B.Sc (C.B.Z) Botany Syllabus

Sem	Course No	Course Name	Course Type (T/P/L)	Hrs/Week Science: 4+2	Credits Science: 4+2	Max. Marks Count/Internal/ Mid Assessment	Max. Marks Sem- End Exam
I	1	Fundamentals of Microbes and Non-vascular Plants	T	4	4	25	75
	2	Fundamentals of Microbes and Non-vascular Plants	L	2	1	-	50
II	3	Basics of Vascular plants and Phytogeography	T	4	4	25	75
	4	Basics of Vascular plants and Phytogeography	L	2	1	-	50
III	5	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	T	4	4	25	75
	6	Anatomy and Embryology of Angiosperms, Plant Ecology andBiodiversity	L	2	1	-	50
IV	7	Plant Physiology and Metabolism	T	4	4	25	75
	8	Plant Physiology and Metabolism	L	2	1	-	50
	9	Cell Biology, Genetics and Plant Breeding	T	4	4	25	75
	10	Cell Biology, Genetics and Plant Breeding	L	2	1	-	50
V	11 &12	Mushroom cultivation Plant tissue culture					

Programme (B.Sc.) Objectives: The objectives of bachelor's degree programme with Botany are:

1. To provide a comprehensive knowledge on various aspects related to microbes and plants.
2. To deliver knowledge on latest developments in the field of Plant sciences with a practical approach.
3. To produce a student who thinks independently, critically and discuss various aspects of plant life.
4. To enable the graduate to prepare and pass through national and international examinations related to Botany.
5. To empower the student to become an employee or an entrepreneur in the field of Botany
6.

Programme Outcomes :

1. Understand the basic concepts of Botany in relation to its allied core courses.
2. Perceive the significance of microbes and plants for human welfare, and structural and functional aspects of plants.
3. Demonstrate simple experiments related to plant sciences, analyze data, and interpret them with the theoretical knowledge.
4. Work in teams with enhanced inter-personal skills.
5. Develop the critical thinking with scientific temper.
6. Effectively communicate scientific ideas both orally and in writing.

Domain Subject(Botany) Objectives :

1. To impart knowledge on origin, evolution, structure, reproduction and interrelationships of microbes and early plant groups.
2. To provide knowledge on biology and taxonomy of true land plants within a phylogenetic framework.
3. To teach aspects related to anatomy, embryology and ecology of plants, and importance of Biodiversity.
4. To explain the structural and functional aspects of plants with respect to the cell organelles, chromosomes and genes, and methods of plant breeding.
5. To develop a critical understanding on SPAC, metabolism and growth and development in plants.
6. To enable the students proficient in experimental techniques and methods of analysis appropriate for various sub-courses in Botany.

Domain Subject(Botany) Outcomes:

1. Students will be able to identify, compare and distinguish various groups of microbes and primitive plants based on their characteristics.
2. Students will be able to explain the evolution of trachaeophytes and also distribution of plants on globe.
3. Students will be able to discuss on internal structure, embryology and ecological adaptations of plants, and want of conserving Biodiversity.
4. Students will be able to interpret life processes in plants in relation to physiology and metabolism.
5. Students will be able to describe ultrastructure of plant cells, inheritance and crop improvement methods.
6. Students will independently design and conduct simple experiments based on the knowledge acquired in theory and practicals of the different sub-courses in Botany.

B.Sc.	Semester – I	Credits: 4
Course: 1	Fundamentals of Microbes and Non-vascular Plants	Hrs/Wk: 4

Learning Outcomes: On successful completion of this course, the students will be able to:

- Explain origin of life on the earth.
- Illustrate diversity among the viruses and prokaryotic organisms and can categorize them.
- Classify fungi, lichens, algae and bryophytes based on their structure, reproduction and life cycles.
- Analyze and ascertain the plant disease symptoms due to viruses, bacteria and fungi.
- Recall and explain the evolutionary trends among amphibians of plant kingdom for their shift to land habitat.
- Evaluate the ecological and economic value of microbes, thallophytes and bryophytes

UNIT I: Origin of life and Viruses: 12Hrs.

