



SHIV CHHATRAPATI SHIKSHAN SANSTHA'S

RAJARSHI SHAHU MAHAVIDYALAYA, LATUR
(AUTONOMOUS)

B. Sc. GENERAL (SEMESTER PATTERN)

B. Sc. THIRD YEAR (CBCS)

BOTANY – CURRICULUM

w. e. f. JUNE, 2023



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BOTANY – CURRICULUM STRUCTURE

Semester	Paper/ Lab Course No.	Paper Title	Course Code	Marks		Lectures/ Practicals	Total Marks	Credits
				In Sem. Evaluation	End Sem. Evaluation			
V	CC-IX	Plant Physiology and Metabolism	U-BOT-583	20	30	45	50	02
	DSE-I	Plant Pathology-I/Plant Biotechnology (DSE)	U-BOT-584	20	30	45	50	02
	Lab Course-VII	Based on CC– IX	U-BOT-585	--	--	24	50	02
	Lab Course-VIII	Based on DSE–I	U-BOT-586	--	--	24	50	02
	SEC-III	Fruits and Fruit Processing	U-ADC-540F	--	50	45	50	02
VI	CC-X	Plant Biochemistry and Bioinformatics	U-BOT-683	20	30	45	50	02
	DSE-II	Plant Pathology-II / Cytogenetics (DSE)	U-BOT-684	20	30	45	50	02
	Lab Course - IX	Based on CC –X	U-BOT-685	--	--	24	50	02
	Lab Course-X	Based on DSE-II	U-BOT-686	--	--	24	50	02
	SEC-IV	Basics in Horticulture	U-ADC640H	--	50	45	50	02
						Total	500	20

Workload: 1. Theory: Three Lectures / Paper / Week.

2. Practical: One Practical (Three Lectures) / Batch / Week

S. N. Shinde
Chairman
Board of Studies in Botany

B.Sc. Third Year
Semester-V
BOTANY
CC-IX: Plant Physiology and Metabolism

Lectures: 45 Maximum Marks: 50 Credits: 02 Course Code: U-BOT-583

Course Objectives:

1. To learn the different physiological phenomenon of plants.
2. To know the different metabolic processes in plants.
3. To give knowledge about the energy flow in plants.
4. To understand carbon cycle in plants.

Course outcomes:

The Students will be able to:

1. Describe energy flow in plants.
 2. Explain different physiological phenomenon of plants.
 3. Recognize need of mineral nutrients by plants and its recycling.
 4. Correlate the plant water relation.
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UNIT-I: PLANT WATER RELATIONS (12 L)

1. Importance of water in plant life
2. Different bio-physico-chemical Phenomenon-Permeability and its importance, definition of diffusion, osmosis (exosmosis, endosmosis) plasmolysis, imbibition
3. Absorption of water- Introduction, mechanism of water absorption (active and passive)
4. Ascents of sap- Definition, transpiration pull theories
5. Transpiration- Definition, types, structure of stomata, mechanism of opening and closing of stomata (starch-sugar theory)

UNIT-II: PLANT GROWTH AND DEVELOPMENT (10L)

I. Vegetative Growth:

1. Seed dormancy: Seed dormancy- Introduction, methods of breaking seed dormancy, factors affecting seed dormancy
2. Seed germination: Seed germination- types, factors affecting seed germination.
3. Plant growth hormones: Auxins, gibberellins, cytokinins, abscisic acid, Ethylene (only practical applications)

II. Reproductive Growth:

Physiology of flowering: Photoperiodism (long day plants, short day plants, day neutral plants)

UNIT-III: PHOTOSYNTHESIS AND PHOTORESPIRATION (13 L)

- I. Introduction: photosynthetic pigments, concepts of two Photo systems
- II. Mechanism of photosynthesis:
 1. Light phase- Hill reaction, Cyclic and Non-cyclic photophosphorylation
 2. Dark phase- Calvin cycle (C₃ pathway), Hatch and Slack cycle (C₄ pathway), significance of photosynthesis
- III. Photorespiration: Introduction, Glycolate metabolism (C₂ cycle) significance

UNIT-IV: RESPIRATION (10 L)

- I. Introduction
- II. Types of respiration:
 1. Aerobic respiration- Glycolysis, Krebs's cycle, Electron Transport System (oxidative phosphorylation), ATP structure and function
 2. Anaerobic respiration- Fermentation, significance of respiration

Reference Books:

1. Plant Physiology -Gill P.S. (2000) , S.Chand& Co. New Delhi
2. Text book of Plant Physiology-Verma V. (1995) , Emkay Publication N.Delhi
3. Plant Physiology-Salisbury P.B. & W. Ross (1992) , New York Pub. Co. California USA
4. Plant Physiology-Subhash Chandra Dutta (1992) , Wiley Eastern, New Delhi
5. Plant Physiology-Shrivastava H.S.(2000) , Rastogi Publication, Meerut
6. Elements of Biochemistry- Shrivastava H.S. (1993) - Rastogi Publication, Meerut
7. Biochemistry-Rastogi (2000) Tata McGraw Hill, New York.
8. Biochemistry-Mathews C.F. (2003) - Addison Wesley, New Delhi.
9. Laboratory Manual in Biochemistry-Jayaraman J. (1992) -, Wiley Eastern Ltd., New Delhi.
10. A Textbook of Plant Physiology, Biochemistry and Biotechnology-S.K. Verma, Mohit Verma.
11. A Textbook of Plant Physiology, Biochemistry Volume III- A.K. Singh, Shalini Singh.
12. A Textbook of Plant Physiology, Biochemistry-Badri Vishal Pandey, Poonam Pandey.

