SYLLABUS

Subject: Botany Course Title: Fundamentals of Microbes & Non-Vascular Plants

Semester: I Course Code: 20BTCCMN13

No. of Hours: 60 LTP: 400

Credits:3

Objectives

- To Understand the Structure, Reproduction, Classification and Economic importance of Microbes, Algae, Fungi and Bryophytes.
- To demonstrate the effectiveness of the biofertilizer in agriculture.
- To analyze the plant disease symptoms due to viruses, bacteria and fungi.

Course Outcomes

CO1: Origin of life on the earth.

- CO2: Illustrate diversity among the viruses and prokaryotic organisms and can categorize them.
- **CO3:** Classify fungi, lichens, algae and bryophytes based on their structure, reproduction and life cycles.
- **CO4:** Distinguish the use of bio fertilizers and chemical fertilizers.

UNIT-I Origin of life and Viruses

(10 Hrs.)

- 1. Origin of life, concept of primary Abiogenesis; 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, 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 group of Bacteria and Eubacteria (10 Hrs.)

- 1. Brief account of Archaebacteria and Actinomycetes.
- 2. Cell structure and nutrition of Eubacteria, Reproduction-Asexual (Binary fission and endospores) and bacterial recombination (Conjugation, Transformation. Transduction).

- 3. Economic importance of Bacteria with reference to their role in Agriculture and industry (fermentation and medicine).
- 4. A general account on symptoms of plant diseases caused by Bacteria; Citrus canker.
- 5. Biofertilizers: General account of the microbes used as biofertilizers, Rhizobium- Isolation, Identification and mass multiplication. Cyanobacteria, Azolla, Anabaenaassociation and role of Azolla in agriculture.

UNIT- III Fungi & Lichens

- 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 the 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

- General characteristics of Algae (pigments, flagella and reserve food material);Fritsch classification (Upto classes), Thallus organization in Algae.
- Occurrence, structure, reproduction and life cycle of (a) Spirogyra (Chlorophyceae)and (b) Polysiphonia (Rhodophyceae).
- 3. Algal blooms, eutrophication and biomagnification (From local water bodies). Algaeas food, Medicine, feed, biofuel and indicators of pollution.

UNIT- V Bryophytes

- 1. General characteristics of Bryophytes; classification upto classes.
- 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.

Skill / Hands- on

General microscope lens arrangement, Scanning electron microscopy, Transmissionmicroscopy, Compound microscopy, Fluorescent microscopy

(10 Hrs.)

(10 Hrs.)

(10 Hrs.)

(10 Hrs.)

Co-curricular Activities

- 1. Creative crafts designing to simplify the concepts
- 2. student Seminars
- 3. Quizzes
- Assignments on Applications of Microbes and Nonvascular Plants

Prescribed Text Books

- 1. Botany I (Vriksha Sastram-I) : Telugu Akademi, Hyderabad.
- Bhattacharjee, R.N., (2017) Introduction to Microbiology and Microbial Diversity, Kalyani Publishers, New Delhi.
- 3. Hait, G., K. Bhattacharya & A.K. Ghosh (2011) A Text Book of Botany, Volume-I,New Central Book Agency Pvt. Ltd., Kolkata.
- 4. Pandey, B.P. (2013) College Botany, Volume-I, S. Chand Publishing, New Delhi.

Reference Books

- 1. Alexopoulos, C.J., C. W. Mims & M. Blackwell (2007). Introductory Mycology, Wiley & Sons, Inc., New York.
- 2. Bold, H.C. & M. J. Wynne (1984). Introduction to the Algae, Prentice-Hall Inc., New Jersey.
- Dubey, R.C. & D.K. Maheswari (2013). A TextBook of Microbiology, S. Chand & Company Ltd., New Delhi.
- 4. Fritsch, F.E. (1945). The Structure & Reproduction of Algae (Vol. I & Vol. II)Cambridge University Press Cambridge, U.K.
- 5. John Webster & R. W. S. Weber (2007). Introduction to Fungi, Cambridge University Press, New York.
- 6. Kevin Kavanagh (2005). Fungi; Biology and Applications John Wiley & Sons,Ltd., West Sussex, England.
- Mehrotra, R.S. & K. R. Aneja (1990). An Introduction to Mycology. New AgeInternational Publishers, New Delhi.
- 8. Pelczar Jr., M.J., E.C.N. Chan & N.R. Krieg (2001). Microbiology, Tata Mc GrawHill Co, New Delhi.
- Presscott, L. Harley, J. and Klein, D. (2005). Microbiology, 6th edition, Tata McGraw – Hill, Co. New Delh.

SYLLABUS

Subject: Botany Semester: I Course Title: Fundamentals of Microbes & Course Code: 20BTP1MN12 Non-Vascular Plants- Practical

No. of Hours: 30 LTP: 002 Credits: 2

Objectives

- To observe and identify the bacteria, fungi and viruses and lower groups ofplants on their own.
- To Prepare permanent slides for non-vascular plants.
- To know about microorganisms.

Course Outcomes

CO1: Learn the techniques to use of lab equipment, preparing

- slides and identify the material and draw diagrams exactly as it appears.
- **CO2:** Observation and identify microbes and lower groups of plants on their own.

CO3: Learn the techniques of inoculation, preparation of media.

List of Experiments

- 1. Knowledge of Microbiology laboratory practices and safety rules.
- 2. Knowledge of different equipment for Microbiology laboratory (Spirit lamp, Inoculationloop, Hot-air oven, Autoclave/Pressure cooker, laminar air flow chamber and Incubator) and their working principles.
- 3. Demonstration of Gram's staining technique for Bacteria.
- 4. Study of Viruses (Corona, Gemini and TMV) using electron micrographs/ models.
- 5. Study of Anabaena and Oscillatoria using permanent/temporary slides.
- 6. Study of different bacteria (Cocci, Bacillus, Vibrio and Spirillum) using permanent ortemporary slides/ electron micrographs/ diagrams.
- Study/ microscopic observation of vegetative, sectional/anatomical and reproductivestructures of the following using temporary or permanent slides/ specimens/ mounts:
 - a. Fungi: Rhizopus and Puccinia.
 - b. Lichens: Crustose, foliose and fruticose.

- c. Algae, Spirogyra and Polysiphonia.
- d. Bryophyta: Marchantia and Funaria (Slides)

SYLLABUS

Subject: Botany		Semester: II
Course Title: Basics of Vascular plants & Phytogeography		Course Code: 20BTCCVP23

Objectives

- To bring awareness on the importance of Taxonomy and its role in understanding • evolution.
- To make the students explore the floristic wealth of the nation by following different phytogeographical regions.
- To analyze the morphology of the most common Angiosperm plants of their localities and recognize their families.

Course Outcomes

- **CO1:** Classify and compare Pteridophytes and Gymnosperms based on their morphology, anatomy, reproduction and life cycles.
- **CO2:** Explain the process of fossilization and compare the characteristics of extinct and extant plants.
- CO3: Analyze the morphology of the most common Angiosperm plants of their localities and recognize their families.
- **CO4:** Evaluate the ecological, ethnic and economic value of different tracheophytes and summarize their goods and services for human welfare.

UNIT-I Pteridophytes

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

UNIT-II Gymnosperms

- 1. General characteristics of Gymnosperms; Sporne classification upto classes.
- 2. Occurrence, morphology, anatomy, reproduction (developmental details are not needed) and life history of (a) Cycas (Cycadopsida) and (b) Gnetum (Gnetopsida).

Outlines of geological time scale. 4. A brief account on Cycadeoidea.

UNIT - III Basic aspects of Taxonomy

1. Aim and scope of taxonomy; Species concept: Taxonomic hierarchy, species, genus and family.

(10 Hrs.)

(10 Hrs.)

(10 Hrs.)

- 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) Cucurbitaceae

UNIT - IV Systematic Taxonomy

- 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

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

Skill / Hands- on

- 1. Preparation of Herbarium both manually and digitally and using them in learning taxonomy.
- 2. Preparation of crafts / models related to Phytogeography to simplify the concept. Usage of the internet to understand phytogeography.

Prescribed Text Books

- 1. Acharya, B.C., (2019), Archchegoniates, Kalyani Publishers, New Delhi.
- 2. Botany I (Vrukshasastram-I): Telugu Akademi, Hyderabad.
- 3. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume II, New Central Book Agency Pvt. Ltd., Kolkata.
- 4. Botany II (Vrukshasastram-II): Telugu Akademi, Hyderabad.
- 5. Hait, G., K. Bhattacharya & A.K. Ghosh (2011) A Text Book of Botany, Volume-I, New Central Book Agency Pvt. Ltd., Kolkata.

nuous s

(10 Hrs.)

(10 Hrs.)

(10 Hrs.)