1. Origin of life, concept of primary Abiogenesis; Miller and Urey experiment. Five kingdom classification of R.H. Whittaker
2. Discovery of microorganisms, Pasteur experiments, germ theory of diseases.
3. Shape and symmetry of viruses; structure of TMV and Gemini virus; multiplication of TMV; A brief account of Prions and Viroids.
4. A general account on symptoms of plant diseases caused by Viruses. Transmission of plant viruses and their control.
5. Significance of viruses in vaccine production, bio-pesticides and as cloning vectors.

UNIT II: Special groups of Bacteria and Eubacteria **12Hrs.**

1. Brief account of Archaebacteria, Actinomycetes and Cyanobacteria.
2. Cell structure and nutrition of Eubacteria.
3. Reproduction- Asexual (Binary fission and end oospores) and bacterial recombination (Conjugation, Transformation, Transduction).
4. Economic importance of Bacteria with reference to their role in Agriculture and industry (fermentation and medicine).
5. A general account on symptoms of plant diseases caused by Bacteria; Citruscanker

UNIT III: Fungi & Lichens **12 Hrs.**

1. General characteristics of fungi and Ainsworth classification (upto classes).
2. Structure, reproduction and life history of(a)*Rhizopus*(Zygomycota)and (b)*Puccinia* (Basidiomycota).
3. Economic uses of fungi in food industry, pharmacy and agriculture.
4. A general account on symptoms of plant diseases caused by Fungi; Blast of Rice.
5. Lichens- structure and reproduction; ecological and economic importance.

UNIT IV: Algae **12 Hrs.**

1. General characteristics of Algae (pigments, flagella and reserve food material);Fritsch classification (upto classes).
2. Thallus organization and life cycles in Algae.
3. Occurrence, structure, reproduction and life cycle of (a) *Spirogyra* (Chlorophyceae) and (b) *Polysiphonia* (Rhodophyceae).

4. Economic importance of Algae.

UNIT V: Bryophytes **12 Hrs.**

1. General characteristics of Bryophytes; classification up to classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life cycle of (a) *Marchantia* (Hepaticopsida) and (b) *Funaria*(Bryopsida).
3. General account on evolution of sporophytes in Bryophyta.

B.Sc.	Semester - I	Credits: 1
Course: 1(L)	Fundamentals of Microbes and Non-vascular Plants Lab	Hrs/Wk: 2

Course Outcomes: On successful completion of this practical course, student shall be able to;

1. Demonstrate the techniques of use of lab equipment, preparing slides and identify the material and draw diagrams exactly as it appears.
2. Observe and identify microbes and lower groups of plants on their own.
3. Demonstrate the techniques of inoculation, preparation of media etc.
4. Identify the material in the permanent slides etc.

Practical Syllabus:

1. Knowledge of Microbiology laboratory practices and safety rules.
2. Knowledge of different equipment for Microbiology laboratory (Spirit lamp, Inoculation loop, Hot-air oven, Autoclave/Pressure cooker, Laminar air flow chamber and Incubator) and their working principles. (In case of the non- availability of the laboratory equipment the students can be taken to the local college/clinical lab. with required infrastructural facilities or they can enter a linkage with the college/lab for future developments and it will fetch credits during the accreditation by NAAC).
3. Demonstration of Gram's staining technique for Bacteria.
4. Study of Viruses (Corona, Gemini and TMV) using electron micrographs/ models.
5. Study of Archaebacteria and Actinomycetes using permanent slides/ electron micrographs/diagrams.
6. Study of *Anabaena* and *Oscillatoria* using permanent/temporary slides.
7. Study of different bacteria (Cocci, Bacillus, Vibrio and Spirillum) using permanent or temporary slides/ electron micrographs/ diagrams.
8. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts :
    a. Fungi : *Rhizopus,Penicillium* and *Puccinia*
    b. Lichens: Crustose, foliose and fruiticose
    c. Algae :*Volvox, Spirogyra*, *Ectocarpus*and *Polysiphonia*
    d. Bryophyta : *Marchantia* and *Funaria*
9. Study of specimens of Tobacco mosaic disease, Citrus canker and Blast of Rice.

