



Semester-wise Syllabus for Undergraduate Programme

Botany

To be introduced from August 2013

DEPARTMENT OF BOTANY

COTTON COLLEGE STATE UNIVERSITY

PREPARED FOR COTTON COLLEGE STATE UNIVERSITY



<u>Sub Code</u>	<u>Subject Title</u>	<u>L+T+P</u>	<u>Credits</u>
SEMESTER - I			
BOT 101C	Plant Kingdom, Evolution and Algae	2+1+1	4
BOT 102C	Fungi , Lichen and Bryophytes	2+1+1	4
BOT 103C	Pteridophytes, Gymnosperms & Paleo- botany	2+1+1	4
BOT 104E	Diversity of Microbes ,Cryptogams and Gymnosperms	2+0+1	3
SEMESTER – II			
BOT 201C	Angiosperm morphology and Angiosperm taxonomy	2+1+1	4
BOT 202C	Ethnobotany & Pharmacognosy	2+1+1	4
BOT 203C	Ecology, Biodiversity and Conservation	2+1+1	4
BOT 204E	Cell Biology and Genetics	2+0+1	3
SEMESTER – III			
BOT 301C	Instrumentation and Laboratory Techniques	2+1+1	4
BOT 302C	Cell Biology	2+1+1	4
BOT 303C	Molecular Biology	2+1+1	4
BOT 304E	Plant physiology and biochemistry	2+0+1	3
SEMESTER – IV			
BOT 401C	Anatomy & Embryology	2+1+1	4
BOT 402C	Microbiology	2+1+1	4
BOT 403C	Plant Pathology	2+1+1	4
BOT 404E	Diversity of Seed Plants and their systematic	2+0+1	3
SEMESTER - V			
BOT 501C	Plant Physiology	2+1+1	4
BOT 502C	Biochemistry, Palynology & Biomatrix	2+1+1	4
BOT 503C	Cytogenetics & Plant Breeding	2+1+1	4
BOT 504E	Structure, development and reproduction in flowering plants	2+0+1	3
SEMESTER - VI			
BOT 601C	Bio resources, Computer application	2+1+1	4
BOT 602C	Biotechnology & Bioinformatics	2+1+1	4
BOT 603C	Choice Based Credit Paper	2+1+1	4
BOT 604E	Ecology and Utilization of plants.	2+0+1	3

(All Practicals should be supported with field studies, field reports, herbariums and collections or photographs & Practical records).

SEMESTER - I

BOT 101C	Plant Kingdom, Evolution and Algae.
BOT 102C	Fungi , lichen and Bryophytes,
BOT 103C	Pteridophytes, Gymnosperms & Paleo- botany
BOT 104E	Diversity of Microbes ,Cryptogams and Gymnosperms

BOT 101C: Plant Kingdom, Evolution and Algae.

No of Lectures – 32.

Course Outline:

Plant Kingdom:

- Classification of plant kingdom and criteria, diversity, form, life span, nutrition and ecological status.

Evolution

- **Molecules and Origin of Life:** Introduction; Evidences of organic evolution, Origin of basic biological molecules– Oparin concept, Miller’s experiment, Evolution of prokaryotic and eukaryotic cells. Archaeobacteria.
- **Theories on origin and evolution** -Spontaneous generation – Lamarckism – Darwinism, arguments and support, Weismann and deVries, Neo-Darwinism and its objection.
- **Genetic Constancy and Creation of Variability-** Application of Hardy Weinberg’s Principle Mutation and Selection– Random genetic drift – Genetic Polymorphism.
- **Molecular phylogenetics & Speciation:** Evolutionary clocks, Modes of speciation – sympatric and allopatric.

Algae:

- General characteristics, morphology, range of thallus structure, reproduction, alteration of generation, phylogeny and economic importance of Algae
- Algae as food, feed ,medicine and commercial products, role of algae in soil fertility
- Life history of:
 - Cyanophyceae (*Microcistis, Anabaena, Ocillatoria*)
 - Chlorophyceae (*Chlamydomonas, Volvox, Cladophora, Chara*),
 - Xanthophyceae (*Vaucheria*),
 - Bacillariophyceae (General account-Diatoms),
 - Phaeophyceae (*Ectocarpus, Fucus*),
 - Rhodophyceae (*Batracospermum, Polysiphonia*).

BOT 101C: (Practicals)

Study of morphology and reproductive structures of the following Algal types:

1. Cyanophyceae (*Microcystis*, *Anabaena*, *Oscillatoria*)
 2. Chlorophyceae (*Chlamydomonas*, *Volvox*, *Cladophora*, *Chara*),
 3. Xanthophyceae (*Vaucheria*),
 4. Bacillariophyceae (General account-Diatoms),
 5. Phaeophyceae (*Ectocarpus*, *Fucus*),
 6. Rhodophyceae (*Batracospermum*, *Polysiphonia*).
- **All Practicals should be supported with field studies, field reports, collections or photographs and Practical records.**

Suggested Readings:

1. Bold, H.C. and Wayne, M.J. - Introduction to Algae (2nd Edition). Prentice Hall, New Jersey.
2. Campbell, N.A. and Reece, J.B. - Biology. Pearson Benjamin Cummings, San Francisco.
3. Campbell H.D, - The Evolution of land plants (Embryophyta), Univ. Press, Stanford.
4. Lee, R.E. - Phycology, Cambridge University Press, USA.
5. Sambamurthy, A - A Textbook of Algae. I. K. International Pvt. Ltd., New Delhi.

BOT 102C: Fungi, Lichen and Bryophytes.

No of Lectures – 32.

Course Outline—

Fungi :

1. General characters, cell structure, nutrition, reproduction and sexuality,
2. Role of fungi in agriculture, fungi as food, medicine and commercial products (Antibiotics, alcohols), mycotoxins and mycotoxicosis and Economic importance of fungi.
3. Mycorrhiza and its role in plant development.
4. Classification, phylogeny and life history of main classes of fungi with special reference to the types as mentioned; Phycomycetes (*Phytophthora*, *Mucor*); Ascomycetes (*Saccharomyces*, *Penicillium*); Basidiomycetes (*Puccinia*, *Agaricus*); Deuteromycetes (*helminthosporium*, *Colletotrichum*).

Lichen:

1. General account, classification, structure and reproduction of Lichens
2. Economic Uses: As food, Dyes, Cosmetics and perfumes, Medicinal uses- (in nanomedicine (*Usnea ongissima*), treatment of cancer, Homoeopathy), Lichens as indicator plants.

Bryophytes:

1. Classification and general account of structure, morphology, anatomy, reproduction and Economic importance of Bryophytes.
2. Phylogenetic relationship among Hepaticopsida with reference to *Riccia* and *Marchantia*, Anthocerotopsida with reference to *Anthoceros*, Bryopsida with reference to *Sphagnum* and *Polytrichum*.

