

Nutan Mahavidyalaya Selu

Department of Botany

List of where the institution integrates Cross Cutting Issue Related to into the Curriculum




Class :- B.Sc.FY

Name of the Course	Subject	Professional ethics	Gender	Environment	Human Values	Sustainability
Theory Paper-I: Viruses, Bacteria Algae , Fungi , Lichens and Mycorrhiza	Botany	No	No	Yes	Yes	No
Theory Paper-II: Plant Ecology , Phytogeography and Environmental Biology		No	No	Yes	Yes	No
Theory Paper-III: Bryophytes, Pteridophytes Gymnosperms and paleobotany		No	No	Yes	No	No
Theory Paper-IV: Taxonomy of Angiosperms		No	No	Yes	Yes	No
Practical Paper-V: Practicals based on theory papers of CCB-I&II		No	No	No	No	Yes

Class :- B.Sc.SY


Name of the Course	Subject	Professional ethics	Gender	Environment	Human Values	Sustainability
Theory Paper-VI: Plant Anatomy	Botany	No	No	Yes	No	No
Theory Paper-VII: Plant Physiology and Biochemistry		No	No	Yes	No	No
Theory Paper-VIII: Plant Embryology		No	No	Yes	No	No
Theory Paper-IX: Plant Metabolism and Biotechnology		No	No	Yes	Yes	No
Practical Paper-X: Practicals based on CCB-III (Section-A) CCB-IV (Section-A)		No	No	No	No	Yes
Practical Paper-XI: Practicals based on CCB-III (Section-B) CCB-IV (Section-B)		No	No	No	No	Yes


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Class :- B.Sc.TY

Name of the Course	Subject	Professional ethics	Gender	Environment	Human Values	Sustainability
DSCB-I: Cell and Molecular biology (Theory Paper-XII)	Botany	No	No	Yes	Yes	No
DECB-I: Plant Pathology-I (Theory Paper-XIII)		No	No	Yes	Yes	No
DSCB-II: Genetics and Plant Breeding (Theory Paper-XIV)		No	No	Yes	Yes	No
DECB-II: Plant Pathology-II (Theory Paper-XV)		No	No	Yes	Yes	No
DSCBP-I: Practicals based on DSCB-I & II (Practical Paper-XVI)		No	No	No	No	Yes
DECBP-I: Practicals based on DECB-I & II (Practical Paper-XVII)		No	No	No	No	Yes


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SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Semester pattern curriculum under
Choice Based Credit System (CBCS) for

BOTANY

B.Sc. F.Y.

Semester - I

CCB-I (A)

Theory Paper - I



Viruses, Bacteria, Algae, Fungi, Lichens and Mycorrhiza

Periods - 45

Credits :02

Maximum Marks - 50

Learning Objectives

1. To study and impart knowledge about the occurrence, distribution, structure and life history of lower plants such as algae, fungi, lichens
2. To instill in students an appreciation for the diversity of plant forms and structural organization that exists within plant bodies that allow plants to develop and live as integrated organisms in diverse environments

Learning outcomes:

1. Understand the morphology, structure and importance of the various organisms
2. Differentiate between various groups of Algae, Fungi, Bacteria, Viruses, and Lichens & Mycorrhiza
3. Learn the life cycles of individuals belonging to Algae, Fungi, Bacteria, Viruses, Lichens & Mycorrhiza

Unit I: Microbes (10 Lectures)

Viruses - Introduction, general characters of viruses, replication (general account), and RNA virus (TMV); Economic importance; study of yellow vein mosaic of Bhendi
Bacteria - Introduction, General characters and cell structure; Reproduction - vegetative, asexual (Binary Fission) and recombination (conjugation,) Study of Citrus Canker and Economic importance of Bacteria.

Unit II: Algae (12 Lectures)

Introduction, General characters, Ecology and distribution; Range of thallus organization and reproduction; Classification of algae (F. E. Fritch's 1935); Morphology and life-cycles of the following: *Nostoc*, *Oedogonium* and *Ectocarpus*. Economic importance of algae

Unit III: Fungi (13 Lectures)

Introduction- General Characteristics, ecology and significance, cell wall composition, nutrition, reproduction and classification (Alexopolous & Mims 1979); General characteristics, ecology, significance and life cycle of, *Penicillium*, *Alternaria* (Deuteromycota), *Agaricus* (Basidiomycota).

Unit IV: Lichens and Mycorrhiza (10 Lectures)

Lichens: General characters, types and economic importance.

Mycorrhiza: General characters, ectomycorrhiza and endomycorrhiza and their significance.

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Semester pattern curriculum under
Choice Based Credit System (CBCS) for

BOTANY

B.Sc. F.Y.

Semester - I

CCB-I (B)

Theory Paper -II



Plant Ecology, Phytogeography and Environmental Biology

Periods - 45

Credits :02

Maximum Marks - 50

Learning Objectives:

1. Acquainted with basic concepts of Ecology, Ecosystem Ecological factors, community ecology and phytogeography
2. To provide students with skills necessary for Ecological studies

Learning outcomes:

1. Able to understand the ecological principles, interactions taking place in the Ecosystems and the flow of energy
2. Learn about the concept of phytogeography and its relations with other disciplines

Unit I: Ecological Factors (10 Lectures)

Introduction, Scope of Ecology, Ecological Factors: Climatic factors- Light, Temperature, Wind, Humidity, Edaphic factors- Soil moisture, Temperature, Soil pH, Soil formation, Composition and Soil profile.

Unit II: Ecological Adaptations (11 Lectures)

Morphological and anatomical adaptations in Hydrophytes (*Hydrilla* stem and *Nymphaea* petiole), Xerophytes (*Nerium* leaf and *Casuarina* stem), General characters of Halophytes and Epiphytes.

Unit III: Ecosystem and Plant Communities (12 Lectures)

Ecosystem: Introduction, Structure, types (Pond ecosystem and Forest ecosystem), Tropic levels, Energy flow in ecosystem, food chain, food web and ecological pyramids. Community ecology: Community characteristics, Frequency, Density, Life forms and ecological succession (Hydrosere), Analysis of Plant communities (quadrant method).

Unit IV: Phytogeography and Environmental Biology (12 Lectures)

Introduction, Bio-geographical regions of India, Bio-diversity hot spots of India
Environmental pollution: Air, Water and soil pollution (Causes, effects and control measures),
Soil erosion and soil conservation, afforestation, deforestation and Chipko movement,
Environmental education and awareness.

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Bryophytes, Pteridophytes, Gymnosperms & Paleobotany

Periods - 45

Credits -02

Maximum Marks - 50

Learning Objectives:

1. To study the occurrence, distribution, structure and life history of bryophytes, pteridophytes and gymnosperms
2. To provide students with skills in paleobotany studies

Learning outcomes:

1. Learn the life cycles of individuals belonging to Bryophytes, Pteridophytes and Gymnosperms
2. Learn about process of fossil formation and fossils plants

Unit I: Bryophytes (10 Lectures)

General characters, Classification (N.S.Parihar), morphology, anatomy and reproduction of *Marchantia* and *Funaria*. (Developmental study not expected), Economic importance of bryophytes.