Reference Books

- 1. Arnold, C.A., (1947) An introduction to Paleobotany McGraw -Hill Book Company,INC, New York.
- 2. Bhatnagar, S.P. & Alok Moitra (1996) Gymnosperms. New Age International, NewDelhi.
- Coulter, J.M. & C.J. Chamberlain (1910) Morphology of Gymnosperms, TheUniversity of Chicago Press, Chicago, Illinois.
- 4. Govil, C.M. (2007) Gymnosperms: Extinct and Extant. KRISHNA Prakashan Media
- (P) Ltd. Meerut & Delhi.
- 5. Heywood, V. H. and D. M. Moore (1984) Current Concepts in Plant Taxonomy.Academic Press, London.
- 6. Jeffrey, C. (1982) An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge. London.
- Kramer, K.U.&P. S. Green (1990) The Families and Genera of Vascular Plants, Volume -I: Pteridophytes and Gymnosperms (Ed. K. Kubitzki) Springer-Verlag, NewYork.
- 8. Lawrence, George H.M. (1951) Taxonomy of Vascular Plants. The McMillan Co., New York.
- 9. Pandey, B.P. (2013) College Botany, Volume-I, S. Chand Publishing, New Delhi.
- 10. Pandey, B.P. (2013) College Botany, Volume-II, S. Chand Publishing, New Delhi.
- 11. Sambamurty, A.V.S.S. (2005) Taxonomy of Angiosperms I. K. International Pvt.Ltd., New Delhi.
- 12. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd.,New Delhi.

SYLLABUS

Subject: Botany Course Title: Basics of Vascular plants & Phytogeography - Practical No. of Hours: 30 LTP: 002 Semester: II Course Code: 20BTP2VP22

Credits: 2

Objectives

- To know about the basic vascular plants like Pteridophytes and Gymnosperms.
- To know about the identification of plants by using taxonomical methods.
- To know about the various Phytogeographical regions in India.

Course Outcomes

- **CO1:** Compare and contrast the morphological, anatomical and reproductive features ofvascular plants.
- **CO2:** Identify the local angiosperms of the families prescribed to their genus and species level and prepare herbarium.
- **CO3:** Exhibit skills of preparing slides, identifying the given twigs in the lab and drawingfigures of plant twigs, flowers and floral diagrams as they are.

List of Experiments

- Study/ microscopic observation of vegetative, sectional/anatomical and reproductive structures of the following using temporary or permanent slides/ specimens/ mounts:
 - a. Pteridophyta: Lycopodium and Marselia
 - b. Gymnosperms: Cycas, Pinus and Gnetum.
- 2. Study of fossil specimens of Cycadeoidea and Pentoxylon (photographs /diagramscan be shown if specimens are not available).
- 3. Demonstration of herbarium techniques.
- 4. Systematic / taxonomic study of locally available plants belonging to the families prescribed in theory syllabus. (Submission of 30 Herbarium sheets of wild plants with the standard system is mandatory).
- 5. Mapping of phytogeographical regions of the globe and India.

SYLLABUS

Subject: Botany Semester: III Course Title: Anatomy & Embryology of Course Code:20BTCCAE33 Angiosperms, Plant Ecology & Biodiversity

No. of Hours: 60 LTP: 400 Credits: 3

Objectives

- To create awareness in students on tissues and tissue systems in plants.
- To make students aware of different embryological and phenological events in plant life by facilitating them with different examples.
- To educate the students about ecology and its importance.

Course outcomes

- **CO1:** Explain the organization of tissues and tissue systems in plants.
- **CO2:** Illustrate and interpret various aspects of embryology.
- **CO3:** Outline the basic concepts of plant ecology and its interaction with both biotic and abiotic factors.
- **CO4:** Explain the qualitative and quantitative dynamism of population and community.
- **CO5:** Summarize the importance of biodiversity and conservation strategies

UNIT – I: Anatomy of Angiosperms

(10 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

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

UNIT – III: Basics of Ecology

(10 Hrs.)

(10 Hrs.)

- 1. Ecology: definition, branches and significance of ecology.
- 2. Ecosystem: Concept and components, energy flow, food chain, food web, ecological pyramids.
- 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 (10 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

- 1. Biodiversity: Basic concepts, Convention on Biodiversity Earth Summit.
- 2. Value of Biodiversity; types and levels of biodiversity and Threats to biodiversity
- 3. Biodiversity Hotspots 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.

Skill/Hands- on

(10 Hrs.)

1. Grafting techniques



(10 Hrs.)

- 2. Pollination, Evolutionary aspects in embryology
- 3. study of ecosystem-observation of grassland and pond ecosystems.
- 4. Indirect measurement of Anabolism or Catabolism. (Biomass)
- 5. RET plants conservation techniques

Prescribed Text Books

- 1. Botany III (Vrukshasastram-I): Telugu Akademi, Hyderabad
- 2. Botany IV (Vrukshasastram-II): Telugu Akademi, Hyderabad
- 3. Pandey, B.P. (2013) College Botany, Volume-II, S. Chand Publishing, New Delhi
- 4. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
- 5. Bhattacharya, K., G. Hait & Ghosh, A. K., (2011) A Text Book of Botany, Volume-II, New Central Book Agency Pvt. Ltd., Kolkata

Reference Books

- 1. Esau, K. (1971) Anatomy of Seed Plants. John Wiley and Son, USA.
- 2. Fahn, A. (1990) Plant Anatomy, Pergamon Press, Oxford.
- 3. Cutler, D.F., T. Botha & D. W m. Stevenson (2008) Plant Anatomy: An Applied Approach, Wiley, USA.
- Paula Rudall (1987) Anatomy of Flowering Plants: An Introduction to Structure and Development. Cambridge University Press, London
- 5. Bhojwani, S. S. and S. P. Bhatnagar (2000) The Embryology of Angiosperms (4th Ed.), Vikas Publishing House, Delhi.
- 6. Pandey, A. K. (2000) Introduction to Embryology of Angiosperms. CBS Publishers & Distributors Pvt. Ltd., New Delhi
- 7. Maheswari, P. (1971) An Introduction to Embryology of Angiosperms. McGraw Hill Book Co., London.
- Johri, B.M. (2011) Embryology of Angiosper ms. Springer- Verlag, Berlin √ Pandey, B.P. (2013) College Botany, Volume - III, S. Chand Publishing, New Delhi
- 9. Bhattacharya, K., A. K. Ghosh, & G. Hait (2011) A Text Book of Botany, VolumeIV, New Central Book Agency Pvt. Ltd., Kolkata

- 10. Kormondy, Edward J. (1996) Concepts of Ecology, Prentice-Hall of India Private Limited, New Delhi
- 11. Begon, M., J.L. Harper & C.R. Townsend (2003) Ecology, Blackwell Science Ltd., U.S.A.
- 12. Eugene P. Odum (1996) Fundamentals of Ecology, Natraj Publishers, Dehradun

SYLLABUS

Subject: BotanySemester: IIICourse Title: Anatomy & Embryology ofCourse Code: 20BTP3AE32Angiosperms, Plant Ecology & Biodiversity - Practical

No. of Hours: 30 LTP: 002 Credits: 2

Objectives

- To impart microscopy skills
- To educate about different tissues and tissue systems and their roles in different phenological events of plant life.
- To inculcate quantitative and qualitative aspects of ecology and its dynamism.

Course Outcomes

- **CO1:** Handle the techniques of section making, staining and microscopic study of vegetative, anatomical and reproductive structure of plants.
- **CO2:** Observe externally and under microscope, identify and draw exact diagrams of the lower plant material in the lab.
- **CO3:** Demonstrate application of methods in plant ecology and conservation of biodiversity and qualitative and quantitative aspects related to populations and communities of plants.

List of Experiments

- 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 and minimum thermometer, anemometer, rain gauge, 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 and abundance.
- 12. Identification of vegetation/various plants in college campus and comparison with Raunkiaer's frequency distribution law.
- 13. Find out the alpha-diversity of plants in the area
- 14. Mapping of biodiversity hotspots of the world and India.

Semester: IV Subject: Botany Course Code: 20BTCCPP43 Course Title: Plant Physiology & Metabolism

LTP: 400 No. of Hours: 60 Credits: 3

Objectives

- To educate students about the importance of water and minerals and their role in different metabolisms.
- To educate students about the physical and chemical factors that affect the life of plants.
- To sensitize the students about the chances to improve photosynthesis.
- To impart knowledge on the importance of element nitrogen and its functions in different metabolisms.
- To educate students about the importance of Plant Growth Regulators in growth and development of any plant.

Course outcomes

- **CO1:** Outline the importance of water and its transport mechanism in plants.
- **CO2:** Explain the role of minerals and enzymes in plant nutrition, metabolism and deficiency symptoms.
- **CO3:** Summarize the processes of photosynthesis and photorespiration.
- **CO4:** Explain the metabolism of nitrogen and lipids.
- **CO5:** Outline the effect of physiological factors on plant growth under normal and stress conditions.

UNIT – I: Plant-Water Relations

Importance of water to plant li fe, physical properties of water, diffusion, imbibition, osmosis. water potential, osmotic potential, pressure potential.