BOT 102C: (Practicals)

1. **Fungi: Phytophthora, Mucor, Penicillium, Puccinia, Agaricus, Helminthosporium.**
2. **Lichen: Thallus morphology of Foliose; Crustose; Fruticose types.**
3. **Bryophytes: Riccia, Marchantia, Anthoceros, Polytrichum, Sphagnum.**

(All Practical should be supported with field studies, field reports collections or photographs and Practical records)

Suggested Readings:

1. Alexopoulos C. J. et al., Introductory Mycology, John Wiley and Sons.
2. Chopra R.N. and P.K. Kumar- Biology of Bryophytes. Wiley Eastern Ltd. New Delhi.
3. Pandey and Trivedi- A text book of Fungi, Bacteria and Virus Bikash Publishing House, New Delhi.
4. Parihar, N.S. An Introduction to Bryophyta Central Book Depot, Allhabad.
5. Shaw.J.A. and Goffinet B. -Bryophyte Biology, Cambridge University Press.
6. Vasishta B.R. Bryophyta. - S. Chand and Co. New Delhi.
7. Watson E.V. - The structure and life of Bryophytes. London.
8. Webster, J. and Weber, R.-Introduction to Fungi. 3rd edition, Cambridge University Press, Cambridge.

BOT 103C: Pteridophytes, Gymnosperms & Paleobotany

No of Lectures – 32.

Course Outline—

1. **Pteridophytes:** Classification, comparative study of morphology, anatomy, reproduction, steelar diversity, heterospory and seed habit with reference to Psilopsida (*Psilotum*), Lycopsidea (*Lycopodium*, *Selaginella*), Sphenopsida (*Equisetum*) and Pteropsida (*Adiantum and Marsilea*).
2. **Gymnosperms:** Classification, evolutionary significance and salient features, Comparative study of morphology, anatomy and reproduction of Cycadales (*Cycas*), Coniferales (*Pinus*, *Cryptomeria*, *Thuja*), Ginkgoales (*Ginkgo*) and Gnetales (*Gnetum*)
3. **Paleobotany:** Process of fossilization, General account, anatomy and reproduction of Psilophyta (*Rhynia*), Lepidodendrales (*Lepidodendron*) and Sphenophyllales (*Sphenophyllum*), Cycadofilicales (*Lyginopteris*), Bennettitales (*Williamsonia*) and Cordaitales (*Cordaites*).

BOT 103C: (Practicals)

Study of morphology and reproductive structures of the following types:

- **Pteridophytes:** *Lycopodium*, *Selaginella*, *Equisetum*, *Adiantum*, *Marsilea*
- **Gymnosperm:** *Cycas*, *Pinus*, *Ginkgo*, *Gnetum*.
- **Paleobotany:** Specimen and slides studies in theory paper.

(All Practical should be supported with field studies, field reports, herbariums and collections or photographs & Practical records).

Suggested Readings:

1. Bhatnagar, S.P and Alok Moitra - **Gymnosperms** New Age International (P) Ltd.
2. Clark DL -**Fossils, Palaeobotany and Evolution** W.M.C. Brown Company New York.
3. Misra SP and Shukla AC - **Essentials of Palaeobotany** Vikas Publishing House, New Delhi
4. Parihar, N.S-**The Biology and Morphology of Pteridophytes**-Central Book Depot, Allahabad.
5. Sporne K.R. - **The Morphology of Gymnosperms**, Hutchinson and Co. Ltd. London.
6. Sporne, K.R-**The Morphology of Pteridophytes** (The Structure of Ferns and Allied Plants) London.
7. Sreevastava H.N. -**A Text Book of Gymnosperms**. S. Chand and Co. Ltd., New Delhi.

8. Sundara Rajan, S., **Introduction to Pteridophyta** New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi,
9. Surnage K. R., **Indian Fossil Pteridophytes** C.S.I.R. New Delhi
10. Thomas B. A. and Spice RA- **The Evolution and Palaeobotany of land Plants** Publ Crom Helm London & Sydney
11. Vashista, P. C., **Botany for Degree Students-Pteridophyta**. S. Chand & Co., New Delhi,
12. Vashista, P. C., **Botany for Degree Students – Gymnosperms (2nd Edition)** S. Chand & Co. New Delhi

**BOT 104E: Diversity of Microbes, Cryptogams and Gymnosperms.
No of Lectures – 32.**

Course Outline—

1. Introductory botany: Classification of plant kingdom, importance of plant for human life and support system.
2. Algae- General characters, classification, life history, Origin, evolutionary significance and economic importance of Cyanophyceae (*Anabaena*), Chlorophyceae (*Volvox*, *Oedogonium*), Phaeophyceae (*Ectocarpus*), Rhodophyceae (*Polysiphonia*).
3. Viruses, bacteria and lichen- General account, classification of bacteria, ultra structure, reproduction and economic importance.
4. General characters, cellular organisation, nutrition, reproduction, classification, Origin, differences and evolutionary significance and economic importance of Fungi; Type study: Phytophthora, Mucor, Saccharomyces, Penicillium, Peziza, Puccinia, Helminthosporium.
5. Plant disease symptoms, disease cycle and control measures.
6. Bryophytes- Morphology, structural organization, habit, reproduction classification, Origin, differences and evolutionary significance, type study: Marchantia, Anthoceros and Funaria.
7. Pteridophytes: Origin, differences and evolutionary significance,, classification, type study: *Lycopodium*, *Selaginella* ; *Equisetum* ,*Pteris*,

8. Gymnosperms: Introduction, general characters, classification, Origin, difference and evolutionary significance of gymnosperms, evolution of seed habit, type study: *Cycas, Pinus, Gnetum*
9. Fossilization processes, general characteristics of Cycadofilicales, Bennettitales.

BOT 104E: (Practical)

1. Study of vegetative, reproductive bodies of genera included under Algae, Fungi (inclusive of plant diseases) of theory syllabus.
2. Study of morphology, anatomy and detailed reproductive structures of Bryophyta and Pteridophyta genera included under theory syllabus.
3. Gram staining of bacteria.
4. Gymnosperms: Study morphology and anatomy of leaf/ stem, detailed reproductive structures of *Cycas, Pinus, Gnetum*.
5. Study of fossil specimens and slides of theory syllabus.

(All Practicals should be supported with local field studies, field reports, herbariums and collections or photographs and Practical records).

SEMESTER – II

BOT 201C	Angiosperm morphology and Angiosperm taxonomy
BOT 202C	Ethnobotany & Pharmacognosy
BOT 203C	Ecology, Biodiversity and Conservation
BOT 204E	Cell Biology and Genetics

BOT 201C: Angiosperm morphology and Angiosperm taxonomy.

No of Lectures – 32

Course Outline—

Angiosperm morphology

1. Origin & evolution of angiosperm, Types of Germination, Leaf- Phyllode Theory,
2. Origin and Types of Inflorescence, Flower as modified reproductive shoot.
3. Morphology of stamen and carpel (Telome theory, Carpel polymorphism, inferior ovary). Role of morphology in plant classification.

TAXONOMY OF ANGIOSPERMS :

1. Aim and objectives of plant taxonomy, history of plant classification Concept of classificatory systems i.e. artificial, natural, Phylogenetic, phenetic, phyletic, cladistic and APG.
2. Detail study of Bentham and Hooker, Takhtajan system of classifications.
3. Principles & rules of binomial nomenclature, ICBN- Rules & Recommendations, type concept; concept of biocode, species, genus & family.
4. Taxonomic Keys, taxonomy & computers, herbarium, documentation (Floras, Monographs, Manuals, Journals, Icones), numerical taxonomy and biosystematics.
5. Affinity, phylogeny, economic importance and comparative studies of the following families:
Magnoliaceae, Malvaceae, Brassicaceae, Fabaceae, Caesalpiniaceae, Mimosaceae, Euphorbiaceae, Rubeaceae, Solanaceae, Cucurbitaceae, Verbenaceae, Lamiaceae, Acanthaceae, Asteraceae, Arecaceae, Cyperaceae, Poaceae, Musaceae, Zingiberaceae, Liliaceae, Commelinaceae, Orchidaceae.

