

“Dissemination of Education for Knowledge, Science and Culture”

-Shikshanmaharshi Dr. Bapuji Salunkhe



Shri Swami Vivekanand Shikshan Sanstha's
VIVEKANAND COLLEGE, KOLHAPUR
(AN EMPOWERED AUTONOMOUS INSTITUTE)

DEPARTMENT OF BOTANY

Three/Four- Years UG Programme
Department/Subject Specific Core or Major (DSC)

NEP- 2.0

**Curriculum, Teaching and
Evaluation Structure**
(As per NEP-2020 Guidelines)
for
B.Sc.-III- Botany

Semester-V&VI
(Implemented from academic year **2026-27** onwards)



Department of Botany

Departmental Teaching and Evaluation scheme Third Year Semester-V & VI

Sr. No.	Course Abbr.	Course code	Course Name	Teaching Scheme Hours/week		Examination Scheme and Marks				Course Credits
				TH	PR	ESE	CIE	PR	Marks	
Semester-V										
1	DSC-IX	2DSC03BOT51	Mycology and Plant Pathology	2	-	40	10	-	50	2
2	DSC-X	2DSC03BOT52	Plant Ecology	2	-	40	10	-	50	2
3	DSC-XI	2DSC03BOT53	Plant Anatomy	2	-	40	10	-	50	2
4	DSE-I	2DSE03BOT51	Plant Physiology and Metabolism	2	-	40	10	-	50	2
		2DSE03BOT52	Agri Based Microenterprises							
5	FP	2FPR03BOT51	Field Project	2		-	-	50	50	2
6	DSC-PR-V	2DSC03BOT59	DSC Botany Lab-5	-	16	-	-	100	100	8
Semester –V Total				10	16	160	40	150	350	18
Semester-VI										
1	DSC-XII	2DSC03BOT61	Plant Taxonomy	2	-	40	10	-	50	2
2	DSC-XIII	2DSC03BOT62	Cytology and Genetics	2	-	40	10	-	50	2
3	DSC-XIV	2DSC03BOT63	Molecular Biology and Biotechnology	2	-	40	10	-	50	2
4	DSE-II	2DSE03BOT61	Research Technique in Botany	2	-	40	10	-	50	2
		2DSE03BOT62	Herbal Technology							
5	VSC-PR-V	2VSC03BOT69	Plant Nursery	-	4	-	-	25	25	2
6	OJT	2OJT03BOT61	On Job Training	2	-	-	-	50	50	2
7	DSC-PR-VI	2DSC03BOT69	DSC Botany Lab-6	-	16	-	-	100	100	8
Semester –VI Total				10	20	160	40	175	375	20

Note: Minimum passing for 10 marks Internal evaluation = 04 marks
 Minimum passing for 40 marks Theory paper = 16 marks
 Minimum passing for 25 marks Practical = 10 marks
 Minimum passing for 50 marks Practical/FP/OJT = 20 marks
 Minimum passing for 100 marks Practical/FP = 40 marks

Semester-V



Department of Botany

B.Sc. III (Botany), Semester: V

DSC-IX: 2DSC03BOT51: Mycology and Plant Pathology

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain the concept of mycology and plant pathology.

CO2: Understand the classification of fungi and plant diseases.

CO3: Analyze the life cycles, symptoms and management of major fungal diseases.

CO4: Understand virus, viroid, mycoplasma and lichen.

Unit	Syllabus	Lectures
Unit 1	Introduction to Mycology Introduction, Definition, History, Branches and Importance. Classification of Fungi – Ainsworth (1973) Origin and phylogeny of Fungi Fungal body and cells, Fungal physiology, Nutrition and growth, Fungal ecology, Thallus organization, Cell wall composition.	07
Unit 2	Classification of Fungi Study of division Myxomycotina, Eumycotina with reference to general characters up to classes with suitable examples. Study of virus, viroid, mycoplasma and lichen (with reference to introduction, types, economic importance.)	07
Unit 3	Plant Pathology Introduction, need and importance, Classification of plant diseases based on pathogens, crops and symptoms, Study of mechanism of infection in disease development (Biochemical changes), prevention and control of plant diseases. Role of quarantine, significance of plant pathology. Different Instruments used in plant pathology.	08
Unit 4	Study of Diseases A) Study of Fungal Diseases 1. Phycomycetes : White rust of Crucifers 2. Ascomycetes : Powder mildew 3. Basidiomycetes : Corn Smut 4. Deuteromycetes : Leaf spot (Tikka) disease of Groundnut B) Study of Bacterial Disease : Citrus canker C) Study of Viral Disease : Yellow vein mosaic of Bhendi	08

Reference Books:

1. Vashista B. R. and Sinha A. K. (2007), Botany for degree students - Fungi, S. Chand and Company Ltd. Ram Nagar, New Delhi.
2. Rangaswami G. and Mahadevan A. (1999), Diseases of crop plants in India., Prentice Hall, 4th ed., Limited, Delhi.
3. Agrios G. N. (1997), Plant Pathology, Academic Press, London.
4. Sharma P. D. (2010), Plant Pathology, Rastogi Publication, Meerut, India.



