

**Adikavi Nannaya University**  
**III B. Sc - SEMESTER- V: BOTANY SYLLABUS**  
**THEORY PAPER – V**  
**Paper-V: Cell Biology, Genetics and Plant Breeding**  
 Total hours of teaching 60 hrs @ 3 hrs per week

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**UNIT – I Cell Biology:**

**(12hrs)**

1. Cell, the unit of life- Cell theory, Prokaryotic and eukaryotic cells; Eukaryotic cell components.
2. Ultra structure and functions of cell wall and cell membranes.
3. Chromosomes: morphology, organization of DNA in a chromosome (nucleosome model), Euchromatin and heterochromatin.

**UNIT – II Genetic Material:**

**(12hrs)**

1. DNA structure (Watson & Crick model) and replication of DNA (semi-conservative)
2. Types of RNA (mRNA, tRNA, rRNA), their structure and function.

**UNIT – III Mendelian Inheritance:**

**(12 hrs)**

1. Mendel's laws of Inheritance (Mono- and Di- hybrid crosses); backcross and test cross.
2. Chromosomal mapping – 2-point & 3-point test cross.
3. Linkage: concept, complete and incomplete linkage, coupling and repulsion
4. Crossing Over: concept & significance.

**UNIT – IV Plant Breeding:**

**(12 hrs)**

1. Introduction and Objectives of plant breeding.
2. Methods of crop improvement: Procedure, advantages and limitations of Introduction, Selection, and Hybridization (outlines only).

**UNIT – V Breeding, Crop Improvement and Biotechnology:**

**(12 hrs)**

1. Role of mutations in crop improvement.
2. Role of somaclonal variations in crop improvement.
3. Molecular breeding – use of DNA markers in plant breeding and crop improvement (RAPD, RFLP).

**Suggested activity:** Seminar, Debate, Quiz, observation of live cells and nucleus in Onion peels, observation of Meiotic nuclei in Maize pollen. Solving Genetics problems.

**Books for Reference:**

1. Old, R.W. and Primrose S.B. 1994, Principles of Gene Manipulation Blackwell Science, London
2. Grierson, D. and Convey S.N. 1989, Plant Molecular Biology, Blackie Publishers, New York.

2. Lea, P.J. and Leegood R.C. 1999, Plant Biochemistry and Molecular Biology, John Wiley and Sons, London.
3. Power C.B., 1984, Cell Biology, Himalaya Publishing Co. Mumbai
4. De. Robertis and De Robertis, 1998, Cell and Moleceular Biology, K.M. Verghese and Company .
5. Sinnott, E.W., L.C. Dunn & J. Dobshansky (1958) : Principles of Genetics (5th Edition) McGraw Hill Publishing Co., N.Y. Toronto, London.
6. Winchester, A.M. (1958) : Genetics(3rd Edition) Oxford & IBH Publishing House, Calcutta, Bombay, New Delhi.
7. Singleton, R.(1963) : Elementary Genetics, D. Van Nostrand Co., Ltd., Inc., N.Y. & Affiliated East West Press (P) Ltd., New Delhi.
8. Strickberger, M.W. (1976): Genetics(2nd Edition) MacMillan Publishing Co., Inc., N.Y., London
9. Watson, J.D. (1977): Molecular Biology of the Gene, W.A. Benjamin, Inc., Menlo Park-California, Reading-Massachusetts, London, Amsterdam, Don Mills, Ontario, Sydney.
10. Gardner,E.J & Snusted, D.P.(1984): Principles of Genetics (7thedition) John Wiley & Sons, N.Y. Chichester, Brisbane, Toronto, Singapore.
11. Lewin, B. (1985) Genes VII Wiley Eastern Ltd., New Delhi, Bombay, Calcutta, Madras, Hydrabad.
12. Allard R.W(1999): The Principles of Plant Breeding, John & Wiley and Sons.
13. Poelman J.M: Breeding Field Crops, Springer.
14. George Acquaaah(2012):Principles of Plant Genetics & Breeding: Wiley-Blackwell.

### III B. Sc - BOTANY SYLLABUS SEMESTER- V

#### Practical Paper-V: CELL BIOLOGY, GENETICS AND PLANT BREEDING

Total hours of teaching 30hrs @ 2hrs per week

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#### Suggested Laboratory Exercises:

1. Study of the structure of cell organelles through photomicrographs.
2. Study of structure of plant cell through temporary mounts.
3. Study of various stages of mitosis using cytological preparation of Onion root tips.
4. Study of effect of organic solvent on permeability of cell membrane.
5. Numerical problems solving Mendel's Laws of inheritance
6. Chromosome mapping using 3 point test cross data.
7. Hybridization techniques – emasculation, bagging (for demonstration only).
8. Field visit to a plant breeding research station.

### III B. Sc – SEMESTER- V, BOTANY PRACTICAL MODEL PAPER PAPER-V: CELL BIOLOGY, GENETICS AND PLANT BREEDING

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1. Perform the Experiment A .Perform squash on onion root tip, prepare the slide, identify at least one division stage. Write the procedure and draw the diagram of reported stage.

1 x 15 = 15marks

2. Describe the procedure of Hybridization technique B

1 x 10 = 10 marks

3. Solving numerical problems on Mendelian inheritance C,D

2x 7 1/2 =15 marks

1. Record & Viva

= 10 marks

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50 marks

A-Onion root squash technique

B- Emasculation & Bagging

C&D Numerical problems on Mendelian Inheritance.

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**III B. Sc - SEMESTER- V: BOTANY THEORY SYLLABUS**  
**PAPER-VI: PLANT ECOLOGY & PHYTOGEOGRAPHY**

Total hours of teaching 60 hrs @ 3 hrs per week

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**UNIT – I. Elements of Ecology (12 hrs)**

1. Ecology: definition, branches and significance of ecology.
2. Climatic Factors: Light, Temperature.
3. Edaphic Factor: Origin, formation, composition and soil profile.
4. Biotic Factor: Interactions between plants and animals.

**UNIT– II. Ecosystem Ecology (12 hrs)**

1. Ecosystem: Concept and components, energy flow, Food chain, Food web, Ecological pyramids.
2. Productivity of ecosystem-Primary, Secondary and Net productivity.
3. Biogeochemical cycles- Carbon, Nitrogen and Phosphorous.

