

GUJARAT UNIVERSITY
STRUCTURE OF M. Phil CREDIT SYSTEM IN BOTANY
IMPLEMENTED FROM 2018

| Department | Semester | Course | No. of hours per week | | | | Course credits | |
|----------------------------|----------|--------------------|--|----------|--------|-----------|----------------|-------|
| | | | Name | Lectures | Others | Practical | | Total |
| B O T A N Y | 1 | BOT 601 | RESEARCH METHODOLOGY | 3 | 1 | -- | 4 | 4 |
| | | BOT 602 | RECENT ADVANCES IN BOTANY AND INSTRUMENTATIONS | 3 | 1 | -- | 4 | 4 |
| | | BOT 603 APP | ADVANCED PLANT PHYSIOLOGY | | | | | |
| | | BOT 603 APE | ADVANCED PLANT ECOLOGY | 3 | 1 | -- | 4 | 4 |
| | | BOT 603 PBM | PLANT BIODIVERSITY AND ITS MANAGEMENT | | | | | |
| | | BOT 604 | SEMINAR, FIELD WORK & REVIEW | 3 | 1 | -- | 4 | 4 |
| | 2 | BOT605 | DISSERTATION | -- | -- | 8 | 8 | 8 |
| | | | Total | 12 | 4 | 8 | 24 | 24 |

Department of Botany, Bioinformatics, Climate Change Impacts Management
Syllabus for M.Phil. in Botany
W.E.F 2018-19
Course Structure for M.Phil

BOT 601: Research methodology

Unit I Laboratory Techniques

- Basic principles of safety in a laboratory, Health and safety: general safety, Chemicals-routine, reactive and toxic, care of handling and safety, burns in a lab and fire safety, Electric, UV and Radiation protection, Hazards-biological, Physical, chemical, precautions, disposal of chemicals and hazardous material.
- Basic laboratory procedures: distillation, drying, solvent extraction, preparing standard solutions, percent -ppm-molar solutions, buffer solutions and pH, Cleaning glasswares, storing reagents, keeping stock of chemicals and glasswares.
- Use and care of Laboratory instruments, equipments, microscopes, computers, printers etc.
- Making and recording measurements, SI units and their use, Scientific method (Accuracy, Precision, comparison correlation and regression).

Unit II Information Technology

- Information technology and library resources: The Internet and World Wide Web, internet resources for Botany using spreadsheets. Word processors, database and other packages.
- Finding and citing information, Online tools, Research ethics: Falsification and fabrication of data, Plagiarism, IPR,
- Biological collections -The Convention on Biological Diversity,(1992), Biodiversity Act (2002), National Biodiversity Authority, guidelines for biological collections.
- Databases and their responsible use: NCBI, Biodiversity databases.

Unit III Research Design

- Research problem: meaning of research problems, sources of research problems.Criteria / characteristics of good research problem, errors in selecting a research problem ;
- Types of research: Qualitative -exploratory research and Quantitative -conclusive descriptive and casual research,Data collection-primary and secondary data,surveys and experimentation,
- Communicating information : General aspects of scientific writing, Reporting practical and practical work, writing literature surveys and reviews, organizing a poster display,Research Report: Format of research proposal, Format of the research report, style of writing the report, references and bibliography writing essays, Online tools meant for citation, correct usage of technical language and scientific peer network, and Presentations, print and online journals, ISSN, ISBN, H-index, impact factor, ResearchGate, Scopus, Google Scholar, etc

- Presentation skills: Effective oral scientific communication to specialized audiences, including peer groups, as well as general audiences such as students, the general population and policy makers.

Unit IV Statistics in research methodology

- Sample and population, measures of central tendency, measures of dispersion and variability. Standard deviation, Standard error, Quality assurance and quality control, errors - types of errors, Data analysis, Distributions, summary statistics,
- Hypothesis testing: One sample, two sample, paired sample and multiple sample hypothesis. Statistical analysis. Testing of hypothesis,
- Probability- definition, various events in probability, laws, Bayes' Theorem.
- Regression and correlation: Simple linear correlation and linear regression, multiple regression, significance of p, coefficient of determination and correlation coefficient. Use of t-test, chi-square test and F-statistics, Analysis of Variance - ANOVA, use of computer in statistical analysis, SPSS, confidence limits,

References

1. Research Methodology. Methods and Techniques C. R. Kothari

BOT 602: RECENT ADVANCES IN BOTANY & INSTRUMENTATION

UNIT — 1: PLANT MORPHOLOGY AND PLANT EMBRYOLOGY

- Plant morphology and internal structure, quantitative description (morphometrics). Developmental origin of plant organs, morphospace and constraints on variation. Developmental, biomechanical and comparative evolutionary analysis of structural diversity.
- Agamospermy: Apomeiosis, Parthenogenesis, Autonomous & pseudogamous endosperm development. Zygotic embryogenesis - Maternal to Zygotic Transition, Cell Polarity, Patterning.
- Phenomics: Plant phenotyping technologies, Plant growth analysis, Phenomic tools, Imaging and Image analysis, Applications of modelling to plant phenotyping.
- Molecular genetics of plant development: Approaches to study plant development, generation of Mutants - Random mutagenesis, random Insertional mutagenesis, genome-wide mutagenesis, targeted mutagenesis, T-DNA based, transposon based, RNAi / artificial miRNA based, CRISPR-Cas based genome editing. Analysis of Mutants and case studies: Mutants of leaf development, shoot development, root development, flower and fruit development.