B.Sc.	Semester - II	Credits: 4
Course: 2	Basics of Vascular plants and Phytogeography	Hrs/Wk: 4

Learning Outcomes: On successful completion of this course, the students will be able to:

- Classify and compare Pteridophytes and Gymnosperms based on their morphology, anatomy,reproduction and life cycles.
- Justify evolutionary trends in tracheophytes to adapt for land habitat.
- Explain the process of fossilization and compare the characteristics of extinct and extant plants.
- Critically understand various taxonomical aids for identification of Angiosperms.
- Analyze the morphology of the most common Angiosperm plants of their localities andrecognize their families.
- Evaluate the ecological, ethnic and economic value of different tracheophytes and summarizetheir goods and services for human welfare.
- Locate different phytogeographical regions of the world and India and can analyze their floristicwealth.

UNIT I: Pteridophytes 12 Hrs.

1. General characteristics of Pteridophyta; classification of Smith (1955)up to divisions.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and lifehistoryof (a) *Lycopodium* (Lycopsida) and (b) *Marsilea* (Filicopsida).
3. Stelar evolution in Pteridophytes;
4. Heterospory and seed habit.

UNIT II: Gymnosperms 14 Hrs.

1. General characteristics of Gymnosperms; Sporne classification up to classes.
2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and lifehistory of (a) *Cycas*(Cycadopsida) and (b) *Gnetum* (Gnetopsida).
3. Outlines of geological time scale.
4. A brief account on *Cycadeoidea.*

UNIT III: Basic aspects of Taxonomy 13Hrs.

1. Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family.
2. Plant nomenclature: Binomial system, ICBN- rules for nomenclature.
3. Herbarium and its techniques, BSI herbarium and Kew herbarium; concept of digital herbaria.
4. Bentham and Hooker system of classification;
5. Systematic description and economic importance of the following families:
   (a) Annonaceae (b) Curcurbitaceae

UNIT IV: Systematic Taxonomy 13 Hrs.

1. Systematic description and economic importance of the following families:
   (a) Asteraceae (b) Asclepiadaceae (c)Amaranthaceae (d) Euphorbiaceae
   (e) Arecaceae and (f) Poaceae
2. Outlines of Angiosperm Phylogeny Group (APG IV).

UNIT V: Phytogeography 08 Hrs.

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

B.Sc.	Semester - II	Credits: 1
Course: 2(L)	Basics of Vascular plants and Phytogeography Lab	Hrs/Wk: 2

Course Outcomes : On successful completion of this course students shall be able to :

- Demonstrate the techniques of section cutting, preparing slides, identifying of the material anddrawing exact figures.
- Compare and contrast the morphological, anatomical and reproductive features of vascularplants.
- Identify the local angiosperms of the families prescribed to their genus and species level andprepare herbarium.
- Exhibit skills of preparing slides, identifying the given twigs in the lab and drawing figures ofplant twigs, flowers and floral diagrams as they are.
- Prepare and preserve specimens of local wild plants using herbarium techniques.

Practical Syllabus:

1. Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structuresof the following using temporary or permanent slides/ specimens/ mounts :
   a. Pteridophyta : *Lycopodium* and *Marselia*
   b. Gymnosperms : *Cycas*and *Gnetum*
2. Study of fossil specimens of *Cycadeoidea* and *Pentoxylon*(photographs /diagrams can be shownif specimens are not available).
3. Demonstration of herbarium techniques.
4. Systematic / taxonomicstudy of locally available plants belonging to the families prescribed in theory syllabus. (Submission of 30 number of Herbarium sheets of wild plants with the standardsystem is mandatory).
5. Mapping of phytogeographical regions of the globe and India.