Department of Botany

B.Sc. III (Botany), Semester: V

DSC-X: 2DSC03BOT52: Plant Ecology

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

CO1: Understand the basic principles of ecology and ecological factors.

CO2: Classify ecosystem and ecological succession.

CO3: Analyse community interactions.

CO4: Understand the concept of Phosphorus and Nitrogen cycle.

Unit	Contents	Lectures
1	Introduction to Ecology Introduction and definition of Ecology. Ecological Factors: 1. Edaphic Factors – Soil origin and formation, Composition of soil water, soil air, soil temperature, soil organic matter and soil microbes. 2. Climatic factors – Light, Temperature, Precipitation, Atmospheric humidity and Rainfall. Ecological Adaptations – Hydrophytes, Xerophytes, Epiphytes and Parasites. Soil Pollution – Preventive and Curative methods.	08
2	Ecological Succession and Interaction Introduction, Process of succession, Types of succession- Hydrosere, Xerosere. Introduction of ecological interaction. Intra-specific interaction – Co- operation, Communication, Competition. Inter-specific interaction – Symbiosis, Commensalism, Parasitism and Predation.	07
3	Ecosystem Introduction and structure, Composition – Biotic and Abiotic components Energy flow trophic organization, Food chains and food webs Ecological pyramids, production and productivity Types of ecosystems – Aquatic and Terrestrial (One examples of each type)	08
4	Biogeochemical cycles and Phytogeography Biogeochemical cycles – Introduction, Phosphorus, Nitrogen and Carbon cycles Phytogeography – Introduction, Phytogeographical regions of India (As per Chatterjii and Mani)	07

Reference Books:

1. Ambasht R. S. (1988), A Textbook of Plant Ecology, Students Friends Co, Varanasi.
2. Weaver J. E. and Clements M. J. (1966), Plant Ecology , Tata McGraw Publishing Co. Ltd, Bombay.
3. Chapman J. L. and Reiss M. J. (1955), Ecology : Principles and Applications, Cambridge University, Press
4. Dash M. C. (1993), Fundamentals of Ecology, Tata McGraw Publishing Co. Ltd, New Delhi.



Department of Botany

B.Sc. III (Botany), Semester: V

DSC- XI:2DSC03BOT53: Plant Anatomy

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain basic concepts of plant anatomy and tissue systems.

CO2: Classify plant tissue and describe structure and function.

CO3: Analyze internal structure of root, stem and leaf.

CO4: Evaluate anatomical adaptations in plants under different environments.

Unit	Contents	Lectures
Unit 1	Organization of Higher plant body Introduction to plant organs Development of plant body up to seedling development Internal organization of plant body	04
Unit 2	Tissue and Tissue system Definition, Importance Meristem : Introduction, Characteristics and classification of meristems based on position Theories of structural development i) Apical cell theory ii) Histogen theory iii) Tunica corpus theory Permanent tissue – Simple tissue – Parenchyma, Collenchyma and Sclerenchyma Complex tissue – Xylem and Phloem Types of vascular bundles	10
Unit 3	Primary and secondary structures of plant body Primary structure of monocotyledon and dicotyledon root, stem and leaf Normal secondary growth in dicotyledon root and stem Anomalous secondary growth in <i>Bignonia</i> (Dicot) and <i>Dracaena</i> (Monocot) stem Periderm and Lenticel, Epidermal tissue system, Secretary tissue system, Mechanical tissue system	09
Unit 4	Plant Adaptations Hydrophytes, Xerophytes and Mesophytes Carnivorous plant Epiphytic and Parasitic plant Mangrove Biology	07

Reference Books:

1. Vashista P. C. (1984), Plant Anatomy, Pradip Publications, Jalandhar.
2. Pandey B. P. (2001), Plant Anatomy, S. Chand and Company Ltd., New Delhi.
3. Culter E. G. (1969), part – I – Cell and Tissues, Edward Arnold, London.
4. Esau K. (1977), Anatomy of Seed Plants, 2nd Edition, John Wiley and Sons, New York.



Department of Botany

B.Sc. III (Botany), Semester: V

DSE-I: 2DSE03BOT51: Plant Physiology and Metabolism

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

CO1: Know the plant water relationship.

CO2: Explain physiological processes like photosynthesis and respiration.

CO3: Analyse the role of minerals in plant growth.

CO4: Understand the properties and classification of carbohydrates and protein.

Unit	Contents	Lectures
Unit 1	Plant water relationship Introduction, Physiological importance of water, Permeability, Diffusion and Osmosis, Absorption of water (Active and Passive), Factors affecting absorption of water. The Ascent of sap (Mechanism and different Theory) Transpiration – Introduction, types and mechanism Guttation and Wilting – Introduction and mechanism	07
Unit 2	Mineral Nutrition Role of mineral elements in plants, Macro and micro elements, Specific role and deficiency symptoms of elements, Sites for absorption of mineral ions. Plant Metabolism: Carbohydrate, Fat (Lipid) and Protein metabolism with reference to properties, classification and importance	07
Unit 3	Photosynthesis Introduction, site of photosynthesis, Photosynthetic pigments, Mechanism of photosynthesis, Light reaction, Dark reaction (C ₃ , C ₄ and CAM pathway of carbon fixation), Significance.	08
Unit 4	Respiration Introduction, site of respiration, types of respiration, fermentation, mechanism of respiration- Glycolysis, link reaction, Krebs cycle, ETS in mitochondria, Significance and Respiratory ratio.	08