Absorption and lateral transport of water; Ascent of sap Transpiration: stomata structure and mechanism of stomatal movements (K+ion flux).

Mechanism of phloem transport; source-sink relationships.

(10 Hrs.)

UNIT – II: Mineral Nutrition, Enzymes and Respiration (10 Hrs.) Essential macro and micro mineral nutrients and their role in plants; symptoms of mineral deficiency Absorption of mineral ions; passive and active processes. Characteristics, nomenclature and classification of Enzymes. Mechanism of enzyme action, enzyme kinetics. Respiration: Aerobic and Anaerobic; Glycolysis, Krebs cycle; mechanism of oxidative electron transport system, phosphorylation, Pentose Phosphate Pathway (HMP shunt).

UNIT – III: Photosynthesis and Photorespiration (10 Hrs.) Photosynthesis: Photosynthetic pigments, absorption and action spectra; Red drop and Emerson enhancement effect Concept of two photosystems; mechanism of photosynthetic electron transport and evolution of oxygen; photophosphorylation Carbon assimilation pathways (C3, C4 and CAM); Photorespiration - C2 pathway.

UNIT – IV: Nitrogen and Lipid Metabolism (10 Hrs.)

Nitrogen metabolism: Biological nitrogen fixation – asymbiotic and symbiotic nitrogen fixing organisms. Nitrogenase enzyme system. Lipid metabolism: Classification of Plant lipids, saturated and unsaturated fatty acids.

Anabolism of triglycerides, β -oxidation of fatty acids, Glyoxylate cycle.

UNIT - V: Plant Growth - Development and Stress Physiology (10 Hrs.) Growth and Development: Definition, phases and kinetics of

growth.

Physiological effects of Plant Growth Regulators (PGRs) - auxins, gibberellins, cytokinins, ABA, ethylene and brass in osteroids. Physiology of flowering: Photoperiodism, role of phytochrome in flowering.

Seed germination and senescence; physiological changes.

Skill / Hands

(10 Hrs.)

- 1. Study of different types of stomata.
- 2. Role of enzymes- regulation; Observation of mineral deficiency symptoms in different plants. Measurement of anabolism.
- 3. Different techniques and Formulae to measure catabolism.
- 4. Collection of root nodules and TS of root nodules.

5. Observation of different seed germination and viability studies

Prescribed Text books

- 1. Botany IV (Vruksha sastram-II): Telugu Akademi, Hyderabad
- 2. Pandey, B.P. (2013) College Botany, Volume-III, S. Chand Publishing, New Delhi
- 3. Ghosh, A. K., K. Bhattacharya & G. Hait (2011) A Text Book of Botany, Volume III, New Central Book Agency Pvt. Ltd., Kolkata

Reference Books

- 1. Aravind Kumar & S.S. Purohit (1998) Plant Physiology Fundamentals and Applications, Agro Botanica, Bikaner.
- Datta, S.C. (2007) Plant Physiology, New Age International (P) Ltd., Publishers, New Delhi.
- Hans Mohr & P. Schopfer (2006) Plant Physiology, Springer (India) Pvt. Ltd., New Delhi.
- Hans-Walter heldt (2005) Plant Biochemistry, Academic Press, U.S.A.
- 5. Hopkins, W.G. & N.P.A. Huner (2014) Introduction to Plant Physiology, Wiley India Pvt. Ltd., New Delhi.
- 6. Noggle Ray & J. Fritz (2013) Introductory Plant Physiology, Prentice Hall (India), New Delhi.
- Pandey, S.M. & B. Sinha (2006) Plant Physiology, Vikas Publishing House, New Delhi.
- 8. Salisbury, Frank B. & Cleon W. Ross (2007) Plant Physiology, Thomsen & Wadsworth, Australia & U.S.A.
- 9. Sinha, R.K. (2014) Modern Plant Physiology, Narosa Publishing House, New Delhi.
- 10. Taiz, L.&E. Zeiger (2003) Plant Physiology, Panima Publishers, New Delhi.
- 11. Verma, V. (2007) Text Book of Plant Physiology, Ane Books India, New Delhi

Subject: Botany		Semester: IV	
Course Title: Plant Phys	siology Cours	e Code: 20BTP 4PP42	
& Metab	olism - Practical		
No. of Hours: 30	LTP: 002	Credits: 2	

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Objectives

- To give hand on training to set the experimental glassware and measure different metabolic activities accurately.
- To train students on quantitative and qualitative analysis scientifically.
- To educate the students on the factors which alter different metabolisms.

Course outcomes

- **CO1:** Conduct lab and field experiments pertaining to Plant Physiology, that is, biophysical and biochemical processes using related glassware, equipment, chemicals and plant material.
- **CO2:** Estimate the quantities and qualitative expressions using experimental results and calculations
- **CO3:** Demonstrate the factors responsible for growth and development in plants.

List of Experiments

- 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.
- Determination of rate of transpiration using Cobalt chloride method / Ganong's potometer (at least 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 Enzyme concentration.

- 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- auxanometer, ascent of sap through xylem, cytoplasmic streaming.

SYLLABUS

Subject: Botany		Semester: IV	
Course Title: Cell Biol	ogy, Genetics	Course Code: 20BTCCCG43	
& Plar	nt Breeding		
No. of Hours: 60	LTP: 400	Credits: 3	

Objectives

- To differentiate between prokaryotic and eukaryotic cells and the ultrastructure of different parts and organelle s.
- To teach the usage of different microscopes and their purpose.
- To explain the importance of mendelian genetics in understanding the genetic variations in plants.

Course outcomes

- **CO1:** Explain the organization of an eukaryotic chromosome and the structure of genetic material.
- **CO2:** Demonstrate techniques to observe the cell and its components under a microscope.
- **CO3:** Discuss the basics of Mendelian genetics, its variations and interpret inheritance of traits in living beings.
- **CO4:** Elucidate the role of extrachromosomal genetic material for inheritance of characters.

CO5: Evaluate the structure, function and regulation of genetic material. UNIT- I: The Cell (10 Hrs.)

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

UNIT - II: Chromosomes

(10 Hrs.)

1. Prokaryotic vs eukaryotic chromosome. Morphology of a eukaryotic 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 (10 Hrs.)

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

UNIT- IV: Structure and functions of DNA (10 Hrs.)

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

UNIT-V: Plant Breeding

- Plant Breeding and its scope; Genetic basis for plant breeding. 1. Plant Introduction and acclimatization.
- 2. Definition, procedure; applications and uses; advantages and I imitations of a) Mass selection, (b) Pure I ine selection and (c) Clonal selection.
- 3. Hybridization - schemes, and technique; Heterosis (hybrid vigour).
- A brief account on Molecular breeding DNA markers in plant 4. breeding. RAPD, RFLP.

Skill/ Hands on activities

- Crafts and models preparation of prokaryotic and eukaryotic cells 1. and organelles like mitochondria and chloroplasts.
- 2. Observation of nucleosome model. DNA isolation - Group activity or Demonstration.
- 3. Problem solving.

(10 Hrs.)

(10 Hrs.)

- 4. Preparation of DNA model
- 5. Plant breeding techniques at Horticultural university / plant tissue culture laboratory.

Prescribed text books

- 1. Botany III (Vrukshasastram- I): Telugu Akademi, Hyderabad $\sqrt{}$ Pandey, B. P. (2013) College Botany, Volume III, S. Chand Publishing, New Delhi
- 2. Ghosh, A.K., K. Bhattacharya &G. Hait (2011) A Text Book of Botany, Volume-III, New Central Book Agency Pvt. Ltd., Kolkata
- 3. Chaudhary, R. C. (1996) Introduction to Plant Breeding, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi

Books for Reference

- 1. S. C. Rastogi (2008) Cell Biology, New Age International (P) Ltd. Publishers, New Delhi
- 2. P. K. Gupta (2002) Cell and Molecular biology, Rastogi Publications, New Delhi
- 3. B. D. Singh (2008) Genetics, Kalyani Publishers, Ludhiana
- A.V. S.S. Sambamurty (2007) Molecular Genetics, Narosa Publishing House, New Delhi
- 5. Cooper, G.M. & R.E. Hausman (2009) The Cell A Molecular Approach, A.S.M. Press, Washington
- 6. Becker, W.M., L.J. Kleinsmith & J. Hardin (2007) The World of Cell, Pearson Education, Inc., New York
- De Robertis, E.D. P. & E.M.F. De Robertis Jr. (2002) Cell and Molecular Biology, Lippincott Williams & Wilkins Publ., Philadelphia
- 8. Robert H. Tamarin (2002) Principles of Genetics, Tata McGraw -Hill Publishing Company Limited, New Delhi.
- 9. Gardner, E.J., M. J. Simmons & D.P. Snustad (2004) Principles of Genetics, John Wiley & Sons Inc., New York
- 10. Micklos, D.A., G.A. Freyer & D.A. Cotty (2005) DNA Science: A First Course, I.K. International Pvt. Ltd., New Delhi
- Chaudhari, H.K. (1983) Elementary Principles of Plant Breeding, TMH publishers Co., New Delhi
- 12. Sharma, J.R. (1994) Principles and Practice of Plant Breeding, Tata McGraw- Hill Publishers, New Delhi
- 13. Singh,B.D. (2001)Plant Breeding : Principles and Methods ,Kalyani

Publishers, Ludhiana

- Pundhan Singh (2015) Plant Breeding for Undergraduate Students, Kalyani Publishers, Ludhiana
- 15. Gupta, S.K. (2010) Plant Breeding: Theory and Techniques, Agrobios (India), Jodhpur
- 16. Hayes, H.K., F.R. Immer & D.C. Smith (2009) Methods of Plant Breeding, Biotech Books, Delhi

Subject: Botany		Semester: IV
Course Title: Cell Biolo	gy, Genetics	Course Code: 20BTP5CG42
& Plant Breed	ling - Practical	
No. of Hours: 30	LTP: 002	Credits: 2

Objectives

- To impart microscopy skills to observe different organelles.
- To train the students to solve problems related to crosses and genetic interactions.
- To demonstrate the basic plant breeding techniques.