**UNIT – II Population & Community Ecology (12 hrs)**

1. Population -definition, characteristics and importance, outlines –ecotypes.
2. Plant communities- characters of a community, outlines – Frequency, density, cover, life forms, competition.
3. Interaction between plants growing in a community.

**UNIT – IV Phytogeography (12 hrs)**

1. Principles of Phytogeography, Distribution (wides, endemic, discontinuous species)
2. Phytogeographic regions of India.
3. Phytogeographic regions of World.
4. Endemism – types and causes

**UNIT- V: Plant Biodiversity and its importance (12 hrs)**

1. Definition, levels of biodiversity-genetic, species and ecosystem.
2. Biodiversity hotspots- Criteria, Biodiversity hotspots of India.
3. Loss of biodiversity – causes and conservation (*In-situ* and *ex-situ* methods).
4. Seed banks - conservation of genetic resources and their importance

**Suggested activity** :Collection of different soils, studying their texture, observing polluted water bodies, student study projects, debates on man's activity on ecosystem and biodiversity conservation methods, visiting a nearest natural vegetation area. Visit to NGO, working in the field of biodiversity and report writing; to study Honey Bees and plants yielding honey.

**Books for Reference:**

1. Daubenmire, R.F. ( ): Plants & Environment (2nd Edn.,) John Wiley & Sons., New York
2. Puri, .G.S. (1960): Indian Forest Ecology (Vol.I & II) Oxford Book Co., New Delhi & Calcutta.

3. Billings, W.B. (1965): Plants and the Ecosystem Wadsworth Publishing Co., Inc., Belmont.
4. Misra, R. (1968): The Ecology work Book Oxford & INH Publishing Co., Calcutta
5. Odum E.P. (1971): Fundamentals of Ecology (2nd Edn.,) Saunders & Co., Philadelphia & Natraj Publishers, Dehradun.
6. Odum E.P. (1975): Ecology By Holt, Rinert & Winston.
7. Oosting, H.G. (1978): Plants and Ecosystem Wadworth Belmont.
8. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.,) New Delhi, Bombay, Calcutta-226pp.,
9. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
10. Kumar H.D. (2000): Biodiversity & Sustainable Conservation Oxford & IBH Publishing Co Ltd. New Delhi.
11. Newman, E.I. (2000): Applied Ecology Blackwell Scientific Publisher, U.K.
12. Chapman, J.L&M.J. Reiss (1992): ecology (Principles & Applications). Cambridge University Press, U.K.
13. Cain, S.A . (1944): Foundations of Plant Geography Harper & Brothers, N.Y.
14. Mani, M.S (1974): Ecology & Biogeography of India Dr. W. Junk Publishers, The Haque
15. Good, R. (1997): The Geography of flowering Plants (2nd Edn.) Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi

### **III B. Sc - SEMESTER- V: BOTANY PRACTICAL PRACTICAL PAPER-VI: PLANT ECOLOGY& PHYTOGEOGRAPHY**

Total hours of teaching 30 hrs @ 3 hrs per week

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1. Study of instruments used to measure microclimatic variables; soil thermometer, maximum and minimum thermometer, anemometer, rain gauge, and lux meter.
2. Permeability (percolation; total capacity as well as rate of movement) of different soil samples.
3. Determination of soil pH
4. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (4 each)
5. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus by species area curve method
6. Study of Phytoplankton and macrophytes from water bodies.
7. To study field vegetation with respect to stratification, canopy cover and composition.
8. Study of plants included in agro forestry and social forestry.
9. To locate the hotspots, phyto geographical regions and distribution of endemic plants in the map of India.

10. The following practical should be conducted in the Field/lab with the help of photographs, herbarium, Floras, Red data book- Study of endangered plants species, critically endangered plants species, vulnerable plant species and monotypic endemic genera of India.

**III B. Sc - SEMESTER- V: BOTANY PRACTICAL MODEL PAPER  
PAPER–VI: PLANT ECOLOGY & PHYTOGEOGRAPHY**

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1. Study Project under supervision	=	15 Marks
2. Record & Viva-Voce	=	10 Marks
3. Experiment <b>A</b>	=	10 Marks
4. Anatomical adaptations of <b>B</b> (Section cutting)	=	10 Marks
5. Spotters <b>C&amp;D</b> (2x2 1/2)	=	5 Marks
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	Total =	50 Marks

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1. Study Project of a surrounding Ecosystem (terrestrial or aquatic)(plant diversity, animal diversity, human activity, pollution levels, restoration efforts under supervision.
2. Presentation of the project work in Q & A session.
3. **A** -determination of soil porosity/PH/percolation/retaining capacity.
4. **B**- Xerophyte/Hydrophyte anatomical adaptations.
5. **C & D**-anemometer/rain gauze/lux meter.

**SEMESTER-VI: Electives**

Andhra Pradesh State Council of Higher Education

w.e.f. 2015-16 (Revised in April 2016)

**III B. Sc - BOTANY SYLLABUS SEMESTER- VI****PAPER – VII – ELECTIVE [(A) or (B) or (C)]****Paper VII-(A): ORGANIC FARMING & SUSTAINABLE AGRICULTURE**

Total hours of teaching 60hrs @ 3hrs per week

**Unit - I: Concept of organic farming: (12hrs)**

1. Introduction: Farming, organic farming, concept and development of organic farming.
2. Principles of organic farming, types of organic farming, biodynamic farming.
3. Benefits of organic farming, need for organic farming, conventional farming v/sorganic farming
4. Scope of organic farming; Andhra Pradesh, National and International status.
5. Agencies and institutions related to organic agriculture.
6. Requirements for organic farming, farm components for an organic farm.

**Unit - II: Organic plant nutrient management: (12hrs)**

1. Organic farming systems, soil tillage, land preparation and mulching.
2. Choice of varieties.
3. Propagation-seed, planting materials and seed treatments, water management
4. Green manuring, composting- principles, stages, types and factors, composting methods, Vermi composting
5. Bulky organic manures, concentrated organic manures, organic preparations, organic amendments and sludges.
6. Bio-fertilizers- types, methods of application, advantages and disadvantages, standards for organic inputs- fertilizers

**Unit-III: Organic plant protection: (12hrs)**

1. Plant protection- cultural, mechanical, botanical pesticides, control agents
2. Weed management
3. Standards for organic inputs- plant protection.

