



**GULBARGA UNIVERSITY**  
**DEPARTMENT OF BOTANY**

**M Sc BOTANY**  
**CHOICE BASED CREDIT SYSTEM (CBCS)**

**SEMESTER SYLLABUS**  
**&**  
**SCHEME OF INSTRUCTION/EVALUATION**

***(W E F ACADEMIC YEAR 2017-18 ONWARDS)***

**MARCH 2017**

## **PREAMBLE**

*Botany- the Plant Science today is a fusion of the traditional components with the modern aspects of molecular biology and biotechnology. Over the years, botany has shown enormous gain in information and applications owing to tremendous inputs from research in all its aspects. The plant biologists, with global recognition of the need for conservation, have contributed significantly in assessing plant diversity. The plant taxonomists have explored newer dimensions for the classification of plants. In recent years new insights have been gained in functional and structural aspects of plant development by utilizing novel tools and techniques for botanical researches. The challenging areas of teaching and research have emerged today in many areas of botany. The Department of Post-Graduate Studies and Research in Botany established after the foundation of Gulbarga University, Kalaburagi in fulfillment of the long-standing needs and aspirations of the people of Hyderabad Karnataka aims in achieving academic excellence in its innovative teaching and research programs diversifying into emerging and interdisciplinary areas of Plant Sciences. Further it is essential for the postgraduate students to acquaint themselves with various tools and techniques for exploring the world of plants up to the subcellular level. A revision of the curriculum, keeping in view both the advances in the subject area and the students of this region will have the benefit of a balanced course structure taking care of different aspects of plant science, namely plant diversity, physiology, biochemistry, molecular biology, reproduction, anatomy, taxonomy, ecology, economic botany and environmental botany. All these aspects have been carefully crafted and spread over four semesters. The present course curriculum is proposed to provide an opportunity to the students to engage themselves with the learning of modern theories, tools and techniques in plant sciences; further applied courses have also been incorporated keeping in mind employment potential. These courses shall provide the botany students hands on experience and professional inputs. The present curriculum, on the whole, is a source of lot of information and is supported by rich resource materials. It is hoped that a student graduating in botany with the new curriculum will be a complete botanist at postgraduate level. The well organized curricula including basic as well as advanced concepts in the plant sciences shall inspire the students for pursuing higher studies in botany with greater employability for becoming an excellent academician, researcher and an entrepreneur.*

The M Sc in Botany is a two-year course spread over four semesters comprising theory and practicals. The eligibility, intake, attendance and examination are governed by the university course regulations.

### COURSE STRUCTURE: M SC BOTANY

<b>MASTER OF SCIENCE (M SC) BOTANY: SEMESTER CBCS &amp; CAGP SCHEME</b>				
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<b>IV- Semester</b>				
<b>Hard Core</b>				
HCT 4.1	Plant Pathology and Plant Protection	4:0:0		4
HCT 4.2	Plant Breeding and Plant Biotechnology	4:0:0		4
<b>Soft Core(Any One)</b>				
SCT 4.3.1	Applied Mycology	4:0:0		4
SCT 4.3.2	Applied Phycology			
<b>Practicals</b>				
HCP 4.4	Plant Pathology and Plant Protection	0:0:2		2
HCP 4.5	Plant Breeding and Plant Biotechnology	0:0:2		2
SCP 4.6.1	Applied Mycology	0:0:2		2
SCP 4.6.2	Applied Phycology			
HMP 4.7	Hardcore Major Project	0:0:6		6
<b>Total for Fourth Semester</b>				<b>24</b>

Lecture (L): Tutorial (T): Practical/Practice (P)

*Note: A Compulsory Botanical Study Tour shall be undertaken by the students at the end of the M Sc First*

*Semester*

**M Sc BOTANY: SEMESTER-IV: CBCS-CAGP SCHEME OF INSTRUCTION/EVALUATION**

Sem	Course	Paper	L:T:P	Credits	Teaching hrs/Week	Int Assessment		Semester Exam		Total Marks
						Duration hrs	Marks	Duration hrs	Marks	
IV	BOT:HCT 4.1	Plant Pathology and Plant Protection	4:0:0	4	4	1	20	3	80	100
	BOT:HCT 4.2	Plant Breeding and Plant Biotechnology	4:0:0	4	4	1	20	3	80	100
	BOT:SCT 4.3.1 BOT:SCT 4.3.2	Applied Mycology Applied Phycology	4:0:0	4	4	1	20	3	80	100
	BOT: HCP 4.4	Plant Pathology and Plant Protection	0:0:2	2	4	1	10	3	40	50
	BOT: HCP4.5	Plant Breeding and Plant Biotechnology	0:0:2	2	4	1	10	3	40	50
	BOT: SCP 4.6.1 BOT: SCP 4.6.2	Applied Mycology Applied Phycology	0:0:2	2	4	1	10	3	40	50
	BOT:HMP 4.7	Hardcore Major Project	0:0:6	6	6	-	30	PR viva	90 30	150