B.Sc. Third Year
Semester-V
BOTANY
DSE-I: Plant pathology –I

Lectures: 45 Maximum Marks: 50 Credits: 02 Course Code: U-BOT-584

Course Objectives:

1. To know about microbial world and the nature of plant diseases.
2. To understand the principles and concept in plant pathology.
3. To learn the relationships between pathogens and host.
4. To become familiar with terms and methods used to diagnose plant diseases.
5. To explain the concept of plant disease and disease pyramid.
6. To give information about modes of plant disease transmission.

Course outcomes:

The Students will be able to:

1. Explain the nature of plant diseases.
 2. Describe modes of plant disease transmission.
 3. Discuss the disease pyramid.
 4. Correlate the relationships between pathogens and host.
 5. Identify pathogens on the basis of symptoms.
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UNIT-I: FUNDAMENTALS OF PLANT PATHOLOGY (10 L)

1. Introduction
2. Scope, importance and history of plant pathology
3. Classification of plant diseases on the basis of causal organism and symptoms
4. Pure culture technique, Koch's postulates for pathogenicity

UNIT-II: PLANT DISEASES-I (12 L)

Symptoms, causal organisms, disease cycle and control measures of:

1. Green ear of Bajara
2. Leaf spot of Tomato
3. Red rot of Sugarcane
4. Angular leaf spot of Cotton
5. Yellow vein mosaic of Bhendi

UNIT-III: PLANT DISEASES-II (13 L)

Symptoms, causal organisms, disease cycle and control measures of:

1. Ergot of Bajara
2. Whip smut of Sugarcane
3. Leaf spot of Turmeric (*Colletotrichum capsici*)
4. Citrus canker
5. Little leaf of Brinjal

UNIT-IV: PLANT DISEASE DEVELOPMENT (10 L)

1. Definition of disease and disease pyramid
2. Disease development- Mode of entry of pathogens (through stomata, wounds, root hairs and buds),
3. Dispersal of plant pathogens (by air, water, insects and animals)

Reference Books:

1. Fundamentals of plant pathology-Pathak, Khatri, Pathak, 2003, Agrios
2. Plant Pathology-Mehrotra, R.S. 1991, , Tata Mc Graw Hill Co. Delhi
3. Plant Protection Techniques-Chatterjee, P.B., 1997, Bharati Bhawan, Publ. Patana
4. Plant Pathology-Agrios, G.N. 2006-, Elsevier Academic Press. Pandey, B.P.2009, Plant Pathology, S. Chand Co.
5. Molecular Plant Pathology Dickinson, M.2008, -, Bios Scientific Publishers, London
6. Plant pathology-Trigiano, Windham and Windham, 2003, Concepts and laboratory exercises. CRC Press London
7. Text book of plant diseases-Gupta, G.P.2004, Discovery Publ. House, New, Delhi Aneja, K.R. 2001, Experiments in Microbiology, plant pathology, tissue culture and Mushroom production technology, New Age International Publishers.
8. Practical Microbiology-Dubey, R.C. Maheshwari, D.K. 2005, S. Chand & CO.
9. Plant Diseases-Singh, R.S.2004, Oxford & IBH Publishing Co. Pvt. Ltd., Delhi.
10. Diseases of Crop plants of India-Rangaswami, G.,Mahadevan,A.,2002 ,Practice Hall of India.

B.Sc. Third Year Semester-V
BOTANY
Theory Paper- X: PLANT BIOTECHNOLOGY (DSE)

Lectures: 45	Maximum Marks: 50	Credits: 02	Course Code: U-BOT-584
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Course Objectives:

1. To learn the different phenomenon of Plant Biotechnology
2. To understand the different genetic engineering processes in plants.
3. To know the gene, transfer in plants.
4. To give information of Bio-fertilizers and process of Nitrogen Fixation.

Course Outcome:

The Students will be able to:

1. Explain the techniques of plant biotechnology.
 2. Justify concept of proteomics and genomics.
 3. Identify GMOs.
 4. Describe Bio-fertilizers and process of Nitrogen Fixation
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UNIT-I INTRODUCTION TO BIOTECHNOLOGY (10L)

1. Introduction
2. History of Biotechnology
3. Traditional and Modern Biotechnology
4. Global Impact and Current excitements of Biotechnology - Health care, Environment, genomics and proteomics.
5. Biotechnology in India and Global Trends
6. Achievements of Biotechnology- Genetic Foods (GMO's), Prevention and Misused biotechnology, Biodiversity conservation, Intellectual Property Rights and Protection-forms of protection, Cryopreservation of plant stock cells and Gene bank

UNIT-II GENETIC ENGINEERING (12L)

1. Introduction
2. Brief history of G.E.
3. Molecular Tools of G.E.-Restriction Endonucleases, DNA ligase, Alkaline Phosphatase, DNA modifying enzymes.
4. Steps and tools in G.E: Gel permeation, PAGE, SDS-PAGE, 2-D gel electrophoresis, spectroscopy, colorimeter,
5. Genetic engineering and human welfare-Insulin, Genes for Vaccine, DNA probe, Monoclonal antibodies, Hybridoma