**Unit- IV: Organic crop production practices: (12hrs)**

1. Organic crop production methods- rice, coconut.
2. Organic crop production methods- vegetables- okra, amaranthus, cucurbits.
3. Livestock component in organic farming.
4. Sustainable Agriculture-Apiculture, Mushroom cultivation.

**Unit- V: Organic Certification (12hrs)**

1. Farm economy: Basic concept of economics- demand & supply, economic viability of a farm.
2. Basic production principles, reducing expenses, ways to increase returns, cost of production system. Benefit/ cost ratio, marketing, imports and exports.
3. Policies and incentives of organic production.
4. Farm inspection and certification.
5. Terrace farming.

**Books for Reference:**

1. Palaniappan SP & Anandurai K. 1999. Organic Farming–Theory and Practice. Scientific Publishers, Jodhpur
2. Joshi, M. 2014. New Vistas of Organic Farming 2nd Ed. Scientific Publishers, Jodhpur.
3. Farming system : Theory and Practice - S.A.Solaimalai
4. Organic Farming: Theory and Practice- S.P.Palaniappan and K.A. Annadurai
5. A hand book of Organic Farming by A.K.Sharma

**Suggested Activities:** Preparation of Vermicompost in small scale, observing sewage sludge disposal mechanisms in urban/semi urban areas, studying the usage, of green manures, neem oil, neem cake, pongamia oil in organic farming, livestock component in various farming methods, visiting an Apiculture center, drawing various terrace farming models



**Paper-VII-A : Practical**  
**Semester – VI, Paper-VII-A : Organic Farming and Sustainable Agriculture**  
 Total hours of teaching 30 hrs @ 2 hrs per week

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1. Study of different bio pesticides, weedicides, inorganic and organic fertilizers
2. Deficiency symptoms of nutrient deficiency symptoms (photographs)
3. Soil testing, liming, and fertilizing
4. Preparation of enriched Farm Yard Manure.
5. Study of composting methods.
6. Preparation of vermin-compost.
7. Study of recycling of farm waste.
8. Study of methods of green manuring.
9. Study of steps in mushroom cultivation
10. Visit to urban waste recycling unit.
11. Study project report under supervision of lecturer – farm manure preparation/vermi-compost// /waste management// green manures/ mushroom cultivation / nutrient requirements of vegetables

**Expected domain skills to be achieved:** Performing Soil analysis, soil enrichment methods, composting procedure, recycling of wastes, use of waste materials in mushroom cultivation, understanding nutrient requirement of various crops, identifying various methods of keeping soil health

**PRACTICAL MODEL PAPER**

**Paper-VII-(A) : Organic Farming and Sustainable Agriculture**

<b>Q1. Project report (A)</b>	<b>- 15 marks</b>
<b>Viva-voce on study project</b>	<b>-05 marks</b>
<b>Q2. Identify and write notes on B, C, D, and E (4x5)</b>	<b>-20 marks</b>
<b>B- inorganic manures/bio-weedicides/bio-pesticides (photograph/ specimen)</b>	
<b>C- Compost preparation method ( photograph/instrument)</b>	
<b>D- Green manure type (plant specimen/photograph)</b>	
<b>E- Waste recycling method (photograph/live specimen/institute/organization)</b>	
<b>Q4. Field report</b>	<b>- 05 marks</b>
<b>Q5. Record</b>	<b>- 05 marks</b>
<b>TOTAL:</b>	<b>50 marks</b>

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**III B. Sc - BOTANY SYLLABUS SEMESTER- VI**  
**PAPER – VII – ELECTIVE**  
**Paper VII-(B): Nursery, Gardening and Floriculture.**  
Total hours of teaching 60hrs @ 3hrs per week

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**Unit I: Nursery:** (12 hrs.)

1. Definition, objectives, scope and building up of infrastructure for nursery.
2. Planning and seasonal activities - Planting - direct seeding and transplants.
3. Nursery Management and Routine Garden Operations.

**Unit III: Gardening** (12 hrs.)

1. Definition, objectives and scope - different types of gardening.
2. Landscape and home gardening - parks and its components, plant materials and design .
3. Computer applications in landscaping.
4. Gardening operations: soil laying, manuring, watering.
5. Landscaping Places of Public Importance: Landscaping highways and Educational Institutions)
6. Some Famous gardens of India.

**Unit III: Propagation methods** (12 hrs.)

1. Sowing/raising of seeds and seedlings, transplanting of seedlings.
2. Air-layering, cutting, selection of cutting, propagule collecting season, treatment of cutting rooting medium and planting of cuttings - Hardening of plants.
3. Propagation of ornamental plants by rhizomes, corms tubers, bulbs and bulbils.
4. .Green house - mist chamber, shed root, shade house and glass house for propagation.

**Unit IV: Floriculture:** ( 12 hrs.)

1. Ornamental Plants: Flowering annuals; herbaceous, perennials; Shade and ornamental trees.
2. Ornamental bulbous and foliage plants; Cacti and succulents.
3. Ornamentals-palms.
4. Cultivation of plants in pots; Indoor gardening; Bonsai.

**Unit V: Commercial Floriculture****( 12 hrs.)**

1. Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life of flowers
2. Cultivation of Important cut flowers (Aster, Dahlia, Gerbera, Anthuriums, Marigold, Rose, Liliun)
3. Management of pests, diseases and harvesting.
4. Methods of harvesting.

**Books for Reference:**

1. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
3. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. institution)
4. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.

**Suggested Activities:** Raising a nursery, managing it, studying and drawing various land scaping designs, practicing layering methods, using shade nets to protect horticultural crops, practicing indoor gardening techniques, visiting florists and recording their methods of prolonging vase life of commercial cut flowers.

**III B. Sc - BOTANY SYLLABUS SEMESTER- VI (Elective)**  
**Practical Syllabus, Paper VII-(B): Nursery, Gardening and Floriculture**

Total hours of teaching 30hrs @ 2hrs per week

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1. Tools, implements and containers used for propagation and nursery techniques.
2. Propagation by cutting, layering, budding and grafting
3. Seed propagation- preparation of portable trays, seed treatments, sowing and seedling production.
4. Identification and description of annuals, herbaceous perennials, climbers, creepers, foliage and flowering shrubs, trees, palms, ferns, ornamental grasses; cacti and succulents..
5. Planning and designing of gardens, functional uses of plants in the landscape
6. Preparation of land for lawn and planting.
7. Identification of commercially important flower crops and their varieties.
8. Propagation practices in flower crops, sowing of seeds and raising of seedlings of annuals.
9. Use of chemicals and other compounds for prolonging the vase life of cut flowers.
10. Grading, packing and marketing of cut flowers.
11. Visit to commercial nurseries and commercial tissue culture laboratory
12. Study project under supervision of lecturer – nursery/ornamental flowers/ plants/lawn designing/ landscape designing

**Expected domain skills to be achieved:** Ability to use a variety of garden tools and implements, proficiency in layering and grafting techniques (cleft grafting and bud grafting), land scape drawings using computers, raising of healthy nurseries of flowering plants, managing vase life of cut flowers etc.