BOT 201C (Practicals)

1. Study of special types of inflorescences – Cyathium, Hypanthodium, Verticillaster, Hypanthium
2. Study of special types of Fruits – Spurious fruits (Dillenia); Aggregate fruits (Custard apple, Michelia, Periwinkles, Polyalthia); Multiple fruits (Pine apple, Jack fruit).
3. Description of specimen from members of locally available Dicotyledonous and Monocotyledonous families included in the theory.
4. Description of specimens with preparation of keys up to generic level of locally available plants.
(All Practical should be supported with field studies, field reports, herbariums and collections or photographs and Practical records) .

Suggested Readings:

1. Cronquist, A- An Integrated System of Classification of Flowering Plants. Columbia University Press.
2. Datta S C- Systematic Botany, 4th Ed, Wiley Estern Ltd., New Delhi
3. Eames M.S - Morphology of Angiosperms Mc Graw Hill New York.
4. Gifford EM. And Foster A S- Morphology and Evolution of Vascular Plants W.H.Freeman, New York
5. Raghavan, V- Developmental Biology of Flowering plants, Springer, Netherlands.
6. Simpson, M.G- Plant Systematics. Elsevier Academic Press, London
7. Singh G. - Plant systematics: Theory and Practice. Oxford and IBH Pvt. Ltd. New Delhi.
8. Takhtajan --- Flowering Plants Edinburg, Oliver & Boyd.

BOT 202C: PHARMACOGNOSY and ETHNOBOTANY.**No of Lectures – 32.****Course Outline—**

1. Aims ,Objectives of Pharmacognosy,
2. Methods of identification (Eg: Ginger, Turmeric, Chirata, Rauwolfia, Adhatoda, Ipecae, Basil, Andrographis, Cinchona, Opium Poppy),
3. Plant crude drugs: Types, methods of collection, processing and storage practices. Evaluation of crude drugs, Adulteration of plant crude drugs and methods of identification.
4. Ethnobotany at a glance--Diversity and development of folk taxonomies,
5. Securing the genetic heritage, Traditonal and indigenous knowledge system of Tribes of NE India, Intellectual Property Rights.

BOT 202C (Practicals).

1. Organogaphis studies of Ginger, Turmeric, Chirata, Rauwolfia, Adhatoda, Ipecae, Basil, Andrographis, Cinchona & Opium Poppy

2. Study of select plant Aswagandha(*Withania somnifera*), Jaluk (*Piper longum*), Amlokhi (*Phyllanthus emblica*), Brahmi (*Bacopa monnieri*), Kalabanda (*Aloe vera*).

(All Practicals should be supported with field studies, field reports, herbariums and collections or photographs and Practical records).

Suggested Readings:

1. Jain SK - *Glimpses of Indian Ethnobotany* Oxford & IBH, New Delhi
2. Jain SK - *A Manual on Ethnobotany* Scientific Publisher Jodhpur
3. Jain SK and Mundgal -*Handbook of Ethnobotany* London,
4. P.C.Trivedi: Ethnobotany.
5. Quadri & Shah: Pharmacognosy.

BOT 203C: Ecology, Biodiversity and Conservation.

No of Lectures – 32.

Course Outline—

Ecology:

1. Introduction: Holocoenotic nature of environment, Climatic factors Edaphic factor (soil profile, physico-chemical properties).
2. Plant adaptations in response to water, temperature and light (Morphological, anatomical and physiological response).
3. Ecosystem: structure and function - food chain, food web, energy flow, biogeochemical cycles (carbon, nitrogen, phosphorus), ecological pyramids.
4. Population ecology: Concept, Density, Natality and Mortality, Age distribution of population, Carrying capacity, Population interactions.
5. Community ecology: Introduction, Community characteristics (density, frequency, cover), ecological succession: types and pattern, Concept of species diversity – α , β and γ .
6. Environmental pollution: water, air & soil and their impact on ecosystems, EIA, ecological footprint, plant indicators.

BIODIVERSITY AND CONSERVATION:

1. Concept & scope of biodiversity, levels and value of biodiversity, Threats to biodiversity, Importance of biodiversity.
2. Hotspot of Biodiversity in India, Biodiversity in India with special reference to North eastern region, endemism.
3. The Earth Summit, Conservation (IUCN) of biodiversity, Significance of conservation of biodiversity, extinction of species. Conservation of Bamboo, Botanic garden, National parks and protected areas.
4. Evidences, theories and mechanism of evolution; origin of new species, gene pool; genetic drift; changes in gene frequencies in population.

BOT 203C (Practicals)

- To study about the working principle and uses of instruments for the measurement of :
 - Temperature (air and soil) ;
 - Moisture(rainfall and relative humidity) ;
 - Wind velocity ;
 - Light intensity.
- Quantitative analysis of abundance, density and frequency of herbaceous vegetation by quadrat method.
- To measure the dissolved oxygen content in polluted and unpolluted water samples.
- Study of anatomical peculiarities with reference to ecological adaptations (xerophytes: Nerium Leaf, Aloe & Cocoloba and hydrophytes: Hydrilla, Water Hyacinth & Nymphaea).
- Study of vegetation, local and different localities in the state through academic excursions.

(All Practical should be supported with field studies, field reports photographs and Practical records).

References

1. Kandy A K and Gupta A - Advances in frontiers of Ecological Researches in India,
2. Misra K C - Manuals of Plant Ecology (3rd Edition) Oxford and IBH Publishing Co., New
3. Odum, E P- Ecology. Oxford and IBH Publisher.

4. Sharma, P.D. - Ecology and Environment, (8th Edition) Rastogi Publications, Meerut.
5. Singh, J S., Singh, SP. and Gupta, S- Ecology Environment and Resource Conservation.
6. Wilkinson, D.M. - Fundamental Processes in Ecology. An Earth System Approach.

BOT 204E: Cell Biology and Genetics

No of Lectures – 32.

Course Outline—

1. Structure of prokaryotic and eukaryotic cell, ultra structure of nucleus, mitochondria and chloroplast
2. Chromosome organisation- morphology of chromosome, types of chromosome; structure and function of DNA and RNA & their replications
3. Cell division- Mitosis and Meiosis and their significance
4. Gene expression- Structure of genes, protein synthesis, regulation of gene expression in prokaryotic and eukaryotic cell
5. Mendelian genetics- Laws of segregation and independent assortment, allelic and non-allelic interactions, incomplete dominance
6. Linkage & crossing over and their significance; changes in chromosome structure and number and their role in evolution, mutations- Spontaneous and induced

BOT 204E: (Practicals)

1. Study of various stages of mitosis and meiosis using appropriate stain and plant materials.
2. Karyotype study in onion, garlic and Aloe vera
3. Study of chromosomal aberration in *Tradescantia* / *Rhoeo*
4. Study of gene interaction
5. Study of emasculation process in any plant
6. Submission of permanent slides (at least 5 numbers).
 - **Practicals should be supported with Practical records.**

SEMESTER – III

BOT 301C	Instrumentation and Laboratory Techniques
BOT 302C	Cell Biology
BOT 303C	Molecular Biology
BOT 304E	Plant physiology and biochemistry

BOT 301C: Instrumentation and Laboratory Techniques.

No of Lectures – 32.

