SURENDRANAGAR UNIVERSITY

FACULTY OF SCIENCE

Syllabus for

M. Sc. (BOTANY)

With Effect From: 2021-22

Department of Biosciences
Course Structure and Scheme of Examination
For Choice Based Credit System (CBCS)
(Total 96 credits)
Effective from June 2021

M. Sc. Botany
Program Outcomes (PO)

PO - 1 : Critical Thinking

M.Sc. Botany is a link between B.Sc. and PhD. degree. The students are encouraged to go for M.Sc. degree, to develop significant thinking and analytical ability for research criteria and future studies and jobs. It develops knowledge of students in plant sciences and theoretical skills with interactions and explanations.

PO - 2 : Social Interaction

The program helps in development of interest in planning and implementation of research in cooperative manner. The MSc degree in Botany divinely enhances the analytical skill of the students and harbor great confidence in them.

PO - 3 : Core academic skills

Exposure in MSc prides deeper undertaking of the subject and in fact students get more exposure and develop confidence in conceptualization of the research theme and deciding the topic, designing of the experiments, analyzing the data and deriving outcome from it.

PO-4 :Research and Development

Students develop skills to handle biochemical and molecular techniques to plan and carry out experiments. The programme will enable them to develop skills in analyzing data, testing of hypotheses using statistical software's and draw conclusions from the experimental data.

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PO - 5: Communication Skills

Students gain confidence in delivering seminars, as teaching in MSc is largely interactive that includes, class room teaching, seminar delivering by the students, writing a concept note and assignment on the recent topics and developments in the field.

They are able to communicate effectively with scientific community and with Society at large.

PO - 6: Continuous Learning

Recognize and integrate life-long learning skills to become pro-active in personal and professional live. The students develop interest in persuading higher studies.

M. Sc. Botany
Program Specific Outcomes (PSO)

PSO1:

M.Sc. Botany is a course to develop a theoretical understanding of values and significance of plant science. Students will be benefited with knowledge of core subjects like plant diversity, physiology, biochemistry, genetic, biostatistics, bioinformatics and resources utilization.

PSO2:

It is a combination of basic and applied plant science which is beneficial to students to develop skills in plant taxonomy, ecology, anatomy, embryology, propagation techniques, conservation techniques, plant breeding and plant genetics.

PSO3:

Studies on plant taxonomy will develop their knowledge on identification of plant species such as algae, bryophytes, pteridophytes, gymnosperms and Angiosperms

PSO4:

Studies on the ultrastructure and function of plant cells, cell to cell communications, phytohormonal signaling, plant anatomy and embryology will increase knowledge of students in plant physiology, growth and development.

PSO5:

Studies on plant diversity and ecology will improve their knowledge on plant conservation statergies, economic use of plant resources, conservation of economically important floral species, destruction of plant species due to degradation of land, forest and habitat, evolutionary changes in plants due to change in habitat, season and climate.

PSO6:

Studies on Plant biochemistry will divert their knowledge on medicinal uses of plant species. Histochemical and Biochemical significance will help in Development of herbal, pharmaceutical and biotechnological products from plant parts.

PSO7:

Studies on plant propagation, breeding and genetics has application in agriculture sector in development of disease resistant varieties, drought resistant variety, increase resistance of plants in saline environment, high fruit yielding varieties, increase flowering in plants and conservation of germplasm of specific variety.

Semester -1

Course Code	Course Name	Hours /Week	Credits
	Core		
Bot - 101	Cell Biology	04	04
Bot - 102	Molecular Biology, Genetics & Evolution	04	04
Bot - 103	Biodiversity & Biosystematics	04	04
	Inter disciplinary		
Bot- 104	Biostatistics and Bioinformatics	04	04
Bot- 105	Combined Practical Course	14	08
Bot- 106	Seminar Course – 1	02	00
	TOTAL		**24**

Semester -2

Course Code	Course Name	Hours /Week	Credits
	Core		
Bot - 207	Biochemistry	04	04
Bot - 208	Biotechnology & Immunology	04	04
Bot - 209	Environmental Science	04	04
	Interdisciplinary		
Bot- 210	Analytical Techniques	04	04
Bot- 211	Combined Practical Course	14	08
Bot– 212	Seminar Course – 2	02	00
	TOTAL		**24**

Semester -3

Course Code	Course Name	Hours /Week	Credits
	Core		
Bot - 313	Plant Anatomy, Morphogenesis & Embryology	04	04
Bot - 314	Plant Ecology	04	04
	Elective Course (Any one)	04	04
Bot - 315	Plant Propagation Techniques		
Bot - 316	Herbal Technology - I		
Bot - 317	Diversity of Plant Life		
Bot- 318	Combined Practical Course	08	04
Bot - 425	Dissertation / Project Course: Part-1	09	00
Bot-106+212	Seminar Course (1 + 2)	00	02
	TOTAL		**18**

Semester -4

Course Code	Course Name	Hours /Week	Credits
	Core		
Bot - 419	Plant Resource Utilization and Conservation	04	04
Bot - 420	Plant Physiology and Metabolism	04	04
	Elective (Any one)	04	04
Bot - 421	Plant Biotechnology and Genetic		
Bot - 422	Herbal Technology - II		
Bot - 423	Salinity, Desertification & Restoration Ecology		
Bot - 424	Combined Practical Course	08	04
Bot - 425	Dissertation / Project Course	09	12
Bot - 426	Educational Tour / Field Work Course	00	02
	TOTAL		**30**

SEMESTER-1

BOT 101: CELL BIOLOGY

Course Outcome:

CO1: These fundamental courses develops knowledge of students in plants cell biology.