UNIT-III AGRICULTURAL BIOTECHNOLOGY (10L)

1. Introduction Bio Fertilizers-Algal, Bacterial, Azolla, Frankia, Mycorrhizal with reference to Structure, Characterization, Mass production and application
2. Biotechnology of Biological Nitrogen Fixation
3. Non symbiotic Nitrogen Fixation-Diazotrophs and their ecology, special features, Mechanism of N₂ Fixation
4. Symbiotic N₂ Fixation- establishment of symbiosis, factors affecting and mechanism of symbiotic N₂ Fixation

5. Genetics of Diazotrophs- Nod genes, Nif gene

UNIT-IV PLANT TISSUE CULTURE (8L)

1. Brief History
2. Plant protoplast culture
3. Somaclonal variation
4. Plant tissue culture in Forestry
5. Application of Tissue culture in GMO's, Plant pathology, Plant breeding, molecular farming
6. Nutritional quality (cyclodextrins, Vit-A, quality of seed protein, edible vaccines, edible antibodies, edible interferons)

Reference Books: -

1. A Text Book of Biotechnology-R. C. Dube (2008)-, S. Chand
2. Elements of Biotechnology -P.K. Gupta Satyanarayana
3. Plant tissue culture Biotechnology- Kalyan Kumar De-
4. Fundamentals of Molecular Biology -Pal J.K. and Ghaskadabi S.S.(2008)
5. Molecular Biology -Verma and Agrawal
6. Principle and Methods of plant Molecular Biology -Devi P.2008,
7. Biochemistry and Genetics Agrobios, Jodhpur, India.
8. Methods in Plant Molecular Biology and Biotechnology-Glick B.R. and Tompson J.E. 1993 CRC Press Boca Raton, Florida.
9. Plant cell culture -Hall R.D. (Ed.)1999 Protocol human press Inc., New Jersey, USA A Text Book of Biotechnology-Kumar H.D. 2002 2nd Edn. Affiliated Easyt-West Press Private Ltd New Delhi.
10. Introduction to Plant Biotechnology- H.S. Chavla
11. Plant Biotechnology: A Textbook- S.M. Paul Khurana, Narendra Kumar.

B. Sc. Third Year
Semester-V
BOTANY
SEC-III: Fruits and Fruit Processing

Lectures: 45 Maximum Marks: 50 Credits: 02 Course Code: U- ADC-540F

Course Objectives:

1. To develop skills and making the students become self-reliable and employable.
2. To give ideas of various fruit product and their processes.
3. To learn the fruit nutritional value of fruits.
4. To know various preservation techniques of fruits.

Course Outcome:

The Students will be able to:

1. Describe the nutrition value of fruits.
 2. Prepare different fruit products.
 3. Explain fruit harvesting and preservation techniques.
 4. Justify processes used during fruit transformation.
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UNIT I: A) BIOLOGY, BIOCHEMISTRY, NUTRITION, AND MICROBIOLOGY

1. Physiology and Classification of Fruits
2. Biochemistry of Fruits and Fruit Products
3. Flavor of Fruits and Fruit Products and their Sensory Qualities
4. Microbiology of Fresh and Processed Fruits
5. Nutritional Quality of Fruits

B) POST HARVEST HANDLING AND PRESERVATION TECHNOLOGIES

1. Postharvest Storage Systems: Biology, Physical Factors, Storage, and Transport
2. Freezing Preservation of Fruits
3. Conventional Thermal Processing and Preservation
4. Dehydration Preservation of Fruits
5. Developments in Minimal Processing of Fruits
6. Aseptic Processing and Packaging
7. Food Additives in Fruit Processing

UNIT II: A) PROCESSED FRUIT PRODUCTS AND PACKAGING

1. Manufacturing Fruit Beverages and Concentrates
2. Manufacturing Jams and Jellies
3. Fresh-Cut Fruits
4. Fruit and Fruit Products as Ingredients
5. Developments in Packaging of Fresh Fruits and Fruit Products

B) PROCESSING PLANT, SAFETY, AND REGULATIONS

1. Fruit Processing Plants and Equipments
2. Fruit Processing Waste Management
3. Microbial Safety and Sanitation of Fruits and Fruit Products
4. Fresh and Processed Fruits: Safety and Regulations

Practicals:

Practicals 1-2. Preparation of Wine from different fruits. (Grapes, Orange)

Practicals 3. Processing of Citrus Juices

Practicals 4. Preparation of Amla Candy

Practicals 5-7. Production, Processing and Quality of Guava, Mango and Papaya

Practicals 8. Preparation of Jam and Jellies from different fruits

Practicals-9. Visit to Fruit cultivated farm

B. Sc. Third Year
Semester-V
BOTANY
Laboratory Course-VII
(Based on CC- IX)

Practicals: 10 Maximum Marks: 50 Credits: 02 Course Code: U-BOT-585

Course Objective:

1. To determine the Osmotic Potential of plant cell.
2. To understand the separation technique of Photosynthetic pigments.
3. To study the effect of temperature and organic solvents on plasma membrane.
4. To learn the effect of different colors of light on photosynthesis.

