Introduction to Bioinformatics : Sundararajan S & Balaji R; Himalaya publishing House.
- 6 Bioinformatics – Principles and application: Ghosh,Z & B. Mallick
- 7 Introduction to Information Technology :V.Rajaraman, Prentice Hall
- 8 Learning Computer Fundamentals : Ramesh Bangia, Khanna Book Publishers

**Web Resources**

1. [www.fgcu.edu/support/office2000](http://www.fgcu.edu/support/office2000)
2. [www.openoffice.org](http://www.openoffice.org) Open Office Official web site

3. [www.microsoft.com/office](http://www.microsoft.com/office) MS Office web site
4. [www.lgta.org](http://www.lgta.org) Office on-line lessons
5. [www.learnthenet.com](http://www.learnthenet.com) Web Primer
6. [www.computer.org/history/timeline](http://www.computer.org/history/timeline)
7. [www.computerhistory.org](http://www.computerhistory.org)
8. <http://computer.howstuffworks.com>
9. <http://vmoc.museophile.org> Computer History
10. [www.dell.com](http://www.dell.com) Dell Computers
11. [www.intel.com](http://www.intel.com) Intel
12. [www.ibm.com](http://www.ibm.com) IBM
13. 14. [www.technopark.org](http://www.technopark.org)

**Course : CT-4-BOT-606**

**Ecology and Plant Geography**

**Total Marks -80, Credit 4, 7 Classes/Week**

**Plant Ecology: Marks: 55**

**Total Class 45**

Unit – 1. Introduction: definition and scope of plant ecology, development of plant ecology in India and abroad, division of plant ecology; ecological factors -climatic, edaphic and physiographic factors.

Unit 2. Autecology and population dynamics: definition, plant environment interaction and ecological clock; characteristics of population-density, natality and mortality, population growth forms, age structure, biotic potential and environmental resistance, r & k selection, interaction of population, plant adaptation.

Unit 3. Synecology and community dynamics: structure and classification of plant community, community characteristics, analytic and synthetic characters; plant succession- types of succession, causes of succession, the climax concept.

Unit 4. Ecosystem ecology: definition, types, structure and function of ecosystem, concept of energy flow through ecosystem; the productivity concept, ecological efficiency, nutrient cycling and biogeochemical cycles with special reference to water, oxygen, carbon, nitrogen, sulphur and phosphorus cycles.

Unit -5. Conservation ecology: natural resources and their conservation( renewable and non- renewable); causes and consequences of deforestation, IUCN species categories; ex – situ and in-situ conservation, (Biosphere Reserve, National Park, Wild life Sanctuary), concept on biodiversity, hot spot- importance, threat and conservation strategies, World's biodiversity hot spots.

Unit – 6. Habitat degradation: Pollution of air, water, soil and its impact on our environment; control of pollution with special reference to phytoremediation, public awareness and people's participation; global climatic change -global warming, green house effect and ozone layer depletion; concept of sustainable developments.

**Phytogeography Marks 15**

**Total Class 5**

Unit –1. Principles of static and dynamic phytogeography; general idea of the distribution of plants over the globe (from tropical to arctic zones) with special reference to the Phytogeographical regions of India; endemism-theories of endemism, age and area hypothesis, endemic flora of India with special reference to N. E. region

**Course : CP-2-BOT-607**

**Based on Course : CT-BOT-606**

**Total Marks -40, Credit 2, 4 Classes/Week**

**Ecology:** Study of components of terrestrial and aquatic ecosystems, Major Study of floristic composition, determination of minimum sampling size, numbers for community study, determination of percentage frequency, abundance density of species of certain ecosystem, calculation of standing crop biomass and productivity of ecosystem, study of anatomical peculiarities with reference to ecological adaptations, soil analysis (qualitative)

**Phytogeography:**

Preparation of chart on the major biomes of the world / landscape with distribution of plants with reference to particular ecological condition

## SCHEME OF THE PRACTICAL EXAMINATION:

**Time: 4 hrs. Marks: 40**

1. Ecology	
a. Major	12
b. Minor	10
2. Phytogeography (submission of chart)	05
3. Practical record book	5
4. Viva-Voce	08

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### **Books Recommended :**

- 1 A text book of Plant Ecology : Ambasht R.S. Students Friends Co. Varanasi.
- 2 A Text Book of Plant Ecology : Shukla R.S. & P.S. Chandel; S. Chand & Co. Ltd.
- 3 Basics of Ecology : Odum E.P. ; Saunders International UN Edition.
- 4 Ecology and Environment : Sharma, P.D. Rastogi Publication.
- 5 Elements of Ecology : Gopal, B and Bhardwaj, Vikas Publishing House Pvt. Ltd.
- 6 Environmental Science: Ahluvalia V.K. Malhotra S. ; Ane Books – New Delhi.
- 7 Fundamental Concepts in Environmental Studies : Mishra D.D S. Chand & Co.,
- 8 Fundamentals of Ecology : Dash M.C. ; Tata McGraw Hill Publishing Company Ltd.
- 9 Modern Concepts of Ecology : Kumar H.D. Vikas Publications. New Delhi.
- 10 Plant Ecology : Vasishta, P.C, Vishal Publication.
11. Plant Ecology and Soli Science : Shukla, R.S and Chandel.P.S S. Chand Co.
12. Text Book of plant Ecology: Verma, V,A; Emkay Publication
13. .Practical Methods in Ecology and Environmental Science by Tripathi, Goel & Trisal  
Enviro Media Publications, Karad (India).
14. . Ecology Work Book by R. Misra, Oxford & IBH Pub. Co. New Delhi.

**Course : PR-2-BOT-608**

**Project Report**

**Total Marks -40, Credit 2, 4 Classes/Week**

**PROJECT WORK:** Topic of the Project work should be allotted in the Semester-V and report will be evaluated in **Semester-VI**. Separate project preferably be given to each student.

**Students are to be oriented in –**

Identification/selection of the problem, aims and objectives, methodology to fulfill the objectives, collection, compilation and presentation of data in tabular/graphical/photographic forms (after statistical analysis), interpretation with citation and discussion, summary/conclusion, books recommended

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(Dr. Binita Hazarika)

HOD, Botany, N.L.College (Autonomous)

02. Dr. S.N. Phukan

03. Dr. P. K. Mitra

04. Dr. Rupa Phukan

05. Dr. C. R. Bora

06. Mr. Anil Bora