CO2: This helps students in getting job at teaching and research institutes.

UNIT 1: Cell Structure & Cell Cycle

Cell Concept, Ultrastructure of Plasma Membrane, microbial and Plant Cell Wall. Ultrastructure of Nucleus and Nucleolus. Pore Complex of Nuclear envelop. Ultrastructure of Chromosome, Chromosomal Models, Special types of chromosomes. Cell Cycle, G1/S Transition, Cyclines and cyclin dependent kinases. Regulation of CDK - cycline activity.

UNIT 2: Cellular Organization

Mitochondria: Membrane Organization, Biogenesis and role in cellular energetics. Chloroplasts: Ultrastructure, biogenesis, Photosynthetic units and reaction centres. Ultrastructure and functions of Lysosome, Peroxisomes & Glyoxisomes. GERL System and its functions. Vacuoles and their role in cell structure and function.

UNIT 3: Cytoskeleton, Cellular Transport & Sorting

Cytoskeleton: Ultrastructure and functions of Microtubules, microfillaments and associated proteins. Cytoskeleton: Ultrastructure and functions of Actin, Myosin, IF and associated proteins. Intracellular Junctions and their functions. Ca++ dependent homophillic and non-homophillic cell-cell adhesion. Transport across cell membrane: diffusion, active transport and pumps, uniports, symports and antiports.

UNIT 4: Cellular Communication, Apoptosis and Cancer

Cell surface receptors and their mode of action. Phenomenon of exocytosis and endocytosis. Second messenger system, MDP kinase pathways. Apoptosis: Mechanism and significance. Cell biological approach of cancer, AIDS.

REFERENCES

1. Cell Biology – De Robertis
2. Cell Biology – C.B. Power
3. Molecular Biology of The Cell - Bruce Alberts
4. Essential Cell Biology, II Edition- Bruce Alberts et al.

BOT 102: MOLECULAR BIOLOGY, GENETICS & EVOLUTION

Course Outcome:

CO1: These fundamental courses develops knowledge of students in plants molecular biology, genetics, adaptation and evolution.

CO2: This helps students in getting job at teaching and research institutes.

UNIT 1: Population Genetics

A Principles of Mendalian genetics, Hardy-Weinberg genetic equilibrium, Natural selection, Genetics of Speciation, Origin of life: Coacervates, Miller's experiment, theories of organic evolution.

UNIT 2: DNA as a hereditary material

Structure of Nucleic acids, Structural differences in prokaryotic and eukaryotic DNA, DNA constancy and C-value paradox, DNA replication and DNA methylation, Linkage and genetic (chromosome) mapping B.

UNIT 3: Gene structure and function (Prokaryotic and Eukaryotic)

Loci, alleles, and Gene structure, Genetic code, Transcription, Translation.

UNIT 4: Structural Changes in DNA material and Extra Chromosomal inheritance

Molecular basis of spontaneous and induced mutations, Chromosomal aberration, DNA damage and repair, Extra-chromosomal inheritance.

REFERENCES

1. Genes-VII - Benjamin Lewis
2. Fundamentals of Biochemistry - Lehninger

BOT 103: BIODIVERSITY & BIOSYSTEMATICS

Course Outcome:

CO1: These course trains students in identification and classification of plant species.

CO2: This helps them to get job in forest, seed banks, botanical gardens, biotechnological, pharmaceutical and other research institutes as plant taxonomist.

UNIT 1: Biodiversity

Basic Concepts of Biodiversity: Genetic, species and ecological diversity. Terrestrial, Marine Biodiversity, Eco-tourism and Biodiversity. Conservation and Sustainable use of Biodiversity. Ecosystem monitoring and Rehabilitation. Threats to Biological Diversity: Habitat Destruction, Invasive species, Disease, Over-exploitation, Pollution, Climate change and Biodiversity. Structure and functions of the Convention on Biological Diversity (CBD), CBD mechanisms and working bodies. National Action Plan.

UNIT 2: Microbial Taxonomy

Principles of systematics and classification of microbes. Introduction to akaryotes, virus, archea& bacteria, cyanobacteria and prokaryotes. Fungus like protists: Cellular slime moulds, plasmodial slime moulds. General features of Fungus. Classification of Zygomycetes, Ascomycetes, Basidiomycetes, Mycorrhizea.