Unit II: Pteridophytes (13 Lectures)

General characters, classification (N.S.Parihar), morphology, anatomy and reproduction of *Lycopodium* and *Marsilea*. (Developmental study not expected), Homospory, Heterospory and seed habit, stelar evolution, economical importance of Pteridophytes.

Unit III: Gymnosperms (12 Lectures)

General characters, classification (K.R.Sporne, 1964), morphology, anatomy and Reproduction of *Cycas* and *Pinus*. (Developmental study not expected), Ecological and Economic importance.

Unit-IV: Paleobotany (10 Lectures)

Introduction to palaeobotany, process of plant fossilization; types of fossils, geological time scale, Study of fossil Gymnosperms-*Lyginopteris oldhamia* (stem), *Bennettites* (flower) and General characters of *Ginkgo* (A living fossil).

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Semester pattern curriculum under
Choice Based Credit System (CBCS) for

BOTANY

B.Sc. F.Y.

Semester – II

CCB-II (B)

Theory Paper –IV

Taxonomy of Angiosperms



Periods – 45

Credits :02

Maximum Marks – 50

Learning Objectives:

1. To study the types of classifications- artificial, Natural and phylogenetic
2. To study the principles and rules of ICN and taxonomical terminology
3. To study the various plant families and their economic importance

Learning Outcomes:

1. Proficiency with the basic terminology of plant morphology
2. Able to identify the major families of plants and their economic importance
3. Understand the methods of collecting and preserving plants

Unit I: Introduction (10 Lectures)

Aims of Taxonomy, Principles of Taxonomy, Identification, Nomenclature and Classification, Principles and rules of ICN (Rank of taxa, typification, author citation) Importance of Herbarium, important herbaria and botanical gardens of the India.

Unit II: Plant Classification (11 Lectures)

Taxonomic hierarchy, Types of classification-artificial, natural and phylogenetic. Bentham and Hooker, Engler and Prantl (up to family level with reference to families mentioned in the syllabus).

Unit III: Morphology of Angiosperms (12 Lectures)

Root: Definition, characters, types (tap root and adventitious) and functions. Stem: Definition, characters and functions. Leaf: Definition, structure of typical leaf (Hibiscus), functions, types- Simple (Hibiscus), Compound (unipinnate, bipinnate, tripinnate, unifoliate, bifoliate, trifoliate, multifoliate), venation- definition, types (reticulate, parallel), Phyllotaxy. Inflorescence: Definition, types- Racemose (characters), Cymose (characters). Flower: Definition, symmetry, actinomorphic, zygomorphic, types (hypogynous, epigynous, perigynous), structure of typical flower (Hibiscus), calyx (polysepalous, gamosepalous), corolla (polypetalous, gamopetalous), Androeceum (parts of a stamen), Gynoecium –structure of carpel, apocarpous, syncarpous, placentation (axile, parietal, free central, marginal, basal) Fruit: Definition, forms- simple (dry, legume, fleshy, berry), aggregate (Etario of berries), composite (Sorosis).

Unit IV: Study of Plant Families (12 Lectures)

Study of vegetative and floral characters of following families: Brassicaceae, Fabaceae, Solanaceae, Lamiaceae and Poaceae .


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B.Sc. General (Semester Pattern)

Choice Based Credit System (CBCS) Pattern

B. Sc. P.Y.

Annual Pattern

CCBP-1

PRACTICAL PAPER-VI BASED ON THEORY PAPERS-I, II, III & IV



Practicals-24

Credits: 04 Maximum Marks - 100

Practical Exercises:

1. Study of morphology of Bacteria by Gram staining method
2. Study of citrus canker disease
3. Study of symptoms of yellow vein mosaic of Bhendi
4. Study of Algae : Systematic position and external features of *Nostoc*, *Oedogonium*, *Ectocarpus*
5. Study of Fungi: systematic position, external and internal features of *Penicillium*, *Alternaria*, *Agaricus*
6. Study of different forms of Lichens
7. Study of ectomycorrhiza and endomycorrhiza
8. Study of *Marchantia*- morphology of thallus, w.m. rhizoids and scales, v.s. thallus through gemma cup, w.m. gemmae (all temporary slides), v.s. antheridiophore, archegoniophore, L.S. of sporophyte (all permanent slides)
9. Study of *Funaria*- morphology, w.m. leaf, rhizoids, operculum, peristome, annulus, spores (temporary slides); permanent slides showing antheridial and archegonial heads, L.S. of capsule and protonema
10. *Lycopodium*- morphological and anatomical study
11. *Marsilea*- morphological and anatomical study of petiole and rhizome
12. *Cycas*- morphology, T.S of rachis, T.S. of leaflet, male and female cone
13. *Pinus*- morphology (long and dwarf shoots, w.m. dwarf shoot, male and female cone).
14. Study of fossil Plants
15. Estimation of soil Bulk density and porosity

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16. Study of morphological and anatomical adaptations of hydrophytes (*Hydrilla* stem and *Nymphaea* petiole) and xerophytes (*Nerium* leaf and *Casuarina* stem)
17. Determination of dissolved oxygen (DO) in water samples
18. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus
19. Quantitative analysis of herbaceous vegetation in the college campus
20. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):
Brassicaceae , Fabaceae , Solanaceae , Lamiaceae , Poaceae.
21. Excursion/ study tour for plant specimen collection

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SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)

BOTANY
B.Sc. Second Year
Semester III
CCB-III (A)
Theory Paper- VI
Plant Anatomy

Credits: 02
Maximum Marks: 50

Periods 45

Learning Objectives:

1. To know about the internal structure of the most evolved group of plants, the Angiosperm.
2. To study cells, tissues, meristem, epidermal and vascular tissue system in plants.
3. To acquire knowledge of tissue systems, histology and growth pattern in plants.

Learning Outcomes:

1. The students will be able to understand the meristem (RAM & SAM) different simple and complex tissues and secondary growth in root and stem.
2. Students will acquire knowledge of anatomy of root, stem and leaf in dicot and monocot plants.

UNIT I: MERISTEMATIC TISSUE (10 Period)

Introduction and Scope of Plant Anatomy

Meristematic Tissues: Definition, classification based on origin, function, position and development, organization of root apical meristem (RAM) and shoot apical meristem (SAM), apical cell theory, Histogen theory and Tunica corpus theory.

Unit II : TISSUE SYSTEMS IN PLANTS (12 Period)

Simple Tissues: Parenchyma, Collenchyma, Sclerenchyma.

Complex tissues: Xylem and Phloem.

Secretory Structures in Plants: Laticiferous tissues (Latex cells and vessels), glandular tissues (External glands-digestive glands, nectary glands & internal glands-Oil glands, hydathodes).

Adaptive & Protective systems in plants: stomata, Epidermis, cutin, cuticle & other types of coverings, epidermal appendages.

UNIT III: ANATOMY -I (11 Period)

Vascular Bundles: Definition and types.