Course outcomes:

The Students will be able to:

1. Explain the separation technique of Photosynthetic pigments.
2. Determine the Osmotic Potential of plant cell.
3. Correlate the effect of temperature and organic solvents on plasma membrane
4. Describe the effect of different colors of light on photosynthesis

Practical 1. Effect of temperature on plasma membrane (Beet root) in terms of pigment leaked out.

Practical 2. Effect of different organic solvents on plasma membrane (Beet root) in terms of pigment leaked out.

Practical 3. Effect of different concentrations of organic Solvent on plasma membrane (Beet root) in terms of pigment leaked out.

Practical 4. Separation of the Photosynthetic pigments by paper chromatography

Practical 5. Determine the Osmotic Potential of Vacuolar Sap by plasmolysis

Practical 6. Determine the water potential of potato tuber.

Practical 7. Demonstrations of Moll's half leaf experiments (Requirements, procedure, workings)

Practical 8. Demonstrations of Kuhne's fermentation tube (Requirements, procedure, workings)

Practical 9. Effect of intensity of light on photosynthesis.

Practical 10. Effect of different colors of light on photosynthesis.

Practical 11. Estimation of Chl-a and Chl-b from plant leaf extract.

Practical 12. Demonstrations of R.Q (Carbohydrate / fat/ proteins)

Practical 13. Demonstration of osmosis by potato osmoscope.

Practical 14-15. Botanical Excursions (one Short excursion and one Long excursion and Visits to laboratories / companies/factory etc.

B. Sc. Third Year
Semester-V
BOTANY
Laboratory Course- VI (DSE)
(Based on DSE- I)

Practical's: 10 Maximum Marks: 50 Credits: 02 Course Code: U BOT-586

Course outcomes:

The Students will be able to:

1. Identify plant disease on the basis of symptoms.
2. Perform experiment on Micrometry.
3. Isolate air spore.
4. Explain the symptoms, causal organisms and control measures of plant diseases.
5. Handle various instruments like hot air oven, laminar air flow, etc.

Practical 1. Study of laboratory equipment's- Autoclave, Hot air oven, inoculating chamber, Laminar air flow, Air sampler, Incubator, Centrifuge

Practical 2. Preparation of culture media- PDA, NA

Practical 3. Micrometry- Calibration of microscope and measurement of fungal spore.

Practical 4. Effect of pH on growth of pathogens

Practical 5-6. Study of symptoms and causal organisms of Leaf spot of tomato and Leaf spot of turmeric

Practical 7. Study of symptoms and causal organisms of Green ear and Ergot of bajra

Practical 8. Study of symptoms and causal organism of oil spot disease of pomegranate

Practical 9. Study of symptoms and causal organism of Whip smut of sugarcane

Practical 10. Study of symptoms and causal organism of Rust of soybean

Practical 11. study of symptomology of the Bunchy top of banana

Practical 12. study of symptoms and causal organism of Red rot of sugarcane.

Practical 13-14: study of symptoms and causal organisms of little leaf of Brinjal and Citrus canker

Practical 15-16: study of symptoms and causal organisms of Yellow vein mosaic of bhendi and Angular leaf spot of Cotton

Practical 17-18: Botanical excursions- several local and at least one long excursion one local excursion is equal to one to two practical's.

B. Sc. Third Year Semester-
V
BOTANY
Laboratory Course- VIII
(Based on DSE –I)
PLANT BIOTECHNOLOGY (DSE)

Periods:45 Maximum Marks:50 Credits:02 Course Code: U-BOT-586

Course Objectives

1. To learn sterilization techniques.
2. To study Micropropagation technique.
3. To know process of Somatic Hybridization.
4. To understand process of media preparation.

Course Outcomes:

The students will be able to:

- 1 Describe various sterilization techniques.
 - 2 Explain and perform the Micropropagation technique.
 - 3 Prepare of media preparation.
 - 4 Perform experiment on Somatic Hybridization.
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Practicals:

Practical 1. Preparation and sterilization of the medium, slant preparation and Inoculation-MS medium.

Practical 2-4. Micropropagation of Banana / Sugarcane/ Gerbera

Practical 5. Aseptic seed germination-legume seed

Practical 6. Study of different Bio fertilizers.

Practical 7. Isolation of protoplast.

Practical 8-9. Somatic Hybridization

Practical 10-12. PAGE, SDS-PAGE

N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion

B.Sc. Third Year
Semester-VI
BOTANY
Theory Paper-XI Biochemistry and Bioinformatics

Lectures: 45 Maximum Marks: 50 Credits: 02 Course Code: U BOT-683

Course Objectives:

1. To understand the biochemical constituents of the plant cell.
2. To characterize the biological impacts of different biomolecules on plants
3. To learn the methods of biochemical analysis.
4. To study the role enzymes.
5. To know the technique DNA and Protein sequencing.