Course Outline—

Instrumentation:

1. Scope and development of biophysics, Microscopy: working principles of electron, electron Microscope- TEM/SEM , phase contrast and fluorescence microscopy; image documentation: camera lucida principle, Types and techniques of micro technique, principles and applications of hot air oven, incubators, autoclave, and laminar air flow chamber, centrifuge, lux meter, pH meter.
2. Chromatography: introduction , definition , concept of partition co efficient, paper chromatography- principle, method advantages; TLC and column chromatography, spectrophotometry, Mass spectrophotometry , X-ray crystallography, chromatography, autoradiography.

Laboratory techniques:

1. Fixatives and stains: principles, types, procedures and application; methods of sterilization and culture media; mounting media,
2. Concept of solutions, indicators, pH and buffers (Preparation of normal, molal, molar, ppm and percent solutions; reagents (Acid & Base), different indicators, pH and buffer).
3. Field and herbarium techniques, preservation of museum and herbarium specimation , preservation techniques for special types of plant (submersed aquatic plant , succulent and xerophytes, palm, canes and bamboos)

BOT 301C (Practicals)

1. Preparation of solutions (normal, molal, molar, ppm and percent solutions) of known concentrations using pure samples and stock solutions.
2. Measurement of pH using pH meter.
3. Preparation of buffers (phosphate/ acetate buffer)
4. Paper chromatographic separation of any plant material,
5. Preparation of Reagents, Fixatives, stains and Indicators,
6. Determination of Plant pigments by Spectrophotometric method (absorption spectra).
7. Visit to some Laboratories outside the state.

Suggested Readings:

BIOLOGICAL INSTRUMENTATION

1. Bajpai, P.K.: Biological instrumentation & methodology.
2. Rana, S.V.S.: Biotechniques – Theory and Practice.

PLANT MICROTECHNIQUE

1. Johansen, D.A.: Plant Microtechnique.
2. Khasim, J. K.: Botanical Microtechnique, Principles and Practice.
3. Prasad and Prasad: Outlines of Botanical Micro technique.
4. Sas. Joe E: Botanical Microtechnique.

BOT 302C : Cell Biology

No of Lectures – 32.

Course Outline—

1. **Introduction to cell biology:** Introduction to cell, Cellular organelles -nucleus- structure and dynamism, chloroplast, mitochondria , endoplasmic reticulum, secretory membrane system and golgi apparatus, peroxisomes and endosomal membrane system, cilia & flagella.
2. **Membrane structure and function** (membrane pump, membrane carrier, membrane channels, membrane physiology), membrane trafficking.

3. Post translational targeting of **protein**, Signaling mechanism, signal transductions , signal protein.
4. Structure and function of DNA **and RNA, chromosome-** physical and chemical structure of chromosome, Histone code, special types of chromosome and their significance.
5. **Cell cycle:** Cell reproduction, cell cycle (G phase and regulation of cell proliferation, S phase, G2 phase.)

BOT 302 C: (Practical).

1. Study of cell by onion peeling,
2. Study of Mitosis and Meiosis.

Suggested Readings:

1. Alberts et al. : *Essential Cell Biology* Garland Publishers
2. Berry, A. K. : A Text Book of Cell Biology
3. Power, C. B.: Cell Biology.
4. Rastogi, S. C.: Cell biology.
5. Singh S.P & B. S. Tomar: Cell biology.
6. Sundara Rajan, S.: Introduction Cell Biology.

BOT 303C: Molecular biology

No of Lectures – 32.

Course Outline—

1. Protein structure and modifications, Structure and organisation of gene, expression and regulation of gene in prokaryotes (Lac operon concept), genetic code; properties and evidences.
2. DNA replication , transcription and translation in prokaryotes, concept of exons and introns,
3. Mutation: point mutation – deletion, insertion and substitution, chemical mutagenesis (tautomerization, alkylation, deamination, base analogues, dimerization).

BOT 303C: (Practicals)

1. Prepare the standard curve of protein and determine protein content in plant materials by Biuret method.

2. Separate and identify amino acids present in plant extract by (i) Paper Chromatography, (ii) Thin Layer chromatography.
3. Determine Titratable Acid Number (TAN) in Bryophyllum leaves.
4. Visit to some Laboratories inside/outside the state.

Suggested Readings:

1. Alberts et al., Molecular Biology of the Cell Garland Publishers
2. Becker, W. M. et al., The World of the Cell. 7th edition. P. B. C. Publishing, San Francisco.
3. Upadhyaya A. and K Upadhyayo-Basic Molecular Biology Himalaya Publishers.

BOT 304E: Plant physiology and biochemistry

No of Lectures – 32.

Course Outline—

1. Plant water relations: Permeability, diffusion, osmosis, Plasmolysis, imbibitions, Absorption of water- Ascent of sap- Transpiration.
2. Mineral nutrition: role in plants (deficiency, symptoms, disease and function), Translocation of organic solutes-Mechanism.
3. Plant metabolism: Photosynthesis: Respiration,
4. Growth and development: Plant growth substances, hormones and their practical application; seed dormancy, physiology of flowering, plant movements.
5. Biochemistry: introduction, different organic constituents of the cell, functions of carbohydrates(mono/oligo/polysaccharides)starch, cellulose, hemicelluloses, proteins and nucleic acids, lipid , alkaloids, gums, mucilage and organic acids; nitrogen metabolism; introduction, physical and biological nitrogen fixation, nitrogen in soil, ammonification and nitrification, denitrification; enzyme and co-factors.

BOT 304E: (Practicals)

1. Determine the osmotic potential of cell sap by plasmolytic method.
2. Determine the diffusion pressure deficit (DPD) of plant cells by wt method.
3. Determine the effect of time period on the rate of imbibitions in different types of seeds.
4. Measure the effect of different environmental conditions on the rate of transpiration of a twig by Ganong's Potometer.
5. Determine the effect of CO₂ concentration on the rate of photosynthesis.
6. Determine RQ of different germinating seeds.
7. Qualitative analysis of plant materials to prove the presence of sucrose, glucose, proteins, fats and cellulose.

SEMESTER – IV

BOT 401C	Anatomy & Embryology
BOT 402C	Microbiology
BOT 403C	Plant Pathology
BOT 404E	Diversity of Seed Plants and their systematic

BOT 401C: Anatomy & Embryology

No of Lectures – 32

Course Outline—

Plant anatomy:

1. Introduction: Brief history and significance,
2. Plant cell- Structure, types with regard to size and shape
3. Cell wall and cell membrane: Origin, ultra structure, chemical constituents and function of Cell wall and cell membrane, Models of cell membrane and organization, Growth of cell wall - Apposition, Intususception, Extra cell wall materials - lignin, cutin, suberin callose, wax., Cell wall properties.
4. Non-living inclusions with special emphasis on economic importance:-
 - a. Reserve food materials - carbohydrates, proteins, fats & oils
 - b. Secretory materials.
 - c. Waste materials - Nitrogenous – alkaloids, Non-nitrogenous - glucosides, gums, resins, tannins, Mineral crystals - Calcium oxallate - raphides, Calcium carbonate - cystoliths with examples

5. Tissues and their classification:

- a. Theories of structural development and differentiation of roots and shoots,
- b. Different tissue systems and their functions,
- c. Anatomy of primary monocot and dicot roots/stems,
- d. Secondary growth of stems and roots (normal and anomalous).