Course Outcomes:

CO1: Handle microscopes, identify and demonstrate the stages of Mitosis and Meiosis in the laboratory.

- CO2: Explain the cellular parts of a cell through models or pictures
- **CO3:** Solve the problems related to crosses and gene interactions.
- CO4: Demonstrate plant breeding techniques such as emasculation and bagging

List of Experiments

- 1. Study of ultrastructure of plant cell and its organelles using Electron microscopic Photographs/ models.
- 2. Demonstration of Mitosis in *Allium cepa /Aloe vera* roots using squash technique; observation of various 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 on monohybrid, dihybrid, back and test crosses.
- 6. Solving problems on gene interactions.
- 7. Chromosome mapping using 3- point test cross data.
- 8. Demonstration of emasculation, bagging, artificial pollination techniques for hybridization.

SYLLABUS

Subject: Botany Course Title: Plant Propagation No. of Hours: 45 LTP: 300 Semester: V/VI Course Code: 20BTSEC11PP3 Credits: 3

Objectives

- To know about the advantages of by using propagation techniques
- To learn the process of Apomixis.
- To understand the grafting and budding

Course Outcomes

CO1: Explain various plant propagation structures and their utilization.

- **CO2:** Understand advantages and disadvantages of vegetative, asexual and sexual plant propagation methods.
- **CO3:** Assess the benefits of asexual propagation of certain economically valuable plants using apomictics and adventive polyembryony.
- **CO4:** Demonstrate skills related to vegetative plant propagation techniques such as cuttings, layering, grafting and budding.
- CO5: Apply a specific macro-propagation technique for a given plant species.

UNIT – I: Basic concepts of propagation (9 Hrs.)

1. Propagation: Definition, need and potentialities for plant multiplication; asexual and sexual methods of propagation - advantages and disadvantages.

2. Propagation facilities: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery - tools and implements.

3. Identification and propagation by division and separation: Bulbs, pseudobulbs, corms, tubers and rhizomes; runners, stolons, suckers and offsets.

UNIT – II: Apomictics in plant propagation (9 Hrs.)

 Apomixis: Definition, facultative and obligate; types – recurrent, non-recurrent, adventitious and vegetative; advantages and disadvantages.

2. Polyembryony: Definition, classification, horticultural significance; chimera and bud sport.

3. Propagation of mango, Citrus and Allium using apomictic embryos.

UNIT – III: Propagation by cuttings

1. Cuttings: Definition, different methods of cuttings; root and leaf cuttings.

Stem cuttings: Definition of stem tip and section cuttings; plant propagation by herbaceous, soft wood, semi hard wood, hard wood and coniferous stem cuttings.
 Physiological and bio chemical basis of rooting; factors influencing rooting of cuttings; Use of plant growth regulators in rooting of cuttings.

UNIT – IV: Propagation by layering (9 Hrs.)

1. Layering: Definition, principle and factors influencing layering.

2. Plant propagation by layering: Ground layering – tip layering, simple layering, trench layering, mound (stool) layering and compound (serpentine layering).

3. Air layering technique - application in woody trees.

UNIT – V: Propagation by grafting and budding (9 Hrs.)

1. Grafting: Definition, principle, types, graft incompatibility, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification; micrografting.

2. Propagation by veneer, whip, cleft, side and bark grafting techniques.

3. Budding: Definition; techniques of 'T', inverted 'T', patch and chip budding.

Co- Curricular Activities

- Assignments on vegetative plant propagation techniques
- Group discussion
- Student presentations and seminars
- Online quiz

Reference Books

1. Sharma RR and Manish Srivastav.2004. Plant Propagation and Nursery Management International Book Distributing Co. Lucknow.

2. Hartman, HT and Kester, D.E.1976. Plant Propagation: Principles and Practices, Prentice Hall of India Pvt. Ltd. Bombay.

3. Sadhu, M.K. 1996. Plant Propagation. New Age International Publishers, New Delhi.

4. Web resources suggested by the teacher concerned and college librarian including reading material.

(9 Hrs.)

SYLLABUS

Subject: Botany Course Title: Plant Propagation - Practical No. of Hours: 45 LTP: 003 Semester: V/VI Course Code: 20BTP611PP2 Credits: 2

Objectives

- To learn the preparation of nursery beds
- To understand the propagation techniques
- To prepare the potting mixture, potting and repotting

Course Objectives

- CO1: Make use of different plant propagation structures for plant multiplication.
- **CO2:** Explore the specialized organs or asexual propagules in some plants for their proliferation.
- **CO3:** Demonstrate skills on micro propagation of plants through vegetative propagation techniques.
- CO4: Evaluate and use a suitable propagation technique for a given plant species.

List of Experiments

(30 Hrs.)

- 1. Preparation of nursery beds flat, raised and sunken beds.
- 2. Propagation through apomictic.
- 3. Propagation by separation and division technique.
- 4. Propagation by cuttings.
- 5. Propagation by layering
- 6. Propagation by grafting.
- 7. Propagation by budding.
- 8. Preparation of potting mixture, potting and repotting.

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

1. Training of students by experts in plant vegetative propagation methods.

2. Assignments (including technical assignments like identifying propagation structures and their operational techniques for a specific plant species.

3. Seminars, Group discussions, Quiz, Debates etc. (suggested topics):

4. Preparation of videos on plant propagation techniques in relation to different economically useful plants.

5. Collection of material/figures/photos related to plant propagation methods, writing and organizing them in a systematic way in a file.

6. Visits to Horticulture/Agriculture/Forest nurseries, research organizations, universities etc.

7. Invited lectures and presentations on related topics by experts in the specified area.

References Books

1. Prasad, V. M. and Balaji Vikram, (2018). Practical Manual on Fundamentals of Horticulture and Plant Propagation, Write & Print Publications, New Delhi

2. Upadhyay S. K. Ed. (2013). Practical Manual Basic Horticulture-I, Akashdeep Printers, New Delhi

3. Web sources suggested by the teacher concerned.

SYLLABUS

Subject: Botany Course Title: Seed Technology LTP: 300 No. of Hours: 45

Semester: V/VI Course Code: 20BTSEC12ST3 Credits: 3

Objectives

- To know about seed processing and seed storage procedures
- To acquire skills related to various seed testing methods
- To understand the legislations on seed production and certification.

Course Outcomes

CO1: Explain the causes for seed dormancy and methods to break dormancy.

CO2: Understand critical concepts of seed processing and seed storage procedures.

CO3: Acquire skills related to various seed testing methods.

CO4: Identify seed borne pathogens and prescribe methods to control them.

CO5: Understand the legislations on seed production and procedure of seed certification.

UNIT - I: Seed dormancy

1. Seed and grain: Definitions, importance of seed; structure of Dicot and Monocot seed.

2. Role and goals of seed technology; characteristics of quality seed material.

3. Dormancy: Definition, causes for seed dormancy; methods to break seed dormancy.

UNIT – II: Seed processing and storage

1. Principles of seed processing: seed pre-cleaning, precuring, drying, seed extraction; cleaning, grading, pre-storage treatments; bagging and labelling, safety precautions during processing.

Seed storage; orthodox and recalcitrant seeds, natural longevity of seeds.

3. Factors affecting longevity in storage; storage conditions, methods and containers.

UNIT - III: Seed testing

1. Definition of seed vigour, viability and longevity; seed sampling and equipment; physical purity analysis.

2. Seed moisture - importance - methods of moisture determination.

3. Seed germination tests using paper, sand or soil - standard germination test; TZ

(9 Hrs.)

(9 Hrs.)

(9 Hrs.)

test to determine seed viability; seed health testing.

UNIT – IV: Seed borne diseases

(9 Hrs.)

1. A brief account of different seed borne diseases and their transmission.

2. Different seed health testing methods for detecting microorganisms.

3. Management of seed borne diseases; seed treatment methods: spraying and dusting.

UNIT – V: Seed certification

(9 Hrs.)