**PRACTICAL MODEL PAPER**

**Paper-VII-(B): Nursery, Gardening and Floriculture**

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|---|-------------------|
| <b>Q1. Project report (A)</b>                               | <b>- 15 marks</b> |
| <b>Viva-voce on study project</b>                           | <b>-05 marks</b>  |
| <b>Q2. Identify and write notes on B, C, D, and E (4x5)</b> | <b>-20 marks</b>  |
| <b>B- Tool/instrument/container used in nursery</b>         |                   |
| <b>C-Seed propagation technique</b>                         |                   |
| <b>D- Plant used in lawn (plant specimen/photograph)</b>    |                   |
| <b>E-ornamental flower (photograph/live specimen)</b>       |                   |
| <b>Q4. Field report</b>                                     | <b>- 05 marks</b> |
| <b>Q5. Record</b>   | <b>- 05 marks</b> |
|   | <b>50 marks</b>   |
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**III B. Sc - BOTANY SYLLABUS SEMESTER- VI**  
**PAPER – VII – ELECTIVE**

**Paper VII-(C): Plant tissue culture and its biotechnological applications**

Total hours of teaching 60hrs @ 3hrs per week

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**Unit I: PLANT TISSUE CULTURE – 1**

**(12hrs)**

1. History of plant tissue culture research - basic principles of plant tissue callus culture, meristem culture, organ culture, Totipotency of cells, differentiation and dedifferentiation.
2. Methodology - sterilization (physical and chemical methods), culture media, Murashige and Skoog's (MS medium), phytohormones, medium for micro-propagation/clonal propagation of ornamental and horticulturally important plants.
3. Callus subculture maintenance, growth measurements, morphogenesis in callus culture – organogenesis, somatic embryogenesis.

**UNIT-II: Plant Tissue culture -2**

**(12hrs)**

1. Endosperm culture – Embryo culture -culture requirements – applications, embryo rescue technique.
2. Production of secondary metabolites.
3. Cryopreservation; Germplasm conservation.

**Unit III: Recombinant DNA technology**

**(12hrs)**

1. Restriction Endonucleases (history, types I-IV, biological role and application); concepts of restriction mapping.
2. Cloning Vectors: Prokaryotic (pUC 18, pBR322, Ti plasmid and Lambda phage, Eukaryotic Vectors (YAC and briefly PAC)
3. Gene cloning (Bacterial Transformation and selection of recombinant clones, PCR mediated gene cloning)
4. Construction of genomic and cDNA libraries, screening DNA libraries to obtain gene of interest by complementation technique, colony hybridization.

**Unit IV: Methods of gene transfer**

**(12hrs)**

1. Methods of gene transfer- Agrobacterium-mediated, direct gene transfer by Electroporation, Microinjection, Micro projectile bombardment.
2. Selection of transgenics– selectable marker and reporter genes (Luciferase, GUS, GFP).

**Unit V: Applications of Biotechnology****(12 hrs)**

1. Applications of Plant Genetic Engineering – crop improvement, herbicide resistance, insect resistance, virus resistance.
2. Genetic modification – transgenic plants for pest resistant (Bt-cotton); herbicide resistance (Round Up Ready soybean); improved agronomic traits - flavrSavr tomato, Golden rice); Improved horticultural varieties Moon dust carnations)

**Books for Reference:**

1. Pullaiah. T. and M.V.Subba Rao. 2009. Plant Tissue culture. Scientific Publishers, New Delhi.
2. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
4. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd., New Delhi. 5th edition.
5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics. John Wiley and Sons, U.K. 5th edition.
6. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.

**Suggested Activities:** In vitro initiation of callus on artificial medium, seminars on utilization of rDNA technology, debates on applications of Biotechnology (whether it is a boon or bane to the society) studying growth patterns, vegetative characteristics of Bt.cotton and identifying the features of its pest resistance

**III B. Sc - BOTANY SYLLABUS SEMESTER- VI**  
**PAPER – VII-(C) Elective**  
**Practical Paper VII-(C): Plant Tissue Culture & Plant Biotechnology**  
**Total hours of teaching 30hrs @ 2hrs per week**

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1. (a) Preparation of MS medium.  
 (b) Demonstration of in vitro sterilization methods and inoculation methods using leaf and nodal explants of Tobacco/ Datura/ Brassica etc.
2. Study of embryo and culture, micro propagation of Banana, somatic embryogenesis, artificial seeds through photographs.
3. Construction of restriction map of circular and linear DNA from the data provided.
4. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, and micro projectile bombardment.
5. Different steps involved in genetic engineering for production of Bt. cotton, Golden rice, Flavr Savr tomato through photographs.
7. Isolation of plasmid DNA.
8. Restriction digestion and gel electrophoresis of plasmid DNA (optional)
9. Field visit to a lab involved in tissue culture
10. Study project under supervision of lecturer – tissue culture/ genetic engineering

**Expected domain skills to be achieved:** Ability to prepare artificial nutrient media, preparing independently, applying various sterilization procedures for media, glassware and biological materials, in vitro propagation of Banana callus, morphogenesis--s, clonal propagation methods, isolation of plasmid DNA individually and as a group.