Course outcomes:

The students will be able to:

- 1 Explain the biochemical constituents of the plant cell.
 - 2 Characterize the biomolecules.
 - 3 Describe the methods of biochemical analysis.
 - 4 Correlate the technique DNA and Protein sequencing.
 - 5 Evaluate the role enzymes.
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UNIT -I: BASIC BIOCHEMISTRY (10 L)

1. Introduction of different organic constituents of the cell
2. Introduction and Biological functions of:
 - i. Carbohydrates
 - ii. Lipids
 - iii. Proteins
 - iv. Nucleic acids
3. Importance of essential oils, resins, tannins, alkaloids, organic acids, gums and mucilage

UNIT -II: MINERAL NUTRITION (12 L)

1. Essential elements: Major elements (macro nutrients), trace elements (micro nutrients)
2. Physiological role of essential elements (functions and deficiency symptoms) phytosederophores
3. Mineral salt absorption: Introduction, mechanism of passive absorption (Ion exchange theory), active absorption (carrier concept theory).
4. Translocation of organic solutes: Introduction, direction of translocation, mechanism of translocation (Munch hypothesis, protoplasmic streaming theory)

UNIT - III: ENZYMOLOGY (12 L)

1. Introduction, nomenclature and classification (IUB)
2. Properties of enzymes
3. Mechanism of mode of enzyme action (lock and key model, induced fit model)

4. Factors affecting enzyme activity
5. Concept of holoenzyme, apoenzyme, co-enzymes and co-factors
6. Abzyme
7. Ribozyme

UNIT -IV BIOINFORMATICS (11L)

1. Introduction
2. History
3. Biological Databases
 - i. protein databases
 - ii. Nucleic acid databases
4. Bioinformatics applications

Reference Book:

1. Plant Physiology - Gill P.S. (2000) , S. Chand & Co. New Delhi
2. Text book of Plant Physiology - Verma V. (1995), Emkay Publication N. Delhi
3. Plant Physiology- Salisbury P.B. & W. Ross (1992) , New York Pub. Co. California
USA
4. Plant Physiology-Subhash Chandra Dutta (1992), Wiley Eastern, New Delhi
5. Plant Physiology-Shrivastava H.S.(2000), Rastogi Publication, Meerut
6. Elements of Biochemistry-Shrivastava H.S. (1993) - Rastogi Publication, Meerut
7. Biochemistry-Rastogi (2000) Tata McGraw Hill, New York
8. Biochemistry-Mathews C.F. (2003) - Addison Wesley, New Delhi
9. Laboratory Manual in Biochemistry-Jayaraman J. (1992), Wiley Eastern Ltd., New
Delhi
10. Bioinformatics Methods and Applications- R.S. Rastogi, Namita Mendiratta, P. Rastogi,
PHI pvt.LT

B.Sc. Third Year
Semester-VI
BOTANY
DSE-II: Plant Pathology –II

Lectures: 45

Maximum Marks: 50

Credits: 02 Course Code: U-BOT-684

Course Objectives:

1. To understand the aerobiology as a science and its applications
2. To study the defense mechanism and disease management.
3. To learn identification of selected pollen and fungal spores.
4. To understand strategies for identify and detect plant pests and pathogens.
5. To know principles of plant disease control.
6. To determine the seed borne pathogens and the techniques of their detection.

Course outcomes:

The Students will be able to:

1. Describe the aerobiology as a science and its applications.
 2. Identify and detect plant pests and pathogens.
 3. Identify of selected fungal spores.
 4. Know the defense mechanism and disease management.
 5. Determine the seed borne pathogens and the techniques of their detection
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UNIT-I: AEROBIOLOGY AND SEED PATHOLOGY (10 L)

1. Aerobiology- Definition, scope and importance
2. Disease forecasting
3. Seed Pathology-Definition
 - i Seed borne pathogens (external and internal)
 - ii. Detection of seed borne pathogens by blotter paper and agar plate methods
 - iii. Seed treatment (hot water, solar, chemical)
 - iv. Seed certification

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

Symptoms, causal organisms, disease cycle and control measures of

1. Tikka disease of groundnut
2. White rust of Mustard
3. Loose smut of Wheat
4. Rust of Jowar
5. Grain smut of Jowar
6. Leaf curl of tomato

UNIT-IV: PLANT DISEASES-II (13L)

Symptoms, causal organisms, disease cycle and control measures of

1. Downy mildew of Grape
2. Stem rust of Wheat
3. Wilt of Tur
4. Late blight of Potato
5. Powdery mildew of pea
6. Papaya mosaic
7. Root Knot of vegetables

UNIT-IV: DEFENCE MECHANISM AND PLANT DISEASE MANAGEMENT (10 L)

1. Structural defense (pre-existing and post infectious)
2. Biochemical defense- preexisting and post infectious (phytoalexins)
3. Exclusion and eradication,
4. Chemical Control-General account of Sulphur, Copper, systemic fungicides and antibiotics,
5. Integrated pest management
6. Biological control

Reference Book:

1. Fundamentals of plant pathology-Pathak, Khatri, Pathak, 2003, Agrbios
2. Plant Pathology-Mehrotra, R.S. 1991, Tata Mc Graw Hill Co.Delhi
3. Plant Protection Techniques-Chatterjee, P.B., 1997 , BharatiBhawan, Publ. Patana
4. Plant Pathology-Agrios, G.N. 2006-, Elsevier Academic Press.
5. Plant Pathology-Pandey, B.P.2009, S.Chand Co.
6. Molecular Plant Pathology-Dickinson, M.2008,-,Bios Scientific Publishers, London
7. Plant pathology-Trigiano, Windham and Windham, 2003, , Concepts and laboratory exercises. CRC Press London
8. Text book of plant diseases-Gupta,G.P.,2004,Discovery Publ.House ,New, Delhi
9. Experiments in Microbiology,plant pathology, tissue culture and Mushroom production technology-Aneja, K.R. 2001, New Age International Publishers.
10. Practical Microbiology-Dubey, R.C.,Maheshwari, D.K. 2005, ,S.Chand& CO.
11. Plant Diseases-Singh, R.S.2004, Oxford & IBH Publishing Co. Pvt. Ltd., Delhi.
12. Diseases of Crop plants of India-Rangaswami,G.,Mahadevan,A.,2002, ,Prantice Hall of India.