1. Objectives - Indian seed Act; seed rules and seed order; new seed policy (1988).

2. Seed Inspector: Duties and responsibilities; classes of seeds, phases of certification standards (i.e., Land requirement, isolation distance) etc.

3. Issue of certificates, tags and sealing; pre and post control check: Genetic purity verification, certification, records and reporting.

Co- Curricular Activities

- Assignments on Seed technology
- Group discussion
- Student presentations and seminars
- Online quiz

References Books

1. Umarani R, Jerlin R, Natarajan N, Masilamani P, Ponnuswamy AS 2006.

Experimental Seed Science and Technology, Agrobios, Jodhpur

2. Agrawal, 2005. Seed Technology. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi

3. Desai B D 2004. Seeds Hand Book: Processing and Storage, CRC Press Prescribed Text Books

1. Agarwal V K and J B Sinclair 1996, Principles of Seed Pathology, CRC Press

2. Tunwar NS and Singh SN. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.

3. McDonald, M.B. and L.O. Copland. 1999. Seed Science and Technology Laboratory Manual. Scientific Publishers, Jodhpur.

SYLLABUS

Subject: Botany Course Title: Seed Technology -Practical Semester: V/VI Course Code: 20BTP712ST2

Credits: 2 LTP: 003 No. of Hours: 45

Objectives

- To know the various methods on seed dormancy.
- To understand the seed germination techniques.
- To learn about the production of healthy seeds.

Course Outcomes

CO1: Demonstrate skills on various methods to break the seed dormancy.

CO2: Determine seed moisture, seed germination percentage, seed viability and vigour.

CO3. Identify the seed borne pathogens and prescribe methods to prevent or control them.

CO4: Evaluate various methods to produce healthy seeds.

List of the Experiments

1. Determination of physical properties of seeds of 3 select local crops (1 each from cereals, millets, pulses and oil seeds).

- 2. Breaking seed dormancy in 3 select local crops.
- 3. Measurement of seed moisture content by O S W A or moisture meter or oven drying

method.

- 4. Seed germination tests and evaluation.
- 5. Seed vigour conductivity test.
- 6. Accelerated ageing tests.
- 7. Tetrazolium test.
- 8. Priming and invigoration treatments for improving germination and vigour.

(30 Hrs.)

9. Techniques of seed health testing - visual examination of seeds, washing test, incubation methods, embryo count method, seed soak method for the detection of certain seed borne pathogens.

10. Using various types of tools for dusting and spraying pesticides/insecticides.

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

1. Training of students by experts in seed technology.

2. Assignments (including technical assignments like seed processing and storage techniques, seed testing, seed certification, seed borne diseases- prevention and control).

3. Seminars, Group discussions, Quiz, Debates etc. (suggested topics):

4. Preparation of videos on various aspects related to seed technology.

5. Collection of material/figures/photos related to seed technology, writing and organizing them in a systematic way in a file.

6. Visits to seed production units in Industries/Horticulture/Agriculture/Forest universities/colleges; research organizations, seed testing laboratories etc.

7. Invited lectures and presentations on related topics by experts in the specified area.

Reference Books

1. Sanjeev Kumar, 2019. Practical Manual Seed Technology of Vegetable Crops, M/s Asian Printery, Ahmedabad

2. Divakara Sastry, E.V., Dhirendra Singh and S.S.Rajput, 2013. Seed Technology: Practical Manual, Swami Keshwanand Rajasthan Agricultural University, Jobner

3. Web sources suggested by the teacher concerned.

SYLLABUS

Subject: Botany Course Title: Vegetable Crops – Cultivation Practices No. of Hours: 45 LTP: 300

Semester: V/VI

Course Code: 20BTSEC21VC3 Credits: 3

(9 Hrs.)

Objectives

- To know about the cultivation of vegetable crops
- To identify the agronomic practices for cultivation of vegetable crops
- To acquire knowledge on water, weed and disease managements

Course Outcomes

CO1: Identify different vegetable plants and realize their value in human nutrition.

- CO2: Analyse the types of soils to cultivate vegetable crops.
- CO3: Demonstrate skills on agronomic practices for cultivation of vegetable crops.
- **CO4:** Acquire knowledge on water, weed and disease managements in vegetable farming.

CO5: Comprehend aspects related to harvesting and storage of produce.

UNIT – I: Introduction to Olericulture

1. Vegetables and Olericulture: Definitions, nutritive value of vegetables and economic significance of vegetable farming.

2. Classification of vegetable crops (Botanical, based on climatic zones and economic parts used).

3. Types of vegetable gardens (kitchen gardening, terrace gardening, market gardening and truck gardening); implements used in vegetable gardening; vegetable forcing – a brief concept.

UNIT – II: Cultivation of leafy vegetables (9 Hrs.)

1. Leafy vegetables: Definition and a brief account of locally cultivated crops.

2. Study of the following leafy vegetable crops: (a) Amaranthus (b) Palak (c) Hibiscus cannabinus (d) Fenugreek: systematic position, nutritive value, origin, area, production, improved varieties.

3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.

Crop specific yield, storage, diseases and pest control and seed production.

UNIT – III: Cultivation of fruity vegetables

1. Fruity vegetables: Definition and a brief account of locally cultivated crops. 2. Study of the fruity vegetable crops: (a) Okra (b) Tomato (c) Chillies (d) Brinjal: systematic position, nutritive value, origin, area, production, improved varieties. 3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.

4. Crop specific yield- storage, disease and pest control and seed production UNIT – IV: Cultivation of peas and beans (9 Hrs.)

1. A brief account of locally cultivated peas and beans.

2. Study of the following crops: (a) Dolichos (b) Cluster bean (c) French bean: Systematic position, nutritive value, origin, area, production, improved Varieties. 3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.

4. Crop specific yield, storage, disease and pest control and seed production.

UNIT – V: Cultivation of root and tuber crops (9 Hrs.)

1. A brief account of locally cultivated root and tuber crops.

2. Study of the following crops: (a) Carrot (b) Radish (c) Sweet potato (d) Potato: Systematic position, family, nutritive value, origin, area, production, improved varieties. 3. General cultivation practices such as sowing, planting distance, fertilizer requirements, irrigation, weed management, harvesting.

4. Crop specific yield, storage, diseases and pest control and seed production.

Co- Curricular Activities

- Assignments on Cultivation practices
- Group discussion
- Student presentations and seminars
- Online guiz

Reference Books

1. Bose T K et al. (2003) Vegetable crops, Naya Udhyog Publishers, Kolkata.

2. Singh D K (2007) Modern vegetable varieties and production, IBN Publisher Technologies, International Book Distributing Co, Lucknow.

3. Premnath, Sundari Velayudhan and D P Sing (1987) Vegetables for the tropical region, ICAR, New Delhi

4. Shanmugavelu, K. G. 1989. Production Technology of Vegetable Crops. Oxford and IBH Publishing Co. Pvt. Ltd. New Delhi.

5. Rana MK. 2008. Scientific Cultivation of Vegetables. Kalyani Publ., New Delhi

6. Rubatzky VE and Yamaguchi M. (Eds.). 1997. World Vegetables: Principles, Production and Nutritive Values. Chapman & Hall, London.

7. Web resources suggested by the teacher concerned and the college librarian including reading material.

SYLLABUS

Subject: Botany Course Title: Vegetable Crops – Cultivation Practices – Practical No. of Hours: 45 LTP: 003 Semester: V/VI

Course Code: 20BTP621VC2 Credits: 2

Objectives

- To know about the handle of different garden implements
- To acquire the skills in cultivation of vegetable crops.
- To identify the pests, diseases and their remedies

Course Objectives

CO1: List out, identify and handle different garden implements.

CO2: Identify the important vegetable crops grown in their locality.

CO3: Demonstrate various skills in cultivation of vegetable crops.

CO4: Identify pests, diseases and their remedies that are specific to a vegetable crop.

List of Experiments

1. Identification of seeds of important local vegetable plants and preparation of herbarium.

2. Identification of local vegetable crops and handling of garden tools.

3. Analysis of garden soil for ratios of physical characteristics by sieve separation.

4. Determination of chemical characters of garden soil (pH, EC, Organic Carbon, SAR).

5. Planning and layout of a vegetable crop farm.

6. Preparation of nursery bed (raised, sunken and flat beds) and sowing of seeds.

7. Transplanting and care of vegetable seedlings.

8. Intercultural operations in vegetable plots.

9. Estimation of Total Soluble Solids (TSS) by Refractometer in a fruit and a leafy vegetable.

10. Estimation of Vitamin - C in a fruit and a leafy vegetable by DCIP method.

(30 Hrs.)

11. Identification of pests and disease-causing organisms on any two vegetable plants. 12. Seed extraction in tomato and brinjal.

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

1. Training of students by related industrial experts or farmers.

2. Assignments (including technical assignments like tools in vegetable gardening and their handling, agronomic practices, modern irrigation methods, organic farming practices etc.)

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on cultivation practices for vegetable crops.