**PRACTICAL MODEL PAPER**

**Paper-VII-(C) : Plant Tissue Culture & Plant Biotechnology**

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| Q1. Project report (A)                             | - 15 marks |
| Viva-voce on study project                         | -05 marks  |
| Q2. Identify and write notes on B, C and D (3x4)   | -12 marks  |
| B- Tool/instrument/container used in sterilization |            |
| C- Tool/instrument/container used in gene transfer |            |
| D- GM crops (Photographs)                          |            |
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Q3. Construct restriction map of circular and/ or linear DNA from the data provided –  
08 marks

Q4. Field report - 05 marks

Q5. Record - 05 marks

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50 marks

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CLUSTER ELECTIVES (Cluster–A or Cluster-B)  
**III B.Sc.: BOTANY SYLLABUS SEMESTER- VI**  
**Paper VIII, CLUSTER ELECTIVE, Cluster-A,**  
**Paper VIII-A-1 : PLANT DIVERSITY AND HUMAN WELFARE**  
 Total hours of teaching 60hrs @ 3hrs per week

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**Unit- I: Plant diversity and its scope: (12hrs)**

- i. Genetic diversity, Species diversity, Plant diversity at the ecosystem level, Agro biodiversity and cultivated plant taxa, wild taxa.
- ii. Values and uses of biodiversity: Ethical and aesthetic values,
- iii. Methodologies for valuation, Uses of plants.

**Unit -II: Loss of biodiversity: (12hrs)**

- i. Loss of genetic diversity, Loss of species diversity, Loss of ecosystem diversity, Loss of agro biodiversity, projected scenario for biodiversity loss
- ii. Management of plant biodiversity: Organizations associated with biodiversity management-Methodology for execution-IUCN, UNEP, UNESCO, WWF, NBPGR; Biodiversity legislation and conservations, Biodiversity information management and communication.

**Unit-III: Contemporary practices in resource management: (12hrs)**

- i. Environmental Impact Assessment (EIA), Geographical Information System GIS, Participatory resource appraisal, Ecological footprint with emphasis on carbon footprint, Resource accounting;
- ii. Solid and liquid waste management

**Unit -IV: Conservation of biodiversity (12hrs)**

- i. Conservation of genetic diversity, species diversity and ecosystem diversity, *In situ* and *ex situ* conservation,
- ii. Social approaches to conservation, Biodiversity awareness programmes, Sustainable development. ]

## Unit- V: Role of plants in relation to Human Welfare (12hrs)

- i. Importance of forestry, their utilization and commercial aspects-
  - a) Avenue trees, b) ornamental plants of India. c) Alcoholic beverages through ages.
- ii. Fruits and nuts: Important fruit crops their commercial importance.  
Wood, fiber and their uses.

### Suggested Readings:

1. Krishnamurthy, K.V. (2004). An Advanced Text Book of Biodiversity - Principles and Practices. Oxford and IBH Publications Co. Pvt. Ltd. New Delhi.
2. Singh, J. S., Singh, S.P. and Gupta, S. (2006). Ecology, Environment and Resource Conservation. Anamaya Publications, New Delhi.
3. Rogers, P.P., Jalal, K.F. and Boyd, J.A. (2008). An Introduction to Sustainable Development. Prentice Hall of India Private Limited, New Delhi.

**Suggested activities:** Study of flora and its diversity in the college campus or local area, enumerating wild and exotic species (*Parthenium*, Water hyacinth etc.)

Project work on any one of the International organizations striving for preservation of biodiversity, study of conservation efforts of local people, and civic bodies, study of locally available fruits in different seasons, enumerating the avenue plantations and their diversity in your town/city

### **Paper – VIII-A-1 : Practicals: PLANT DIVERSITY AND HUMAN WELFARE**

- 1) Study of plant diversity (flowering plants).
- 2) Study of exotic species- Identification and morphological characteristics.
- 3) Identification of forest trees through bark, wood, flowers, leaves and fruits.
- 4) Maceration, Study of wood (Tracheary elements, fibres).
- 5) Methods of preservation and canning of fruits.
- 6) Visit to the local ecosystem to study the plants.
- 7) Write up on the conservation efforts of International organizations.
- 8) Study of Solid and Liquid waste management systems in rural/urban areas.

**Domain skills expected to achieve:** Identification of exotic plant species, identification of forest trees based on the characteristics of bark, flowers and fruits, understanding the preservation methods of fresh and dry fruits, understanding the methods of safe disposal of biodegradable and non-biodegradable wastes

### SCHEME OF PRACTICAL EXAMINATION

PRACTICAL- VIII-A-1 : Cluster Elective (MODEL QUESTION PAPER)  
PLANT DIVERSITY AND HUMAN WELFARE

Time: 3hrs

Max. Marks: 50

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I. Assign the plants **A, B and C** to their respective families, giving reasons, family name and classification-2 marks, important diagrams- 3 marks.

**15 marks**

II. Give the protocol of **D**

**10 marks**

III. Comment on specimens **E, F and G**

**3x3 = 9 marks**

IV. Report on Field visit

**6 marks**

To study sources of firewood (10 plants), timber-yielding trees (10trees) and bamboos.

V. Viva-Voce

**5 marks**

VI. Practical Record

**5 marks**

### **KEY**

A-Cultivated Plant

B- Wild Plant

C –Exotic plant

D- Preservation and canning of fruits, solid and liquid waste management systems in rural/urban areas

E. Bark/wood/fruit yielding plant

F. Nuts/ Alcoholic beverage plant

G. wood /Fibre yielding plant

### III B. Sc - BOTANY SYLLABUS

#### SEMESTER- VIII : CLUSTER ELECTIVE -A

#### Paper VIII-A-2 : ETHNOBOTANY AND MEDICINAL BOTANY

Total hours of teaching 60hrs @ 3hrs per week

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#### Unit –I: Ethnobotany (12hrs)

- i. Introduction, concept, scope and objectives; Ethnobotany as an interdisciplinary science. The relevance of ethno botany in the present context
- ii. Major and minor ethnic groups or Tribals of India, and their life styles.
- iii. Plants used by the tribal populations: a) Food plants, b) intoxicants and beverages, c) Resins and oils and miscellaneous uses.

#### Unit -II: Role of ethnobotany in modern Medicine: (12hrs)

- i. Role of ethnobotany in modern medicine with special example *Rauwolfia serpentina*, *Trichopus zeylanicus*, *Artemisia annua*, *Withania somnifera*.
- ii. Medico-ethnobotanical sources in India
- iii. Significance of the following plants in ethno botanical practices (along with their habitat and morphology)
  - a) *Azadirachta indica*, b) *Ocimum sanctum*, c) *Vitex negundo*, d) *Gloriosa superba*, e) *Tribulus terrestris*, f) *Phyllanthus niruri*, g) *Cassia auriculata*, h) *Indigofera tinctoria*, i) *Senna auriculata* j) *Curcuma longa*.
- iv. Role of ethnic groups in the conservation of plant genetic resources.