B.Sc.	Semester - III	Credits: 4
Course: 3	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity	Hrs/Wk: 4

Learning outcomes: On successful completion of this course, the students will be able to;

1. Understand on the organization of tissues and tissue systems in plants.
2. Illustrate and interpret various aspects of embryology.
3. Discuss the basic concepts of plant ecology, and evaluate the effects of environmental and bioticfactors on plant communities.
4. Appraise various qualitative and quantitative parameters to study the population and communityecology.
5. Correlate the importance of biodiversity and consequences due to its loss.
6. Enlist the endemic/endangered flora and fauna from two biodiversity hot spots in India andassess strategies for their conservation

UNIT I: Anatomy of Angiosperms 12 Hrs.

1. Organization of apical meristems: Tunica-carpus theory and Histogen theory.
2. Tissue systems–Epidermal, ground and vascular.
3. Anomalous secondary growth in *Boerhaavia* and *Dracaena.*
4. Study of timbers of economic importance - Teak, Red sanders and Rosewood.

UNIT II: Embryology of Angiosperms 12 Hrs.

1. Structure of anther, anther wall, types of tapetum. Microsporogenesis and development of malegametophyte.
2. Structure of ovule, megasporogenesis; monosporic (*Polygonum*), bisporic (*Allium*) andtetrasporic (*Peperomia*) types of embryo sacs.
3. Outlines of pollination, pollen – pistil interaction and fertilization.
4. Endosperm - Types and biological importance - Free nuclear, cellular,helobialand ruminate.
5. Development of Dicot (*Capsella bursa-pastoris*) embryo.

UNIT III: Basics of Ecology 12 Hrs.

1. Ecology: definition, branches and significance of ecology.
2. Ecosystem: Concept and components, energy flow, food chain, food web, ecologicalpyramids.
3. Plants and environment: Climatic (light and temperature), edaphic and biotic factors.
4. Ecological succession: Hydrosere and Xerosere.

UNIT IV: Population, Community and Production Ecology 12 Hrs.

1. Population ecology: Natality, mortality, growth curves, ecotypes, ecads
2. Community ecology: Frequency, density, cover, life forms, biological spectrum
3. Concepts of productivity: GPP, NPP and Community Respiration
4. Secondary production, P/R ratio and Ecosystems.

UNIT V: Basics of Biodiversity 12 Hrs.

1. Biodiversity: Basic concepts, Convention on Biodiversity - Earth Summit.
2. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity
3. Biodiversity Hot spots in India. Biodiversity in North Eastern Himalayas and Western Ghats.
4. Principles of conservation: IUCN threat-categories, RED data book
5. Role of NBPGR and NBA in the conservation of Biodiversity.

B.Sc.	Semester - III	Credits: 1
Course: 3(L)	Anatomy and Embryology of Angiosperms, Plant Ecology and Biodiversity Lab	Hrs/Wk: 2

Course Outcomes: On successful completion of this practical course students shall be able to :

- Get familiarized with techniques of section making, staining and microscopic study of vegetative, anatomical and reproductive structure of plants.
- Observe externally and under microscope, identify and draw exact diagrams of the material inthe lab.
- Demonstrate application of methods in plant ecology and conservation of bio diversity andqualitative and quantitative aspects related to populations and communities of plants.

Practical Syllabus

1. Tissue organization in root and shoot apices using permanent slides.
2. Anomalous secondary growth in stems of *Boerhavia* and *Dracaena*.
3. Study of anther and ovule using permanent slides/photographs.
4. Study of pollen germination and pollen viability.
5. Dissection and observation of Embryo sac haustoria in *Santalum* or *Argemone.*
6. Structure of endosperm (nuclear and cellular) using permanent slides / Photographs.
7. Dissection and observation of Endosperm haustoria in *Crotalaria* or *Coccinia*.
8. Developmental stages of dicot and monocot embryos using permanent slides / photographs.
9. Study of instruments used to measure microclimatic variables; soil thermometer, maximum andminimum thermometer, anemometer, rain gauze, and lux meter. (visit to the nearest/local meteorology station where the data is being collected regularly and record the field visit summary for the submission in the practical).
10. Study of morphological and anatomical adaptations of hydrophytes and xerophytes (02 each).
11. Quantitative analysis of herbaceous vegetation in the college campus for frequency, density andabundance.
12. Identification of vegetation/various plants in college campus and comparison with Raunkiaer'sfrequency distribution law.
13. Find out the alpha-diversity of plants in the area
14. Mapping of biodiversity hotspots of the world and India.