UNIT 3: Plant Taxonomy

Principles of systematics and classification of Plants. General features and Classification of green protists like diatom, dinoflagellates, lichens and algae. Non-tracheophytes (Mosses) and Non-Seed Tracheophytes (Ferns and Fern allies). Seed plants: Gymnosperm and Angiosperms.

UNIT 4: Animal Taxonomy

Principles of systematics and classification of Animals. Classification of Protista (Flagellates, Amoebas, Ciliates and Apicomplexans). Major invertebrate phyla, Lower chordates. Vertebrates: Fish, Amphibia, Reptiles, Birds and Mammals.

REFERENCES

1. Fundamentals of Ecology – EP Odum
2. Modern Textbook of Zoology by R.L. Kotpal

BOT 104: BIOSTATISTICS AND BIOINFORMATICS

Course Outcome:

CO1: In bioinformatics they will gain deep understanding of using computer tool to visualize, explore and model sequence analysis using different software.

CO2: Students will able to recognize the importance of statistical analysis, and approach to problem solving, in various disciplines.

UNIT 1: Basics and concepts of Biostatistics

Data, Tabulation, Classification, Frequency distribution and Graphics. Measure of Central Tendency – Mean, Mode & Median: Definition, Objectives, Merits, Demerits & Uses. Measure of Dispersion – Range, Variance, Standard deviation, Coefficient of Variation. Confidence limit and confidence interval.

UNIT 2: Statistical tests in Biology

Student's t-test: Paired and Unpaired, Analysis of Variance, Regression and Correlation analysis, Chi-square test.

UNIT 3: Basics of Bioinformatics and Biological Database

Introduction of Bioinformatics (Biological and IT links), Basic terminology. Application of bioinformatics in various fields: Medicine, Agriculture, Industries etc. Types of biological database, File formats and Structure of database. Primary and Secondary database.

UNIT 4: Sequence alignment, Gene prediction and Basic concepts of Omics

Sequence alignment: Nucleotide and Protein sequences, Pairwise and multiple sequence alignment, Phylogenic relationship and importance of the study. Gene prediction: Gene structure in prokaryotic and eukaryotic systems, Prediction tools for the gene. Genomics: Definition and importance of the study. Other Omics (Transcriptomics, Proteomics and Metabolomics: Definition and importance of the study).

REFERENCES

1. Fundamental of Biostatistics – Veer Bala Rastogi
2. An Introduction to Biostatistics – N. Gurumani
3. Biostatistics – P. N. Arora & P. K. Malhan

4. Basic Biostatistics for Geneticists and Epidemiologists – Robert C. Elston & William D. Johnson
5. Introductory Biostatistics – Chap T. Le

SEMESTER-2

BOT 207: BIOCHEMISTRY

Course Outcome:

CO1: These course develops knowledge of students on biomolecules of plants such as primary and secondary metabolites.

CO2: This helps students to develop their understanding on use of plants material in development of pharmaceutical, medicinal and biotechnological products.

UNIT 1: Carbohydrates, Lipids and Fatty Acid metabolism

Monosaccharides and disaccharides: Types and properties, Polysaccharides: Homopolysaccharides and hetropolysaccharides, Classification and properties of simple and compound lipids, Function of lipids, Metabolism of fatty acids: Beta oxidation.

UNIT 2: Protein Structure and Function

Properties of amino acid, titration curves and function of proteins. Primary and Secondary structure of protein. Tertiary structure of protein, Ramchandran Plots. Quaternary structure of protein: globular and fibrous.

UNIT 3: Enzymes: Basic Concepts and Kinetics

An introduction to enzymes: Nomenclature and classification. Principles and mechanism of enzymes catalysis: single and multisubstrate, Coenzymes and cofactors. Kinetic properties of enzymes, Michaelis-Menten Model, Double reciprocal plot. Enzyme Inhibition: Competitive, Non- competitive, Uncompetitive and Mixed type.

UNIT 4: Metabolism: Basic Concepts and Regulation

Concept of Bioenergetics: laws of thermodynamic, Entropy and Enthalpy, Energy rich compounds and electron carriers. Glycolysis and Citric Acid Cycle. Other pathways of carbohydrate metabolism ED, Pentose Phosphate, Glyoxylate, Gluconeogenesis. Allosteric proteins, Feedback inhibition.

REFERENCES

1. Fundamentals of Biochemistry by Voet and Voet
2. Principles of Biochemistry - L. Stryer
3. Principles of Biochemistry - Lehninger, D.W. Nelson & M.M.Cox
4. Harper's Illustrated Biochemistry - Robert K. Murray
5. Biochemistry : U. Satyanarayana
6. Color Atlas of Biochemistry : Jan Koolman
7. Biochemistry : Reginald H. Grarrett
8. Protein structure and function : Mike Williamson
9. Biochemistry : Mary K. Campbell, Shawn O. Farrell

BOT 208: BIOTECHNOLOGY & IMMUNOLOGY

Course Outcome:

CO1: The students will get the experimental knowledge of genetic engineering and immunological fields.