**BOT: HCT. 4.1 PLANT PATHOLOGY AND PLANT PROTECTION**

***Preamble***

*This paper deals with the study of plant diseases caused by fungi, bacteria and viruses and their control measures. The students would learn epidemiology, genetics of host-pathogen interaction, defense mechanism, aerobiology in diseases assessment, tools used in epidemiology, different methods of disease control, seed borne and storage diseases.*

**Unit-I**

[16 hrs]

History and development of Plant Pathology; Disease concept in plants: Disease classification, causal factors-biotic and abiotic; Disease diagnosis, Koch's postulates; Defense mechanism in plants- Structural and Biochemical; Genetics of host-Interaction, Molecular aspects of host pathogen interactions-PR proteins, degradation of phytoalexins, systemic resistance mechanism; Pathogenesis related proteins (PRPs), Coat protein mediated resistance (CPMR) and antisense genes and gene silencing; Candidate genes to combat microbial pathogens and antifungal proteins(Ribosome inactivating proteins-RIPs); Gene to gene and polygene hypotheses; Immune and hypersensitive reactions

**Unit-II**

[16 hrs]

Epidemiology: Traditional and modern concepts of disease triangle and tetrahedron; Role of host, pathogen and environment in plant disease development; Aerobiology in relation to epidemiology; Methods of assessment of disease incidence, disease severity and estimation of yield loss; New tools in epidemiology- GIS, remote sensing, Image analysis, Information technology in Plant Pathology: Plant disease clinics, use of database and application of bioinformatics in plant pathology.

**Unit-III**

[16 hrs]

Seed Pathology: Seed borne and storage fungi; Mechanism of seed transmission and entry point of seed infection; Seed borne bacteria and viruses; Seed borne diseases and their management; Diseases of locally important crop plants- Jawar, Bajra, Wheat, Rice, Red gram, Green gram, Grapes, Papaya, Sugar cane, Groundnut, Banana, Tomato, Chili and their management; Post harvest diseases and management of plant products of the aforesaid crops

**Unit-IV**

[16 hrs]

**Plant disease control:** Regulatory Methods: Plant quarantine regulation, inspection and certification. Physical Methods: Heat and cold treatment- hot water, hot air, radiation treatments; Cultural Methods: Crop rotation, Flooding, Solarization, trap crops; Chemical Methods: Classification of fungicides, chemical nature, mode of action and methods of application of the following- Sulphur fungicides, Copper fungicides, Mercurial compounds, Quinones, Heterocyclic compounds, Oxanthiins, Benzimidazole, Miscellaneous fungicides and Prophylactants; Methods of fungicide application; Seed and soil treatment; Control of post harvest diseases; Biological Methods: Use of antagonistic microorganisms in plant disease control; VAM fungi in control of soil borne diseases, cross protection; Molecular approach in improving biocontrol agents; Integrated disease management- General account, importance and basic principles

[64 hrs]

**References**

1. Plant Pathology: Agrios G N (4<sup>th</sup> Edn, Academic, USA 1997).
2. Diseases and plant population biology: Burdon (Cambridge Univ Press)
3. Plant disease epidemiology: Nagarajan (Oxford & IBH, New Delhi 1983).
4. Population of plant pathogen: Wolfe M S and Caten C E (Black Well, Oxford 1987).
5. Innovative approaches to plant disease control: Ilan Chet (Wiley Inter Science NY 1987)
6. Fungal spores, their liberation and dispersal: Ingold C T (Oxford Univ Press 1971)
7. Principle of diagnostic techniques in plant pathology: Fox. R T V (CABI, 1993).
8. Diseases of crop plants in India: Rangaswamy G (Prentice Hall, New Delhi, 1979).
9. Introduction to principles of plant pathology: Singh R S (Oxford & IBH New Delhi)
10. An introduction to plant diseases: Wheeler (John Wiley & Sons, UK. 1972).
11. Information technology, plant pathology and biodiversity: Bridge, P., Jeffriens, P. and Morse, D.R (CAB international, 1998)
12. Applications of PCR in mycology: Bridge, P.D., Arora, D.K., Reddy, C.A. & Elander, R.P (1998)
13. Molecular Plant Pathology, Vol. I & II: Gurr, S.J. & Mc. Pherson, M.J. & Bowles, D.J. (Oxford 1992)
14. Crop diseases and their management: V.S. Pundhi (BPB Pubs, Delhi)
15. Fungal plant pathogens: Charles Lane, Paul Beales, Kevin Hughes (CABI, 2012)