B.Sc.	Semester - IV	Credits: 4
Course: 4	Plant Physiology and Metabolism	Hrs/Wk: 4

Learning outcomes: On successful completion of this course,the students will be able to;

- Comprehend the importance of water in plant life and mechanisms for transport of water andsolutes in plants.
- Evaluate the role of minerals in plant nutrition and their deficiency symptoms.
- Interpret the role of enzymes in plant metabolism.
- Critically understand the light reactions and carbon assimilation processes responsible for synthesis of food in plants.
- Analyze the biochemical reactions in relation to Nitrogen and lipid metabolisms.
- Evaluate the physiological factors that regulate growth and development in plants.
- Examine the role of light on flowering and explain physiology of plants under stress conditions.

UNIT I: Plant-Water relations 10 Hrs.

1. Importance of water to plant life, physical properties of water, diffusion, imbibitions, osmosis.water potential, osmotic potential, pressure potential.
2. Absorption and lateral transport of water; Ascent of sap
3. Transpiration: stomata structure and mechanism of stomatal movements (K^+ ion flux).
4. Mechanism of phloem transport; source-sink relationships.

UNIT II: Mineral nutrition, Enzymes and Respiration 14 Hrs.

1. Essential macro and micro mineral nutrients and their role in plants; symptoms of mineraldeficiency
2. Absorption of mineral ions; passive and active processes.
3. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action,enzyme kinetics.
4. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; electron transport system, mechanism of oxidative phosphorylation, Pentose Phosphate Pathway (HMP shunt).

UNIT III: Photosynthesis and Photorespiration 12 Hrs.

1. Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emersonenhancement effect.
2. Concept of two photosystems; mechanism of photosynthetic electron transport and evolution ofoxygen; photophosphorylation
3. Carbon assimilation pathways (C3,C4 and CAM);
4. Photorespiration - C2 pathway

UNIT IV: Nitrogen and lipid metabolism 12 Hrs.

1. Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixingorganisms. Nitrogenase enzyme system.
2. Lipid metabolism :Classification of Plant lipids, saturated and unsaturated fatty acids.
3. Anabolism of triglycerides, β-oxidation of fatty acids, Glyoxylate cycle.

UNIT V: Plant growth - development and stress physiology **12 Hrs.**

1. Growth and Development: Definition, phases and kinetics of growth.
2. Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins,ABA, ethylene and brassinosteroids.
3. Physiology of flowering :Photoperiodism, role of phytochrome in flowering.
4. Seed germination and senescence.
5. Physiological changes during water stress.

B.Sc.	Semester - IV	Credits: 1
Course: 4(L)	Plant Physiology and Metabolism Lab	Hrs/Wk: 2

Course outcomes: On successful completion of this practical course, students shall be able to:

- Conduct lab and field experiments pertaining to Plant Physiology, that is, biophysical andbiochemical processes using related glassware, equipment, chemicals and plant material.
- Estimate the quantities and qualitative expressions using experimental results and calculations
- Demonstrate the factors responsible for growth and development in plants.

Practical Syllabus

1. Determination of osmotic potential of plant cell sap by plasmolytic method using *Rhoeo*/*Tradescantia* leaves.
2. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
3. Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (atleast for a dicot and a monocot).
4. Effect of Temperature on membrane permeability by colorimetric method.
5. Study of mineral deficiency symptoms using plant material/photographs.
6. Demonstration of amylase enzyme activity and study the effect of substrate and Enzymeconcentration.
7. Separation of chloroplast pigments using paper chromatography technique.
8. Demonstration of Polyphenol oxidase enzyme activity (Potato tuber or Apple fruit)
9. Anatomy of C3, C4 and CAM leaves
10. Estimation of protein by biuret method/Lowry method
11. Minor experiments – Osmosis, Arc-auxonometer, ascent of sap through xylem, cytoplasmicstreaming.