Primary structures: Root anatomy of Monocotyledons (Maize) and Dicotyledons (Sunflower),

Stem anatomy of Monocotyledons (Maize) and Dicotyledons (Sunflower),

Leaf anatomy of Monocotyledons (Maize) and Dicotyledons (Sunflower),

Primary growth in roots and stems of plants.

UNIT IV: ANATOMY -II (12 Period)

Secondary Growth- Normal Secondary growth in root and stem of Dicotyledons (Sunflower),

Anomalous Secondary growth: *Achyranthes* stem, *Mirabilis*, *Bignonia* and *Dracaena* stem.

Wood Anatomy- Annual rings, Wood Elements, heartwood and sapwood, Springwood, Summer wood,

Tension Wood, Economic importance of wood and wood elements, Dendrochronology.

Periderm: Development and composition of periderm, rhytidome and lenticels.

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SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)

BOTANY
B.Sc. Second Year

Semester III
CCB-III (B)

Theory Paper- VII

Plant Physiology and Biochemistry

Periods 45

Credits: 02
Maximum Marks: 50

Learning Objectives:

1. To make students realize how plants function, namely the importance of water, minerals, hormones, and light in plant growth and development; understand transport mechanisms and translocation in the phloem, applications of plant physiology.
2. To acquaint the students with the types and their functions of different biomolecules and secondary metabolites
3. To know the role of different plant growth regulators in plant physiology.

Learning Outcomes:

1. Students will gain the knowledge of water and nutrient uptake, movement in plants, role of mineral elements, translocation of sugars, Role of various plant growth regulators, phytochrome in plants.
2. Students shall learn different types of biomolecules and secondary metabolites
3. Students will learn the flowering physiology, vernalization and seed dormancy in plants.

UNIT-I: PLANT WATER RELATIONS (11 periods)

Physical aspects of water absorption – Diffusion, DP, DPD Imbibition Osmosis – OP, Exosmosis, Endosmosis, Plasmolysis, Water potential, Mechanism of water absorption by root – active and passive absorption

Ascent of sap: Introduction and mechanism (transpiration pull theory)

Transpiration: Definition, types, structure of stomata, mechanism of opening and closing of Stomata (starch-sugar theory and K⁺ pump theory), guttation, antitranspirants.

Plant movements: Introduction, classification, paratonic and nastic movements.

UNIT-II: MINERAL NUTRITION (11 periods)

Major and Minor elements: Introduction, source, deficiency symptoms and their role. Foliar nutrition, hydroponic technique.


Mineral salt absorption: Introduction, mechanism of passive absorption (ion exchange theory) and active absorption (carrier concept theory)

Translocation of organic solutes: Introduction, mechanism of translocation (Munch-Mass Flow hypothesis)

UNIT-III: GROWTH AND DEVELOPMENT (12 periods)

Growth and Plant growth regulators: Introduction, phases of growth, measurement of growth (Arc indicator and Pfeiffer's auxanometer), factors affecting growth.

Chemical nature and practical applications of Auxins, Gibberellins, Cytokinins, Abscisic Acid and Ethylene. Circadian Rhythms in plants.


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Seed dormancy: Introduction, causes of seed dormancy and methods of breaking seed dormancy

Seed germination: Introduction, types and mechanism of seed germination

Physiology of flowering: Introduction, Photoperiodism of $1H$, $2H$ and $3H$ and $4H$; Phytochrome system and its role in response to photoperiodism; Flavin, auxin, gibberellin, ethylene, cytokinin, phytochrome, abscisic acid

Vernalization and de-vernalization: Introduction, mechanism and significance

UNIT-IV: BIOMOLECULES AND SECONDARY METABOLITES (10 periods)

Carbohydrates: Introduction, structure and classification, Monosaccharides, disaccharides and polysaccharides (starch and cellulose) Biological functions of carbohydrates

Protein: Introduction, classification and biological functions of Primary, secondary, tertiary and quaternary structure of proteins

Lipids: Introduction, structure classification and biological functions of lipids

Secondary metabolites: Biological functions of tannins, terpenoids, flavonoids, alkaloids, essential oils and organic acids



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SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)

BOTANY
B.Sc. Second Year
Semester IV
CCB-IV (A)
Theory Paper- VIII
Plant Embryology

Periods 45

Credits: 02
Maximum Marks: 50

Learning Objective:

1. To study the flowering and fruiting, reproduction process, role of pollinators, ovule fertilization, Endosperm and seed development in angiosperms.

Learning Outcomes:

1. This course will be able to demonstrate foundational knowledge in embryology of plants.
2. Students will be able to understand the development of pollen, Ovule, and fertilization and palynological information.

UNIT I: EMBRYOLOGY (13 Periods)

Introduction- Definition and Scope,

Contribution of embryologists: W. Hofmeister, E. Strasburger, S.G. Nawaschin, P. Maheshwari, B.G.L. Swamy and B.M. Johri

Microsporangium- Structure of typical anther, T.S. of Anther, Microsporogenesis, Structure of Pollen grain, Development of male gametophyte, male sterility, Pollen germination, Pollen tube growth and guidance, Pollen storage, Pollen allergy, Pollen embryo. Brief account of Palynology

UNIT II: POLLINATION BIOLOGY (10 Periods)

Pollination, introduction, definition, Agents of pollination, mechanism of pollination in *Salvia* plant, types of pollination, self-pollination, cross pollination, adaptations (contrivances) in pollination

UNIT III: MEGASPORANGIUM AND FERTILIZATION -II (11 Period)

Megasporangium- Structure of typical ovule, L.S. Ovule, types of ovule (Orthotropous, Anatropous, Hemianatropous, Amphitropous, Camphyotropous and Circinotropous)

Megasporogenesis, structure of the embryo sac, Development of Monosporic (*Polygonum* type),

Bisporic (*Allium* type) and Tetrasporic (*Adoxa* type) female gametophytes,

Fertilization- Double fertilization and triple fusion, Significance of fertilization

UNIT IV: EMBRYO AND ENDOSPERM (11 Period)

Endosperm- Definition and types of endosperms (Nuclear, Cellular and Helobial endosperm),

Embryo- Definition, Development of Dicot (Crucifer type)-embryo and Monocot (*Sagittaria* type), Development of seed and Fruit (Post fertilization changes), Seed dispersal and Seed germination, Seed appendages, Endospermic and non-endospermic seeds.

A brief account of Polyembryony, Apomixis and Parthenocarpy

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SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM (CBCS)

BOTANY

B.Sc. Second Year

Semester IV

CCB-IV (B)

Theory Paper- IX

Plant Metabolism and Biotechnology

Periods 45

Credits: 02
Maximum Marks: 60

Learning Objectives:

1. To study of different pathways in Photosynthesis, respiration, nitrogen metabolism
2. To gain the knowledge of basic aspects and applications of plant tissue culture
3. To study the different aspects of genetic engineering and bioinformatics

Learning Outcomes:

1. Students will be able to understand the various metabolic processes such as photosynthesis, respiration, Nitrogen metabolism etc. which are important for life.
2. Students shall become familiar with the gene cloning and its transfer in plants
3. Students shall learn different databases and their applications

UNIT-I: PHOTOSYNTHESIS & RESPIRATION (11 periods)

Photosynthesis: Introduction, ultra structure of chloroplast, photosynthetic pigments, concepts of two Photosystems, Mechanism of photosynthesis, Light reaction, Hill's reaction, Cyclic and Non-cyclic photophosphorylation, Calvin cycle (C_3) and Hatch and Slack (C_4) pathway, CAM pathway, Significance of photosynthesis, photorespiration.