B. Sc. Third Year
Semester-VI
BOTANY
DSE-II: CYTOGENETICS

Lectures: 45 Maximum Marks: 50 Credits: 02 Course code: U-BOT-684

Course Objectives:

1. To learn the cell structure, function and different aspects of cytogenetical studies.
2. To study importance of cell division.
3. To understand the Karyotypes and genetic disorder
4. To provide training Structural and Numerical alterations of chromosomes.
5. To know the concept of Linkage and crossing over.

Course Outcome:

The Students will be able to:

1. Explain the cell structure, function and different aspects of cytogenetical studies.
2. Know importance of cell division.
3. Describe the Karyotypes and genetic disorder
4. Discuss the different Structural and Numerical alterations of chromosomes.
5. Correlate the of Linkage and crossing over

UNIT-I: MENDELIAN GENETICS (12L)

1. Cell division: Mitosis and Meiosis.
2. Concept of Gene: Allele, Multiple allele, Pseudoallele, Complementation test
3. Mendelian Principles: Dominance, Segregation and Independent assortment
4. Extensions of Mendelian Principles: Codominance, Incomplete dominance, Gene interaction, Pleiotropy, Genomic imprinting, Penetrance, Expressivity and Phenocopy

UNIT-II: MICROBIAL GENETICS (12L)

1. Microbial genetics: Mapping of bacterial genome by interrupted mating
2. Mutation: Types, causes and detection, Mutant types-lethal, Conditional, Biochemical, Gain of function, Loss of function, Germinal vs somatic mutant, Insertional mutagen
3. Linkage and mapping in eukaryotes: Linkage and crossing over, Sex linkage, Sex limited and sex influenced characters. Recombination: homologous and non-homologous including transposition

UNIT-III: NUMERICAL GENETICS (11L)

1. Extra chromosomal inheritance: Inheritance of mitochondria and chloroplast genes, Maternal inheritance and its effect
- 2 Quantitative genetics- Introduction to complex traits, Polygenic inheritance. Heritability & its measurement, QTL Mapping

3. Structural alterations of chromosomes: Deletion, Duplication, Inversion, Translocation, Complex translocation heterozygotes, Robertsonian translocations, BA translocations and their genetic implications
4. Numerical alterations of chromosomes: Euploidy and aneuploidy and their genetic implications

UNIT-IV: GENE MAPPING (10L)

1. Linkage maps, Lod score for linkage testing, Mapping by 3-point test cross, Mapping by tetrad analysis in Yeast and Neurospora, mapping with molecular markers, Mapping by using somatic cell hybrids, Development of mapping population in plants
2. Karyotypes and genetic disorders

Reference Book:

1. The science of genetics-Atherly, A.G., Girton, J.R. and McDonald, J. F. (1999)
2. The science of genetics-Sauders College Pub. Fort Worth USA.
3. Discussions in cytogenetics-Burnham, C.R. (1962) Burgess Pub. Co., Minnesota.
4. Genetics: Principle and analysis-Hartl, D.L., Jones E.W. (2001) (4th edn) Jones and Barlett Pub., USA.
5. Cytogenetics of Aneuploids-Khush, G S (1973) Academic press New York, London.
6. Genes VIII-Lewin, B. Oxford, University press. New York, USA.
7. Genetics-Russel, P.J. 1998. (5th edn). The Benjamin/ Cummins Pub. Co., Inc. USA.
8. Principles of genetics-Snustad, D.P. and Simmons, M.J. 2000. (4th edn). John Wiley and Sons, Inc., USA.
9. Microbial Genetics-Freifelder, D. (1987)
10. Genetics-Strickberger, M.W: (4th edn). Mcmillan Publishing company, New York.
11. Modern genetic analysis-Griffiths, A.J.F. and Gilbert, W.M (2nd edn).. W.H. Freeman and Company, New york.
12. Plant breeding: principles and methods-Singh, B.D. (2005). 7th edn.
13. Principles of plant breeding-Allard, R.W. (1960).John Wiley and sons, Inc., New York.
14. Plant breeding: Theory and practice-Chopra, V.L. (2000) 2nd edn. Oxford & IBH Pub. Co., Ltd. New Delhi.
15. Plant breeding: Mendelian to molecular Approaches- Jain, H.K. and Kharwal, M.C. (2003). Navrosa Publishing House Pvt. Ltd., New Delhi.
16. Advances in Plant breeding-Mandal, A.K. Ganguli, P.K., Banerjee, S.P. (1991).Vol 1 and 2, CBS Pub.& distributors.

B. Sc. Third Year
Semester-VI
BOTANY
SEC -IV: Basics in Horticulture

Lectures: 45 Maximum Marks: 50 Credits: 02 Course Code: U-ADC-640H

Course Objectives:

1. To know Nutritional value of horticultural crops.
2. To learn the Vegetative propagation technique with its merits and demerits
3. To study Playhouse and greenhouse and their maintenance.
4. To give information of important seed treatments

Course Outcome:

The Students will be able to:

1. Describe the Vegetative propagation technique with its merits and demerits
2. Determine the Nutritional value of horticultural crops
3. Correlate Playhouse and greenhouse and their maintenance.
4. Explain the important of seed treatments.