#### Unit-III: Ethnobotany as a tool to protect interests of ethnic groups (12hrs)

- i. Sharing of wealth concept with few examples from India.
- ii. Biopiracy, Intellectual Property Rights and Traditional Knowledge.

#### Unit -IV: History, Scope and Importance of Medicinal Plants. indigenous Medicinal Sciences (12hrs)

- i. Definition and Scope-**Ayurveda**: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments.
- ii. **Siddha**: Origin of Siddha medicinal systems, Basis of Siddha system, plants used in Siddha medicine.
- iii. **Unani**: History, concept: Umoor-e- tabiya, tumors treatments/ therapy, polyherbal

formulations (in brief).

**Unit -V: Conservation of endangered and endemic medicinal plants:  
(12hrs)**

- i. Definition: endemic and endangered medicinal plants,
- ii. Red list criteria
- iii. *In situ* conservation: Biosphere reserves, sacred groves, National Parks
- iv. *Ex situ* conservation: Botanical Gardens.

**Suggested Activities:** Studying plant utilization methods by tribal/rural/migrant populations for their beverages, food, medicinal and uses, seminars on role of ethnic groups in conservation of plant genetic resources, project work on traditional knowledge about plant medicines, study of indigenous medicinal sciences and their efficacy.

**Suggested Readings:**

- 1) S.K. Jain, Manual of Ethnobotany, Scientific Publishers, Jodhpur, 1995.
- 2) Glimpses of Indian. Ethnobotny, Oxford and I B H, New Delhi – 1981.
- 3) S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists, Lucknow, India.
- 4) S.K. Jain, 1990. Contributions of Indian ethnobotny. Scientific publishers, Jodhpur.
- 5) Colton C.M. 1997. Ethnobotany – Principles and applications. John Wiley and sons – Chichester
- 6) Rama Ro, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
7. Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
8. Purohit and Vyas, 2008. Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.
9. Pal, D.C. & Jain, S.K., 1998. Tribal Medicine. Naya Prakash Publishers, Calcutta
10. Raychudhuri, S.P., 1991. (Ed.) Recent advances in Medicinal aromatic and spice crops. Vol.1, Today& Tomorrow's printers and publishers, New Delhi

### Cluster Elective VIII-A-2: Practical:

#### ETHNOBOTANY AND MEDICINAL BOTANY

1. Ethnobotanical specimens as prescribed in theory syllabus
2. Detailed morphological and anatomical study of medicinally important part(s) of locally available plants (Minimum 8 plants) used in traditional medicine.
3. Field visits to identify and collect ethno medicinal plants used by local tribes/folklore.

**Domain skills expected to achieve:** Identification of various plant parts used as medicines by ethnic groups, understanding the difference between ancient wisdom and modern system of medicine, traditional medicine at the rescue of curing drug resistant maladies like malaria and viral diseases, understanding the role of spices in Indian kitchens, their therapeutic role

#### PRACTICAL- VIII-A-2 Cluster Elective : MODEL QUESTION PAPER Paper VIII-A-2: ETHNOBOTANY AND MEDICINAL BOTANY

Time: 3 Hours

Max. Marks- 50

I. Identify the specimen A- Give reasons (morphological and anatomical) and draw labeled sketches 15marks

II. Identify and write about the medicinal uses of B-and C- 2x5= 10 marks.

III. Comment on D and E. 2x 4=8 marks

IV. Report on Field visit: 7 marks

List to be prepared mentioning special features of plants used by tribal populations as Medicinal Plants & Spices. Write their botanical and common names, parts used and diseases/disorders for which they are prescribed.

V. Viva-voce 5 marks

VI. Record 5 marks

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Total = 50 marks

#### KEY

A-Plants given in unit II (i)

B-Plants used in Ayurvedic preparations (Amla in Chyavanprash, Senna in Laxatives)

C - - Do -

D. Photographs of National parks, Biosphere reserves and Botanical gardens.

E. Photograph of famous personalities in Ayurveda/Siddha medicine.

**III B. Sc - BOTANY SYLLABUS SEMESTER- VIII**  
**CLUSTER ELECTIVE, Paper VIII-A-3**

**Paper VIII-A-3: Pharmacognosy and Phytochemistry**

Total hours of teaching 60hrs @ 3hrs per week

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**Unit-I: Pharmacognosy (12hrs)**

Definition, Importance, Classification of drugs - Chemical and Pharmacological, Drug evaluation methods

**Unit –II: Organoleptic and microscopic studies: (12hrs)**

Organoleptic and microscopic studies with reference to nature of active principles and common adulterants of *Alstonia scholaris* (bark), *Adhatoda vasica* (leaf), *Strychnos nuxvomica* (seed), *Rauwolfia serpentine* (root) and *Zinziber officinalis* *Catharanthus roseus*.

**Unit-III: Secondary Metabolites: (12hrs)**

i. Definition of primary and secondary metabolites and their differences, major types - terpenes, phenolics, alkaloids, terpenoids, steroids.

ii. A brief idea about extraction of alkaloids. Origin of secondary metabolites – detailed account of acetate pathway, mevalonate pathway, shikimate pathway.

**UNIT-IV: Phytochemistry: (12hrs)**

Biosynthesis and sources of drugs:

- (i) Phenols and phenolic glycosides : structural types, biosynthesis, importance of simple phenolic compounds, tannins, anthraquinones, coumarins and furanocoumarins, flavones and related flavonoid glycosides, anthocyanins, betacyanins, stilbenes, lignins and lignans).
- (ii) Steroids, sterols, saponins, withanolides, ecdysones, cucurbitacins: Biosynthesis, commercial importance.
- (iii) Alkaloids: Different groups, biosynthesis, bioactivity.
- (iv) Volatile oils, aromatherapy.

**UNIT-V: Enzymes, proteins and amino acids as drugs: (12hrs)**

- i. Vaccines, toxins and toxoids, antitoxins, immune globulins, antiserums,
- ii. Vitamins, Antibiotics – chemical nature, mode of action.
- iii. Pharmacological action of plant drugs – tumor inhibitors, PAF antagonists, antioxidants, phytoestrogens and others.
- iv. Role of different enzyme inhibitors.