UNIT — 2: CYTOCHEMISTRY AND GENETICS

- Microscopy -Light, Phase contrast, Fluorescence, polarizing and Electron. Microscopy (TEM, SEM, AFM),
- Cellular measurements, micrometry, camera lucida application, Cytochemical methods –principle of staining for DNA, RNA, Proteins, Lipids, Insoluble Polysaccharides.
- Cytrophotometer -Components, Principle and applications
- Centrifugation : differential, density gradient and ultracentrifugation, Principle and application

- Spectrophotometric methods,-Infra Red, UV, Visible, Fluorescence, Principle and application

UNIT 3 SEPARATION METHODS

- Electrophoresis: Principle, types, PAGE, SDS-PAGE, PFGE, IEF, technique and application.
- Chromatography: Principle, types, TLC, GLC, HPLC, HPTLC, GC-MS technique and application.
- DNA isolation, purification and quantification, ISH, FISH, GISH, Karyotyping,
- Protein isolation, purification and quantification

UNIT — 4: GENETIC ENGINEERING

- Bioenergetics and Cellular Homeostasis: Concept of Energy, Thermodynamic Principles and Classification of Energy rich Compounds.
- Chromosomal Aberrations, Polyploidy, Chimeric DNA.
- Genetic Engineering: Procedure, Gene-Shotgun method, Cloning, Application of Genetic Engineering, Renewable Energy System: Biomass based Energy, Non conventional renewable sources.
- Bio-remediation of Hazards.

BOT — 603 APP: ADVANCED PLANT PHYSIOLOGY

UNIT — 1: GROWTH AND DEVELOPMENT

- Seed germination and Dormancy, Growth and development, Flowering, Growth correlations, Methods of growth analysis,
- Factors Effecting growth and development. Growth modifications as influenced by environmental factors. Senescence and Abscission.
- Abiotic stress signal transduction pathways. Hormonal regulation of abiotic stress tolerance, Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanisms of resistance to biotic stress and tolerance to abiotic stress
- Reactive oxygen species- production, anti-oxidative mechanisms, physiological implications. Nitric oxide as a signaling molecule in stress and normal growth and development. PTMs of Nitric oxide. ROS-NO crosstalk

UNIT — 2: PLANT GROWTH REGULATORS

- Natural plant hormones: Biosynthesis, Distribution, Translocation, Bioassay, Physiological effects and Mechanisms of action: Auxins, Gibberellins, Cytokinins, Abscisic acid, Ethylene.
- PGRs Structure and function: Brassinoids, Jasmonic acid, Polyamines and Phenols and their uses
- Growth retarding Chemicals: Cycocel, Maleic Hydrazide and Morphactins, structure, function and uses.
- Secondary Metabolites: Alkaloids, Flavonoids, Saponins, Glycosides — Structure, biosynthesis and role in plants.

UNIT — 3: APPLIED PLANT PHYSIOLOGY

- Applications of Plant Physiology in Agriculture, Horticulture and Forestry for improved production,
- Applications of Post-harvest physiology of agricultural and horticulture produce to minimize losses,
- Physiological aspects of rooting, cutting, grafting, layering and propagation by bulbs. Landscape Gardening, Bonsai,
- Green House technology – types, advantages, applications, Green house technology in India and Gujarat

UNIT — 4: BIOTECHNOLOGY

- Plant Tissue Culture — Media, Essential requirements, Types of culture.
 - Large scale multiplication Micro propagation, Somatic embryogenesis, Soma clonal variations, in vitro haploid production, Protoplast fusion.
 - Plant improvement, Germplasm storage, Cryopreservation, GSBTM-mandate and activities,
 - Transgenic plants, Bio-safety and Achievements in Crop Biotechnology, Secondary metabolites.
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BOT 603 APE: ADVANCED PLANT ECOLOGY

UNIT — 1: ECOSYSTEMS

- Structure of an ecosystem, Kinds of ecosystems-terrestrial, aquatic: fresh water, marine, estuarine, Fragile, Threats, degradation, Productivity of an ecosystem.
- Abiotic Factors: Light Factors, Temperature, Precipitation, Humidity, Wind and Microclimate.
- Biotic Factors: Relationships among organisms. Positive interactions, Negative interactions.
- Energy flow in an ecosystem, Ecological Pyramids, Food Chains, Food webs, Ecological Energetic, Energy Flow in Ecosystem