## **BOT: HCT. 4.2 PLANT BREEDING AND PLANT BIOTECHNOLOGY**

### **Preamble**

*The paper concerns plant breeding and plant biotechnology dealing with history and development of plant breeding, plant tissue culture, protoplast culture and somatic hybridization. The students exposed to this paper would be familiar with plant breeding techniques, concept of totipotency, cell lines, germplasm conservation, somaclonal variations- chromosomal and genetic basis, general applications of plant cell, tissue and organ cultures.*

### **Unit-I** [16 hrs]

History of plant breeding; Objectives of plant breeding; Plant breeding techniques- breeding methods in self pollinated, cross pollinated, vegetatively propagated and apomictic plants; Evolution in crop plants and centers of crop origin; .Selection and hybridization; Backcross method of breeding and their merits and demerits.

### **Unit-II** [16 hrs]

Inbreeding depression: Role of heterosis and hybrid vigour in plant breeding; Somaclonal variation in crop improvement; RFLP in plant breeding; Introduction to the principles, techniques, and facilities used for propagation of crop and ornamental plants; Seed propagation, cuttings, grafting, budding, division, layering and tissue cultures.

### **Unit-III** [16 hrs]

History and development of plant tissue culture; Concept of totipotency; Role of Auxins and Cytokinins; Concept of cellular totipotency; Totipotency of cell differentiation, de-differentiation callogenesis and organogenesis; Clonal propagation- Multiplication by apical axillary, adventitious shoots, rooting and acclimatization of plants transferred to soils; Organ Culture: Meristem culture; Haploid culture: Anther and pollen culture pathways.

### **Unit-IV** [16 hrs]

Protoplast culture and Somatic hybridization: Isolation, purification and culture of protoplasts; Somatic hybridization; Somatic embryogenesis and factors effecting somatic embryogenesis; Techniques of selecting cell lines; Bioreactors- Concept, types and use in plant cell cultures; Germplasm conservation; Cryopreservation; Somaclonal variations- chromosomal and genetic basis; General applications of plant cell, tissue and organ cultures.

[64 hrs]

### **References**

1. Plant propagation- Principles and practices: Hartmann, Kester, Davies, and Geneve (2011)
2. Principles of plant breeding: Robert Wayne Allard (John Wiley & Sons 1999)
3. Principles and procedures of plant breeding-Biotechnological and conventional approaches: Chahal G S and Gosal S S
4. Plant breeding principles and methods: Singh B D Ludhiana (Kalyani Pubs, New Delhi 1983)
5. Principles of gene manipulation- An introduction to genetic engineering: Bold R W and Primerose S B (Black Well, London)

6. Introduction to plant biotechnology: Chawla H S (Oxford & IBH, New Delhi 2000).
7. Plant Cell Culture – A practical approach: Dixan and Ganzales RA (Oxford Univ Press NY 1994).
8. Hand Book of Plant Cell Culture vol.-I: Evans *et al.* (Macmillan, New York 1983).
9. Plant cell, tissue and organ culture- Fundamental method: Gambarg O L and Phillips (Naraosa, New Delhi.1996)
10. Applied and Fundamental Aspects of Plant cell, tissue and organ culture: Reinert J and Bajaj Y P S (Narosa, New Delhi 1988).
11. Cell culture and somatic cell genetics of plants vol.-II: Vasil I K (Academic, New York 1985).
12. Genome analysis-A laboratory manual vol-I: Birren *et al.* (Panima, New Delhi/Blore).

### **BOT: SCT. 4.3.1 APPLIED MYCOLOGY**

#### ***Preamble***

*This paper deals with the study on fungi and their role in agriculture, industry, pharmaceuticals and environment. The paper has been designed for students who are well versed in basic botany and planning to enter in specialization. Fungal biotechnology is one of the emerging areas with lots of scope and opportunities in research and teaching. The student would know that fungi are not only important in causing diseases but also useful in human welfares.*

#### **Unit –I**

[16 hrs]

Fungal diversity in different ecosystems and succession: Effect of environment and substrate on fungal growth; Fungal classification; Structure and composition of fungal cell and mycelia reproduction; Stains and staining techniques; Fungal toxins: Mycotoxicoses-fungi with special reference to dermatomycosis, aspergillosis and fungal allergen in humans and animals.