Embryology of Angiosperms:

1. Basics of embryology, microsporogenesis and megasporogenesis, development of male and female gametophytes.
2. Types of embryosacs and evolutionary significance.
3. Fertilization, embryo development, polyembryony, apomixis, endosperm development, types, haustorial structure.
4. Experimental embryology: role in crop improvement.

BOT 401C: (Practicals).

Anatomy:

1. Gross anatomy: Study of gross anatomical details of cells, tissues and various other organs of plants
2. Microscopic studies on: types of stomata, (Monocot and dicot)
3. Anatomical study of stem and root (Dicots and Monocots) by making double stained temporary/permanent slides
4. Anatomical studies of anomalous secondary structure in stem of *Mirabilis*, *Bignonia*, *Bougainvillea* and *Dracaena* by making double stained permanent slides

Embryology:

1. Study from permanent preparation of slides
2. T.S. of young Anther; T.S. of mature Anther.
3. L.S. of different types of Ovules.
4. L.S. of ovule showing different nuclear stages of embryo sac.
5. L.S. of ovule showing types of Endosperm
6. L.S. of Embryo – Dicotyledonous, Monocotyledonous.

Suggested Readings:

1. Bhojwani, S.S & S.P. Bhatnagar: The Embryology of Angiosperms.
2. Cuttler, E.G. - Plant Anatomy, Edward Arnold Ltd., London.
3. Eames, AJ and LH Mac Daniels-An Introduction to Plant Anatomy. Tata MacGraw- Hill Publishing Company Ltd. New Delhi.
4. Esau k - Plant Anatomy 2nd Edition Wiley Eastern, New Delhi.
5. Johri, B.D- : Embryology of Angiosperms.
6. Maheshwari, P.: An Introduction to the Embryology of Angiosperms.
7. Pandey, S.N. & A. Chadha: Plant Anatomy & Embryology.
8. Sen DN - Anatomy of Angiosperms. S. Nagini & Co.
9. Vasishta P.C. - Plant Anatomy, Pradeep Publication, Jalandhar.

BOT 402C: Microbiology**No of Lectures – 32.****Course Outline—****Microbiology:**

1. General Microbiology: History and development, scope of Microbiology, introduction to microbial world, isolation of microorganisms, different culture media, pure culture concept, germ theory of disease and Koch's postulates. Control of microorganisms, Microbial nutrition, growth and metabolism, microbiology of soil, air and water, role of microorganisms in biogeochemical cycles (N, C, S cycles) in nature.
2. Microbial taxonomy and its modern trends, distinguishing features of Actinomycetes, Archaeobacteria and Mycoplasma, Rickettsiae & Chlamydiae. Concept of immunology, types of immunity, antigen and antibody-structure and classes.
3. General account & Classification of Bacteria-Modern concept of Bacterial cell, - genetic recombination; Economic uses of bacteria.
4. General characteristics, classification, nature & Transmission of Viruses, Replication of viruses. Viroids, Virusoids, Prions,

BOT 402C: (Practicals)

1. Techniques on cleaning and Sterilization of equipments.
2. Preparation of media (Potato-dextrose- Agar and Rose Bengal Agar Media)
3. Pure culture technique: slant, Streak-plate methods; Pour-plate method.
4. Inoculation of microbes from air, soil and water by serial dilution.
5. Determination of microbial population by haemocytometer.
6. Study of Gram positive and Gram negative bacteria.
7. Isolation of *Rhizobium* from root nodules.

Suggested Readings:

1. Banerjee, A. K. & N. Banerjee: Fundamentals of Microbiology and Immunology.
2. Clifton, A. : Introduction to Bacteria
3. Dubey, R. C & D.K. Maheswari: A Text Book of Microbiology.
4. Kumar, H. D. & S. Kumar: Modern Concept of Microbiology.
5. Madahar, C. L.: Introduction of Plant Virus.
6. Pelczar, Chan and King : Microbiology
7. Purohit, S. S.: Microbiology.
8. Purohit, S. S. : Viruses, Bacteria and Mycoplasma
9. Rangaswami, R. & C. K. J. Panikar: Text Book of Microbiology.
10. Singh, V. & V. Srivastava: Introduction of Bacteria.

BOT 403C: Plant Pathology

No of Lectures – 32.

Course Outline—

Plant Pathology:

1. General account and historical development; Common symptoms of plant diseases; mode of infection, Host-parasite interaction, Physiology of parasitism, Defense mechanism: concept and definition; structural, chemical and biochemical mechanisms , dissemination and transmission of plant pathogens, Epidemiology. Plant disease management- chemical control, biological control and development of transgenic for controlling plant diseases.

2. Concept of disease cycle, Study of following diseases with reference to causal organisms, symptoms, disease cycle and control measures: Late blight of potato, Rust of wheat, Grey blight of tea, White rust of crucifers, Powdery mildew of pea, Leaf spot disease of cabbage, Citrus canker, Yellow mosaic of bhindi, , and Tobacco mosaic virus (TMV) disease .
3. Disease resistance, R genes. gene for gene concept , immunity (PTI & ETI), hypersensitive response and cell death; Physiology of parasitism; Host-parasite interaction.

BOT 403C: (Practicals)

1. Isolation of fungal pathogens from diseased plant parts.
2. Isolation and culture of plant pathogen and establishment of Koch's postulates and their pathogenicity.
3. Study of plant diseases like Late blight of potato; Black rust of *Justicia* and wheat; Leaf spot disease of cabbage; Grey blight disease of tea; Citrus canker; Yellow mosaic disease of papaya and bhindi; Tobacco mosaic virus representing Fungal, Bacterial and Viral diseases studying their symptoms and by making permanent slides where ever possible.

Collection, identification and preparation of field notes on diseased specimen of any locality (at least 10 numbers).

Suggested Readings:

1. Agrios, G.N- Plant Pathology, 4th edition, Academic Press, U.K.
2. Bilgrami & Dube: A Text Book of Modern Plant Pathology.
3. Mehotra RS - Plant Pathology 12th Edition, Tata Mc Graw-Hill Co, New Delhi
4. Pandey, B.P.: Plant Pathology, Pathogen and Plant Diseases.
5. Pathak, V.N.: Fundamentals of Plant Pathology.
6. Rangaswami, G.: Diseases of Crop Plants of India.
7. Sharma, P.D.: Plant Pathology.
8. Singh, R.S- Plant Diseases. 7th edition, Oxford and IBH, New Delhi
9. Wheeler B.E J - An Introduction to Plant Diseases, Oxford and IBH.

BOT 404E: Diversity of Seed Plants and their systematic.

No. of Lectures – 32

Course Outline—

1. Taxonomy of angiosperms: Introduction, scope & objectives, binomial nomenclature, taxonomic ranks.
2. General accounts of system of classifications- Artificial, Natural, Phylogenetic, Salient features of classification systems with merits and demerits of Bentham & Hooker; Engler & Prantl.
3. Diversity of flowering plants: Systematic position (Bentham & Hooker system) distribution, general characters, floral formula, floral diagram, distinguishing characters and economically important plants of the following families:
 - a) Dicotyledons :: i) Magnoliaceae, ii) Malvaceae, iii) Papilionaceae, iv) Caesalpinaceae, v) Mimosaceae, vi) Apiaceae, vii) Euphorbiaceae, viii) Lamiaceae, ix) Solanaceae, X) Verbenaceae, xi) Asteraceae.
 - b) Monocotyledons: **i. Poaceae**, ii. Orchidaceae

BOT 404E: (Practicals)

1. Angiosperms: Description of specimens from representative of locally available plants belonging to the families included in theory syllabus.
2. Submission of practical notebooks, permanent slides.
3. Local field studies, Field work report, collection or photograph.