Reference Books:

1. Verma V. (2007), A text book of Plant Physiology, Ane Books India, New Delhi.
2. Malik and Shrivastava (1982), Plant Physiology, S. Chand and Company Ltd., New Delhi.
3. Sundararajan S. (2003), Physiology of transport in plants, Anmol Publications, Pvt. Ltd., New Delhi.
4. Jain V. K. (2018), Fundamentals of Plant Physiology, S. Chand and Company Ltd., New Delhi.



Department of Botany

B.Sc. III (Botany), Semester: V

DSE-I: 2DSE03BOT52: Agri Based Micrpenterprises

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain the principles of sustainable agriculture and organic farming.

CO2: Describe and apply the knowledge of biopesticides.

CO3: Analyze the environment in which the agribusiness is conducted.

CO4: Evaluate recent trends and advances in agriculture.

Unit	Contents	Lectures
Unit 1	Organic Farming and composting technique 1a. Introduction and definition. 1b. Advantages of organic manures and fertilizers. 1c. Composition of fertilizers – NPK content of various fertilizers. 1d. Common organic manure- cow dung, oil cake, poultry waste, organic compost and bone meal. 1e. Study of preparation and advantages of both aerobic and anaerobic compost. 1f. Study of preparation of vermicompost and vermiwash. 1g. Study of Biofertilizers with suitable examples and its importance.	10
Unit 2	Biopesticides 2a. Introduction and definition. 2b. Importance of green pesticide. 2c. Study of green pesticide with suitable examples. 2d. Study of different green pesticide formulation.	06
Unit 3	Agri business and Agrieconomics 3a. Definition and scope of agribusiness. 3b. Study of various business models in agri business. 3c. Agri economics meaning, definition and scope. 3d. Basic concepts – goods, services and utility.	07
Unit 4	Advances in agriculture 4a. Remote sensing, GIS and GPS in agriculture. 4b. Study of agro meteorological instruments. 4c. Scope of agribusiness. 4d. Study of agrotourism	07

Reference Books:

1. Bose T. K., Mukherjee D. (1972), Gardening in India, Oxford and IBH Publishing Co. New Delhi.
2. Gupta M. K. (2008), Handbook of organic farming and bio fertilizers, ABD Publishers, Jaipur.
3. Hartmann H. T., Kester D. E. (1975), Plant propagation principles and practices, India Prentice Hall.
4. Roy R. K. (2013), Fundamentals of Garden Designing, A color encyclopedia India, New India Publishing Agency.



Department of Botany

B.Sc. III (Botany), Semester: V

DSC-PR-V: 2DSC03BOT59: DSC-Botany Lab-5

Credits: 06

Practical: 180hrs.

Marks: 100

(Practical: Four lectures of 60 minutes thrice in a week per batch)

Practical - I Study of Mycology and Plant Pathology

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain the principles, composition and preparation of culture media.

CO2: Understand the technique of isolation of microorganisms from soil.

CO3: Analyse major fungal, bacterial, viral and mycoplasmal diseases.

CO4: Understand virus, viroid, mycoplasma and lichen.

Practicals:

1 to 4) Study of symptoms, causal organism, disease cycle and control measure.

A) Study of Fungal Diseases

1. Phycomycetes: White rust of Crucifers

2. Ascomycetes: Powdery Mildew

3. Basidiomycetes: Corn Smut

4. Deuteromycetes: Leaf spot (Tikka) disease of Groundnut

B) Study of Bacterial Disease: Citrus canker

C) Study of Viral Disease: Yellow vein mosaic of Bhendi

D) Study of Mycoplasmal disease :Little leaf of Brinjal (Egg plant), Grassy shoot disease of Sugarcane(GSD).

5) Study of types of Lichen – Crustose, Foliose, Fruticose.

6) Preparation of culture media: PDA, NA.

7) Isolation of microorganism from soil sample.

8) Study of different instruments used in mycology: Autoclave, Inoculation loop, Laminar air flow, Incubator, Oven, Digital Balance, pH meter.

Reference books:

1. Vashista B. R.andSinha A. K.(2007), Botany for degree students - Fungi, S. Chand and Company Ltd. Ram Nagar, New Delhi.

