

## **1. M.Phil. (Botany): Courses**

**(MP- 01): Microbiology and Industrial Biotechnology**

**(MP- 02): Medicinal and Aromatic Plants**

**(MP- 03): Applied Phycology**

**(MP- 04): Physiology of Stress in Plants**

**(MP- 05): Environmental Issues and Policies**

**(MP- 06): Advance Mycology and Plant Pathology**

**(MP- 07): Plant Cell, Tissue and Organ Culture**

**(MP-004): Research Methodology and Computer Applications (common for Pre-Ph.D. course of Life Science Departments)**

**(MP-005): Advanced Botany**

## **M.Phil. BOTANY**

**Teaching hours: 50**

### **Course (MP- 01): Microbiology and Industrial Biotechnology**

1. Bioconversion of agricultural crop residues and garbage by microbes for the production of alcohol and biogas.
2. Antimicrobial drugs and their mechanisms of action; drug resistance, overcoming drug resistance.
3. Immunotechnology: Antibody engineering, modern methods of vaccine development.
4. Phylloplane microbiota: use in biological control of pathogens and pollution management.
5. Rhizosphere and rhizosphere technology for managing soil- borne plant pathogens; Microbial fuel cells.
6. Methods of microbial strain improvement.
7. Biotransformation through microbes.
8. Recombinant DNA technology for improvement of antibiotics and selected industrial products.
9. Bioreactors- types and applications.
10. Rhizobial technology for crop improvement: molecular methods and applications.

## M.Phil. BOTANY

Teaching hours: 50

### Course (MP- 02): Medicinal and Aromatic Plants

1. **Medicinal Plants:** Origin, Evolution and Cultivation methods of medicinal plants (*Aloe, Withania, Plantago, Centella, Andrographis, Convolvulus, Ocimum* and *Curcuma*).
2. General methods for the extraction of herbal drugs, processing and analytical profile, stability, preservation and evaluation of extracts.
3. Extraction, isolation, purification and estimation of following phyto-constituents i.e. alkaloids, glycosides, resins, essential oils, terpenoids, fixed oils, carbohydrates, fats, tannins, steroids, pectins, etc. from natural drugs.
4. **Aromatic plants:** Studies on botanical features, Chemical constituents and Cultivation methods of *Mentha, Coriandrum, Ocimum, Geranium, Cymbopogon, Citronella, Cuminum, Syzygium, Eucalyptus, Cardamomum*.

**Aromatherapy:** Various oils used in Aromatherapy with their Significance.

**Ethnobotany:** Scope, interdisciplinary approaches. Ethnomedicine and Botanicals of *Adhatoda vasica, Asparagus racemosus, Argemone mexicana, Boerhaavia diffusa, Hollarhina antidysenterica, Tinospora cordifolia Terminalia arjuna, Terminalia bellerica, Terminalia chebula, Pterocarpus marsupium, Eclipta prostrata, Withania sominifera, Rauwolfia serpentina,*

5. **Techniques:** Application of various chromatographic techniques i.e. Paper chromatography, TLC, HPTLC, HPLC, GLC, GC-MS for the standardization of plant extracts.

## **M.Phil. BOTANY**

**Teaching hours: 50**

### **Course (MP-03): Applied Phycology**

This module will give students a comprehensive view of algal origin, diversity, thallus structure, biology, reproduction and their biotechnological uses.

1. Salient features of prokaryotic and eukaryotic algae, diversity in thallus structure, reproduction and life cycle patterns
2. Biodiversity and ecological aspects of algae, algal habitats, algal growth and blooms. Algal photosynthetic pigments, food reserves and flagellation
3. Algal classification, relationships within different algal groups and other plants. Algal natural products (Exopolysaccharides, proteins, phycobilins, carotenoids, scytonemin and lipids), their extraction and uses
4. Isolation, purification, development of unialgal cultures and culturing of microalgae (*Spirulina* and *Chlorella*), algal cultivation in photobioreactor and raceway ponds
5. Biotechnological application of algae, algae as food, feed, colouring agents, use of algae in CO<sub>2</sub> sequestration, biomining and phycoremediation of waste water, as biofertilizer and source of energy (biofuel) and development of algal based entrepreneurs

## **M.Phil. BOTANY**

**Teaching hours: 50**

### **Course (MP- 04): Physiology of Stress in Plants**

1. Types of Stress- Abiotic (Including pollutants) and Biotic. Alterations in physiology of plants due to the enlisted stress and their mechanisms to combat:

a) Stress due to prolonged sun light & UV, mechanism of resistance to UV e.g. through induction of pigment synthesis, plant repair enzymes

Stress due to chilling, mechanism of resistance

Stress due to high temperature, mechanism of avoidance and reduction

b) Stress due to water – Plants and water, chemical & water potential gradients, transpiration, mechanism of opening & closing, antitranspirants, Effect of water stress on accumulation of proline and betaines and their possible role in osmotic adjustment under such conditions. Drought tolerance/resistance mechanism, Screening methods for water stress tolerant varieties.