**Suggested Activities:** Isolation techniques of active principles from various parts of popular medicinal plants, debates on the efficacy of plant medicines and palliative cure, volatile oils from plants-extraction methods, project work on crude drugs

**BOOKS FOR REFERENCE:**

1. Wallis, T. E. 1946. Text book of Pharmacognosy, J & A Churchill Ltd. 2. Roseline, A. 2011. Pharmacognosy. MJP Publishers, Chennai.
2. Gurdeep Chatwal, 1980. Organic chemistry of natural productis. Vol.I.Himalaya Publishing house.
3. Kalsi, P. S. and Jagtap, S., 2012. Pharmaceutical medicinal and natural product chemistry N.K. Mehra . Narosa Publishing House Pvt. Ltd. New Delhi.
4. Agarwal, O. P. 2002. Organic chemistry–Chemistry of organic natural products. Vol. II. Goel publishing house , Meerut.
5. Harborne, J. B. 1998. Phytochemical methods –a guide to modern techniques of plant analysis 3 rd edition, Chapman and Hall
6. Datta & Mukerji, 1952. Pharmacognosy of Indian roots of Rhizome drugs. Bulletin No.1 Ministry of Health, Govt. of India.

**VIII-A-3: Pharmacognosy and Phytochemistry: PRACTICALS**

1. Physical and chemical tests for evaluation of unorganized drugs- Asaphoetida. Honey, Castor oil. Acacia
2. Identification of bark drugs – cinchona, cinnamom
3. Identification of fruit drugs – Cardamom, Coriander
4. Identification of root and rhizome drugs- Ginger, Garlic, Turmeric
5. Identification of whole plant – Aloes, Vinca, Punarnava



6. Herbarium of medicinal plants ( minimum of 20 platns)

7. Collection of locally available crude drugs from local venders (minimum of 20)

**Domain skills expected to achieve:** Identification of various plant parts used as medicines, extraction of active principles from them, isolation by chromatographic techniques, learning callus culture techniques for secondary metabolite enrichment and understanding ethno-pharmacological principles

**PRACTICAL: VIII-A-3 Cluster Elective: MODEL QUESTION PAPER**  
**Pharmacognosy and Phytochemistry**

Time: 3hrs.

Max. Marks=50

I. Identify the given crude drugs **A & B** by morphological study and chemical tests. **10 marks**

II. Perform suitable chemical test and identify the given phytochemical **C** **10 marks**

III. Comment on D and E **2x5=10 marks**

IV. Herbarium and submission of drugs **-10 marks**

IV. Viva-Voce **5 marks**

V. Practical Record **5 marks**

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**Total = 50 marks**

**KEY**

A-Flower/fruit drugs

B-Rhizome/whole plant drugs

C- Tannins/ phenolics/steroids/ isoprenoids /Asaphoetida/ Honey/ Castor oil/ Acacia

D. Column Chromatography/ Gas Chromatogram/HPLC (photograph/ instrument used for chemical analysis of drugs

E. photograh/instrument used for tissue culture

## III B.Sc.: BOTANY SYLLABUS SEMESTER- VI

**Cluster Electives, CLUSTER-B****CLUSTER ELECTIVE, PAPER-VIII-B-1****Paper VIII-B-1: Biological instrumentation and Methodology**

Total hours of teaching 60hrs @ 3hrs per week

**Unit -I: Imaging and related techniques: (12hrs)**

Principles of microscopy; Light microscopy; Fluorescence microscopy; Electron Microscopy (a) Flow cytometry (b) Applications of fluorescence microscopy: Chromosome banding, FISH, chromosome painting; Transmission and Scanning electron microscopy – sample preparation for electron microscopy, cryofixation, negative staining, shadow casting, freeze fracture, freeze etching.

**Unit- II: pH and Centrifugation: (12 hrs)**

pH meter: Principles and instrumentation, Centrifugation: Principles, types of centrifuges, types of rotors, differential and density gradient centrifugation, application. Sonication, Freeze drying.

**Unit- III: Spectrophotometry: (12hrs)**

Principle involved in Spectrophotometer; Spectrophotometric techniques, Instrumentation: ultraviolet and visible spectrophotometry (single and double beam, double wavelength spectrophotometers), Infrared spectrometers - Luminometry and densitometry – principles and their applications - Mass Spectroscopy- principles of analysis, application in Biology.

**Unit- IV: Chromatography: (12hrs)**

Chromatographic techniques: Principle and applications – Column - thin layer – paper, affinity and gas chromatography - Gel filtration - Ion exchange and High performance liquid chromatography techniques – Examples of application for each chromatographic system - Basic principles of electrophoresis.

**Unit-V: Preparation of molar, molal and normal solutions, buffers, the art of scientific writing (12hrs)**

Understanding the details on the label of reagent bottles. Molarity and normality of common acids and bases. Preparation of solutions. Dilutions. Percentage solutions. Molar, molal and normal solutions. Technique of handling micropipettes; Knowledge about common toxic chemicals and safety measures in their handling.

The art of scientific writing and presentation of scientific matter. Scientific writing and ethics. Writing references. Powerpoint presentation. Poster presentation. Introduction to copyright-academic misconduct/plagiarism in scientific writing.

**Suggested Readings:**

1. Bajpai, P.K. 2006. Biological Instrumentation and methodology. S. Chand & Co. Ltd.
2. K. Wilson and J. Walker Eds. 2005. Biochemistry and Molecular Biology. Cambridge University Press.
3. K. Wilson and KHGoulding. 1986. Principles and techniques of Practical Biochemistry. (3 edn) Edward Arnold, London.
4. Dawson, C. (2002). Practical research methods.UBS Publishers, New Delhi.
5. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual. West Africa Rice Development Association, Hong Kong.
6. Ruzin, S.E. (1999). Plant micro technique and microscopy. Oxford University Press, New York, U.S.A.

**Suggested activities:** Preparing various laboratory reagents, operating laboratory instruments, noting instrument readings, calculating results accurately, Skills on writing scientific articles, presentation of scientific results through tables, graphs, poster presentations and practicing power point presentations.