5. Collection of material/figures/photos related to different vegetable crop species, writing and organizing them in a systematic way in a file.

6. Visits to horticulture universities, research organizations, private vegetable farming units etc.

7. Invited lectures and presentations on related topics by field/industrial experts Model

References Books

1. Akhilesh Sharma (Ed.), 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi

2. Biswajit Saha and Shri Dharampal Singh, 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi

3. Saini RS, K.D. Sharma, O.P. Dhankhar and R.A. Kaushik (Eds.). 2001. Laboratory Manual of Analytical Techniques in Horticulture. Agrobios, Jodhpur

4. Ranganna S. 1986. Handbook of Analysis and Quality Control for Fruit and Vegetable Products. Tata-McGraw Hill, New Delhi

5. Web sources suggested by the teacher concerned.

SYLLABUS

Subject: Botany Course Title: Vegetable Crops-Post Harvesting Practices No. of Hours: 45 LTP: 300

Course Code: 20BTSEC22VP3 Credits: 3

Objectives

- To understand the various practices for vegetable production.
- To acquire the skills on storage, processing and preservation of vegetables.
- To learn about the packaging and marketing of vegetables.

Course Outcomes

- **CO1:** Understand various practices for vegetable produce from harvesting to marketing.
- CO2: Demonstrate skills on storage, processing and preservation of vegetables.
- CO3: Summarize causes for spoilage of vegetables before and during storage and methods to prevent and control them.
- CO4: Make use of preservation methods to reduce the loss of vegetable produce.

CO5: Explain about value added products, packaging and marketing of vegetables.

UNIT – I: Introduction to Post Harvest Practices (9 Hrs.)

1. Post-harvest technology: Definition; importance, scope and future status of postharvest management of vegetables.

2. Study of maturity standards of vegetables; harvest techniques of vegetables, methods stages, signs of harvesting; harvesting and its relationship with quality, sorting and grading.

3. Careful handling of harvested vegetables; pre-harvest and post-harvest factors responsible for ripening.

UNIT - II: Methods of storage

1. Climacteric and non-climacteric types of vegetables.

2. Methods of storage to prolong shelf life of harvested vegetables; on-farm storage, evaporatively cooled stores, ventilated storage, pit storage etc.

3. Refrigerated storage, refrigeration cycle, controlled and modified atmosphere. hypobaric storage.

UNIT – III: Processing of vegetables

1. Causes for spoilage of vegetables and control measures during storage; postharvest disease and pest management.

2. Techniques to prevent deterioration; vegetable processing equipment; minimal processing of vegetables.

(9 Hrs.)

(9 Hrs.)

Semester: V/VI

3. Safe chemicals and microbial limits; application of growth regulators for quality assurance; grading.

UNIT - IV: Preservation and value-addition (9 Hrs.)

1. Importance and scope of vegetable preservation in India; principles underlying general methods of preservation.

2. Methods of preservation; food additives and food colours.

3. Fried products, process of frying; dried vegetables; sauces and chutneys, pickles and salted vegetables; by-product and waste utilization.

(9 Hrs.)

UNIT – V: Marketing

1. Packing line operations, packaging of vegetables and their products; transportation; codex norms for export of perishables.

2. Demand supply analysis of important vegetables; market potential of various vegetables products.

3. Important marketing agencies and institutions; importance of cooperative marketing.

Co- Curricular Activities

- Assignments on Methods of storage to prolong shelf life of harvested vegetables
- Group discussion
- Student presentations and seminars
- Online quiz

Reference Books

1. Salunkhe DK and Kadam SS. (Ed.). (1998). Hand Book of Vegetable Science and Technology: Production, Composition, Storage and Processing. Marcel Dekker, New York.

2. Arthey D and Dennis C. (1996). Vegetable Processing. Blackie/Springer-Verlag, New York

3. Verma LR and Joshi VK. (2000). Post-harvest Technology of Fruits and Vegetables: Handling, Processing, Fermentation and Waste Management, Indus Publishing Company, New Delhi

4. Srivastava RP and Kumar S. (2003). Fruit and Vegetable Preservation: Principles and Practices. International Book Distribution Company, Lucknow.

5. Giridharilal GS, Siddappa and Tandon GL. (1986). Preservation of Fruits and Vegetables. ICAR, New Delhi.

6. Web resources suggested by the teacher concerned and the college librarian including reading material.

SYLLABUS

Subject: Botany Semester: V/VI Course Title: Vegetable Crops-PostHarvesting Practices – Practical Course Code: 20BTP722VP2 No. of Hours: 45 LTP: 003 Credits: 2

Objectives

- To know the different stages of maturity in vegetable crops
- To understand storage of vegetables
- To identify the physical and biological causes for spoilage of vegetables

Course Outcomes

CO1: Identify stages of maturity in vegetable crops.

CO2: Handle material for storage of vegetables.

CO3: Identify physical and biological causes for spoilage of vegetables.

CO4: Make some value-added products of vegetables.

List of the Experiments

1. Maturity selection and harvest, harvesting practices.

2. List and cost of equipment, utensils, and additives required for small scale processing industry.

3. Study of different types of spoilages in fresh as well as processed vegetables.

4. Identification and classification of spoilage organisms.

5. Estimation of total carbohydrates (Anthrone method) in a stored vegetable and unstored vegetable.

- 6. Estimation of protein (Lowry method) in a stored vegetable and un-stored vegetable.
- 7. Sensory evaluation of fresh and processed vegetables.
- 8. Assessment of quality and grading, pre-packaging and protective treatments.

9. Identification of packaging materials, containers for packaging.

10. Preparation of pickle from a vegetable.

11. Preparation of tomato sauce, ketchup and chutney.

(30 Hrs.)

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

1. Training of students by related industrial experts or farmers.

2. Assignments (including technical assignments like tools and techniques for storage, processing and preservation, causes for spoilage and methods to avoid losses, value added products of some vegetables, packaging and marketing etc.)

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on cultivation practices for vegetable crops.

5. Collection of material/figures/photos related to harvesting, storage, processing and preservation of vegetable crop produce, writing and organizing them in a systematic way in a file.

6. Visits to horticulture universities, research organizations; storage, processing industries in public or private sector; industries making value added products of vegetables etc.

7. Invited lectures and presentations on related topics by field/industrial experts.

Reference Books

1. Swati Barche, Reena Nair and P. K. Jain, 2016. A Practical Manual on Post Harvest Value Addition and Processing of Horticulture Crops. Agrobios (India), Jodhpur

2. Antonio L. Acedo Jr., Md. Atiqur Rahman, BorarinBuntong and Durga Mani Gautam, 2016. Vegetable Postharvest Training Manual, AVRDC - The World Vegetable Center, Taiwan

3. Akhilesh Sharma (Ed.), 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi

4. BiswajitSaha and Shri Dharampal Singh, 2013. Practical Manual Olericulture-I, Sheel Packers, New Delhi

5. Web sources suggested by the teacher concerned.

SYLLABUS

Subject: Botany Course Title: Plant Tissue Culture No. of Hours: 45 LTP: 300 Semester: V/VI Course Code: 20BTSEC31PT3 Credits: 3

Objectives

- To understand the applications of plant tissue culture.
- To identify various facilities required to plant tissue culture
- To acquire a critical knowledge on sterilization techniques

Course Outcomes

CO1: Comprehend the basic knowledge and applications of plant tissue culture.

- CO2: Identify various facilities required to set up a plant tissue culture laboratory.
- **CO3:** Acquire a critical knowledge on sterilization techniques related to plant tissue culture.
- CO4: Demonstrate skills of callus culture through hands on experience.
- **C05:** Understand the biotransformation technique for production of secondary metabolites.

UNIT - I: Basic concepts of plant tissue culture (9 Hrs.)

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 - II: Sterilization techniques and culture media (9 Hrs.)

1. Aseptic conditions – Fumigation, wet and dry sterilization, UV sterilization, ultrafiltration.

2. Brief account on commonly used Nutrient culture media: IBA, NAA, organic constituents, vitamins, amino acids etc.

3. Composition and preparation of Murashige and Skoog culture medium.

UNIT - III: Callus culture technique

(9 Hrs.)

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 in brief.

UNIT – IV: Micropropagation

(9 Hrs.)

1. Brief account on 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 – V: Applications of plant tissue culture (9 Hrs.)

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.

Co- Curricular Activities

- Assignments on various steps in callus culture
- Group discussion
- Student presentations and seminars
- Online quiz

Reference Books

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.

SYLLABUS

Subject: BotanySemester: V/VICourse Title: Plant Tissue Culture -PracticalCourse Code:20BTP631PT2LTP: 003Credits: 2

Objectives

- To know about various equipment in plant tissue culture lab.
- To learn the procedures of preparation of media
- · To acquire skills in observing and measuring callus growth

Course Outcomes

CO1: List out, identify and handle various equipment in plant tissue culture lab.

CO2: Learn the procedures of preparation of media.