Availability of soil water & determination of soil water potential, Mechanism of plant resistance to water logging.

Stress due to salinity and sodicity, mechanism of salt tolerance in higher plants, achievements in increasing plant sustenance to salinity

2. Mechanism of plant resistance to nutrient deficiency stress

3. Elementary idea of mechanism of plant resistance to aluminium and heavy metal toxicity, Phytoremediation

4. Elementary idea of mechanism of interaction of plants with other plants (Allelopathy).

5. Stress associated proteins.

6. Oxidative stress, stress markers, mechanism of stress resistance.

## **M.Phil. BOTANY**

**Teaching hours: 50**

### **Course (MP- 05): Environmental Issues and Policies**

1. Global Change: Global land cover and land use change; Multiple impacts of land use change; Causes, effects and mitigation strategies for global climate change and stratospheric ozone loss
2. Biotic Invasions: Extent and mechanisms of biological invasions; Ecological and economic impacts; Management strategies
3. Loss of Biodiversity: Threats and pattern of biodiversity loss; Natural and anthropogenic causes; IUCN threat categories, Red data books; Conservation and restoration of biodiversity
4. Environmental Pollution: Causes and effects of air, water, soil, noise, radioactive pollution; Basic pollution abatement practices and technologies
5. Global Water Crisis: Distribution, withdrawal and consumption patterns; Causes and effects of water crisis; Water conservation approaches
6. Global Energy Crisis: Sources of energy supply; Current potential and future prospects of energy sources; Energy crisis; Energy conservation strategies
7. Challenges of Urbanization: Trends of urbanization; Environmental impact of urbanization; Concept of green cities
8. National Policies on Environment: National Forest Policy; National Water Policy; National Energy Policy; National Action Plan on Climate Change; National Biodiversity Action Plan

#### **Suggested Readings:**

1. McConnell, R. (2008) Environmental issues: An introduction to sustainability. Pearson.
2. Wali, M.K., Fatih Evrendilek, M. Siobhan Fennessy (2009) The environment: science: Issues and solutions. CRC Press.
3. Neelin, J. (2011) Climate change and climate modelling. Cambridge University Press.
4. John Marshall, R. Alan Plumb (2008) Atmosphere, ocean and climate dynamics: An introductory text. Elsevier
5. Phillips, B., D. Thomas, A. Fothergill, L. Blinn-Pike (2009) Social vulnerability to disasters. CRC Press.
6. Hill, M. (2010) Understanding environmental pollution. Cambridge University Press.

## **M.Phil. BOTANY**

**Teaching hours: 50**

### **Course (MP- 06): Advance Mycology and Plant Pathology**

1. Current trends in the classification of the Fungi
2. Current trends in the classification of Bacteria
3. Modern molecular tools for disease diagnosis
4. Emerging and re-emerging viral diseases of plants
5. Significance of seed borne diseases
6. Plant quarantine
7. Host -pathogen interaction, current molecular approaches
8. Biological control of soil borne plant diseases
9. Biological control of foliar plant diseases
10. Genomic analysis of host-pathogen interaction

## **M.Phil. BOTANY**

**Teaching hours: 50**

### **Course (MP- 07): Plant Cell, Tissue and Organ Culture**

1. Techniques of organ, tissue, free cell and protoplast culture.

Methods of preparation and sterilization of tissue and culture media.

Aspects of nutrition of plant tissue and organ cultures.