SEMESTER - V

BOT 501C	Plant Physiology
BOT 502C	Biochemistry, Palynology & Biomatrix
BOT 503C	Cytogenetics & Plant Breeding
BOT 504E	Structure, development and reproduction in flowering plants

BOT 501C: Plant Physiology

No of Lectures – 32

Course Outline—

1. Plant-soil-water relationship: absorption, transpiration, ascent of sap, Mineral nutrition and mineral salt absorption, criteria of essentiality of elements, deficiency symptoms.
2. Carbon assimilation (C_3 , C_2 , C_4 cycle, CAM pathway) and chemosynthesis, Respiration- Breakdown of sugar.
3. Translocation of organic solutes, Amino acid metabolism.
4. Enzymes, Growth and development, Growth Hormones, Application of plant growth regulators in agriculture, physiology of flowering- photoperiodism and vernalization; seed dormancy; senescence and aging; stress physiology –concept of biotic and abiotic and xenobiotic stress.

BOT 501C (Practicals)

1. Determine the osmotic potential of cell sap by plasmolytic method.tissue.
2. Determine the water potential of plant tissue.
3. Determine the stomatal index, stomatal frequency and estimate the transpiration rate of different types of leaves.
4. Study the effect of temperature on the rate of imbibitions and determine the Q_{10} .
5. Determine RQ of different plant materials (Seeds, Leaf buds, Flower buds).
6. Determine effect of CO_2 concentration on the rate of photosynthesis.
7. Extract and separate chloroplast pigments by solvent method and Paper chromatography.
8. Quantitative estimation of reducing sugar and total sugar by Somogyi's method.

BOT 502C: Biochemistry, Palynology & Biomatrix

No. of Lectures – 32.

Course Outline—

Biochemistry:

1. introduction, different organic constituents of the cell, functions of carbohydrates (mono/oligo/polysaccharides) starch, cellulose, hemicelluloses, proteins and nucleic acids, lipid, alkaloids, gums, mucilage and organic acids;
2. Nitrogen metabolism-introduction, physical and biological nitrogen fixation, nitrogen in soil, ammonification and nitrification, denitrification;
3. Enzyme and co-factors.

Palynology:

1. Aspects and prospects of Palynology, historical perspective,
2. Pollen morphology, Types of Pollen production and dispersion in time and space, methods of studying pollen and sterility,
3. Pollen- pistil interaction, Compatibility and incompatibility
4. Applied palynology: Aero - palynology, Pollen allergy;
5. Pollen/spore morphology and its role in taxonomy

Biomatrix:

1. Collection of data, Sampling theory and methods ; Measures of central tendency (mean, mode, median), Standard deviation and Standard error. Coefficient of variation, Probability, Test of significance(t-test, chi-square test), ANOVA, Measurement of gene frequency, Hardy-Weinberg equilibrium .

BOT 502C: (Practicals)

1. Qualitative analysis of sugar, starch, fats & oil in plant material.
2. Qualitative analysis of the presence of proteins, cellulose and hemicelluloses in plant material.
3. Qualitative analysis of plant ash to prove the presence of Iron, Potassium, Calcium, Magnesium, Phosphorus.

4. Study the pollen morphology of *Hibiscus*, *Datura*, and pollinia of *Cryptostegia* and *Calotropis* by acetolytic method
5. Viability test for pollen
6. *In vitro* germination using sugar solution. (cavity slide method)
7. Tetrazolium test, Acetocarmine test (Acetocarmine & Glycerine 1:1).
8. To work out mean, mode, standard deviation and standard error.

- Submission of practical notebooks.

Suggested Readings:

1. Erdtman, G.: Pollen Morphology and Plant Taxonomy.
2. Faegri, K. & J. Iverson: Text Book of Pollen Analysis.
3. Malik, C.P.: Plant Physiology.
4. Mandal and Nambiar Agricultural Statistics, Agrobios Publications, Jodhpur
5. Mukherji, S, & A.K. Ghosh: Plant Physiology.
6. Nair, P.K.K.: Pollen Morphology of Angiosperms.
7. Nelson, D.L., Cox, M.M- Lehninger Principles of Biochemistry, 4th Edition, WH Freeman and Company, New York, USA.
8. Parihar P Biostatistics & Biometry, Agrobios Publications, Jodhpur
9. Salisbury, F.B. and Ross, C.W- Plant Physiology, Wadsworth Publishing Co. Ltd.
10. Steve Selvin. : Biostatistics: how it works
11. Wilkins, M.B.: Advanced Plant Physiology.

BOT 503C: Cytogenetics & Plant Breeding.

No. of Lectures –32.

Course Outline—

1. Principles of inheritance- Mendel's law, allelic and non-allelic gene interaction, quantitative and polymeric gene interaction, epigenetics, sex linked inheritance , non mendelian inheritance, extra chromosomal inheritance.
2. Linkage and crossing over, recombination and cytological basis of crossing over, linkage map, - Structural and numerical changes of chromosome and their evolutionary significance .

3. Principles of plant breeding- -Introduction, domestication of crops, center of origin and diversity, selection , hybridization and back & test cross method, heterosis and inbreeding depression – genetic basis ;male sterility, breeding for disease resistance ,induced mutation and crop improvement, induction of polyploidy and crop evolution.

BOT 503C: (Practicals)

1. Karyotype study in onion, garlic and Aloe vera ,
2. Study of chromosomal aberration in *Tradescantia* / *Rhoeo*
3. Study of gene interaction
4. Study of emasculation process in any plant

Submission of permanent slides (at least 5 numbers).

Suggested Readings:

1. Chauduri, H.K. : Elementary Principles of Plant Breeding.
2. Gupta, P.K. : Genetics.
3. Pawar, C.B. : Genetics- (Vol. I & II)
4. Powar, C.B. : Essential of Cytology
5. Singh, B.D. : Plant Breeding.
6. Strickberger : Genetics Shukla & Chandel. : Cytogenetics & Plant Breeding
7. Verma, P.S. & V.K. Agarwal : Genetics.

BOT 504E: Structure, development and reproduction in flowering plants.

No of Lectures – 32.

Course Outline—

1. Basic body plant of flowering plants, modular type of growth, diversity in plant forms- annuals, biennials and perennials, historical organisation of root and shoot apices, various theories of cellular organisation.
2. Types of tissue: meristematic tissue- meristem, structure and types based on origin and position, permanent tissues:simple, complex and secretory , epidermal tissue: trichomes and stomata.

3. Anatomy: primary structure of root, stem and leaf of monocot and dicot, secondary growth in root and stem, wood anatomy: growth rings, heart wood and sap wood, periderm: origin, structure and functions, floral biology.
4. Embryology: microsporogenesis and development of male gametophyte, megasporogenesis and development of female gametophyte, double fertilization and its significance.
5. Development of dicot embryo, structure, development and types of endosperm, fruit: development and maturation of fruit, types and parts of fruits, fruit dispersal strategies, vegetative propagation: grafting, layering and budding.
6. Seed: types of seed, germination of seed types and nature and dispersal of seeds, factors affecting germination.