Respiration: Introduction, ultra structure of mitochondria, structure and functions of ATP, significance of respiration. Respiratory quotient (RQ)

Types of respiration:

Aerobic respiration- Glycolysis, Krebs' cycle, Electron Transport System. Anaerobic respiration- Fermentation (Alcoholic and Lactic acid)

UNIT-II: ENZYMES AND NITROGEN METABOLISM (11 periods)

Enzymes: Introduction, nomenclature and classification (IUB), mechanism of enzyme action (Lock and key model, induced fit model), Concept of holoenzyme, mechanism of regulation of Enzyme activity-Feedback and allosteric regulation.

Nitrogen metabolism: Introduction, types of nitrogen fixation- Physical and biological (Symbiotic and Asymbiotic), Ammonification, Nitrification and Denitrification, Nitrate reductase, Nitrogen cycle.

UNIT -III: BIOTECHNOLOGY-PLANT TISSUE CULTURE (12 periods)

Introduction to Biotechnology, current uses of biotechnology,

Plant Tissue Culture: Introduction to plant tissue culture, totipotency of plant cells, basic aspects


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...culture, laboratory, nutrient media composition and its preparation. Production of plant
...culture: selection and genetic engineering of explants, micropropagation, tissue culture
...and light response. Transition of culture cultures and cell suspension culture.
...of plants: callus formation and cell suspension culture.
Applications of tissue culture: (i) micropropagation, Production of disease free plants, production
of secondary metabolites, Amelioration and production of mutants, production of transgenic
...hybridization, cytoplasmic male



UNIT-IV: BIOTECHNOLOGY GENETIC ENGINEERING (14 periods)

Introduction to genetic engineering, tools and techniques and applications of recombinant DNA
technology, Cloning vectors (Plasmid, Pst, λ), Restriction enzymes (I, II, III, IV), DNA
cloning, Cosmid Vectors and cDNA Vectors, Agrobacterium mediated gene transfer, Transgenic
plants, Polymerase Chain Reaction and its applications
Bioinformatics: Introduction, Biological database, BLAST, BLAST


Professor
H. Anil Kumar, Bapatla, S.V. U.


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BOTANY CURRICULUM

B.Sc. Botany (Semester Pattern)
Choice Based Credit System (CBCS) Pattern
B. Sc. Second Year
Annual Pattern
BTBP II

PRACTICAL PAPER X: BASED ON THEORY PAPERS VI & VII
Maximum Marks: 50

Practical Exercises:

1. Study of Meristematic tissues (Study of root apex and shoot apex) with the help of Slides/ Models/Charts/ Photocopies (2 practicals)
2. Study of tissues, Parenchyma, Collenchyma, Sclerenchyma, Xylem And Phloem (Permanent slides only) (2 practicals)
3. Maceration of tissues and the observation of sclereids- types, vessels- thickening
4. Study secretory tissues with the help of Slides/Models/Charts/ Photocopies
5. Study of Epidermal tissue system; stomata types; trichomes; non-glandular and glandular
6. Microtomy; dehydration, clearing and embedding of material, section cutting, dewaxing
7. Preparation of a double stained permanent slide of stem of *Maize*, *Sunflower*, *Achyranthus*, *Mirabilis*, *Bignonia* and *Dracaena*, for the study of internal structures (6 practicals)
8. Study of wood specimens for Heart wood ,sap wood etc.
9. Study of Leaf anatomy : Dicot and Monocot leaf (only Permanent slides)
10. Study of root anatomy; Monocot: *Zea mays*; Dicot: *Hollanthus*; Secondary growth; *Helianthus* (only Permanent slides).
11. Study of T.S of anther with help of *Datura* flower
12. Mounting of pollen grains (available flowers only) *Ipomoea*, *Vinca*, *Malvaceae* and Legume.
13. Study of Ovule/Types of ovules–Megasporogenesis and Female gametophyte (permanent slides/ Models)
14. Study of embryo and types of Endosperms (permanent slides/ Models/ Charts)
15. Study of Seed dispersal mechanisms (adaptations through photographs / specimens)
16. Field study of several types of flower with different pollination mechanisms (Wind pollination, thrips pollination, bee/butterfly pollination, bird pollination)
17. One short and one long Botanical excursion are compulsory


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BOTANY - CURRICULUM

B.Sc. General (Semester Pattern)
Choice Based Credit System (CBCS) Pattern
B. Sc. Second Year
Annual Pattern
CCBP-III




PRACTICAL PAPER-XI: BASED ON THEORY PAPERS-VII & IX

Maximum Marks: 50

Practical Exercises:

1. To determine the water potential of potato tuber
2. To determine the osmotic potential of vacuolar sap by plasmolysis
3. To study the effect of temperature/ organic solvent/ concentration of different organic solvents on permeability of plasma membrane (Beet root) by using colorimeter / spectrophotometer.
4. Separation of photosynthetic pigments by paper chromatography.
5. To study the effect of light intensity on rate of photosynthesis.
6. Determination of RF value and identification of amino acids in a mixture.
7. Preparation of standard graph of starch/Glucose using Colorimeter/ Spectrophotometer and determination of starch / Glucose content of the given plant material.
8. Preparation of standard graph of protein using Colorimeter/ Spectrophotometer and determination of protein content from given plant material.
9. To estimate the percentage of oil content in given oil seeds using Soxhlet extractor.
10. Study of catalase activity under different pH and temperature.
11. To study the phenomenon of seed germination (effect of light and darkness).
12. Demonstration of osmosis by potato osmoscope.
13. Demonstration of Ascent of Sap by Balsam plant .
14. To study the mineral deficiency symptoms in at least four locally available plants.
15. Demonstrations of the Arc indicator (lever auxanometer), Clinostat (Geotropism), Kuhn's fermentation tube experiment (Requirements, procedure and workings of the same are expected).
16. Qualitative analysis of proteins (Biuret/ Xanthoproteic/ Millon tests), Carbohydrates (Molisch /Fehlings /Benedict's) Glucose, sucrose, starch, Cellulose and Pectin.
17. Qualitative test of tannin, terpenoids, saponins, flavonoids and alkaloids.
18. Micro chemical test for organic acids - Tartaric acid, Citric acid, Oxalic and Malic acid.
19. Study of tools used in Tissue culture laboratory for sterilization and inoculation. Principle and working of Autoclave, oven, incubator, Laminar Air flow,
20. Preparation of media for tissue culture.
21. Establishment of callus cultures -from carrot.
22. Different steps involved in genetic engineering for production of Bt. cotton, Golden rice, Flavr Savr tomato through photographs.
23. Study of methods of gene transfer through photographs: *Agrobacterium*-mediated gene transfer .
24. Study major biological databases.
25. Botanical Excursions (Two short excursions and one long excursion and visits to Research laboratories)