CO2: Students will able to gain hands-on experience on plant tissue culture and immunological qualitative and quantitative techniques.

UNIT 1: Biotechnology -1

Bioremediation: Principles and Methods, Techniques of immobilization of enzymes & cells, Applications of Immobilized Enzymes & Cells, Principles and techniques of animal tissue culture.

UNIT 2: Biotechnology -2

Basics of genetic engineering, DNA isolation techniques, Restriction enzymes, Gene targeting. Vectors : plasmids, cosmids and phages, Host vector system, Screening of the recombinant clones.

UNIT 3: Plant Tissue culture

Principles and Techniques of Plant Tissue Culture, Basic Steps of Plant Tissue Culture, Selection of Plant Culture Media, Types of Plant Tissue Cultures.

UNIT 4: Immunology

Antigen Antibody: Structure of Ig, Ig Classes & Biological Activities, Factors Influencing Immunogenicity, Monoclonal Antibodies, Innate and Adaptive Immune System, Antigen-Antibody Interactions: ELISA Test, Agglutination, Precipitation, Immunofluorescence, Delayed and Immediate Hypersensitive Reactions, and Autoimmunity.

REFERENCES

1. Immunology - Kuby
2. Essential of Immunology by S.K. Gupta
3. Plant Biotechnology – H.S. Chawda

BOT 209: ENVIRONMENTAL SCIENCE

Course Outcome:

CO1: This course creates awareness among students on conservation and judicial use of plant species.

CO2: It helps students to understand the significance of each plant species available in specific geographical region.

CO3: This helps students to get job in plant conservation centers, seed banks, botanical gardens etc.

UNIT 1: Environment

Definition, principles and Scope of Environmental science. Earth, Man and Environment, Ecosystems, Pathways in Ecosystems, Physico-chemical and Biological factors in the Environment, Geographical classification and zones. Structure and composition of atmosphere, hydrosphere, lithosphere and biosphere. Scale of Meteorology, pressure, temperature, precipitation, humidity, radiation and wind. Atmospheric stability, inversions and mixing heights, windroses.

UNIT 2: Ecosystem

Definition, Principles and scope of ecology, Human ecology and human settlement, Ecosystems: Structure and functions, abiotic and Biotic components, food chains, food web, ecological pyramids, population, community ecology and parasitism, prey-predator relationships, Biomes of the world. Overview of Sanctuaries, National park and Botanical garden.

UNIT 3: Pollution

Air: Natural and anthropogenic sources of pollution, primary and secondary pollutants, Transport and diffusion of pollutants. Gas laws governing the behavior of pollutants in the atmosphere. Methods of monitoring and control of air pollution SO2, NOx, CO, SPM. Effects of pollutants on human beings, plants, animals, materials and on climate, Acid rain, Air Quality Standards. Water: Types, Sources and consequences of water pollution, physic-chemical and bacteriological sampling and analysis of water quality. Standards, sewage and waste water treatment and recycling. Water quality standard. Soil: Physico-chemical as bacteriological sampling as analysis of soil quality, Soil pollution control, Industrial waste

effluents and heavy metals, their interactions with soil components. Degradation of different insecticides, fungicides and weedicides in soil. Soil organic and inorganic components. Global Environmental problems: Ozone depletion, global warming and climatic change, clean development mechanism.

UNIT 4: Environmental Impact Assessment

Introduction to environment impact analysis, Environmental impact statement and environmental management plan, Impact Assessment methodologies. Generalized approach to impact analysis. Procedure for reviewing environmental impact analysis and statement. Principles of Remote sensing and its applications of environmental sciences, Application of GIS in Environmental management.

REFERENCES

1. Environmental Science – Y.K. Singh
2. A textbook on Environmental Science by D. Som and N. Gaurav

BOT 210: ANALYTICAL TECHNIQUES

Course Outcome:

CO1: This course trains students in handling sophosticated instruments such as HPLC, LCMS, GCMS, Sequencer, PCR etc.

CO2: This helps them to get job opportunities in research, biotechnological and pharmaceutical institutes.

UNIT 1: Microscopy and Autoradiography

Theories of Tissue fixation and staining techniques. Principles of Transmission and Scanning Electron microscopy. Principles of Phase Contrast and Fluorescence Microscopy. Principle and applications of Autoradiography.

UNIT 2: Spectroscopy

Basic principles of Spectroscopy, UV, IR, Raman, ESR, ORD, CD and structure of proteins using NMR and ESR, Neutron and X-Ray diffraction for elucidation of 3D structure, Molecular modelling, Mass Spectrometry

UNIT 3: Chromatographic techniques

Basic Principle and types of Chromatography, Gas Chromatography, GC-MS, LC – MS / MS, Ion Exchange Chromatography, gel permeation, Affinity and reverse phase chromatography, HPLC and FPLC.