UNIT-I: HORTICULTURE-I

1. Definition – Horticulture – scope and importance of horticultural crops
2. Nutritive value of horticultural crops
3. Division and classification of horticultural crops

UNIT-II: HORTICULTURE-II

1. Definition – propagation, merits and demerits and propagation methods
2. Seed propagation – merits and demerits
3. Importance of seed treatments, sowing and seedling establishment

UNIT-III: PROPAGATION

1. Vegetative propagation – merits and demerits
2. Propagation through cuttings – merits and demerits
3. Propagation through layering – merits and demerits
4. Propagation through grafting – merits and demerits
5. Propagation through budding – merits and demerits

UNIT- IV: CULTIVATION AND MAINTENANCE

1. Protected cultivation – Principles and special structure used for propagation
2. Mist chamber and their maintenance
3. Poly house and their maintenance
4. Shade net house and their maintenance
5. Green house and their maintenance

Practical

- Practical 1. Study of Horticultural tools and implements used for various operations
- Practical 2. Preparation of pot mixture, potting and repotting
- Practical 3-6. Practicing propagation methods- Cutting, layering Budding and grafting
- Practical 7. Pruning practices in horticultural crops
- Practical 8. Preparation and use of growth regulators
- Practical 9. Disease management in horticultural crops

Reference Book:

1. Vegetable Breeding: Principle and Practices Hari Har Ram, 2013. Kalyani Publishers. Ludhiana.
2. Vegetable Science & Technology in India - Vishnu Swaroop, 2014. Kalyani Publishers. Ludhiana
3. Vegetable Breeding-Kallo.G, 1998. (Vol.I to IV). CRC Press. Florida. 1988.
4. Vegetable Varieties of India-H.P. Singh, 2009. Studium Press (India) Pvt Ltd. New Delhi.
5. Techniques of Developing Hybrids in Vegetable Crops-M.S. Dhaliwal. 2012. Agrobios. Jodhpur.
6. Vegetable Seed Production & Hybrid Technology-M.S.Dhaliwal, 2009. Kalyani Publishers Ludhiana.
7. Vegetable Crops- Breeding and Seed Production-Fageria, M.S., 2011. Kalyani Publishers, Ludhiana.
8. Text book of vegetable, tuber crops and Spices-S. Thamburaj 2014. ICAR, New Delhi.
9. A Text book on production technology of vegetables-B.R.Choudhary 2009. Kalyani Publishers Ludhiana.
10. Vegetable Crops-T. K. Bose. 2002. Nayaprakash Kolkata.
11. Modern Technology in Vegetable Production-P.Hazra. 2011.. New India Publishing Agency, New Delhi.
12. Vegetable Crops-T.R.Gopal Krishnan, 2007. New India Publishing Agency. New Delhi.
13. Handbook of Vegetable Crops-M.S.Dhaliwal, 2008. Kalyani Publishers. Ludhiana
14. Indian Vegetables-Singh, Umashankar, 2008. Anmol Publications. Pvt.Ltd .New Delhi.
15. Olericulture in India-M.K.Rana, 2008. Kalyani Publishers. Ludhiana
16. Vegetable science-P.Hazra. 2006. Kalyani Publishers .Ludhiana
17. Vegetables : Disease Diagnosis and Biomangement- Pratibha Sharma, 2007. Avishkar 20.Publishers. Jaipur
21. Vegetables for the Tropical Regions-Nath Prem. 1994. ICAR New Delhi
22. Vegetable Crops Bose, T.K. 2003. Nayaudyog publishers, Kolkata. 2002. Naya Prakash, Calcutta

B. Sc. Third Year
Semester-VI
BOTANY
Laboratory Course-IX
(Based on CC- X)

Lectures: 45 Maximum Marks: 50 Credits: 02 Course code: U-BOT-685

Course Objectives:

1. To familiarize the students with techniques of biochemistry.
2. To estimate the chlorophyll-a and b from leaf extracts
3. To study the estimation methods of biomolecules.
4. To learn micro chemical tests of organic acids, Protein and secondary metabolites.

Course outcomes:

After completion of course Students will be able to:

1. Find out the various biomolecules.
2. Estimate the chlorophyll-a and b from leaf extracts.
3. Determine the micro chemical tests of organic acids, Protein and secondary metabolites
4. Explain different methods of biomolecules.

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1. Estimation of Starch using colorimeter/ Spectrophotometer from given material
 2. Estimation of Glucose using colorimeter/ Spectrophotometer from given material
 3. Estimation of Protein using colorimeter/ Spectrophotometer from given material
 4. Estimate the percentage of oil content in given oilseeds using Soxhlet extractor
 5. Identify the amino acids in a mixture and find out the RF value
 6. Study of catalase activity under different pH
 7. Study of catalase activity under different temperature
 8. Micro chemical Carbohydrate (Molisch /Fehlings /Benedict's) Glucose, sucrose, starch, Cellulose, Pectin
 9. Micro chemical tests for cutin, Latex, Lignin, Tannin Lipid, fats & oils.
 10. Micro chemical Test of organic acids – Tartaric acid, Citric acid, Oxalic and Malic acid
 11. Micro chemical Test for proteins (Biuret/ Xanthoproteic/ Millon tests)
 12. Study of acid phosphatase activity from fruits
 13. Estimation of chloro-a and b from leaf extracts
 - 14-15. Botanical Excursions (one Short excursion and one Long excursion and Visits to laboratories / companies/factory etc.