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course cutting ISSUP - sustainability

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PRACTICAL PAPER-XI: BASED ON THEORY PAPERS-VII & IX

Maximum Marks: 50

Practical Exercises:

1. To determine the water potential of potato tuber
2. To determine the osmotic potential of vacuolar sap by plasmolysis
3. To study the effect of temperature/ organic solvent/ concentration of different organic solvents on permeability of plasma membrane (Beet root) by using colorimeter / spectrophotometer.
4. Separation of photosynthetic pigments by paper chromatography.
5. To study the effect of light intensity on rate of photosynthesis.
6. Determination of RF value and identification of amino acids in a mixture.
7. Preparation of standard graph of starch/Glucose using Colorimeter/ Spectrophotometer and determination of starch / Glucose content of the given plant material.
8. Preparation of standard graph of protein using Colorimeter/ Spectrophotometer and determination of protein content from given plant material.
9. To estimate the percentage of oil content in given oil seeds using Soxhlet extractor.
10. Study of catalase activity under different pH and temperature.
11. To study the phenomenon of seed germination (effect of light and darkness).
12. Demonstration of osmosis by potato osmoscope.
13. Demonstration of Ascent of Sap by Balsam plant . .
14. To study the mineral deficiency symptoms in at least four locally available plants.
15. Demonstrations of the Arc indicator (lever auxanometer), Clinostat (Geotropism), Kuhn's fermentation tube experiment (Requirements, procedure and workings of the same are expected).
16. Qualitative analysis of proteins (Biuret/ Xanthoproteic/ Millon tests), Carbohydrates (Molisch /Fehlings /Benedict's) Glucose, sucrose, starch, Cellulose and Pectin.
17. Qualitative test of tannin, terpenoids, saponins, flavonoids and alkaloids.
18. Micro chemical test for organic acids – Tartaric acid, Citric acid, Oxalic and Malic acid.
19. Study of tools used in Tissue culture laboratory for sterilization and inoculation. Principle and working of Autoclave, oven, incubator, Laminar Air flow,
20. Preparation of media for tissue culture.
21. Establishment of callus cultures –from carrot.
22. Different steps involved in genetic engineering for production of Bt. cotton, Golden rice, Flavr Savr tomato through photographs.
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PRACTICAL PAPER-XI: BASED ON THEORY PAPERS-VII & IX
Maximum Marks: 50

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SECB-I (A) FRUIT AND VEGETABLE PROCESSING

Periods: 45

Credits: 02 (Marks-50)

UNIT I

Production and processing scenario of fruits and vegetables in India and World, Scope of fruit and vegetable preservation industry in India. Present status, constraints and prospects, Overview of principles and preservation methods of fruits and vegetables (Physical and Chemical), Commercial processing technology of fruits and vegetables, Primary processing and pack house handling of fruits and vegetables; Peeling, slicing, cubing, cutting and other size reduction operations for fruits and vegetables, Minimal processing of fruits and vegetables Blanching operations and equipment.

UNIT II

Preparation and preservation of juices, squashes, syrups, sherbets, nectars, cordials, etc; Problems on squash and RTS; Processing and equipment for above products and FSSAI specification Preparation, preservation and machines for manufacture of crystallized fruits and preserves, jam, jelly and candies, Preparation, preservation and machines for manufacture of preserve, concentrate, fruit wine, pickles, sauce, paste, ketchup; toffee, cheese, lather, soup powders; FSSAI specification, Commercial processing technology of selected fruits and vegetables for production of various value added processed products.

Practicals :

1. Preparation of jam/ jelly from selected fruit
2. Preparation of RTS beverage e.g. Amala, Mango and Pineapple etc
3. Preparation of squash
4. Preparation of fruit candy
5. Preparation of fruit leather
6. Preparation of fruit toffee
7. Preparation of pickle
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8. Preparation of banana and potato wafers
9. Visit to fruits and vegetable processing unit

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SECB-I (B) BIOINSTRUMENTATION
Periods: 45 Credits: 02 (Marks-50)



UNIT I

Chromatography and Centrifugation: General principles of separation, paper chromatography, thin layer, affinity, gel permeation, ion exchange, GLC, HPTLC, preparative and analytical centrifugations and their application

UNIT II

Electrophoresis and Spectroscopy: Basic principles of electrophoresis, Factor affecting, Electrophoretic mobility, native and denaturing PAGE, isoelectric focusing, 2DE, Pulse field gel, Electrophoresis. Spectroscopy: Theory and applications of Ultra violet and visible spectroscopy, IR, Nuclear magnetic resonance, Mass and applications.

Practicals

1. Centrifugation

- Isolation of cell organelles like cell membrane, mitochondria, ribosomes etc.
- Determination of molecular weight of protein by centrifugation

2. Chromatography

- Separation of amino acids by paper chromatography
- Separation of sugars by TLC.
- Separation of plant pigments by paper/ TLC
- Purification of proteins by Column / ion exchange / Molecular sieve chromatography

3. Electrophoresis

- Separation of soy bean proteins by PAGE

4. Spectroscopy

- Validation of Lambert-Beer's law (Photometer)
- Estimation of DNA by DPA method (UV spectrophotometer)
- Estimation of reducing sugars by DNSA method (VIS-Spectrophotometer.)

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SECB-II (A) NURSERY AND GARDENING

Periods: 45 Credits: 02 (Marks-50)

UNIT I

Nursery: definition, objectives and scope and building up of infrastructure for nursery, planning and seasonal activities - Planting - direct seeding and transplants.

Vegetative propagation: air-layering, cutting, selection of cutting, collecting season, treatment of cutting, rooting medium and planting of cuttings, Hardening of plants, green house, mist chamber, shed roof, shade house and glass house.

Gardening: definition, objectives and scope, different types of gardening, landscape and home gardening, parks and its components, plant materials and design, computer applications in landscaping, Landscaping highways and Educational institutions.

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

UNIT II

Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vine; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas; Cultivation of plants in pots; Indoor gardening; Bonsai, diseases and Pests of Ornamental Plants.

Principles of Garden Designs: English, Italian, French, Persian, Mughal and Japanese gardens; Features of a garden (Garden wall, Fencing, Steps, Hedge, Edging, Lawn, Flower beds, Shrubbery, Borders, Water garden). Some Famous gardens of India.

Practicals:

1. Preparation of nursery beds and sowing of seeds.
2. Study of Soil sterilization process
3. Seed sowing and transplantation methods
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4. Study Garden tools and implements, Study of containers - earthen containers, pots, polybags, cement pots and ceramic pots.
5. Garden designing and hedge preparation methods
6. Identification of landscape trees, shrubs / climbers and ground covers.
7. Layout of land for lawn and Preparation of land for lawn.
8. Designing of home gardens
9. Identification and growing of indoor plants of their basic requirements
10. Patterns of flower arrangement in vase
11. Study of disease and pests of ornamental plants
12. Visit to commercial nursery.