UNIT 4: Centrifugation and Electrophoretic Techniques

Principle and applications of Centrifugation techniques, Basic principles of Electrophoresis, Agarose gel, native and SDS-PAGE, Isoelectric focusing, 2D-PAGE and their uses in protein research, Fractionation and Blotting Techniques.

REFERENCES

1. Principles and Techniques of Biochemistry and Molecular Biotechnology – K. Wilson and J. Walker

SEMESTER-3

BOT 319: PLANT ANATOMY, MORPHOGENESIS AND EMBRYOLOGY

Course Outcome:

CO1: The students will gain ability to apply the acquired knowledge and skills in the field of plant morphology, anatomy and embryology

CO2: The students are enabled to understand the morphogenesis and embryology mechanisms of plant growth and development.

UNIT 1: Anatomy

Meristematic and permanent tissues of plants, Shoot and root apex organization, Special and secretory tissues of plants, Types of tissue systems, Anatomical features of dicotyledonous and monocotyledonous plants, Secondary and anomalous growth in plants.

UNIT 2: Morphogenesis

Evolution of morphogenetic pattern, Organogenesis of root, stem and leaf. Organogenesis of bud, flower and inflorescence. Morphogenesis: light, temperature and precipitation affecting on morphogenesis.

UNIT 3: Embryology

Micro and Mega sporangium, Female and Male gametophyte, Fertilization, Endosperm Types, Embryogenesis and types of embryo.

UNIT 4: Applied Embryology

Apomix, Polyembryony, Embryology in relation to taxonomy, Experimental Embryology.

REFERENCES

1. Plant Cell Morphogenesis - Zarsky, Viktor, Cvrckova, Fatima; Plant Morphogenesis - Edmund Ware Sinnott
2. Plant Organogenesis - De Smet
3. Vascular Morphogenesis – Ribatti and Domenico

4. Morphogenesis - Jonathan Bard
5. The Embryology of Angiosperms – SS Bhojwani and SP Bhatnagar
6. Plant Anatomy – A Fann
7. Plant Anatomy – BP Pandey
8. A textbook of Plant Anatomy – P Saxena & SM Das
9. Plant Anatomy: Applied Approach – DF Cutler, T Botha & DW Stevenson
10. Plant Anatomy – JD Mauseth
11. An Introduction to Plant Structure and Development – CB Beck
12. Plant Anatomy and Embryology – SN Pandey & A Chadha
13. Plant Anatomy – R Crang & A Vssilyev

BOT 314: PLANT ECOLOGY

Course Outcome:

CO1: The students get to understand the basic concepts of geology, ecology, autecology, population dynamics and advanced ecology.

CO2: Students will learn to process of the establishment of ecosystem, vegetation, plant succession and adaptations.

CO3: Gain the knowledge related to plant diversity and its adaptation in India.

UNIT 1: Structure of Plant Communities

Concept of community and continuum, Community analysis analytical character, Community analysis synthetic characters, Physiognomic characters, growth forms and sampling methods.

UNIT 2: Community Metabolism and Dynamics

Primary production, productivity and methods of measurement, Energy dynamics (energy flow pathways), Litter production and decomposition, Community change (ecological succession).

UNIT 3: Population dynamics and Autecology

Population growth, carrying capacity and population regulation, Species interaction: competition, allelopathy, Concept of ecological niche, Ecotype formation and classification, Plant indicators.

UNIT 4: Soil and Desert

Soil structure, Soil processes, nitrogen mineralization, Desertification: causes and control, Fire: effect on grasslands and forests.

REFERENCES

1. Fundamentals of Ecology: Odum E. P.
2. Fundamentals of Ecology: Agarwal S. K 3.Concept of Ecology: Kormondy E. J.
3. Ecology and Environment : P.D. Sharma
4. Quantitative and dynamic ecology: Kershaw K. A.
5. Plant Ecology : Michael L

6. Encyclopaedia of Soil Science : Rattan lal
7. Fundamentals of soil science : Millar, Charles Ernest
8. Soil: introduction : Michael and Donald 10.Environmental soil science: Kim H. Tan

BOT 315: PLANT PROPAGATION TECHNIQUES

Course Outcome:

CO1: Students will learn the basic principles of in vitro and in vivo propagation techniques.

CO2: This paper will introduce the horticulture industrial skills of plant propagation, such as grafting, budding, layering, cutting and tissue culture.

CO3: Students will understand factors that affect plant propagation techniques.

CO4 : Students will also learn research for the development of agribusiness.

UNIT 1: Introduction to Plant Propagation

Techniques of plant propogation. The development of nurseries and plant propagation organization, Genetic control in propogation (sexual and asexual propagation), Environmental factors regulating plant propagation.

UNIT 2: Vegetative propagation

Clones preparation in vegetative propagation, Propagation by cutting, Propagation by grafting, Techniques of budding, Layering and its natural modification.