#### **Unit –II**

[16 hrs]

Fungi in soil: Litter decomposition, mutualistic, symbiotic and non-symbiotic associations; Fungi in food and beverages: Alcoholic beverage, mushrooms and other macro fungi, edible biomass from yeast and moulds, single cell proteins. Fungi in food processing: Bread, soybean products, cheese and fermented milk and other fermented foods; Medicinal and nutritional value of edible and poisonous mushrooms; Cultivation and economics of *Agaricus bisporus*, *Pleurotus* and *Volvoriell*; Effect of environmental, nutritional and chemical factors on mushroom cultivation (intensive and extensive cultivation methods).

#### **Unit –III**

[16 hrs]

Fermentation technology: Screening and selection of industrially important fungi; Protoplast technology for strain improvement; Fermentor design and operation, solid substrate fermentations; General account of environmental and regulatory aspects of using



genetically-modified microbes; Enzyme technology: Fungal enzymes of commercial importance and their production, free and immobilized cells and enzymes.

**Unit –IV** [16 hrs]

Fungal metabolites: Primary metabolites- vitamins and proteins of economic importance, secondary metabolites in medicine and agriculture; General account of production and application of secondary metabolites- antibiotics, mycotoxins, pigments and alkaloids. Future of fungal biotechnology: Production of mammalian proteins by fungi; Gene cloning in fungi and their importance; Molecular approaches for fungal identification (ITS, genomic and phylogenetics)

[64 hrs]

**References**

1. Hand Book of Applied Mycology (HBAM) vol 1: Soil and Plants: eds Dilip K. Arora Bharat Rai K.G, Mukerji, and R.Knudsen
2. Hand Book of Applied Mycology vol 2-5: Humans, Animals and Insects: eds Dilip K. Arora, Libero Ajello and K.G. Mukerji.
3. The Filamentous fungi vol I: Industrial mycology Smith J E and Berry D R(Edward Arnold London UK 1975)
4. Plant disease vol I-V: Horsfall J G and Cowling E B (Academic, New York 1995).
5. Plant infection-Physiology and biochemical basis: Asada Y, Bushnell NR, Ouchi S and Vance P (Springer Verlag, Berlin 1982).
6. Plant microbe interaction- Molecular and genetic perspectives: Kosuge T and Nester E N (MacMillan, New York 1984).
7. Plant pathology: Agrios, GN (4<sup>th</sup> Edn Academic, London 1995)

**BOT: SCT. 4.3.2 APPLIED PHYCOLOGY**

**Preamble**

*The paper aims to provide introduction to algae, fungi, bacteria and viruses dealing with their historical development, classification, structure and life cycles with elucidative examples. The students on learning this paper become well versed with algae, fungi, bacteria and viruses and their importance in general and especially in agriculture and medicines.*

**Unit-I** [16 hrs]

Algae- Isolation, purification and axenic cultures; Algal biofertilizers- Production and applications; Nitrogen fixation- Heterocysts, differentiation, development and mechanism of nitrogenase; Phycopedology- Physico-chemical parameters of the soils with reference to distribution of algae in different soils

**Unit-II** [16 hrs]

Planktonic algae and their biological significance; Composition and measurements of phytoplankton; Physico-chemical factors controlling phytoplankton and population kinetics; Algae as water quality indicators; Algal blooms-causes and effects

**Unit-III** [16 hrs]  
Ecology of marine algae: Distribution, factors controlling growth and their distribution; Mass cultivation of microalgae; Biochemicals from algae- Pigments, enzymes, vitamins, antibiotics, essential fatty acids, polysaccharides, hydrocarbons, plant growth regulators.

**Unit-IV** [16 hrs]  
Economic importance of algae as food, fodder, medicine, fertilizer and sewage reclaimers; Mutation and genetics of algae; Extracellular products.