BOT 504E: (Practicals)

1. Study of non-living cell inclusions (ergastic matters): starch grain, aleurone grains, raphides, cystolith.
2. Study of types of stomata.
3. Study of epidermal hairs.
4. Study of secondary growth in thickness by permanent preparation of differentially stained slide: *Amaranthus*, *Boerhavia*, *Mirabilis*, *Bougainvillea*, *Dracaena*, *Tinospora*.
5. Study of permanent of slide: T.S. through young and mature anther; male gametophyte; L.S. of ovule showing different nuclear stages of embryo sac; L.S. of ovule showing types of endosperm; L.S. of embryo- dicotyledonous, monocotyledonous.
6. Study of spurious fruits, aggregate fruits, composite fruits (at least 2 types each).
7. Study the adaptation in fruits and seeds for dispersal through air (at least 4 types).
8. Demonstrate the process of: budding; air layering ; Scion grafting.

SEMESTER – VI

BOT 601C	Bio resources, Computer application
BOT 602C	Biotechnology & Bioinformatics
BOT 603C	Choice Based Credit Paper
BOT 604E	Ecology and Utilization of plants.

BOT 601C: Bio resources, Computer application

No of Lectures – 32

Course Outline—

Bio resources:

1. Plants for man – History, Origin of Cultivated Plants: Concept of centers of origin; Plant introduction; Crop domestication;
2. Classification of plant resources on the basis of their uses :
3. Cereals and their role in green revolution, Pulses, fats and oils, spices and condiments;.
4. History, Origin, cultivation and processing of Tea, Sugarcane and Rubber.
5. Characteristics and uses of Medicinal, Fiber, timber yielding plants.
6. Fruits ; Products and byproducts of sugar industry ; herbal dye (henna, manjistha, bixa);
7. Botany and uses of medicinal plants (*Holarhena*, *Rauwolfia*, *Catharanthus*, *Taxus*, *Plumbago*, *Azadirachta*, *Andrographis*).

Computer application:

1. **Application of Information and Communication Technology in life-science**, Internet as a knowledge repository, searching the internet: Browsers, search engines, Meta search engines, Boolean searching, Guidelines for proper usage of computers and internet.IT in teaching, learning and research: Web page designing and web hoisting. Academic web sites, e-journals, Open access initiatives and open access publishing, education software, academic services - INFLIBNET, NICNET, BRNET. Networking- LAN and WAN; Intranet and Internet. Internet protocols-IP address, and Domain Name System, URL.

BOT 601C: (Practicals).

Plant Resource Utilization:

1. Chemical tests for tannins (Tea); Alkaloids (*Vinca rosea*)
2. Pharmacognosical studies of both crude and powdered drugs - Zinger, Holarrhena, Rauwolfia
3. Histochemical test for *Curcuma longa*, starch in non-lignified vessels ,
4. (Zingiber); Alkaloid (*Andrographis*, Neem and *Plumbago*).

Computer Application: As per theory syllabus

BIORESOURCES—

1. Govind Prakash and S.K. Sharma : Introductory Economic Botany.
2. Nehra, S. : Economic Botany.
3. Pandey, B.P. : Economic Botany.
4. Pandey & Chaddha : Economic Botany
5. Subramanyam, Samba Murty : Economic Botany.

COMPUTER APPLICATIONS

1. Bangia, R. : Learning Computer Fundamentals.
2. Norton, P. : Introduction to Computers.
3. Rajaraman, V. : Fundamentals of Computers.
4. Sinha, P.K. : Computer Fundamentals.

BOT 602C: Biotechnology & Bioinformatics.

No of Lectures – 32

Course Outline—

Biotechnology:

1. History, scope and significance of biotechnology.
2. Plant tissue culture – different techniques, somaclonal variation .

3. transgenic plants, plant genetic engineering, techniques and applications (restriction enzymes, construction of DNA libraries, DNA fingerprinting, DNA sequencing),
4. Application in agriculture and medicines.

Bioinformatics:

1. Introduction to Bioinformatics, branches, aim, scope and research areas of bioinformatics.
2. Biological databases, classification format of databases, biological database retrieval systems,
3. Application of bioinformatics (basics of molecular phylogeny, drug discovery and drug design, DNA data bank, genomics, proteomics and their application in crop improvement).

BOT 602C: (Practicals).**Biotechnology:**

1. Preparation and sterilization of the medium, Slant preparation and Inoculation - MS medium.
2. Micro propagation of some important plants.
3. Demonstration of the technique of organ culture
4. Study of Genetic engineering Techniques (photographs): FISH, DNA Fingerprinting, DNA Sequencing, Gene gun, Ti plasmid.
5. Study of steps of genetic engineering techniques from photographs (Bt cotton, Golden rice, Bt Brinjal)
6. Construction of Restriction Map from the data provided.
7. Aseptic seed germination - legume seed
8. Demonstration of preparation of synthetic seeds

Bioinformatics:

1. Nucleic acid and protein databases.
2. Sequence retrieval from databases.
3. Sequence alignment.
4. Sequence homology and Gene annotation.
5. Construction of phylogenetic tree

BIOTECHNOLOGY:

1. Sambrook and Russel. Molecular Cloning: A laboratory manual. (3rd edition)
2. Slater, A., Scott, N. W. & Fowler, M.R- Plant Biotechnology: The Genetic Manipulation of Plants, Oxford University Press.
3. Smith, R- Plant Tissue Culture: Techniques and Experiments, 2nd edition, Academic Press
4. Watson, J. D., et al - Molecular Biology of the Gene 6th Edition. Pearson Pub.
5. Wilson K and J Walker - Principles and Techniques of Biochemistry and Molecular Biology 6th edition, Cambridge University Press, USA.

BIOINFORMATICS

1. Attwood, T.K.: Introduction to Bioinformatics.
2. Bansal, M.: Basic Bioinformatics.
3. Ghosh, Z. & B. Mallick: Bioinformatics: Principles and Applications.
4. Mukherjee, A.: Bioinformatics.
5. Ranga, M.M.: Bioinformatics.
6. Sundararajan, S. & R. Balaji: Introduction to Bioinformatics.

BOT 603C: (Theory +Practical) - (CHOICE BASED CREDIT PAPER)

No. Of Lectures – 32.

PAPERS OFFERED (any one from the following):-

- **METHODOLOGY AND PERSPECTIVES OF SCIENCE**
- **MUSHROOM CULTIVATION**
- **HORTICULTURE AND NURSERY MANAGEMENT**
- **BIOFERTILIZER TECHNOLOGY AND ORGANIC FARMING**

- **COURSE CONTENTS OF CHOICE BASED CREDIT PAPER.**

- **METHODOLOGY AND PERSPECTIVES OF SCIENCE**

Course Outline—

Unit- I: Science and scientific studies

Unit- II: Experimentation in science-

Unit- III: Methods in Biological Science

Unit- IV: Statistical methods

Unit- V: Application of Information and Communication Technology in lifescience

METHODOLOGY AND PERSPECTIVES OF SCIENCE (Practical)

- Preparation of solutions of known concentrations using pure samples and stock solutions
- Preparation of buffers (phosphate/ acetate buffer)
- Measurement of pH using pH meter.
- Paper chromatographic separation of aminoacids
- Demonstration of the working of different kinds of centrifuges
- Preparation of standard graph and determination of the concentration using colorimetry.
- Work out the problems related to mean, median, mode, standard deviation, probability, Chi-square test, t-test and correlation.
- Technique of data representation (tables, bar-diagram, histogram, pie-diagram and frequency curve (manual and using computer)

Suggested Readings:

1. Alberts *et al* -Essential Cell Biology Garland Publishers
2. Bajpai, P.K. : Biological instrumentation & methodology.
3. Johansen, D.A. : Plant Microtechnique.
4. Rana, S.V.S. : Biotechniques – Theory and Practice.
5. Sas. Joe E : Botanical Microtechnique.