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SECB-II (B) BIO-FERTILIZERS
Periods: 45 Credits: 02 (Marks – 50)

UNIT 1

General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.
Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. *Azotobacter*: classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass multiplication. Cyanobacteria (blue green algae), *Azolla* and *Anabaena azollae* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

UNIT II

Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.
Organic farming – Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting – field Application. Biofertilizers - Storage, shelf life, quality control and marketing.

Practicals:

1. Isolation of Phosphate solubilizing micro-organisms from rhizosphere
2. Isolation of Rhizobium from root nodules of leguminous crop
3. Isolation and purification of *Azotobacter* from soil
4. Isolation and purification of *Beijerinckia* from soil
5. Isolation of *Azospirillum*
6. Isolation Blue Green Algae from soil
7. Isolation of organic matter decomposing microorganisms
8. Mass multiplication of *Rhizobium*, *Azotobacter*, and *Azospirillum* inoculum
9. Production and application of blue green algae
10. Production of *Azolla* biofertilizers
11. Isolation of arbuscular mycorrhizal spores from rhizospheric soil
12. Methods of application of biofertilizers
13. Standards for commercial production of biofertilizers- Quality control of biofertilizers.

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SECB-II (B) BIO-FERTILIZERS
Periods: 45 Credits: 02 (Marks - 50)

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6. Isolation Blue Green Algae from soil
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8. Mass multiplication of *Rhizobium*, *Azotobacter*, and *Azospirillum* inoculum
9. Production and application of blue green algae
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SEMESTER-V

DISCIPLINE SPECIFIC COURSE IN BOTANY-DSCB (A Theory Course)

DSCB-I: Cell and Molecular Biology (Theory Paper-XII)

Periods: 45

Credits: 02

Maximum Marks: 50



Learning Objectives:

1. To know about the ultra structure of a cell, cell wall, cell membrane, cell organelles and chromosomes, cell cycle and cell division.
2. To study in detail the structure of DNA and RNA, protein synthesis, gene structure, gene mutation and related diseases.
3. To acquire knowledge of cell and molecular biology

Learning Outcomes:

1. The students will be able to understand ultra structure of a cell, cell wall, cell membrane, cell organelles and chromosomes, cell cycle and cell division.
2. The students will be able to understand in detail the structure of DNA and RNA, protein synthesis, gene structure, gene mutation and related diseases.
3. Students will acquire knowledge of cell and molecular biology

UNIT-I: CELL BIOLOGY-I (11 Periods)

1. Cell: the unit of life, ultra structure of Prokaryotic and eukaryotic cells, 2. Ultra structure and functions of cell wall and cell membranes (Fluid Mosaic Model), 3. Ultra Structure and functions of cell organelles: Golgi apparatus, Endoplasmic reticulum, Ribosomes, Lysosomes, Peroxisomes, Glyoxisomes and Nucleus.

UNIT-II: CELL BIOLOGY-II (12 Periods)

1. Chromosome: Morphology, structure and function of typical chromosome and Karyotype and Idiogram, 2. Structure and significance of giant Chromosomes: Polytene chromosome and Lampbrush chromosome, 3. Cell cycle: G₀ - G₁ - S - G₂ phase, Cell division: Process and significance of Mitosis and Meiosis.

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UNIT-III: MOLECULAR BIOLOGY-I (11 Periods)

1. Nucleic Acids- Introduction, Chemical composition, Structure of DNA (Watson and Crick model), Replication of DNA (Meselson and Stahl expt.), Structure, function and types of RNA
Protein synthesis: Genetic code (Nature and Properties), Transcription; Translation.

UNIT-IV: MOLECULAR BIOLOGY-II (11 Periods)

1. Classical concept of gene (theory of Morgan), Fine structure of gene (Seymour Benzer's), Regulation of gene expression in prokaryotes (Lac Operon Model) 2. Mutation: Introduction, Mutagens, Molecular basis of gene mutation and related diseases: Phenylketonuria (PKU), Alkaptonuria (AKU), Albinism, Sickle cell anaemia and Amniocentesis (Detection of genetic diseases).



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SEMESTER-V



DISCIPLINE ELECTIVE COURSE IN BOTANY-DECB (A Theory Course)
DECB-I: Plant Pathology-I (Theory Paper-XIII)

Periods: 45

Credits: 02

Maximum Marks: 50

Learning Objectives:

1. To know about the fundamentals of plant pathology.
2. To study in detail the process of plant disease development.
3. To acquire knowledge of different plant diseases in different plants.

Learning Outcomes:

1. The students will be able to understand fundamentals of plant pathology.
2. The students will be able to understand in detail the process of plant disease development.
3. Students will acquire knowledge of different plant diseases in different plants.

UNIT-I: FUNDAMENTALS OF PLANT PATHOLOGY (11 periods)

Scope, importance, history and advancement of plant pathology, classification of plant diseases on the basis of causal organism and symptoms, field and laboratory diagnosis- Isolation of plant pathogens from infected plant parts, soil and air, pure culture techniques, Koch's postulates for pathogenicity.

UNIT-II: PLANT DISEASE DEVELOPMENT (11 periods)

Disease development- Mode of entry of pathogens (through stomata, wounds, root hairs and buds), Factors affecting disease development- Temperature, moisture, wind and soil pH, Dispersal of plant pathogens (by air, water, insects and animals), Chemical weapons of pathogen: Role of cell wall degrading enzymes and Mycotoxins in pathogenesis.

UNIT-III: PLANT DISEASES-I (12 periods)

Symptoms, causal organisms, disease cycle and control measures of Green ear of Bajra, early blight of tomato, Grain smut of Jowar, Red rot of Sugarcane, Angular leaf spot of cotton, Bacterial blight of Pomegranate, Anthracnose of mango

UNIT-IV: PLANT DISEASES-II (11 periods)

Symptoms, causal organisms, disease cycle and control measures of White rust of Mustard, Whip smut of Sugarcane, Powdery mildew of pea, Leaf spot of Turmeric (*Colletotrichum capsici*), Sigatoka disease of Banana, Brown leaf spot of Rice.

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SEMESTER-VI

DSCB-I: GENETICS AND PLANT BREEDING

(Theory Paper-XIV)



Periods: 45

Credits: 02

Maximum Marks: 50

Learning Objectives:

1. To study Mendelian genetics, gene interaction.
2. To study sex determination, linkage, sex linked inheritance and genetic variations.
3. To study various crop improvement methods in plant breeding.

Learning Outcomes: Students shall

1. Understand Mendelian genetics, gene interaction.
2. Learn the sex determination, linkage, sex linked inheritance and genetic variations.
3. Understand various crop improvement methods in plant breeding.