*In vitro* culture and application of the following:

organ cultures- Apical meristem, Anther and pollen, pathways of androgenesis, Ovary, ovule and embryo

2. Somatic hybridization and its application in crop improvement

Totipotency of free angiosperm cell and the significance of free cell culture

Growth, differentiation and organogenesis in plant tissue and organ culture,

Data analysis and Cost benefit analysis

Somaclones and induced variations

Gene delivery systems and role of transgenes in crop improvement with special emphasis on stress resistance and male sterility and restoration

Industrial production of secondary metabolites from callus

## **M.Phil. BOTANY**

**Teaching hours: 50**

### **Course (MP-004): Research Methodology & Computer Applications**

This course is common for doctoral research students of all the subjects in Science faculty. The objective of the course is to acquaint research student with scientific research methods and approaches.

#### **UNIT 1**

Basic principles of research, objectives of research, importance, types of research: basic and applied, Selection of a research topic and problem, assessment of current status of topic chosen, literature survey and reference collection, formulation of hypothesis, research designs, sampling designs, ethics in research, code of ethics fabrication of data, plagiarism, Biosafety regulations in biological research.

#### **UNIT 2**

Types and sources of data, data collection methods, primary data, secondary data, analysis for specific type of data, tabulation and graphical representation, central tendency, dispersion, skewness, correlation, regression, chi-square test, t- and F-tests, ANOVA- One way and two way, Important non-parametric tests- Sign, Run, Kendall's coefficient.

#### **UNIT 3**

Significance of report writing, different steps in writing report and research papers, layout of the research report, oral and written presentation of research (Abstract/Synopsis), mechanics of writing research reports, Precautions in writing research reports, conclusions, Impact factor and Citation index.

#### **UNIT 4**

Computer and Internet: Networking, different WAN and LAN connections, Connection to a network, Web Browsers, Internet security, Web Search Engine, MS Word, Handling graphics, tables and charts, Converting a word document to various formats like- text, rich text, word perfect, html, pdf, etc. MS Power Point: creating slide show with animations, creating a blank presentation, auto layout with power point screen, screen lay out and views, insert a new slide, applying design template, changing slide layout, reordering and hiding slides, slide show and editing, custom slides,

#### **UNIT 5**

Data analysis and display: Facilities in MS Excel for data analysis and display, other data display softwares, case study: origin, software for scientific and statistical analysis, case studies, SPSS database and creating a database.

Educational and research resources on Net: Encyclopaedia, case study: Wikipedia, online tutorials and lectures, Java Applets, Educational Applet, Virtual labs, Electronic journals, e-books, digital libraries, searching research information using J-gate and SCOPUS, Science Direct.

**References:**

Research Methodology: Methods and Techniques by C.R. Kothari, Second revised edition

Research Methodology: A step by step guide for beginners by Ranjit Kumar

Research methodology: Methods and Statistical techniques, by Santosh Gupta

Statistical Methods, by S.P. Gupta

Research Design, Qualitative, Quantitative and mixed method approaches, by W. Creswell, 3<sup>rd</sup> edition.

Information Communication Technology, by Tim Shorts

Handbook of Communication and Social Interaction Skills, by John O. Green, Brant Raney Burlison.

# **M.Phil. BOTANY**

**Teaching hours: 50**

## **Course (MP-005): Advanced Botany**

### UNIT-I

Principles of Microscopy (light, phase-contrast and fluorescence), Electron Microscopy, AFM, Atomic absorption spectrophotometry, Microtomy, Chromatography, Electrophoresis; Immunological methods, Plant tissue culture techniques, Microbial culture techniques.

### UNIT-II

Structure and reproduction of Algae, Fungi, Bryophyte, Pteridophyte and Gymnosperms; Modern trends in taxonomy of plants; Plant resource utilization (important medicinal plants, fibres, spices and condiments); Conservation of plants (ex situ and in situ).

### UNIT-III

Production of alcohol and biogas, Biofertilizers (Mycorrhizae, Algal farming), Microbial fuel cells, SCP (Algae, Fungi); Biodeterioration of paper, historical monuments and textile; Host-pathogen interaction, Plant disease forecasting; Biocontrol of plant pathogens and transgenics; How plants defend themselves against plant pathogens?

### UNIT-IV

Prokaryotic and Eukaryotic genomes, Molecular clock; Cell signaling; Isolation, identification and uses of secondary metabolites; Functions of Plant growth regulators; Stress physiological adaptations in plants, Molecular farming.

### UNIT-V

Basics of Nanotechnology: ethical, legal, social and environmental issues; Genetic engineering and Recombinant DNA technology; Cloning vectors, gene delivery systems and role of transgenics in crop improvement; Application of Plant tissue culture.