### **Paper VIII-B-1: PRACTICAL SYLLABUS**

1. Microscopy – Light microscopy: principles, parts & function
2. Micrometry- principle and measurement of microscopic objects: Low power and high power.
3. Camera Lucida drawing with magnification and scale.
4. Principle and working of phase contrast microscope
5. Principle & operation of Centrifuge
6. Preparation of standard acid and alkali and their standardization.
  - b) Preparation of various solutions (normal, molar, and percent) and ppm/ppb by serial dilutions
7. Study of principle and working of pH meter and Measurement of pH of Milk, Pepsi, Lemon juice etc. using pH paper and pH meter
8. Study of principle of Chromatography and separation of amino acids mixture
  - By ascending Paper Chromatography
7. Principle & operation of Colorimeter
8. Principle & operation of Spectrophotometer
9. Chromosome banding, FISH, chromosome painting
9. Principle and technique of TLC (demonstration)
10. TLC separation of Amino acids from purified samples and biological materials (demonstration)
- 11 PCR - The Polymerase Chain Reaction (protocol) -demonstration
13. Study visit to an institute /laboratory

**Domain skills expected to achieve:**

Skill in operating laboratory equipment, their upkeep, and adept at various biological techniques. Ability to prepare molar, molal, normal solutions and solutions of different dilutions. Interpreting scientific results, and ability to present results in a scientific way through graphs, photographs, poster presentations and power point presentations.

**Paper VIII-B-1: Theory: Biological instrumentation and Methodology****PRACTICAL MODEL PAPER**

- |   |               |
|---|---------------|
| 1. Perform the experiment (A). Write the protocol of the experiment -                                   | 15 marks      |
| 2. Measure the pH of given sample (B) using pH paper and pH meter. Write the procedure and observation. | 10 marks      |
| 3. Identify C, D, and E. Write the principle and use of them.   | 3X5 -15 marks |
| 4. Viva voce on Field visit   | 05 marks      |
| 5. Record   | 05 marks      |

**Key**

- A. Amino acid separation by paper chromatography
  - B. Milk, Pepsi, Lemon juice etc
  - C. Camera Lucida/ Micrometer/phase contrast microscope
  - D. Colorimeter/ Spectrophotometer
  - E. Chromosome banding, FISH, chromosome painting
- 

(Cluster Electives –B)

**III B.Sc.: BOTANY SYLLABUS SEMESTER- VI, CLUSTER ELECTIVE -2-B**

**PAPER – VIII-B-2**

**Paper VIII-B-2: Mushroom Culture and Technology**

Total hours of teaching 60hrs @ 3hrs per week

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**Unit I: Introduction, history:** (12hrs)

Introduction - history - scope of edible mushroom cultivation, Types of edible mushrooms available in India – *Volvariellavolvacea*, *Pleurotuscitrinopileatus*, *Agaricusbisporus*. Nutritional and medicinal value of edible mushrooms; Poisonous mushrooms.

**UNIT II: Pure culture-spawn preparation:** (12hrs)

Pure culture - preparation of medium (PDA and Oatmeal agar medium) sterilization - preparation of test tube slants to store mother culture – culturing of *Pleurotus* mycelium on Petriplates, preparation of mother spawn in saline bottle and polypropylene bag and their multiplication.

**Unit III: Cultivation Technology:** (12hrs)

Infrastructure: Substrates (locally available) Polythene bags, vessels, Inoculation hook, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house) water sprayer, tray, small polythene bag. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves. Factors affecting the mushroom bed preparation - Low cost technology, composting technology in mushroom production.

**Unit IV: Storage and nutrition :** (12hrs)

Short-term storage (Refrigeration - up to 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutrition - Proteins - amino acids, mineral elements nutrition - Carbohydrates, Crude fibre content – Vitamins.

**Unit V: Food Preparation:** (12hrs)

Types of foods prepared from mushrooms; soup, cutlet, omelette, samosa, pickles and curry. Research Centres - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

**Suggested Readings:**

1. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol. II.
5. Biswas, S., M. Datta and S.V. Ngachan. 2011. Mushrooms: A Manual For Cultivation. PHI learning private Ltd., New Delhi, India.

6. Chang, S. and P.G. Miles. 2004. Mushrooms: cultivation, nutritional value, medicinal effect, and environmental impact. CRC Press. USA.

7. Miles, P.G. and S. Chang. 1997. Mushroom Biology:

Concise basics and current developments. World Scientific

Publishing Co. Pte.Ltd. Singapore.

**Suggested activities:** Growing spawn on laboratory prepared medium in petriplates and maintaining, preparing compost and compost beds, packing of beds, spawning, maintaining moisture, picking, blanching and packing. Collecting naturally growing mushrooms and identifying them properly, visits to mushroom houses.

### **Paper VIII-B-2: PRACTICAL SYLLABUS**

1. Identification of different edible and poisonous mushrooms.
2. Microscopic and anatomical observations of different mushroom species.
3. Pure culture - preparation of medium (PDA and Oatmeal agar medium) sterilization.
4. Isolation and preparation of spawn under controlled conditions (preparation of mother spawn in saline bottle and polypropylene bag and their multiplication).
5. Types of Compost preparation and sterilization.
6. Mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves/waste.
7. Inoculation and spawning of compost.
6. Incubation and harvesting of mushrooms (collection, drying and preservation).
7. Diseases of mushrooms (photographs).
8. Post-harvest technology steps (photographs).
9. Study tour to mushroom cultivation farms
11. Project work – cultivation of paddy straw/ oyster/white button mushrooms.

**Domain skills expected to achieve:** Identification of different edible species, skill in media and substrate preparation, isolation of pure culture for spawn, compost preparation, and practices in growing methods of different cultivated mushrooms, Postharvest handling and packing

**SCHEME OF PRACTICAL EXAMINATION**

**PAPER – VIII-B-2 (Cluster Elective): Mushroom Culture and Technology**

PRACTICAL- VIII-B-2: Cluster Elective (MODEL QUESTION PAPER)

Time: 3hrs

Max. Marks: 50

I. Prepare the culture medium for isolation of spawn and make the slants. preparation of the medium (A)	Write the protocol for 20 marks
II. Write the protocol for preparation of compost (B)	08 marks
III. Comment on given specimens C, D and E	3x4 = 12 marks
IV. Report on Field visit	05 marks
V. Practical Record	05 marks
Total = 50 marks	

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**KEY**

- A-PDA /Oatmeal agar medium
- B- Paddy straw compost
- C – Edible mushroom (Photograph)
- D- Poisonous mushroom (Photograph)
- E. Preservation technique (Photograph)

Cluster Electives - B

**III B.Sc.: Botany Syllabus Semester- VI, Theory: Cluster Elective –B-3**

**PAPER – VIII-B-3 (Cluster Elective)**

**Paper VIII-B-3: Internship/ Project Work preferably either in an Institute or Industry**