UNIT-I: GENETICS-I (11 Periods)

1. Mendelian inheritance: Mendel's Laws of inheritance. Explanation and examples of Monohybrid cross, dihybrid cross (back cross and test cross) 2. Gene interaction and epistasis (Allelic and non-allelic) explanation and examples of, 9:7, 9:3:4, 12:3:1 and 15:1 ratios, Collaborator gene (comb shape in fowl) 3. Sex determination: Discovery of sex chromosomes, chromosomal theory of sex determination, sex determination in insects (XOXX), Birds (ZW-ZZ method), Animals (Drosophila and Man), and Plants (*Melandrium* and *Asparagus*).

UNIT -II: GENETICS-II (12 Periods)

1. Linkage: (Definitions and significance) Coupling and repulsion hypothesis. Type of linkage (maize and drosophila) 2. Sex linked inheritance: Definition classification (x-linked, y-linked and xy-linked), Sex linked inheritance in Drosophila (white eye colour), Man (Hemophilia, colour blindness and holandric gene-hypertrochosis) and Birds (barred feathers) 3. Genetic variations: Polyploidy, Euploidy-Autoployploidy and Allopolyploidy with reference to Raphanobrassica and Hexaploid wheat, Aneuploidy (Hyper and Hypoploidy), Syndromes in human i) Down's syndrome ii) Edward's syndrome iii) Patau's syndrome iv) Turner's syndrome v) Klinefelter's syndrome.

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UNIT -III: PLANT BREEDING-I (11 Periods)

1. Introduction and objectives of plant breeding, methods of plant breeding: Selection-Mass selection, pure line selection and clonal selection, 2. Hybridization: definition, objectives, various steps in hybridization, applications, 3. Heterosis and hybrid vigour: definition, effects, utilization and limitations.



UNIT -IV: PLANT BREEDING -II (11 Periods)

1. Plant introduction and acclimatization, types, advantages and disadvantages, 2. Mutational breeding: objectives, procedure, applications, Mutational breeding with reference to groundnut 3. Male sterility: Genetic Male Sterility (GMS), Cytoplasmic Male Sterility (CMS).

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SEMESTER-VI

DECB-I: PLANT PATHOLOGY-II

(Theory Paper-XV)

Periods: 45

Credits: 02

Maximum Marks: 50

Learning Objectives:

1. To know about the fundamentals of aerobiology and seed pathology.
2. To study in detail the process of plant Defense mechanism and management.
3. To acquire knowledge of different plant diseases in different plants.

Learning Outcomes:

1. The students will be able to understand fundamentals of aerobiology and seed pathology.
2. The students will be able to understand in detail the process of plant Defense mechanism and management.
3. Students will acquire knowledge of different plant diseases in different plants.

UNIT-I: AEROBIOLOGY AND SEED PATHOLOGY (11 periods)

Aerobiology-Definition, scope and importance and disease forecasting, Seed pathology-Definition, seed borne pathogens (external and internal) detection of seed borne pathogens (fungi) by blotter paper and agar plate methods, Biodeterioration of food grains, seed treatment (hot water, solar, chemical), and seed certification.

UNIT-II: PLANT DEFENCE MECHANISM AND DISEASE MANAGEMENT

(11 periods)

Structural (pre-existing and Post inflectional) and biochemical Defence-preexisting and Post inflectional (phytoalexins), Exclusion and eradication, Chemical control-General account of Sulphur, Copper, systemic fungicides and antibiotics, Biological control

UNIT-III: PLANT DISEASES-I (11 periods)

Symptoms, causal organisms, disease cycle and control measures of Tikka disease of groundnut, Ergot of Bajra, Loose smut of Wheat, Rust of Jowar, Phanerogamic plant parasites (Cuscuta), Leaf curl of tomato.

UNIT-IV: PLANT DISEASES-II (12 periods)

Symptoms, causal organisms, disease cycle and control measures of Downy mildew of Grape, Stem rust of Wheat, Wilt of Tur, late blight of Potato, Grassy shoot disease of Sugarcane, Papaya mosaic, Leaf Blight and Leaf Rust of Soybean and Leaf spot of cabbage

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PRACTICAL COURSES

DSCBP-I: Practicals based on theory paper-XII&XIV-Cell and molecular
biology & Genetics and plant breeding
(Practical paper-XVI)

Credits: 02

(Maximum Marks: 50)

Annual Pattern

DSCBP-I

Practical paper-XVI: Practicals based on theory paper-XII&XIV
(Cell and molecular Biology & Genetics and Plant Breeding)

Learning Objectives:

1. To study Cell biology.
2. To study Molecular biology
3. To study Genetics and plant breeding.

Learning Outcomes: Students shall

1. Understand Cell biology
2. Learn the molecular biology
3. Understand genetics and plant breeding

Practical Exercises:

1. Study of ultra-structure of cell organelles with the help of photocopies/slides (1 Practical)
2. Study of giant chromosome with the help of photocopies/ slides (1 Practical)
3. Study of Salivary gland chromosome from *Chironomous* larvae (1 Practical)
4. Cell division-study of mitosis (Onion/Garlic root tips or any other available material) and mitotic index (6 Practicals)
5. Study of karyotype and idiogram from photocopies of Onion/ Aloe plant material (1 Practical)
6. Cell division-study of meiosis from Onion/Maize floral buds or any other available material (6 Practicals)
7. Problems based on Monohybrid/Dihybrid-ratio; 9:7/9:3:4/12:3:1/15:1 ratios and collaborator gene (6 Practicals)
8. Problems based on sex-linked inheritance (4 Practicals)
9. Study of syndromes in Man by using photocopies (1 Practical)
10. Perform hybridization techniques-Emasculation, Pollination and Bagging (1 Practical)
11. Study of floral structure of self-pollinated (wheat) and cross pollinated (Maize) crops (1 Practical)
12. Pollen viability tests- Acetocarmine method and Sugar solution method (1 Practical)
13. Botanical excursions- At least one long and several local excursions are expected.
14. Preparation of wool models of mitosis and meiosis is expected

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DECBP-I

Practical paper-XVII: Practicals based on theory paper-XIII&XV
(Plant Pathology-I&II)

Credits: 02

(Maximum Marks: 50)

Learning Objectives:

1. To study different laboratory equipments and micrometry
2. To study in detail the pathogenicity, symptoms and causal organisms of plant diseases, effect of temperature and pH on plant pathogens.
3. To acquire knowledge of culture media, isolation and identification of pathogens from diseased plant parts and from air.

Learning Outcomes:

1. The students will be able to understand working operating of laboratory equipments.
2. The students will be able to understand in detail the pathogenicity, symptoms and causal organisms of plant diseases, effect of temperature and pH on plant pathogens.
3. Students will acquire knowledge of different culture media, isolation and identification of pathogens from diseased plant parts and from air.