UNIT 3: Methods of Micropropagation – I

Basic of plant tissue culture, Selection criteria for explants, Callus induction and sub culturing, Protoplast isolation, culture and selection of hybrids.

UNIT 4: Methods of Micropropagation – II

Anther culture and production of haploids, Organ culture and organogenesis, Somaclonal variation, Preparation of artificial seeds, Production of secondary metabolities.

REFERENCES

1. Plant Propagation - M K. Sadhu
2. Molecular Biotechnology Principles and Practices - Channarayappa
3. Biochemistry and Molecular Biology of Plants - Bob B, Wilhelm G and Russell J

BOT 316: HERBAL TECHNOLOGY

Course Outcome:

CO1: Studies on uses of plant species on development of herbal, pharmaceutical and biotechnological products.

CO2: This provides opportunity to students to get job on research and teaching institutes.

UNIT 1: Medicinal plants: An Introduction

Importance of medicinal plants, Cultivation of medicinal plants, Propagation of medicinal plants, Conservation strategies of medicinal plants.

UNIT 2: Traditional utility of medicinal plants

Traditional and alternative systems of medicine, Major medicinal plants of India, Major medicinal plants of the World, Indigenous traditional drugs.

UNIT 3: Phytoconstituents and their extraction techniques

Pre extraction operation for crude drugs. Effect of solvents on extraction. Procedure for extraction of herbal drugs. Extraction procedure of alkaloids, tannins, saponins, phenols, flavonoids.

UNIT 4: Quality Control techniques

Adulteration and deterioration, Factors affecting herbal drugs quality, Identification by morphological evaluation, Development of standardization parameters.

REFERENCES

1. A Handbook of Medicinal Herbs - Dhananjay J. Deshpande
2. A Handbook of Medicinal Plants - N D Prajapati, S. S. Purohit, A K. Sharma
3. An Introduction to Herbal Medicine in Ethnobotany - Rahat Ali, 4.Ayurvedic Medicinal Plants of India, Vol. 1-2 (Set) - Bhutya, R.K.
4. Handbook of Ayurvedic Medicinal Plants: Herbal Reference Library - L. D. Kapoor
5. Importance Of Medicinal Plants - Noor Ahmed Khan, Syed Aftab Iqbal
6. Indian Medicinal Plants - 8 Volumes (2nd Edition) - K. R. Kirtikar and B. D. Basu

7. Indian medicinal plants forgotten healers guide to ayurvedic herbal medicine – Prakash Paranjpe
8. Indian Medicinal Plants: An Illustrated Dictionary - Khare, C.P.
9. Medicinal Plant : Cultivation : A Scientific Approach - S.S. Purohit and S.P. Vyas
10. Medicinal Plants Cultivation and their Uses - H. Panda
11. Medicinal Plants of India: An Encyclopaedia - Ravindra Sharma
12. Medicinal Plants of the World - Ivan A Ross
13. Quality Standards of Indian Medicinal Plants : Vol. 10 - NeerajTandon and Parul Sharma
14. The Ayurvedic Plants - P. H. Kulkarni, Shahida Ansari
15. The Encyclopedia of Medicinal Plants - Andrew Chevallier
16. Practical Pharmacognosy – CK Kokate
17. Practical Pharmacognosy – KR Khandelwal
18. Herbal drug technology – SS Agrawal & M Paridhavi
19. Herbal technology recent trends and progress – M Danian

BOT 317: DIVERSITY OF PLANT LIFE

Course Outcome:

CO1: Studies on plant diversity and ecology will improve knowledge of students on plant identification and classification

CO2: It provides hands on training on floral identification, calculation of ecological diversity, conservation of rare and economically important plant species.

CO3: This helps students in getting jobs at research institutes such as Gujarat biodiversity board, Botanical survey of India etc.

UNIT 1: Bryophyta

General characters, economic importance and classification of bryophyte, Morphological patterns and variation in leaf, stem and reproductive organ of bryophyte, Anatomical patterns and variation in leaf, stem and reproductive organ of bryophyte, Reproduction and Life-cycles of bryophyta, Evolutionary trends amongst the different groups and their affinities.

UNIT 2: Pteridophyta

General characters, economic importance and classification of pteridophyta, Morphological patterns and variation in leaf, stem, root and reproductive organ of pteridophyta, Anatomical patterns and variation in leaf, stem, root and reproductive organ of pteridophyta, Reproduction and life cycles of pteridophyta, Evolutionary trends amongst the different groups and their affinities 2.6 Stele of pteridophyta.

UNIT 3: Gymnosperms

General characters, economic importance and classification of gymnosperms, Morphological patterns and variation in leaf, stem and reproductive organ of gymnosperms, Anatomical patterns and variation in leaf, stem and reproductive organ of gymnosperms, Reproduction and Life-cycles of gymnosperms, Evolutionary trends among the different groups.