2. Rangaswami G. and Mahadevan A. (1999), Diseases of crop plants in India., Prentice Hall, 4thed.,Limited , Delhi.

3. Agrios G. N. (1997), Plant Pathology, Academic Press, London.

4. Sharma P. D. (2010), Plant Pathology , Rastogi Publication, Merrut, India.



Practical - II Study of Plant Ecology

Course Outcomes: After the completion of the course the student will be able to:

- CO1: Explain the major phytogeographical regions of India.
- CO2: Demonstrate techniques for analysis of soil and water.
- CO3: Analyze the different types of succession.
- CO4: Evaluate biotic interactions (Intraspecific and Interspecific interaction)

Practicals:

- 1) Study of phytogeographical regions of India (As per Chatterji and Mani)
- 2) Study of succession (Hydrosere and Xersere) with suitable examples.
- 3) Study of pH and EC of different soil samples.
- 4) Study of morphological and anatomical characters of hydrophytes and xerophytes.
- 5) Study of intraspecific and interspecific interaction with suitable example.
Intraspecific interaction: Co-operation, Commnication, Competition
Interspecific interaction: Symbiosis, Commensalim, Parasitism and Predation
- 6) Study of ecological instruments- Hygrometer, Anemometer, Rain gauze, Lux meter.
- 7) Study of water holding capacity, moisture content, pH and EC of different soil samples.
- 8) Study of BOD, COD and Turbidity of polluted and non polluted water samples.
- 9) Ecological Study Tour.

Reference Books:

1. Ambasht R. S. (1988), A Textbook of Plant Ecology, Students Friends Co, Varanasi.
2. Weaver J. E. and Clements M. J. (1966), Plant Ecology , Tata McGraw Publishing Co. Ltd, Bombay.
3. Chapman J. L. and Reiss M. J. (1955), Ecology : Principles and Applications, Cambridge University, Press
4. Dash M. C. (1993), Fundamentals of Ecology, Tata McGraw Publishing Co. Ltd, New Delhi.



Practical - III Plant Anatomy

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain the structure, characteristics and functions of different types of tissues.

CO2: Classify and identify different types of vascular bundles in plants.

CO3: Analyze the primary and secondary structure of root, stem and leaf.

CO4: Evaluate anatomical adaptations in plants under different environments.

Practicals:

- 1) Study of root and shoot apex by permanent slide.
- 2) Study of simple and complex tissue.
- 3) Study of different types of vascular bundles.
- 4 to 5) Study of primary structure of dicot and monocot root, stem and leaf.
- 6) Study of normal secondary growth in dicot stem (*Annona*, *Moringa*/ Sunflower) by temporary double stained techniques.
- 7) Study of anomalous/ abnormal secondary growth in *Bignonia* (Dicot stem) and *Dracaena* (Monocot stem)
- 8) Study of Periderm and lenticels, epidermal tissue system (Sunken stomata, multiple epidermis, Stellate hairs), secretory tissue system (Glandular hairs), mechanical tissue system (I – girdle)

Reference Books:

1. Vashista P. C. (1984), Plant Anatomy, Pradip Publications, Jalandhar.
2. Pandey B. P. (2001), Plant Anatomy, S. Chand and Company Ltd., New Delhi.
3. Culter E. G. (1969), Part – I – Cell and Tissues, Edward Arnold, London.
4. Esau K. (1977), Anatomy of Seed Plants, 2nd Edition, John Wiley and Sons, New York.



Practical - IV Plant Physiology and Metabolism

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain the mechanism of stomatal and cuticular transpiration.

CO2: Explain physiological processes like photosynthesis and respiration.

CO3: Analyse the role of minerals in plant growth.

CO4: Understand the properties and classification of carbohydrates and protein.

Practicals:

- 1) Study of stomatal and cuticular transpiration by cobalt chloride paper method.
- 2) Study of role and deficiency symptoms of N, P, K, Ca, Mg, S.
- 3) Study of photosynthetic pigments by paper chromatography.
- 4) Estimation of chlorophyll in healthy and stressed plants.
- 5) Study of Kranz leaf anatomy in C₄ plants.
- 6) Estimation of TAN value in CAM plants.
- 7) Study of fermentation technique.
- 8) Qualitative test for proteins, lipids, sugar, starch and cellulose in plant material. (Any two test for each)

Reference Books:

1. Verma V. (2007), A text book of Plant Physiology, Ane Books India, New Delhi.
2. Malik and Shrivastava (1982), Plant Physiology, S. Chand and Company Ltd., New Delhi.
3. Sundararajan S. (2003), Physiology of transport in plants, Anmol Publications, Pvt. Ltd., New Delhi.
4. Jain V. K. (2018), Fundamentals of Plant Physiology, S. Chand and Company Ltd., New Delhi.



Distribution of Marks for Practical Examination (LAB):
DSC-PR-V: 2DSC03BOT59: DSC- Botany Lab-5

Group	Practical I	Practical II	Practical III	Practical IV	Journal	Submission/ Tour/Project	Total
Marks	20	20	20	20	10	10	100



Semester-VI



Department of Botany

B.Sc. III (Botany), Semester: VI

DSC-XII: 2DSC03BOT61: Plant Taxonomy

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

- CO1: Explain the concepts, principles and international rule of botanical nomenclature and taxonomy.
CO2: Differentiate the natural, artificial and phylogenetic systems of plant classification based on their principles and applications.
CO3: Evaluate the scientific, conservation and educational significance of botanical gardens and herbaria.
CO4: Identify and classify economically important angiosperm families using diagnostic morphological and anatomical characters.