- **MUSHROOM CULTIVATION**

Unit - I: INTRODUCTION

Unit - I: CULTIVATION

Unit - I: DISEASE MANAGEMENT

Unit - I: MARKETING

➤ MUSHROOM CULTIVATION (Practical)

1. Study of Mushroom Morphology and identification of edible and poisonous mushrooms.
2. Practical method of mushroom cultivation.

Suggested Reading --

1. Kaul T N -Biology and conservation of mushrooms. Oxford and IBH publishing company N.Delhi
2. Indian Journal of Mushrooms. Published by I.M.G.A. Mushroom Research Laboratory. College Agriculture, Solan
3. Peter Oei -Mushroom Cultivation III Edition, Backhuyes Publisher USA.
4. Krishnamoorthy AS., Marimuthu T and Nakkern S -Mushroom Biotechnology TNAU Press, Coimbatore, India
5. Nita Bahl - Handbook of Mushroom Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi

➤ HORTICULTURE AND NURSERY MANAGEMENT

Unit - I: Horticulture: Definition, history and development, scope and significance – Different branches of horticulture.

Unit - II: Vegetative and reproductive parts, life cycle of Angiosperm, Plant nomenclature.

Unit - III: External factors influencing propagation: Fertilizers – Chemical, organic, biofertilizer, vermi compost (Preparation) coir pith compost, Pots & potting – Irrigation, Shade regulation.

Unit - IV: Plant propagation – Introduction, principles, concept and significance – Role of propagation in human history. Vegetative propagation Seed propagation, Seed dormancy, seed treatment, transplanting techniques, Micropropagation / Tissue culture (on MS medium Tissue culture technique in different crops, Significances. Applications of tissue culture.

Unit - V: Nursery management, Gardening –. Indoor & Outdoor gardening.

Unit - VI: Floriculture, Ornamental plants, Medicinal plants. Olericulture, Oyster Mushroom culture.

Unit - VII: Protection of Horticultural plants, Harvesting and post harvest management: harvesting, handling, storing, fumigation, preservation and processing of horticultural produces.

Unit - VIII: Marketing : Strategies to ensure market, participatory approach – significance.

Practicals:.

- Preparation of nursery bed and polybag filling.
- Preparation of potting mixture – Potting and repotting.
- Field work in cutting, grafting, budding, layering.
- Identification of plant pests and diseases of in the campus.
- Identification and use of garden tools and implements.
- Laying out drip irrigation, sprinklers.
- Topiary and pruning.
- Establishment of vegetable garden.
- Fruit preservation methods.
- Cultivation of an important horticultural crop or a flower or a medicinal plant and prepare a report on the same.

Visit of important nurseries and tissue culture laboratories and submission of report.

References:

1. Andiance and Brison- Propagation Horticultural Plants.
2. Bal, J.S-Fruit growing-Kalyani Publishers, Delhi.
3. Chanda, K.L. and Choudhury, B. Ornamental Horticulture in India.
4. George Acquaah, Horticulture: Principles and Practices. Pearson Education, Delhi.
5. Pandey B P- A textbook of fungi. Chand and company N Delhi.
6. Prasad, S., and U. Kumar. Green house Management for Horticultural Crops, Agrobios, Jodhpur.
7. Premchand, Agriculture and Forest Pest and their Management, Oxford Publication.

➤ **BIOFERTILIZER TECHNOLOGY AND ORGANIC FARMING.**

Unit I: SOIL MICROBIOLOGY

- Biofertilizers, ecofarming, Soil , Mineral particles , Humus, soil atmosphere, soil water , Properties of soils and biological system
- Soil microorganisms - soil flora, role of soil organisms, Methods of studying micro organisms

Unit II: APPLIED MICROBIOLOGY,

Unit III: ORGANIC FARMING

- Soil Fertility, Organic Matter Decomposition, Anaerobic *fermentation* of Human, Animal and Agricultural wastes, Vermi culture, Plant protection Studies Insecticidal Material for common use: Kerosene emulsion, Tobacco decoction, Neem kernel supervision, Pheromone trap

Practical:

1. Algal inoculum preparation - Small scale; Large scale
2. *Azolla* inoculum preparations, spore production
3. *Rhizobium* - methods of inoculation
4. *Azospirillum* inoculation
5. Inoculation production of VAM fungi
6. Preparation of biopesticides and fungicides

References:

1. Elkan, H.H- Taxonomy and metabolism of *Rhizobium* and its genetic relationship in biological nitrogen fixation, Ed. M. Alexander. Plenum Press, New York.
2. Kanniyar.S- Biofertilizer Technology for Rice. TNAU , Coimbatore
3. Lumpkin T.A and D.L. Plucknett, - *Azolla*; Botany, Physiology and use as a green manure. *Econ.Bot*; 34:111-153.
4. Subha Rao, N.S. - Biofertilizers in agriculture and forestry. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

BOT 604E: Ecology and Utilization of plants.

No of Lectures – 32

Course Outline—

ECOLOGY:

- Ecology: Introduction, ecological organization- species population, community ecosystem and biosphere, Kinds of ecosystem, structure and function of ecosystem, abiotic components, biotic components and their role
- Ecological succession- types & pattern, food chain, food web, ecological pyramid
- Bio- geo chemical cycles- Concept, details of nitrogen and carbon cycle, composition and functioning of ecosystem: i) Simple- pond ecosystem, ii) Complex- forest ecosystem, iii) Artificial- Crop land ecosystem
- Ecological grouping of plants with reference to their significance of adaptive external and internal features: Hydrophytes and Xerophytes. Environmental pollution with special reference to Air and Water pollution- causes, effects and control measures; Green house effect

UTILIZATION OF PLANTS:

- Classification of plants on the basis of botanical sources and uses of rice, wheat, maize
- Sugarcane, Gram, Pea, Coffee and Tea, Black pepper, Turmeric, Clove and Mustard- their uses & botanical sources
- Non- timber plant products- cotton, jute, rubber, bamboo and jatropa. Their uses and botanical sources
- Timber & medicinal plant resources: Teak, Sal, Rauvolfia, Neem, Cinchona- their uses and botanical sources

BOT 604E: (Practicals)

ECOLOGY:

1. Determine the frequency and density of herbaceous species by quadrat method
2. Study the anatomical features of some common Hydrophytes: Root of Eichhornia, petiole of Eichhornia, stem of *Hydrilla*, petiole of *Nymphaea*, Xerophytes: Leaf of *Nerium*, leaf of *Thevetia*, leaf of grass
3. Test for the presence of inorganic salts in the soil: Chloride, Sulphate, Phosphate

UTILIZATION OF PLANTS:

Study the morphology, parts used, chemical nature and uses of the following plants-

1. Cereals- Rice
2. Pulses and legumes- Pea
3. Beverages- Tea
4. Fibres- Cotton, Jute
5. Fats and oils- Mustard
6. Spices- Black pepper, turmeric
7. Medicinal- Neem, Rauwolfia
8. Fuel- Jatropha
9. Sugar- Sugarcane