UNIT 4: Angiosperms

Classification of family as per Bentham& Hooker classification, Merits and demerits of Bentham & Hooker classification, Detailed study: Families of Polypetalae, Gamopetalae and Apetalae, Detailed study: Families of monocotyledons.

REFERENCES

1. College Botany by Das, Datta and Ganguley
2. Bryophytes by Puri P.
3. Bryophyta by N. S. Parihar
4. The morphology of Pteridophyta by Sporne K.K.
5. Pteridophyta by N. S. Parihar
6. Cryptogamic Botany by Smith
7. Angiosperms by R. N. Sutaria
8. Bombay flora by Hook
9. Gymnosperms by Bhatnagar S. P. and Moitra
10. Numerical taxonomy by Cole A. J.
11. Plant Biosystematics by Grant W. F.
12. Diversity and classification of flowering plants

SEMESTER-4

BOT 419: PLANT RESOURCE UTILIZATION AND CONSERVATION

Course Outcome:

CO1: This course provides information to students on ethanobotanical use of plant materials.

CO2: It creates awareness among students on conservation and judicial use of plant resources.

CO3: It provides hands on training to students on conservation of seeds and plant germplasm which helps in getting job at teaching and research institutions.

UNIT 1: Agricultural Products of India

History, origin and distribution of crop plants, Major staple crops: rice, wheat, maize, Minor staple crops: millets, ragi, rye, barley, Major pulses: oil seeds, fibre crops.

UNIT 2: Forest and Forestry

Classification of Indian Forests, Afforestation, Forms and growth of forest trees, Siviculture, Siviculture systems, Forest Menustration and Protection, Major and minor forest products of India.

UNIT 3: Grassland and Fodder Resources

Major grassland area of India and its classification. Importance of fodder grasses, forbs and legumes, Grassland management.

UNIT 4: Intellectual Property Right

Overview of Intellectual Property Plant variety protection, Farmer's and Breeder's rights, Biodiversity act, Protection of traditional knowledge.

REFERENCES

1. Economic Botany – Sampat Nehra
2. Economic Botany - B. P. Pandey
3. Economic Botany: A Profile – Akhil Baruah

4. Economic Botany of Crop Plants - AVSS Sambamurty and NS Subrahmanyam
5. A textbook of Modern Economic Botany - AVSS Sambamurty and NS Subrahmanyam
6. Textbook of Economic Botany - V. Verma
7. Encyclopaedia of Forest Sciences - Evans, Youngguist and Burley
8. Forestry: Principles and Applications - AJ Raj, SB Lal
9. Forestry - Gyan Deep Singh
10. Indian Forestry - K. Manikandan, S. Prabhu
11. Tree and Forest Measurement - P.W. West
12. Forest and Forestry - K.P. Sagreya

BOT 420: PLANT PHYSIOLOGY AND METABOLISM

Course Outcome:

CO1: Students will learn the basic principles and mechanisms of plant growth development.

CO2: This paper will also provide understanding of hormonal action in plant to regulate normal physiological activity of different organ as well as metabolic process.

UNIT 1: Growth and Development

Plant growth processes, Physiology of flowering: vernalization and photoperiodism, Seed viability and germination, Seed and bud dormancy, Senescence and Abscission.

UNIT 2: Mineral Nutrition

Essential elements and their role in plant growth and development, Translocation phenomena in plants, Assimilation of inorganic nutrients, Plant - Water relations, Transpiration and stomatal movement.

UNIT 3: Photochemistry and Photosynthesis

Photosynthetic pigments and light harvest complexes, Photo oxidation of water, Mechanisms of electron and proton transport, Carbon assimilation the Calvin cycle, photorespiration and its significance, The C4 cycle, the CAM pathway, physiological and ecological considerations.

UNIT 4: Plant growth regulators

Physiological effects and mechanism of action of auxins, gibberellins and cytokinins. Physiological role of abscisic acid and ethylene, Minor group of phytohormones: brassinosteroids, polyamines, jasmonic acid, salicylic acid and their role in plant growth and development. Methods of hormones estimation: bioassay and immunoassay. Hormone receptors and Signal transduction.

REFERENCES

1. Plant Physiology: Davlin Robert
2. Plant physiology : Salibury and Ross
3. Plant Physiology: Taiz and Zeiger

4. Biochemistry and Physiology of Plant Hormones : Moore
5. Modern plant Physiology : R.K. Sinha
6. Introduction to Plant Physiology : Hopkins
7. Plant Physiology: Mukharjee and Ghosh
8. Physiology of Plant Growth and Development : Wilkins
9. Hormones, Signals And Target Cells In Plant Development : Daphne And Michael
10. Plant hormone signaling : Peter and Stephen
11. Introductory Plant Physiology : Noggle and Fritz

BOT 421: PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING

Course Outcome:

CO1: The students will have knowledge of tools and strategies used in genetic engineering.

CO2: Gain an in-depth understanding of the basic and recent development in the field of biotechnology.