B.Sc.	Semester - IV	Credits: 4
Course: 5	Cell Biology, Genetics and Plant Breeding	Hrs/Wk: 4

Learning outcomes: On successful completion of this course, the students will be able to:

- Distinguish prokaryotic and eukaryotic cells and design the model of a cell.
- Explain the organization of a eukaryotic chromosome and the structure of genetic material.
- Demonstrate techniques to observe the cell and its components under a microscope.
- Discuss the basics of Mendelian genetics, its variations and interpret inheritance of traits inliving beings.
- Elucidate the role of extra-chromosomal genetic material for inheritance of characters.
- Evaluate the structure, function and regulation of genetic material.
- Understand the application of principles and modern techniques in plant breeding.
- Explain the procedures of selection and hybridization for improvement of crops.

UNIT I: The Cell **12 Hrs.**

1. Cell theory; prokaryotic vs eukaryotic cell; animal vs plant cell; a brief account on ultra-structure of a plant cell.
2. Ultra-structure of cell wall.
3. Ultra-structure of plasma membrane and various theories on its organization.
4. Polymorphic cell organelles (Plastids); ultra structure of chloroplast. Plastid DNA.

UNIT II: Chromosomes **12 Hrs.**

1. Prokaryotic vs eukaryotic chromosome. Morphology of a eukayotic chromosome.
2. Euchromatin and Heterochromatin; Karyotype and ideogram.
3. Brief account of chromosomal aberrations - structural and numerical changes
4. Organization of DNA in a chromosome (solenoid and nucleosome models).

UNIT III: Mendelian and Non-Mendelian genetics **14Hrs.**

1. Mendel's laws of inheritance. Incomplete dominance and co-dominance; Multiple allelism.
2. Complementary, supplementary and duplicate gene interactions (plant based examples are to bedealt).
3. A brief account of linkage and crossing over; Chromosomal mapping - 2 point and 3 point testcross.
4. Concept of maternal inheritance (Corren's experiment on *Mirabilis jalapa*); Mitochondrial DNA.

UNIT IV: Structure and functions of DNA 12 Hrs.

1. Watson and Crick model of DNA. Brief account on DNA Replication (Semi-conservativemethod).
2. Brief account on Transcription, types and functions of RNA. Gene concept and genetic code andTranslation.
3. Regulation of gene expression in prokaryotes - Lac Operon.

UNIT V: Plant Breeding 12 Hrs.

1. Plant Breeding and its scope; Genetic basis for plant breeding. Plant Introduction andacclimatization.
2. Definition, procedure; applications and uses; advantages and limitations of :(a) Mass selection, **(b) Pure line selection and (c) Clonal selection.**
3. Hybridization – schemes, and technique; Heterosis (hybrid vigour).
4. Brief account on Molecular breeding – DNA markers in plant breeding. RAPD, RFLP.

B.Sc.	Semester - IV	Credits: 1
Course: 5(L)	Cell Biology, Genetics and Plant Breeding Lab	Hrs/Wk: 2

Course Outcomes: After successful completion of this practical course the student shall be able to:

- Show the understanding of techniques of demonstrating Mitosis and Meiosis in the laboratoryand identify different stages of cell division.
- Identify and explain with diagram the cellular parts of a cell from a model or picture and preparemodels
- Solve the problems related to crosses and gene interactions.
- Demonstrate plant breeding techniques such as emasculation and bagging

Practical Syllabus:

1. Study of ultra structure of plant cell and its organelles using Electron microscopic Photographs
2. Demonstration of Mitosis in *Allium cepa*/*Aloe vera* roots using squash technique; observation ofvarious stages of mitosis in permanent slides.
3. Demonstration of Meiosis in P.M.C.s of *Allium cepa*flower buds using squash technique;observation of various stages of meiosis in permanent slides.
4. Study of structure of DNA and RNA molecules using models.
5. Solving problems monohybrid, hybrid, back and test crosses.
6. Solving problems on gene interactions (atleast one problem for each of the gene interactions inthe syllabus)
7. Chromosome mapping using 3- point test cross data.
8. Demonstration of emasculation, bagging, artificial pollination techniques for hybridization.