CO3: Demonstrate skills on inoculation, establishing callus culture and

Micro propagation.

CO4: Acquire skills in observing and measuring callus growth.

CO5: Perform some techniques related to plant transformation for secondary Metabolite production.

List of Experiments

S (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. Explant 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.

Skill/Hands-on: Field work/ Mini project

(15 Hrs.)

1. Training of students by related industrial experts.

2. Assignments (including technical assignments like identifying tools in plant tissue culture and their handling, operational techniques with safety and security, IPR)

- 3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).
- 4. Preparation of videos on tools and techniques in plant tissue culture.

5. Collection of material/figures/photos related to products of plant tissue culture, writing and organizing them in a systematic way in a file.

6. Visits to plant tissue culture/biotechnology laboratories in universities, research organizations, private firms, etc.

7. Invited lectures and presentations on related topics by field/industrial experts

Reference Books

1. Reinert, J. and M.M. Yeoman, 1982. Plant Cell and Tissue Culture - A Laboratory

2. Manual, Springer-Verlag Berlin Heidelberg

3. Robert N. Trigiano and Dennis J. Gray, 1999. Plant Tissue Culture Concepts and Laboratory Exercises. CRC Press, Florida

4. Ashok Kumar, 2018. Practical Manual for Biotechnology, College of Horticulture & Forestry, Jhalawar, AU, Kota

5. Chawla, H.S., 2003. Plant Biotechnology: A Practical Approach, Nova Science Publishers, New York

6. Web sources suggested by the teacher concerned.

SYLLABUS

Subject: BotanySemester: V/VICourse Title: Mushroom CultivationCourse Code: 20BTSEC32MC3No. of Hours: 45LTP: 300Credits: 3

Objectives

- To understand the structure and life of a mushroom
- To identify the basic infrastructure to establish a mushroom culture unit.
- To acquire a critical knowledge on cultivation of edible mushrooms.

Course Outcomes

CO1: Understand the structure and life of a mushroom and discriminate edible and poisonous mushrooms.

CO2: Identify the basic infrastructure to establish a mushroom culture unit.

CO3: Demonstrate skills preparation of compost and spawn.

CO4: Acquire a critical knowledge on cultivation of some edible mushrooms.

CO5: Explain the methods of storage, preparation of value-added products and marketing.

UNIT – I: Introduction and value of mushrooms (9 Hrs.)

1. Mushrooms: Definition, structure of a mushroom and a brief account of life cycle; historical account and scope of mushroom cultivation.

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 -Ganoderma lucidum, Phellinus rimosus, Pleurotus florida and Pleurotus pulmonaris – their therapeutic value; Poisonous mushrooms - harmful effects.

UNIT – II: Basic requirements of cultivation system (9 Hrs.)

1. Small village unit and larger commercial unit; layout of a mushroom farm - location of building 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, materials for compost preparation.

3. Methods of composting-long method of composting and short method of composting.

UNIT - III: Spawning and casing

1. Spawn and spawning: Definition, facilities required for spawn preparation; preparation of spawn substrate.

(9 Hrs.)

(9 Hrs.)

(9 Hrs.)

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 - IV: Mushroom cultivation

1. Raw material, compost, spawning, casing, cropping, picking and packing for any

Four of the following mushrooms

2. (a) Button mushroom (b) Oyster mushroom (c) Milky mushroom and (d) Paddy straw mushroom

3. Problems in cultivation (diseases, pests and nematodes, weed molds and their management strategies).

UNIT - V: Post harvest technology

1. Shelf life of mushrooms; preservation of mushrooms - freezing, dry freezing, drying and canning.

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.

Co- Curricular Activities

- Assignments on Nutraceutical value of mushrooms
- Group discussion
- Student presentations and seminars
- Online quiz

Reference Books

1. Tewari Pankaj Kapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication,

New Delhi,

2. Pandey R.K, S. K Ghosh, (1996). A Hand Book on Mushroom Cultivation, Emkey Publications 3. Nita Bhal. (2000). Handbook on Mushrooms (Vol. I and II). Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi

4. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.

5. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. Pvt. Ltd, New Delhi.

6. Pathak V.N., Nagendra Yadav and Maneesha Gaur (2000), Mushroom Production and Processing Technology Vedams Ebooks Pvt. Ltd., New Delhi

7. Web resources suggested by the teacher concerned and the college librarian including reading material.

SYLLABUS

Subject: Botany Course Title: Mushroom Cultivation- Practical No. of Hours: 45 LTP: 003 Semester: V/VI Course Code: 20BTP732MC2 Credits: 2

Objectives

To know about different mushroom morphology.

To know the skills on preparation of spawn, compost and casing material

To understand the various cultivation practices for an edible mushroom

Course Outcomes

CO1: Identify and discriminate different mushrooms based on morphology.

CO2: Understand facilities required for mushroom cultivation.

CO3: Demonstrate skills on preparation of spawn, compost and casing material.

CO4: Exhibit skills on various cultivation practices for an edible mushroom.

List of Experiments

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.

Skill/Hands-on: Field work/ Mini project

1. Training of students by related industrial experts.

(30 Hrs.)

(15 Hrs.)

2. Assignments (including technical assignments like identifying various mushrooms, tools and techniques for culture, identification and control of diseases etc.

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on tools and techniques in mushroom culture.

5. Collection of material/figures/photos related to edible and poisonous mushrooms, cultivation of mushrooms in cottage industries, writing and organizing them in a systematic way in a file.

6. Visits to mushroom culture units in universities, research organizations, private firms, etc.

7. Invited lectures and presentations on related topics by field/industrial experts.

Reference Books

1. Sushma Sharma Sapna Thakur Ajar Nath Yadav, (2018). Mushroom Cultivation: A Laboratory Manual, Eternal University, Sirmour, H.P.

2. Kadhila-Muandingi, N.P., F. S. Mubiana and K. L. Halueendo, (2012). Mushroom Cultivation: A Beginners Guide, The University of Namibia

3. Gajendra Jagatap and Utpal Dey, (2012). Mushroom Cultivation: Practical Manual, LAMBERT Academic Publishing, Saarbrücken, Germany

4. Deepak Som, (2021). A Practical Manual on Mushroom Cultivation, P.K.Publishers & Distributors, Delhi

5. Web sources suggested by the teacher concerned.

SYLLABUS

Subject: BotanySemester: V/VICourse Title: Gardening and LandscapingCourse Code: 20BTSEC41GL3No. of Hours: 45LTP: 300Credits: 3

Objectives

- To acquire a critical knowledge about the aesthetic value, types and styles of gardens
- To identify the various ornamental plants and explain the growth habits.
- To learn the skills of designing and developing a garden.

Course Outcomes

CO1: Acquire a critical knowledge about the aesthetic value, types and styles of gardens.

CO2: Perform filed operations in a garden by understanding the role of a gardener.

CO3: Identify various ornamental plants and explain the growth habits.

CO4: Propagate garden plants through various propagation techniques.

CO5: Demonstrate skills of designing and developing a garden.

UNIT -I: Basics of Gardening

1. Garden and gardening: Definitions, objectives and scope; types of gardens (domestic garden, flower garden, woodland garden, rock garden, water garden and herb and vegetable garden).

2. Speciality gardens (vertical garden, roof garden and scented garden); principles of gardening; garden components and adornments;

3. Styles of garden: formal, informal, free style and wild; some famous gardens of India.

UNIT -II: Garden operation

1. Bio-aesthetic planning, eco-tourism, theme parks, indoor gardening, therapeutic gardening.

2. Gardening operations: soil laying, manuring, watering, management of pests and diseases and harvesting.

3. Lawn making, methods of designing rockery and water garden.

(9 Hrs.)

(9 Hrs.)

UNIT-III: Ornamental plants

1. Ornamental plants: flowering annuals and perennials; climbers and creepers; shade and ornamental trees.

2. Bulbous and foliage ornamental plants; cacti and succulents; palms, ferns.

3. Bonsai: definition, types and styles, art of making bonsal.

UNIT-IV: Propagation techniques

1. Propagation of ornamental plants by rhizomes, corms tubers, bulbs and bulbils.

2. Vegetative propagation techniques – a brief account of cuttings, layering and grafting.

3. Types of seed beds; sowing of seeds and raising seedlings, transplanting of seedlings; growing plants in pots, potting and repotting.

UNIT-V: Landscaping

(9 Hrs.)

1. Landscaping: definition, landscaping of parks and public gardens.

2. Urban planning and planting avenues; Landscaping highways and educational institutions; beautifying villages and colonies.

3. Computer Aided Designing (CAD) for outdoor and indoor-scaping.

Co- Curricular Activities

- Assignments on eco-tourism
- Group discussion
- Student presentations and seminars
- Online quiz

Reference Books

1. Bose T.K. and Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.

2. Sandhu, M.K. 1989 Plant Propagation, Wiley Eastern Ltd., Bengaluru.

3. Nambisan, K. M. P. 1992. Design Elements of Land Scape Gardening Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

4. Bose, T. K. Malti, R. G. Dhua, R. S and Das, P. 2004. Floriculture and Landscaping. Nayaprakash, Calcutta.

5. Arora, J.S. 2006. Introductory Ornamental Horticulture. Kalyani Publishers, Ludhiana.

6. Web resources suggested by the teacher concerned and the college librarian including reading material.

(9 Hrs.)