B. Sc. Third Year
Semester-V
BOTANY
Laboratory Course-VI
(Based on DSE- II) Cytogenetics (DSE)

Practicals: 45 Maximum Marks:50 Credits:02 Course code: U-BOT-686

Course Objectives:

1. To determine the different types of blood group
2. To know the concept of linkage and gene mapping
3. To study the chromosomal aberrations in plant
4. To study the polyploidy induced by colchicine

Course outcomes:

After completion of course Students will be able to:

1. Describe the different types of blood group
 2. Correlate the linkage and gene mapping
 3. Determine the chromosomal aberration in plant
 4. Perform experiment on polyploidy
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Practical 1. Preparation of stains, Fixatives, preservatives and pretreatments to plant material

Practical 2. Problems on determination of blood grouping

Practical 3. Problems based on Multiple alleles

Practical 4. Problems based on Gene mapping

Practical 5. Problems based on linkage

Practical 6. Study of meiotic configuration from suitable plant material

Practical 7. Study of chromosomal aberrations in irradiated plant material

Practical 8. Study of Polygenic inheritance

Practical 9. Problems of Mendelian inheritance and estimation of gene frequencies and heterozygotic frequencies, population genetics and Linkage

Practical 10. Neurospora tetrad analysis

Practical 11. Linear differentiation of chromosomes through banding techniques such as C-Banding, G-Banding and Q-Banding

Practical 12. Floral Biology, study of Pollen Viability, germination in vitro and staining of any two major crops

Practical 13-15. Use of Colchicine for induction of polyploidy in appropriate plant material

N.B: 1) Any ten Practicals

2) Several Short Excursions and at least one Long Excursion

B.Sc. Third Year
Semester-V
BOTANY
Laboratory Course-VI
(Based on DSE -II) Pathology-II (DSE)

Practicals: 45 Maximum Marks: 50 Credits: 02 Course code: U-BOT-686

Course Objectives:

1. To isolation and identify the seed borne pathogens by various methods
2. To identify disease on the basis of symptoms
3. To determine air borne pathogens
4. To acquire knowledge about plant pathogens, disease and their management

Course outcomes:

The Students will be able to:

1. Explain the various diseases on the basis of symptoms
 2. Determine the different types of air borne pathogens
 3. Describe life cycle of causal organism and disease management
 4. Identify the seed borne pathogens by various methods
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Practical 1. Isolation of fungal pathogens from diseased plant parts

Practical 2. Isolation and identification of seed borne pathogens by blotter/ agar plate method

Practical 3-4. Study of air borne pathogens by exposed Petri plates/ air sampler

Practical 5-6. Study Effect of fungicide on spore germination by hanging drop technique

Practical 7-8. Study of symptoms and causal organism of Stem rust of Wheat

Practical 9-10. Study of symptoms and causal organism of Late blight of Potato and Downey mildew of Grapes

Practical 11. Study of symptoms and causal organism of Tikka disease of Groundnut

Practical 12-13. Study of symptoms and causal organism of Rust of Jowar and Grain smut of Wheat

Practical 14. Study of symptoms and causal organism of Loose smut of Wheat

Practical 15. Study of symptomology and causal organism of White rust of Mustard

Practical 16. Study of symptoms and causal organism of Wilt of Tur

Practical 17. Study of symptoms and causal organism of Powdery mildew of Pea

Practical 18-19. Study of symptoms and causal organisms of Papaya mosaic and Root knot of Vegetables.

Practical 20. Study of plant protectants

Practical 21. To determine air borne pathogens from crop field

Practical 22. Botanical excursions-Several local and at least one long excursion. (Each local excursion is equal to 1-2 practicals and long excursion is equal to 3-4 practicals.

N.B: 1) Any ten Practical from above mentioned list.



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya (Autonomous), Latur

B.Sc. III
Semester End Examination
Skeleton of Question Paper

Botany Theory Paper-IX, X, XI and XII

Time: 1.30 hours

Maximum Marks: 30

Note: i) Attempt all questions.
ii) Draw neat and well labeled diagrams wherever necessary.

- Q1. Attempt any four of the following (Each 3 marks) 12
(At least 1 question on each unit)
- a)
 - b)
 - c)
 - d)
 - e)
- Q2. Attempt any Two of the following 08
(Each question on unit 1, 2 & 3)
- a)
 - b)
 - c)
- Q3. Attempt any ONE of the following 10
(Questions on remaining units)
- a)
 - b)



Shiv Chhatrapati Shikshan Sanstha's
Rajarshi Shahu Mahavidyalaya (Autonomous), Latur
B.Sc. III
Practical Examination in Botany
SEE WINTER/SUMMER

Time: Three Hours	Maximum	Marks:	30
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Note: - i) Attempt all questions.
ii) Draw neat and well labeled diagrams wherever necessary.

Q. 1. Long answer type question.	15
Q. 2. Short answer type question.	10
Q. 3. Viva- Voce.	05

S. N. Shinde
Chairman
Board of Studies in Botany