Semester-V
Course 6C: Plant Tissue Culture

Max Marks: 100

(Skill Enhancement Course (Elective), Credits: 5)

I. Learning Outcomes:

Students at the successful completion of the course will be able to:

1. Comprehend the basic knowledge and applications of plant tissue culture.
2. Identify various facilities required to set up a plant tissue culture laboratory.
3. Acquire a critical knowledge on sterilization techniques related to plant tissue culture.
4. Demonstrate skills of callus culture through hands on experience.
5. Understand the biotransformation technique for production of secondary metabolites.

II. Syllabus: (Hours: Teaching: 50, Lab: 30, Field training: 05, others incl. unit tests: 05)
(*Syllabi of theory, practical and lab (skills) training together shall be completed in 80 hours*)

Unit - 1: Basic concepts of plant tissue culture (10h)

1. Plant tissue culture: Definition, history, scope and significance.
2. Totipotency, differentiation, dedifferentiation, and redifferentiation; types of cultures.
3. Infrastructure and equipment required to establish a tissue culture laboratory.

Unit - 2: Sterilization techniques and culture media (10h)

1. Aseptic conditions – Fumigation, wet and dry sterilization, UV sterilization, ultra filtration.
2. Nutrient media: Composition of commonly used nutrient culture media with respect to their contents like inorganic chemicals, organic constituents, vitamins, amino acids etc.
3. Composition and preparation of Murashige and Skoog culture medium.

Unit - 3: Callus culture technique (10h)

1. Explant: Definition, different explants for tissue culture: shoot tip, axillary buds, leaf discs, cotyledons, inflorescence and floral organs, their isolation and surface sterilization; inoculation methods.
2. Callus culture: Definition, various steps in callus culture.
3. Initiation and maintenance of callus - Growth measurements and subculture; soma clonal variations.

Unit – 4: Micro propagation (10h)

1. Direct and indirect morphogenesis, organogenesis, role of PGRs; somatic embryogenesis and synthetic seeds.
2. Greenhouse hardening unit operation and management; acclimatization and hardening of plantlets - need, process, packaging, exports.
3. Pathogen (Virus) indexing- significance, methods, advantages, applications.

Unit – 5: Applications of plant tissue culture (10h)

1. Germplasm conservation: cryopreservation methods, slow growth, applications and limitations; cryoprotectants.
2. Plant transformation techniques and bioreactors; production of secondary metabolites-optimization of yield, commercial aspects, applications, limitations.
3. Transgenic plants- gene transfer methods; BT cotton.

III. References:

1. Kalyan Kumar De (2001) An Introduction to Plant Tissue Culture, New Central Book Agency (P) Ltd., Calcutta
2. Razdan, M.K. (2005) Introduction to Plant Tissue Culture, Oxford & IBH Publishers, Delhi
3. Bhojwani, S.S. (1990) Plant Tissue Culture: Theory and Practical (a revised edition). Elsevier Science Publishers, New York, USA.
4. Vasil, I.K. and Thorpe, T.A. (1994) Plant Cell and Tissue Culture. Kluwer Academic Publishers, the Netherlands.
5. Web resources suggested by the teacher concerned and the college librarian including reading material.

Course 6C: Plant Tissue Culture – Practical syllabus

IV. Learning Outcomes: On successful completion of this practical course, student willbe able to:

1. List out, identify and handle various equipment in plant tissue culture lab.
2. Learn the procedures of preparation of media.
3. Demonstrate skills on inoculation, establishing callus culture and Micro propagation.
4. Acquire skills in observing and measuring callus growth.
5. Perform some techniques related to plant transformation for secondary Metabolite production.