(9 Hrs.)

SYLLABUS

Subject: BotanySemester: V/VICourse Title:Gardening and
Landscaping- PracticalCourse Code: 20BTP641GL2No. of Hours: 45LTP: 003Credits: 2

Objectives

- To Identify the living and non-living components required for garden development.
- To acquire the knowledge on landscape design by using CAD
- To identify the pests and diseases of garden plants and their control

Course Outcomes

CO1: Perform various skills related to gardening.

CO2: Identify the living and non-living components required for garden development.

CO3: Identify the pests and diseases of garden plants and control the same.

CO4: Demonstrate skills of making bonsai and developing lawn.

CO5:Make landscape design using CAD.

List of Experiments

1. Preparation of beds for growing nursery of herbs, shrubs and trees.

- 2. Tools, implements and containers used for propagation and nursery techniques.
- 3. Identification of different ornamental plants.
- 4. Demonstration of types and styles of gardens using photos or videos.
- 5. Gardening operations: soil laying, manuring, watering.
- 6. Identification of pathogenic and non-pathogenic diseases of garden plants and grasses.
- 7. Propagation by cutting, layering, budding and grafting.
- 8. Planning and designing of gardens, functional uses of plants in the landscape.
- 9. Preparation of land for lawn and planting.
- 10. Exposure to CAD (Computer Aided Designing)
- 11. Demonstration of bonsai making.
- 12. Making of topiaries.

Skill/Hands-on: Field work/ Mini project

1. Training of students by related industrial experts.

(15 Hrs.)

(30 Hrs.)

2. Assignments (including technical assignments like identifying ornamental plants, types and styles of gardens, propagation of garden plants, landscaping)

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on plant propagation, garden operations, ornamental gardening.

5. Collection of material/figures/photos related to gardening and landscaping, writing and organizing them in a systematic way in a file.

6. Visits to gardens and parks in public places and/or private firms; famous gardens in A.P. and India etc.

7. Invited lectures and presentations on related topics by field/industrial experts.

Reference Books

1. Paul Wagland, 2011. Garden Landscaping Manual: A Step-by-Step Guide to Landscaping & Building Projects in Your Garden, Haynes Publishing UK

2. Misra Kaushal Kumar, 2016. Practical Manual of Horticulture, Biotech Books, Open Library.org

3. Hemla Naik, B., S.Y. Chandrashekhar and M. Jawaharlal, 2013. Principles of Landscape Gardening, TNAU, Agrimoon.Com.

4. Web sources suggested by the teacher concerned.

SYLLABUS

Subject: Botany Course Title: Aaroforestry No. of Hours: 45

Semester: V/VI Course Code: 20BTSEC42AF3 LTP: 300 Credits: 3

Objectives

- To understand the concepts and economic value of agroforestry.
- To acquire a critical knowledge on systems and design of agroforestry.
- To know about the silviculture practices in relation to agroforestry

Course Outcomes

CO1: Understand the concepts and economic value of agroforestry.

CO2: Acquire a critical knowledge on systems and design of agroforestry.

CO3: Explain silviculture practices in relation to agroforestry.

CO4: Understand the role of agroforestry to reclaim the waste lands.

CO5: Perform skills in relation to tree measurement techniques.

UNIT-I: Basic concepts of Agroforestry

1. Forest and Agroforestry. Definition, objectives, scope and advantages of agroforestry; classification of agroforestry; differences between social forestry and agroforestry.

2. Agroforestry practices as existing in India and Andhra Pradesh.

3. Criteria for selection and screening of tree species; design and diagnosis methodology in relation to agroforestry.

UNIT-II: Systems of Agroforestry

1. Global agroforestry system: shifting cultivation, taungya cultivation, shelter belt and wind breaks, and energy plantation and homestead gardens.

2. Multipurpose tree species and their characteristics; criteria for selection of agroforestry design, role tree architecture and management in agroforestry.

3. Alley cropping, high density short rotation plantation systems, silvicultural woodlots, energy plantations.

UNIT-III: Silviculture of Agroforestry trees (9 Hrs.)

1. Silviculture: Definition, objectives and scope and its place in agroforestry.

(9 Hrs.)

(9 Hrs.)

2. Choice of species, site selection, and pure verses mixed crop, planting techniques and methods, protection of seedlings/ plantations from environmental and biological adversaries, tending operations, concept of coppice etc.

3. Silviculture of agroforestry trees with special reference to: (a) Azadirachta indica,(b) Tectona grandis (c) Emblica officinalis and (d) Tamarindus indica.

UNIT-IV: Waste land reclamation

(9 Hrs.)

1. Wasteland definition, types: ecological characteristics, landslides, soil erosion, hoods, drought, salinity, water logging and fire.

2. Biological causes of deforestation, grazing, shifting cultivation and faulty agricultural practices.

3. Reclamation of wastelands, scientific land use practices, afforestation, soil conservation practices, improvement of water catchment areas and development of recreational and amenity areas.

UNIT-V: Measurements in Agroforestry (9 Hrs.)

1. Tree measurement techniques: Instruments and methods for measurement of tree diameter, height, bark thickness, crown volume crown surface area.

2. Tree stem form, yield tables, volume tables, concept of sustained yield, and kind of tree rotation, increment and yield; estimation of biomass.

3. Determination of tree age and introduction of working plan.

Co- Curricular Activities

- Assignments on economic value of agroforestry
- Group discussion
- Student presentations and seminars
- Online quiz

Reference Books

- 1. Dwivedi, A.P. 1992. Agroforestry: Principles and Practices. Oxford & IBH
- 2. Nair, P.K.R. 1993. An Introduction to Agroforestry. Kluwer.
- 3. Nair P.K.R., M.R. Rai and L.E.Buck, 2004. New Vistas in Agroforestry. Kluwer

4. Rajeshwar Rao G., M. Prabhakar, G. Venkatesh, I. Srinivas and K. Sammi Reddy (2018) Agroforestry Opportunities for Enhancing Resilience to Climate Change in Rainfed Areas, ICAR-CRIDA, Hyderabad

5. Young, A. 1997. Agroforestry for Soil Management. CABI

6. Web resources suggested by the teacher concerned and the college librarian including reading material.

SYLLABUS

Subject: Botany Course Title: Agroforestry – Practical No. of Hours: 45 LTP: 003 Semester: V/VI Course Code: 20BTP742AF2 Credits: 2

Objectives

- To identify suitable tree species for agroforestry and their products
- To acquire skills on measurements related to wood-based products
- To know the estimation of biomass in an energy plantation.

Course Outcomes

CO1: Identify suitable tree species for agroforestry and their products.

CO2: Demonstrate skills on raising tree species from seeds and by vegetative propagation.

CO3: Perform skills on measurements related to wood-based products.

CO4: Estimate biomass in an energy plantation.

List of the Experiments

(30 Hrs.)

1. Identification of agroforestry tree-species.

2. Identification of important major and minor agroforest products.

3. Collection and maintenance of agro-forest products and herbarium

4. Nursery lay out seed sowing and pre-sowing seed treatments.

5. Vegetative propagation techniques - hard wood cuttings and air layering.

6. Diameter measurements using calipers and tape; diameter measurements of forked, buttressed, fluted and leaning trees.

7. Height measurement of standing trees by shadow method, single pole method and hypsometer.

8. Volume measurement of logs using various formulae.

9. Biomass estimation in energy plantations.

Reference Books

1. Meena, R. N. and R.K. Singh, 2014. A Practical Manual on Agroforesty, Srijan Samiti Publication, Varanasi Dadhwal, K.S., P.Panwar, R.Kaushal, H.S.Saralch and R.Chauhan, 2014. Practical Manual on Agroforestry, Jaya Publishing House, Delhi
 Sen, N. L., R. C. Dadheech, L. K. Dashora and T. S. Rawat, 2010. Manual of Agroforestry and Social forestry, Agrotech Publishing Academy, Udaipur
 Web sources suggested by the teacher concerned.

Skill/Hands-on: Field work/ Mini project

1. Training of students by related industrial experts.

2. Assignments (including technical assignments like criteria for selection of agroforestry tree species; silviculture practices in agroforests; measurements in agroforestry; economic, social, land use and cultural services of agroforestry)

(15 Hrs.)

3. Seminars, Group discussions, Quiz, Debates etc. (on related topics).

4. Preparation of videos on various agroforestry methods, silviculture practices, tree measurement techniques etc.,

5. Collection of material/figures/photos related to agroforestry, writing and organizing them in a systematic way in a file.

6. Visits to social forest nurseries, energy plantations and forest research centres; nearby agroforest based industries in A.P.

7. Invited lectures and presentations on related topics by field/industrial experts