Unit	Contents	Lectures
Unit 1	Introductory Taxonomy Need, importance and future of taxonomy Different aspects of taxonomy – Identification, Nomenclature, Numerical, Classification, Systematics, Molecular Systematics Phases of Taxonomy – The Pioneer phase, The Consolidation phase, The Experimental or Biosystematic phase, The Encyclopedic or holotaxonomic phase.	06
Unit 2	Plant Nomenclature Common name, Scientific name, Binomial Nomenclature (Generic name, Specific epithet) Rules and Regulations, International Code of Botanical Nomenclature (ICBN), Systems of classification (up to series), APG III and IV.	07
Unit 3	Tools for Taxonomic Studies Herbarium – Importance, Functions, Different kinds of Herbaria, Important Herbaria of the world, Methods of preparing herbarium. eHerbarium Botanical gardens – History, Role, Special types (Arboretum, Pinetum, Orchidarium, Bambusetum) Study of Royal Botanical Garden, Kew and some major botanical gardens in India.(Lead Botanical Garden – Shivaji University, Kolhapur)	08
Unit 4	Taxonomic Literature and Plant Families Flora, Manuals, Monographs, eFlora, Revisions, Journals, Periodicals, Reference books, Research paper, Websites and Catalogues. Study of Plant Families- Fabaceae, Solanaceae, Euphorbiaceae, Poaceae	09

Reference Books:

1. Lawrence G. M. H. (1951), Taxonomy of vascular plant, Macmillan, London.
2. Naik V. N. (1984), Taxonomy of Angiosperms, Tata Mc. Graw-Hill Publication, New Delhi.
3. Singh V. and Jain D. K. (2004), Taxonomy of Angiosperms, RastogiPublications,Meerut.
4. SivarajanV. V.(1991), Introduction to the Principles of Plant Taxonomy, Cambridge University, Cambridge, England.



Department of Botany

B.Sc. III (Botany), Semester: VI

DSC-XIII: 2DSC03BOT62: Cytology and Genetics

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

CO1: Describe the structure, organisation, composition and functions of the cells and their organelles.

CO2: Apply Mendelian principles and laws of inheritance to solve genetic problems and predict genetic outcomes.

CO3: Analyse the mechanisms, inheritance patterns and phenotypic expression associated with multiple alleles.

CO4: Evaluate the role of genetic linkage and crossing over in gene mapping and genetic variation.

Unit	Contents	Lectures
Unit 1	Cell as a unit of life The cell theory, Cell size and shape, Models of membrane structure, The functions of membrane, Cell cycle, Apoptosis.	07
Unit 2	Cell Organelles Plastids, Endoplasmic reticulum, Ribosomes, Golgi complex, Lysosomes, Mitochondria, Centrosome, Cilia and Flagella, Microbodies (Glyoxysomes, Peroxisomes), Vacuoles, Nucleus and Chromosomes.	07
Unit 3	Genetics Introduction and Importance, Seven Traits, Terminologies, Laws of inheritance (Monohybrid and Dihybrid), Multiple Allelism.	08
Unit 4	Linkage and Crossing over Linkage – concept, history and types of linkage, Crossing over – concept, mechanism and significance, Linkage maps, Extra chromosomal genome, Plastid inheritance and mitochondrial inheritance. Genome organization in prokaryotes and eukaryotes.	08

Reference Books:

1. Arumugam N. and Meyan R. P. (2014), Cell Biology, Molecular Biology, Genetics, Evolution and Ecology- Vol - I, Saras Publications, Kottar.
2. Rusell P. J. (2010), Genetics – A Molecular Approach, Benjamin Cummings, 3rd Edition, U.S.A
3. Gupta P. K. (2002), Cytology, Genetics, Evolution and Plant Breeding, Rastogi Publications, Meerut.
4. Verma P. S. and Agarwal V. K. (2009), Genetics, S. Chand Publisher, New Delhi.



Department of Botany

B.Sc. III (Botany), Semester: VI

DSC-XIV: 2DSC03BOT63: Molecular Biology and Biotechnology

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

- CO1: Explain the historical development, foundational scope, significance and core importance of molecular biology.
- CO2: Describe the mechanism of DNA replication and the roles of enzymes involved in the process.
- CO3: Demonstrate recombinant DNA technology techniques using appropriate molecular biology tools and laboratory procedures.
- CO4: Analyse the principles, applications and methodologies of modern genetic engineering techniques.

Unit	Contents	Lectures
1	Genetic Material Nucleic acids (DNA and RNA), Griffith's and Avery's transformation experiment, Hershey – Chase bacteriophage experiment, DNA structure and Types of DNA, DNA replication, RNA its structure and types, Transcription and Translation process.	07
2	Recombinant DNA technology Introduction and Principle, General methods and Enzymes involved in recombinant DNA technology, Cloning vectors, Blotting techniques – Northern, Southern and DNA finger printing, Gene Amplification : PCR techniques.	08
3	Genetic Engineering Introduction, Methods of gene transfer – <i>Agrobacterium</i> mediated, Direct gene transfer by Electroporation, Microinjection, Microprojectil bombardment, Transgenic plants, Applications of plant biotechnology.	08
4	Plant Tissue Culture Principle, terminology and culture medium, Totipotency and cellular differentiation, Organogenesis and embryogenesis, Applications of plant tissue culture – Protoplast culture, Somatic hybridization and Micropropagation. Structure of Plant Tissue Culture lab.	07

Reference Books:

1. Russell P. J. (2010), Genetics – A Molecular Approach, Benjamin Cummings, 3rd Edition, U.S.A
2. Stewart C. N. (2008), Plant Biotechnology and Genetics – Principles Techniques and Applications, John Wiley and Sons, U.S.A
3. Bhojwani S. S. and Razdan M. K. (1996), Plant Tissue Culture – Theory and Practice, Elsevier Science Amsterdam, The Nether lands.
4. Glick B. R. and Pasternak J. J. (2003), Molecular Biotechnology, Principles and Applications of Recombinant DNA, ASM Press Washington.