UNIT 1: Genetic Engineering

Basic techniques in genetic engineering, Plant based vectors and its properties, Methods for screening of GMO plants, Other techniques of gene cloning in plants.

UNIT 2: DNA Marker Techniques

Non-PCR based technique (Restriction fragment length polymorphism), PCR based technique, Amplified fragment length polymorphism and its significance, Inter simple sequence repeat marker and its significance.

UNIT 3: DNA Marker Techniques

Non-PCR based technique (Restriction fragment length polymorphism), PCR based technique, Amplified fragment length polymorphism and its significance, Inter simple sequence repeat marker and its significance.

UNIT 4: Immunological Techniques

Immunological techniques in identification of plant metabolites, Biological control of pest, Plantibody, Fluorescence techniques for markers.

REFERENCES

1. Molecular Biotechnology Principles and Practices - Channarayappa
2. Biochemistry and Molecular Biology of Plants - Bob B, Wilhelm G and Russell J
3. Genetic Engineering - Smita R and Neelam P
4. Bioinformatics Principles and Applications - Zhumur G and Bibekanand M

BOT 422: HERBAL TECHNOLOGY II

Course Outcome:

CO1: Hands on training to students in development of herbal and pharmaceutical drugs from plant resources.

CO2: It increases chances of students to get job in pharmaceutical and biotechnological industries.

UNIT 1: Analysis of Phytoconstituents

Classification and sources of crude drugs. Identification and extraction of medicinal plants. Secondary metabolites and their importance. Biosynthetic schemes of some important phytoconstituents.

UNIT 2: *In vitro* Screening methods used for herbal drugs

Antimicrobial screening of herbal drugs, Screening for anticancer activity, Screening for antioxidant activity, Screening for antiurolythetic activity.

UNIT 3: *In vivo* Screening methods used for herbal drugs

Screening for anti-inflammation and analgesic activity, Screening for antiulcer activity, Screening for antidiuretic activity, Screening for liver related disorders.

UNIT 4: Drugs from natural origin

Anticancer drugs, Antidiabetic drugs, Antihepatotoxic drugs, Antiulcer and anti-inflammatory drugs.

REFERENCES

1. Bioactive Phytochemicals - V. K. Gupta
2. Handbook of Phytopharmacology - Amritpal Singh Saroya
3. Medicinal Plants Phytochemistry, Pharmacology and Therapeutics (2 vols) - V. K. Gupta, G.D. Singh, Surjeet Singh and A. Kaul
4. Medicinal Plants: Biodiversity and Drugs - M. K. Rai, G A. Cordell, J L. Martinez, M Marinoff, L Rastrelli
5. Modern Phytomedicine – Ahmad Iqbal , AqilFarrukh, Owais Mohammad
6. The Constituents of Medicinal Plants - Andrew Pengelly

7. Herbal medicine: bimolecular & clinical aspects - FF Benzie & SW Galor
8. Quality Control of Herbal Drugs – PK Mukherjee

BOT 423: WATER, SOIL AND DESERTIFICATION

Course Outcome:

CO1: Studies to create awareness among students on destruction of plant species due to degradation of land, forest and habitat.

CO2: Studies on adaptation of plants in harsh environmental conditions. Hands on training to students on propagation of plants in harsh environments and develop stress resistant plant varieties. This helps students to get job in research institutes.

UNIT 1: Water

Physical condition of water in soil and energy concept, Movement of water in soil, Field capacity, evaporation and evapotranspiration, Energy relation in uptake of water by plants.

UNIT 2: Soil – Plant relationships in water availability

Upward movement of water in soil and roots, Optimum depth of free water, Root extension, Water supply and plant behavior, Photosynthesis in relation to transpiration and soil fertility.

UNIT 3: Soil salinity

Soluble salts, Classification of salt affected soils, Excess sodium; physical and nutritional effect, Soil - plant relationship in reference to salinity.

UNIT 4: Desertification

Desertification; cause and control, Plants for conservation of soil and water in arid ecosystem, Ecodevelopment of arid land in India, Restoration of ecosystem.

REFERENCES

1. Water relations of plants by Paul J. Kramer
2. Plants for arid lands by G. E. Wickens, J. R. Goodin& D. V. Field
3. Plants and environment by R. F. Daubenmire
4. The ABC of Soil by Jacob S. Joffe
5. Restoration ecology by William R. Jordan, Michael E. Gilpin and John D. Aber
6. Restoration ecology and sustainable development by Krystyna M. Urbanska, Nigel R. Webb and Peter J. Edwards
7. Ecology by Charles J. Krebs

8. Desertification control by Singh and Kar
9. Fundamental of Ecology by Odum E. P.
10. Fundamentals of soil science by Miller and Charles Ernest

DISSERTATION PROJECT WORK

Dissertation research work is offered to students of Semester III & IV, in which students carry out experiments on the determined project frame under the supervision of the guide. Dissertation commences in the beginning of the third Semester and continues in the fourth semester.