V. Practical (Laboratory) Syllabus: (30 hrs)

1. Principles and applications of- Autoclave, Laminar Airflow, Hot Air Oven.
2. Sterilization techniques for glass ware, tools etc.,
3. MS medium - Preparation of different stock solutions; media preparation
4. Explain preparation, inoculation and initiation of callus from carrot.
5. Callus formation, growth measurements.
6. Induction of somatic embryos, preparation of synthetic seeds.
7. Multiplication of callus and organogenesis.
8. Hardening and acclimatization in green house.

Course 7C: Mushroom Cultivation

(Skill Enhancement Course (Elective)

I. Learning Outcomes

Students at the successful completion of the course will be able to:

1. Understand the structure and life of a mushroom and discriminate edible and poisonousmushrooms.
2. Identify the basic infrastructure to establish a mushroom culture unit.
3. Demonstrate skills preparation of compost and spawn.
4. Acquire a critical knowledge on cultivation of some edible mushrooms.
5. Explain the methods of storage, preparation of value-added products and marketing.

Unit – 1: Introduction and value of mushrooms (10h)

1. Mushrooms: Definition, structure of a mushroom and a brief account of life cycle; historical account and scope of mushroom cultivation; difference between edible andpoisonous mushrooms.
2. Morphological features of any four edible mushrooms, Button mushroom (*Agaric us Bosporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajor-caju*)and Paddy straw mushroom (*Volvariella volvacea*).
3. Nutraceutical value of mushrooms; medicinal mushrooms in South India - *Ganodermalucidum, Phellinus rimosus, Pleurotus florida and Pleurotus pulmonaris* – their therapeutic value; Poisonous mushrooms - harmful effects.

Unit – 2: Basic requirements of cultivation system (10h)

1. Small village unit and larger commercial unit; layout of a mushroom farm - location ofbuilding plot, design of farm, bulk chamber, composting, equipment and facilities, pasteurization room and growing rooms.
2. Compost and composting: Definition, machinery required for compost making, materialsfor compost preparation.
3. Methods of composting- long method of composting and short method of composting

Unit – 3: Spawning and casing (10h)

1. Spawn and spawning: Definition, facilities required for spawn preparation; preparation ofspawn substrate.
2. Preparation of pure culture, media used in raising pure culture; culture maintenance,storage of spawn.
3. Casing: Definition, Importance of casing mixture, Quality parameters of casing soil,different types of casing mixtures, commonly used materials.

Unit – 4: Mushroom cultivation (10h)

Raw material, compost, spawning, casing, cropping, and problems in cultivation (diseases, pests and nematodes, weed molds and their management strategies), picking and packing forany Four of the following mushrooms:

(a) Button mushroom (b) Oyster mushroom (c) Milky mushroom and (d) Paddy strawmushroom

Unit – 5: Post harvest technology (10h)

1. Shelf life of mushrooms; preservation of mushrooms - freezing, dry freezing, drying andcanning.
2. Quality assurance and entrepreneurship - economics of different types of mushrooms;value added products of mushrooms.
3. Management of spent substrates and waste disposal of various mushrooms.

Course 7C: Mushroom Cultivation – Practical syllabus

II. Learning Outcomes: On successful completion of this practical course, student will beable to:

1. Identify and discriminate different mushrooms based on morphology.
2. Understand facilities required for mushroom cultivation.
3. Demonstrate skills on preparation of spawn, compost and casing material.
4. Exhibit skills on various cultivation practices for an edible mushroom.

III. Practical (Laboratory) Syllabus: (30 hrs)

1. Identification of different types of mushrooms.
2. Preparation of pure culture of an edible mushroom.
3. Preparation of mother spawn.
4. Production of planting spawn and storage.
5. Preparation of compost and casing mixture.
6. Demonstration of spawning and casing.
7. Hands on experience on cropping and harvesting.
8. Demonstration of storage methods.
9. Preparation of value-added products.