Department of Botany

B.Sc. III (Botany), Semester: VI

DSE-II: 2DSE03BOT61: Research Technique in Botany

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

CO1: Explain the principles, methodology and components of scientific research.

CO2: Identify major botanical research institutions their facilities and research resources.

CO3: Demonstrate recombinant DNA technology techniques using appropriate molecular biological tools and laboratory procedures.

CO4: Evaluate research practices based on biosafety regulations, ethical principles, legal frameworks and intellectual property rights.

Unit	Contents	Lectures
Unit 1	Introduction to research Meaning of research, its importance, aims and objectives, Criteria of selecting a research problem, Literature collection, Methodology (Experimental design/ Field data collection), Scientific paper writing- Manuscript preparation and presentation, Research journals, Impact factor and paper citation index.	08
Unit 2	Research institutes Major research institutes related to botany in India, A brief idea about government research and Funding agencies as DST, DBT, ICAR, ICMR, CSIR, UGC, CST , BSI etc., IPR and Patenting.	07
Unit 3	Biochemical techniques Principles and methodology of Colorimetry, Spectrophotometry, pH meter, Centrifugation, Chromatography, Micrometry and Microtomy.	07
Unit 4	Techniques Plant micro techniques- Fixatives and staining (Single and Double), Extraction techniques(Soxhlet extraction), Photomicrography, Ethical and legal issues of research – Authentication of specimens, Legal permissions for collection of biological material from local biodiversity committees, Forest department, State biodiversity board, National Biodiversity Authority.	08

Reference Books:

1. Bhattacharya D. K. (2013), Research Methodology, Excel Books, New Delhi.
2. Singh V. P. and Purohit S. (2003), Research Methodology in Plant Sciences, Scientific Publishers (India), Jodhpur.
3. Sundararaj P. and Siddu A.(1995), Qualitative tests and Quantitative procedures in Biochemistry, Wheeler and Co. Ltd., New Delhi, India.
4. Wilson K. and John Walker (1999), Principles and Techniques of Practical Biochemistry, Cambridge university, Press, London.



Department of Botany

B.Sc. III (Botany), Semester: VI DSE-II: 2DSE03BOT62: Herbal Technology

Credits: 02

Theory: 30 hrs.

Marks-50

Course Outcomes: After the completion of the course the student will be able to:

- CO1: Demonstrate standard protocols for the selection, collection, processing, preservation and storage of crude medicinal plant materials.
- CO2: Explain the history, principles, scope and significance of Pharmacognosy in herbal drug development.
- CO3: Categorize diverse plant phytochemicals according to their chemical nature, biosynthetic origin and therapeutic applications.
- CO4: Evaluate the quality and authenticity of crude drugs by applying appropriate physical, chemical and microscopic methods for the detection of adulteration.

Unit	Contents	Lectures
Unit 1	Herbal medicine 1a. Definition of herbal medicine. 1b. History and scope. 1c. Role of medicinal plants in Ayurveda. 1d. Importance of herbal medicine. 1e. Herbal drug industries.	06
Unit 2	Pharmacognosy 1a. History and definition. 1b. Importance of Pharmacognosy. 1c. Study of techniques of Pharmacognosy. 1d. Role of Pharmacognosy in medicines.	08
Unit 3	Phytochemistry 2a. History and definition. 2b. Importance of phytochemicals. 2c. Study of different types of phytochemicals. 2d. Study of different methods of testing of active chemicals. 2e. Role of phytochemical in medicine.	09
Unit 4	Analytical Pharmacognosy 3a. Study of secondary metabolites. 3b. Drug adulteration. 3c. Types of drug adulteration. 3d. Methods of drug evaluation.	07

Reference Books:

1. Arber A. (1999), Herbal plants and drugs, Mangal Deep publications.
2. Shah and Quadry(2005), Pharmacognosy, B. S. Shah prakashan, India.
3. Kokate C. K. (2002), Pharmacognosy, Nirali Prakashan, Pune.
4. Sheth A.(2005), The herbs of Ayurveda, Vol. I, II, III and IV.



Department of Botany

B.Sc. III (Botany), Semester: VI

DSC-PR-VI: 2DSC03BOT69: DSC-Botany Lab-6

Credits: 06

Practical: 180hrs.

Marks: 100

(Practical: Four lectures of 60 minutes thrice in a week per batch)

Practical: I Fundamentals of Plant Taxonomy

Course Outcomes: After the completion of the course the student will be able to:

CO1: Know the concept botanical garden.