[64 hrs]

## References

1. Structure and reproduction of algae: Fritch F E (1945)
2. The algae-a review: Prescott G M (1969)
3. The algae: Chapman V J & Chapman D J (1973)
4. The biology of algae: Round F E (1973)
5. A text book of algae: Bilgrami K S and Saha L S (1992)
6. Introductory phycology: Kumar H D (1985)
7. Cultivation of algae- G S Venkataraman
8. Algae form and function-Venkatraman *et al.*
9. Handbook of phycological methods-Stein J R.
10. Micro-algal Biotechnology–Michael A Borowitzka
11. Algae and Human affairs – Carole A, Lembi *et al*
12. Advances in Phycology: Verma BN, KR Gupta & Goyal SK (APC, New Delhi 1998)
13. Algae- Anatomy, biochemistry and biotechnology- L Barsanti & P Gualtieri. (Taylor & Francis,2006)
14. Phycology: R.L. Lee, (4th Edn, Cambridge Univ Press, 2008)

## M Sc BOTANY SEMESTER-IV: PRACTICALS

### **BOT: HCP. 4.4 Plant Pathology and Plant Protection**

1. Study of locally available diseases
2. Preparation of herbarium of disease specimens
3. Study of Koch's postulations
4. Assessment affected leaf area by Stover's method.
5. Field visits to assess disease incidence and severity
6. Estimation per cent of spore germination
7. Experiment to show fungicidal inhibition of spore germination
8. Spore traps
9. Isolation of fungi from disease plants /parts
10. Methods of monitoring splash borne and airborne inoculum.
11. Isolation and identification of AM Fungi and estimation of root colonization.
12. Demonstration of antagonistic fungi- a. Antibiosis b. Competition c. Mycoparasitism

### **BOT: HCP. 4.5 Plant Breeding and Plant Biotechnology**

1. Study of Gynoecium and Androecium of selected crop plants
2. Emasculation, hand pollination
3. Protoplast isolation and fusion
4. Noting of superior traits
5. Tissue culture of pollen and ovary
6. Study and listing of parthenogenic fruits
7. Callus culture and synthetic seeds
8. Pollen pistil interaction – compatibility and incompatibility factors
9. Preparation of medium, autoclaving and sterilization techniques.
10. Sterilization of plants material and induction of callus.
11. Induction of organogenesis and whole plants
12. Initiation of somatic embryogenesis and production of synthetic seeds/artificial seeds.
13. Isolation of protoplasts and culture
14. Induction and estimation of secondary plants products
15. Induction of suspension cultures.

### **BOT: SCP: 4.6.1: Applied Mycology**

1. Isolation and identification of fungi from soil
2. Preparation of media and stains
3. Detection and quantification of secondary metabolites from fungi
4. Stimulatory effect of plant extracts on spore germination of fungal pathogens.
5. Spawn production
6. Mushroom cultivation.
7. Separation of secondary metabolites from culture filtrates.
8. Detection and separation of mycotoxins by TLC
9. Production of industrially important enzymes from fungi
10. DNA extraction and quantification.

### **BOT: SCP: 4.6.2: Applied Phycology**

1. Preparation of synthetic media and cultivation of Algae.
2. Analysis of physico–chemical parameters of soil and fresh water.
3. Cultivation of soil Algae by using general media.
4. Thallus in Prokaryotic algae
5. Thallus in Eukaryotic algae
6. Separation of algal pigments
7. Study of *Spirulina* as food and medicine.
5. Study of industrial products of Algae.

## M SC BOT: HMP 4.7: HARDCORE MAJOR PROJECT

### ***Preamble***

*This paper involves assignment of a project comprising research, review or survey works to students and thus helps them acquaint with specialised training for exploring the plant kingdom. The project aims to provide hands on experience and professional inputs to students. The students upon exposure to the project would learn the research methodologies-identifying a research area, collecting information, making observations, analysis of results and documentation. It is thus hoped that the project inspires the students for pursuing higher studies and realise their dream career in botany.*

**Project:** The students shall be assigned during the M Sc Fourth Semester, a project comprising research, review or survey works and submit the Project Report (PR) on or before the commencement of the semester end examination.

Dr Pratima Mathad  
Professor & Chairperson  
Department of Botany, Gulbarga University, Kalaburagi

## SEMESTER END EXMINATION QUESTION PAPER PATTERN

### THEORY

Time: 3 Hours

Max.Marks 80

**Note:** Answer any **five** questions. Question no. 1 is compulsory

Q. 1	Answer in one or two sentences	10 x 2 = 20
i.		
ii.		
iii.		
iv.		
v.		
vi.		
vii.		
viii.		
ix.		
x.		
Q.2	Essay type question	15
Q.3	Essay type question	15
Q.4	Essay type question	15
Q.5	Essay type question	15
Q.6	Answer any <b>three</b> of the following	15
a.		
b.		
c.		
d.		

### PRACTICAL

Time: 3 Hours

Max.Marks 40

	Experiments/Demonstrations	35
	Records/Submissions	05