Practical Exercises:

1. Study of laboratory equipments-Autoclave, Hot air oven, inoculating chamber, laminar air flow, Air sampler, Incubator, Centrifuge (2 practical)
2. Preparation of culture media-PDA, NA (2 practical)
3. Micrometry-Calibration of microscope and measurement of fungal spores (2 practical)
4. Isolation of fungal pathogens from diseased plant parts, Toxins & Enzymes (2 practical)
5. Isolation and identification of seed-borne pathogen by blotter / agar plate method (2 practical)
6. Study of air-borne pathogen by exposed Petri plates / Air sampler method (2 practical)
7. Proving of pathogenicity (1 practical)
8. Effect of pH and temperature on the growth and development of plant pathogens (fungi) (2 practical)
9. Study of symptoms and causal organisms of Stem rust of wheat (1 practical)
10. Study of symptoms and causal organisms of Late blight of potato and Downy mildew of grapes (2 practical)
11. Study of symptoms and causal organisms of Tikka disease of groundnut and Anthracnose of Mango (1 practical)

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2. Study of symptoms and causal organisms of Early Blight of tomato and Leaf spot of turmeric (1 practical)
13. Study of symptoms and causal organisms of Rust of jowar and Grain smut of jowar (1 practical)
14. Study of symptoms and causal organisms of loose smut of wheat and Brown Leaf Spot of Rice (1 practical)
15. Study of symptoms and causal organisms of Green ear and ergot of Bajra (1 practical)
16. Study of symptoms and causal organisms of Wilt of tur and Whip smut of sugarcane (1 practical)
17. Study of symptoms and causal organisms of White rust of mustard and Leaf spot of cabbage (1 practical)
18. Study of symptomology of the following diseases-Angular leaf spot of cotton, Papaya mosaic, Leaf Blight and Leaf Rust of soybean, Sigatoka disease of banana, Phanerogamic disease due to Cuscuta (6 practicals)
19. Botanical excursions- At least one long and several local excursions are expected.

A handwritten signature in blue ink, appearing to be "A. S. S.", written over a horizontal line.

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SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Semester Pattern Curriculum Under CBCS For
Faculty of Science & Technology, Under Graduate (UG) Programme

CLASS: B. Sc. THIRD YEAR, SUBJECT: BOTANY

B. Sc. Third Year Botany Curriculum WEF Academic Year 2021-2022 Page 24

Annual Pattern

SKILL ENHANCEMENT COURSES (SEC)

SEC-III: Trichoderma cultivation Technique

OR

SEC-III: Medicinal Plant Product Preparation Skill

SEC-IV: Mushroom Cultivation

OR

SEC-IV: Herbal Drug Technology

Credits: 02 (Maximum Marks: 50)

Periods (Theory & Practicals): 45



SEC-III: TRICHODERMA CULTIVATION TECHNIQUE

UNIT-I: CONCEPT OF BIOCONTROL (6 periods)

Introduction, Definition, Biocontrol agents, Need of biocontrol, Concept of biocontrol (ways, limitations and factors affecting success of biocontrol, Environmental health hazards due to pesticides and fungicides), Plant based products (Azadirachtin, Neem cake, Indiar, Pyrethrines, Phermones, Trichoderma etc.)

UNIT-II: TRICHODERMA CULTIVATION (15 periods)

Introduction, Systematic position, thallus structure, Trichoderma as biocontrol agent, Mode of action, Uses, Trichoderma as a commercial biocontrol agent, Cultivation details of Trichoderma

UNIT-III: PRACTICALS ON TRICHODERMA CULTIVATION (8 practicals)

Principle; Requirement, procedure, observations, Harvesting, results and records precautions, Visit to a Trichoderma cultivation laboratory in nearby area (Students are expected to prepare a model of Trichoderma cultivation laboratory, a visit report and to submit the same at the time of practical examination.

OR

SEC-III: MEDICINAL PLANT PRODUCT PREPARATION SKILL

UNIT-I: MEDICINAL PLANTS (6 periods)

Introduction, Definitions, Scope and Importance, Concept of active principles

UNIT-II: STUDY OF MEDICINAL PLANTS (15 periods)

Description, Identification and Classification, medicinal uses of locally available medicinal plants (Awla, Adulsa, Ginger)

UNIT-III: PRACTICALS ON MEDICINAL PLANT PRODUCT PREPARATION

(8 practicals)

Preparation of Awla candy, Awla masticator (Awla supari), Adulsa syrup, Ginger syrup and cake, Visit to a production industry in nearby area

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students are expected to prepare a model of production industry, a visit report and to submit the same at the time of practical examination

SEC-IV: MUSHROOM CULTIVATION

UNIT-I: FUNGAL BIOMASS AS NON CONVENTIONAL FOOD (6 periods)

Introduction, Concept and need, Advantages, disadvantages and Sources of non-conventional food

UNIT-II: MUSHROOM (*PLEUROTUS*) CULTIVATION (15 periods)

Introduction, Systematic position, thallus structure and fruit body of *Pleurotus*, Merits of *Pleurotus* cultivation, Commercial cultivation of *Pleurotus*, Cultivation details of *Pleurotus* (Substrate, Soaking, Pasteurization, Spawning, Cropping, Picking and Packing, Flow chart), *Pleurotus* products fresh and processed

UNIT-III: PRACTICALS ON MUSHROOM (*PLEUROTUS* CULTIVATION) (8 practicals)

Principle, Requirement, procedure, observations, Harvesting, results and records, Visit to a Mushroom cultivation laboratory in nearby area (Students are expected to prepare a model of Mushroom cultivation laboratory, a visit report and to submit the same at the time of practical examination.

OR

SEC-IV: HERBAL DRUG PROCESSING

UNIT-I: INTRODUCTION (11 periods)

Role of natural products in herbal medicine, General status and importance of herbal medicine, Safety of herbals / herbal pharmacovigilance, WHO policy on herbal medicine, Herbs as raw materials: Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation, Source of Herbs, Selection, identification and authentication of herbal materials drying and processing of herbal raw material, Extraction of Herbal Materials, Choice of solvent for extraction, Methods used for extraction and principles involved in extraction

UNIT-II: STANDARDIZATION OF HERBAL DRUGS (10 periods)

Standardization of herbal formulations and herbal extracts, Standardization of herbal extracts as per WHO and cGMP guidelines, Physical, chemical, spectral and toxicological standardization, qualitative and quantitative estimations exemplified by the method of preparation of at least two standardized extracts, Stability studies for extract, Predictable chemical and galenical changes

UNIT-III: PRACTICALS ON HERBAL DRUG PROCESSING (8 practicals)

Qualitative and Quantitative Microscopic Examination: Microscopic evaluation of powder drugs and their mixtures with adulterants, Exercises based on standardization and quality control of plant drugs, Qualitative and Quantitative Estimation of Phytoconstituents, Determination of phytoconstituents in crude drugs and commercial herbal formulations, Pharmacopoeial evaluation of natural products, Determination of ash values, extractive values, Swelling index and foaming index of crude drugs as per WHO Guidelines, Preparation of detailed monograph of at least one plant drug covering Pharmacognosy and Phytochemical investigation with its use in traditional system of medicine, Experiment on raw material standardization, purification of extracts with chromatographic techniques, Isolation of piperine from pepper, Isolation of Hesperidine from orange peel, Isolation & TLC of Reserpine from Rauwolfia root, Isolation & TLC of Menthol from Mentha oil, Preparation and Evaluation of Herbal formulations



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