CO2: Differentiate the vegetative and reproductive characters among diverse plant family.

CO3: Understand the technique of herbarium.

CO4: Prepare the artificial key for plant classification.

Practicals:

1) Study of following plant families:

Solonaceae, Annonaceae, Fabaceae, Meliaceae, Apocynaceae, Rubiaceae, Acanthaceae, Euphorbiaceae, Amaryllidaceae, Poaceae.

2) Study of herbarium technique.

3) Study of artificial key for plant classification.

4) Study of taxonomic literature with reference to manuals, monographs, eflora, revisions, research paper, websites.

5) Visit to botanical gardens.

6) Study of pollen structure, viability and pollen germination.

7) Identification of genus and species with the help of Cook's flora.

8) Submission of herbarium.

Reference Books:

1. Lawrence G. M. H. (1951), Taxonomy of vascular plant, Macmillan, London.
2. Naik V. N. (1984), Taxonomy of Angiosperms, Tata Mc. Graw-Hill Publication, New Delhi.
3. Singh V. and Jain D. K. (2004), Taxonomy of Angiosperms, Rastogi Publications, Meerut.
4. Sivarajan V. V. (1991), Introduction to the Principles of Plant Taxonomy, Cambridge University, Cambridge, England.



Practical: II Cytology and Genetics

Course Outcomes: After the completion of the course the student will be able to -

CO1: Know the details of cell and its structure.

CO2: Apply Mendelian principles and laws of inheritance to solve genetic problems.

CO3: Categorize different cytological staining technique based on their specificity for distinct cellular organelles.

CO4: Know the different phases of mitosis and meiosis.

Practicals:

1) Study of special chromosome (Polytene and Lampbrush) either by slide or photographs.

2) Study of cell structure from onion peel.

3) Study of cytological technique – preparation of fixative, preparation of stains

(Acetocarmine and Acetoorcein).

4 to 5) Study of genetic example – Mendelian laws, Linkage and crossover, Polygen inheritance, multiple alleles.

6) Study of mitosis in *Allium* and preparation of permanent cytological slide.

7) Study of meiosis in *Allium* and preparation of permanent cytological slide.

8) Preparation of Karyotypes – preparation of ideogram by using photoplates.

.Reference Books:

1. Arumugam N. and Meyan R. P. (2014), Cell Biology, Molecular Biology, Genetics, Evolution and Ecology- Vol - I, Saras Publications, Kottar.
2. Rusell P. J. (2010), Genetics – A Molecular Approach, Benjamin Cummings, 3rd Edition, U.S.A
3. Gupta P. K. (2002), Cytology, Genetics, Evolution and Plant Breeding, Rastogi Publications, Meerut.
4. Chetan Jawale and Laxmikant Dama (2009), Practical Handbook of Cytology, Lambert Academic Publishing, London.



Practical: III Molecular Biology and Biotechnology

Course Outcomes: After the completion of the course the student will be able to –

CO1: Know the technique of DNA isolation from given plant material.

CO2: Gain knowledge about the basic equipment's used in tissue culture.

CO3: Know the mechanism of isolation and quantification of protein.

CO4: Gain the knowledge of genetic engineering.

Practicals:

- 1) Isolation of DNA.
- 2) Study of PCR techniques.
- 3) Isolation and quantification of protein.
- 4) Quantification of DNA by spectrophotometer.
- 5) Study of in vitro culture of suitable plant material – Micro propagation, Anther culture and Embryo culture.
- 6) Study of basic equipments used in tissue culture and sterilization.
- 7) Study of tissue culture medium (M S), its sterilization and inoculation technique.
- 8) Submission of PPT on the basis of molecular biology and biotechnology.
- 9) Visit to Plant Tissue Culture lab.

Reference Books:

1. Rusell P. J. (2010), Genetics – A Molecular Approach, Benjamin Cummings, 3rd Edition, U.S.A
2. Stewart C. N. (2008), Plant Biotechnology and Genetics – Principles Techniques and Applications, John Wiley and Sons, U.S.A
3. Bhojwani S. S. and Razdan M. K. (1996), Plant Tissue Culture – Theory and Practice, Elsevir Science Amsterdam, The Nether lands.
4. Sivaranjani S. and Ramadevi S. (2023), Molecular Biology Practical Handbook, AkiNik Publications, New Delhi.



Practical: IV Research Technique in Botany

Course Outcomes: After the completion of the course the student will be able to –

CO1: Understand the concept of microphotography.

CO2: Know the concept of micrometry.

CO3: Understand the different biochemical techniques.

CO4: Understand the different plant microtechniques.

Practicals:

- 1) Study of extraction technique.
- 2) Study of microphotography.
- 3) Study of plant micro techniques – Fixatives- FAA, Staining techniques.
- 4) Literature collection on any given problem.
- 5) Study of colorimetry, spectrophotometry, pH meter, centrifugation and chromatography.
- 6) Study of measurement of object with the help of micrometry technique.
- 7) Study of micrometry.
- 8) Study of patents with example.
- 9) Abstract/ Research paper writing.