UNIT — 2 PLANT INTERACTIONS

- Autecology, Liebig's Law of minimum, Shelford's Law of Tolerance, Combined concept of Limiting Factors, Population ecology
- Synecology, Ecological Niche, Community ecology
- Ecological Concept of Species and Individuals: Genecology,
- Competition, Mutualism-Mycorrhiza, Herbivory

UNIT — 3 PHYTOGEOGRAPHY

- Phytogeographic regions of the world-Boreal, Palaetropical, Neotropical, South African, Australian and Antarctic; Phytogeographical regions of India- Deccan, Malabar, Indus Plain, Gangetic Plain, Assam, Eastern Himalayas, Central Himalayas, Western Himalayas; Major Plant Community of the World and India,
- Soil, Climate and Vegetation of Gujarat and India
- Forests of India and Gujarat, Allelopathy, The Continental Drift Theory, Endemism.

- Biodiversity Hot spots in India, Biodiversity Heritage sites, NBA, GBB - mandate, activities

UNIT — 4 PRESERVING ECOLOGY

- Forest: Reserve forest, Chipko movement, Forest conservation Law. India's Forest cover, Deforestation, Social Forestry, Agroforestry,
 - Wetlands in India and Gujarat, Threats and opportunities, Mangroves in Gujarat and India, ICZM projects,
 - Environmental Monitoring (Bioindicators), Environmental Impact Assessment, Environmental Projects in Gujarat – Case study.
 - Conservation strategies, Sacred grooves, Sanctuary, Biosphere reserves, ecotourism etc.
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BOT 603 PBM: PLANT BIODIVERSITY AND ITS MANAGEMENT

UNIT – 1 PLANT BIODIVERSITY

- Plant - forms, characteristics, systems of classification.
- Biodiversity - levels, origin, importance, Biodiversity of Gujarat, India, Share in global biodiversity, endemic and threatened forms.
- Protected areas, action plan, management, succession, WWF, GBIF.
- Mapping biodiversity with GIS, documenting biodiversity,

UNIT – 2 CONSERVATION OF BIODIVERSITY

- Biodiversity - threats, issues in agriculture and food security.
- Conservation - need, strategies, global and national programmes, biotechnological approaches.
- Hot spots, sacred grooves, JFM, Chipko movement, other important case studies.
- Government initiatives – Role of NBA, GBB, in conserving Biodiversity.

UNIT - 3 MONITORING BIODIVERSITY

- Remote Sensing: components of Remote Sensing, sensors, Role of Remote sensing in monitoring biodiversity in India and Gujarat, Studies at SAC -ISRO and BISAG
- Biodiversity - sampling techniques, methods of quantification, inventorization, mapping, molecular approaches.
- Plant documentation, herbarium, e-herbarium, and computer based identification, Ethnobotanical studies - methods, role, patenting, important workers.
- Biodiversity bill (2002), Missions, Boards, Global efforts, CBD, IPR.

UNIT – 4 BIOSAFETY AND BIOETHICS

- CBD, Cartagena Protocol, Nagoya Protocol, COP, Aichi Biodiversity Targets, National Biodiversity Strategies & Action Plans (NBSAP),
- Sustainability, organic cultivation, equitable sharing case studies.
- Bio prospecting, biosafety, biopiracy, CITES.

- Capacity building, organization — institutions working in the field — their goals, important issues, Education, awareness, strategies, magazines — journals —newsletters

BOT 604 - Seminar, Field work & Review Writing

1. **Seminar:** Seminar to be delivered on relevant theme.
2. **Field Work: Visit** to industry/National institutes and interaction with experts - Report to be submitted.
3. **Review:** Preparation and submission of review article based on research papers addressing a contemporary research problem.
4. **Professional Development Activities:** Attending National / International workshop / Symposium / Conferences or participation for oral / poster presentation, interaction with M.Sc. students for problem solving.

BOT 605 - Dissertation

Dissertation — Guidelines

- i. **Maximum Marks: 100**
 - ii. Each student has to carry out dissertation work under the supervision of a faculty of the department.
 - iii. The dissertation has to be carried out in the department.
 - iv. The topics of the dissertation can be selected from any of the three branches of Botany ie. Advanced Plant Physiology, Advanced Plant Ecology or Plant Biodiversity and its Management.
 - v. Each student has to submit a dissertation on the topic of their study comprising of
 - a) An introduction on the topic along with literature survey and justification for the selection of the topic
 - b) Materials and methods
 - c) Results and discussion
 - d) Summary
 - e) References
 - vi. Each student has to give a midterm presentation of their work at the department.
 - vii. Dissertation exam would be led by the supervising teacher and external examiner.
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