Reference Books:

1. Bhattacharya D. K. (2013), Research Methodology, Excel Books, New Delhi.
2. Singh V. P. and Purohit S. (2003), Research Methodology in Plant Sciences, Scientific Publishers (India), Jodhpur.
3. Sundararaj P. and Siddu A.(1995), Qualitative tests and Quantitative procedures in Biochemistry, Wheeler and Co. Ltd., New Delhi, India.
4. Wilson K. and John Walker (1999), Principles and Techniques of Practical Biochemistry, Cambridge university, Press, London.



Distribution of Marks for Practical Examination (LAB):
DSC-PR-V: 2DSC03BOT69: DSC- Botany Lab-6

Group	Practical I	Practical II	Practical III	Practical IV	Journal	Tour/Project/ Seminar	Total
Marks	20	20	20	20	10	10	100



Department of Botany

B.Sc. III (Botany), Semester: VI
VSC-PR-V: 2VSC03BOT69: Plant Nursery

Credits: 02

Practical: 60hrs.

Marks-25

(Practical: Four lectures of 60 minutes per week per batch)

Course Outcomes: After the completion of the course the student will be able to:

CO1: Know the techniques of plant propagation.

CO2: Gain knowledge about the nursery tools and implements.

CO3: Determine the most suitable and cost effective weed management and irrigation strategy for an nursery.

CO4: Gain the knowledge about nursery management.

Practicals:

- 1) Study and practice of different propagation method like cutting, layering, division, grafting and budding.
- 2) Study of nursery tools and implements.
- 3) Study of potting mixers.
- 4) Study of rooting medium.
- 5) Transplanting of plants.
- 6) Study of green house, shade house and glass house.
- 7) Study of watering, weeding and nutrients.
- 8) Study of pest and disease management.

Reference Books:

1. Acquaah G. (2019), Horticulture: Principles and Practices (4th edition) India, Pearson India Education Services Pvt. Ltd., India.
2. Lancaster S. P., Base T. K. and Mukherjee D. (1997), Gardening in India, Oxford and IBH publishing Co, Calcutta.
3. Zingare A. K. (2013), A manual of Gardening, Satyam Publishers and Distributors, Jaipur.
4. Singh Bijendra Kumar, Thakur Nidhika (2024), Plant Propagation and Nursery Management, Banda University of Agriculture and Technology Banda, Uttar Pradesh.



Marks Distribution of VSC-PR-V: VSC03BOT69: Plant Nursery

Practical Work	Journal/Report	Total
20 Marks	05 Marks	25 Marks



Department of Botany

B.Sc. Part–III Semester- V & VI BOTANY

Semester End Examination

Structure of Question Paper

Total Marks: 40

Time: 2 hours

Question No.	Question Pattern	Marks
Q.1	Choose and rewrite the correct alternative (One mark each):	08
Q.2	Attempt any TWO (Eight marks each):	16
Q.3	Attempt any FOUR (Four marks each):	16
	Total	40

B.Sc. Part–III Semester- V & VI BOTANY

Continuous Internal Evaluation (CIE)

Evaluation Type	Marks
Home Assignment/ Student Project/ Test/ PPT Presentation	10



Department of Botany

Nature of Question Paper:

Seat No.	
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Q. P. code	
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VIVEKANAND COLLEGE, KOLHAPUR (EMPOWERED AUTONOMOUS)

B.Sc. Part- III (Botany) (Semester- V & VI) Examination.....
Course Code and Name: 2DSC03BOT51: Mycology and Plant Pathology

Day:
Date: --/--/----

Time: 2 hours
Marks : 40

Instructions:

- 1) All the questions are compulsory.
- 2) Figures to the right indicate full marks.
- 3) Draw neat labelled diagrams wherever necessary.

Q. 1. Choose and rewrite the correct alternative (One mark each): [08 Mks]

- i) Xyzabcdefg hijklmnop -----
a) ----- b) ----- c) ----- d) -----
- ii) Xyzabcdefg hijklmnop -----
a) ----- b) ----- c) ----- d) -----
- iii) Xyzabcdefg hijklmnop -----
a) ----- b) ----- c) ----- d) -----
- iv) Xyzabcdefg hijklmnop -----
a) ----- b) ----- c) ----- d) -----
- v) Xyzabcdefg hijklmnop -----
a) ----- b) ----- c) ----- d) -----
- vi) Xyzabcdefg hijklmnop -----
a) ----- b) ----- c) ----- d) -----
- vii) Xyzabcdefg hijklmnop -----
a) ----- b) ----- c) ----- d) -----
- viii) Xyzabcdefg hijklmnop -----
a) ----- b) ----- c) ----- d) -----

Q.2. Attempt any TWO (Eight marks each): [16 Mks]

- i) Xyzabcdefg hijklmnop.
- ii) Xyzabcdefg hijklmnop.
- iii) Xyzabcdefg hijklmnop

Q.3. Attempt any FOUR (Four marks each): [16 Mks]

- i) Xyzabcdefg hijklmnop.
- ii) Xyzabcdefg hijklmnop.
- iii) Xyzabcdefg hijklmnop.
- iv) Xyzabcdefg hijklmnop.
- v) Xyzabcdefg hijklmnop.
- vi) Xyzabcdefg hijklmnop.