

**BHARATHIAR UNIVERSITY : : COIMBATORE-46**  
**M.Sc. BOTANY [CBCS] UNIVERSITY DEPARTMENT**  
**[FOR THE STUDENTS ADMITTING DURING THE ACADEMIC YEAR**  
**2016-2017 BATCH & ONWARDS]**

**SCHEME OF EXAMINATION**

# This curriculum is only for the P.G. courses offered by the University Department

Sem	Code No.	Subjects	Class Hours	University Examination			
				Internal	External	Total	Credits
I	16BOTACO1	Microbiology	5	25	75	100	4
I	16BOTACO2	Plant Diversity -I (Algae, Fungi and Bryophytes)	5	25	75	100	4
1	16BOTACO3	Plant Diversity – II (Pteridophytes, Gymnosperms and Paleobotany)	5	25	75	100	4
I	16BOTA CO4	<b>Practicals:</b> Microbiology , Plant Diversity I & Plant Diversity II	5	25	75	100	4
I	16BOTA E1	Plant Breeding	5	25	75	100	4
I	16BPTA E2	Forest Botany					
I	16BOTA S1	Man and Microbes	2	12	38	50	2
II	16BOTA CO5	Plant Physiology	5	25	75	100	4
II	16BOTA CO6	Embryology and Tissue Culture	5	25	75	100	4
II	16BOTA CO7	Cytology and Anatomy	5	25	75	100	4
II	16BOTA CO8	<b>Practicals:</b> Plant Physiology, Embryology and Tissue Culture; Cytology and Anatomy	5	25	75	100	4
II	16BOTA E3	Economic Botany	5	25	75	100	4
II	16BOTA E4	Plant Genetics					
II	16BOTA S2	Biodiversity Conservation	2	12	38	50	2
III	165BOTA CO9	Plant Biochemistry	5	25	75	100	4

III	16BOTA CO10	Molecular Biology & Plant Biotechnology	5	25	75	100	4
III	16BOTA CO11	Plant Systematics	5	25	75	100	4
III	16BOTA CO12	<b>Practicals:</b> Plant Biochemistry, Molecular Biology & Plant Biotechnology, Plant Systematics	5	25	75	100	4
III	16BOTA E5	Horticulture	5	25	75	100	4
III	16BOTA E6	Applied Botany					
III	16BOTA S3	Plants and Medicine	2	12	38	50	2
IV	16BOTA CO13	Ecology and Phytogeography	5	25	75	100	4
IV	16BOTA CO14	Research methodology	5	25	75	100	4
IV	16BOTA CO15	<b>Practicals:</b> Ecology and Phytogeography; Research methodology	5	25	75	100	4
IV	16BOTA PWV	Project Work & Viva voce	Thesis	50	150	250	10
			Viva voce	12	38		
IV	16BOTA FVR	Field / Industry / Institute visit Report *	-	12	38	50	2

Total Marks for M.Sc. Plant Science: 2250                      Credit; 90

\* To be submitted along with Project work

**NOTE:** 75% ATTENDENCE IS COMPULSORY IN EACH SUBJECT.

15 = Year of starting (admitted during July, 2015); BOT= Department of Botany; A= Course 1;

CO= Core paper; E = Elective paper; S= Supportive paper; PWV =- Project Work & Viva-voce;

FVR = Field Visit Report

### SCHEME OF VALUATION

#### CORE PAPERS

CREDITS – 4; MARKS - 100

#### Marks Distribution:

Internal – 25 Marks

External – 75 Marks

#### SUPPORTIVE PAPERS (No Practicals)

CREDITS – 2; MARKS - 50

#### Marks Distribution:

Internal – 12 Marks

External – 38 Marks

#### FIELD / INDUSTRY / INSTITUTE VISIT REPORT

CREDITS – 2 ; MARKS - 50

#### Marks Distribution:

Internal – 12; External – 38

#### ELECTIVE PAPERS (No Practicals)

CREDITS – 4; MARKS - 100

#### Marks Distribution:

Internal – 25 Marks

External – 75 Marks

#### PROJECT WORK & Viva Voce

CREDITS – 10; MARKS - 250

#### Marks Distribution:

**Project Work & Viva voce (250 Marks)**

**Thesis (200 Marks)**

Internal = 50 Marks; External = 150 Marks

**Viva Voce (50 Marks)**

Internal – 12; External – 38

#### SUPPORTIVE PAPERS OFFERED FOR OTHER DEPARTMENT STUDENTS

Semester	Code No.	Title of the Supportive Paper
1 <sup>st</sup>	16BOT A S1	Man and Microbes
2 <sup>nd</sup>	16BOT A S2	Biodiversity Conservation
3 <sup>rd</sup>	16BOT A s3	Plants and Medicine

**CORE PAPER**

**CODE: 16 BOT A CO1**

**FIRST SEMESTER**

**PAPER: MICROBIOLOGY**

**GOALS:** To provide the basic knowledge of microbes; to introduce the techniques involved in their study; to highlight their role in the human welfare.

**UNIT-1**

Scope of Microbiology; Microbial diversity [Bacteria, Fungi, Algae, Viruses and Protozoa] - a general account, classification, growth and reproduction.

**UNIT-2**

Microbiological Media: Types, preparation, methods of sterilization; enumeration of microorganisms in soil, water and air; isolation of microorganisms from environment and infected plant tissue; Techniques of pure culture, maintenance and preservation; Staining; stains and dyes, types of staining.

**UNIT-3**

Microbial interaction; Mutualism, commensalism, antagonism and parasitism; Nitrogen fixation; symbiotic and asymbiotic; pollution indicator microorganisms, Quantification techniques - MPN and membrane filtration; Role of microorganisms in sewage treatment.

**UNIT-4**

Fermented foods; Beverages, fermented fruits and vegetables; Single cell protein, microbial spoilage of food. Food preservation, microbiology of milk and milk products.

**UNIT-5**

Industrial Microbiology; Fermenters, batch fermentation vs continuous fermentation, Industrial production of enzymes (cellulase, amylase and protease), amino acids (glutamic acid and L-Lysine), and organic acids (lactic acid and citric acid).

**REFERENCES**

1. Prescott, L.M., Harley, J.P. and Klien, D.A. 1996. Microbiology (3<sup>rd</sup> ed.), Brown W.C. Publishers, Boston, USA.
2. Tortora, G.J., Funke, B.R. and Case, C.L. 1995. Microbiology-an Introduction (5<sup>th</sup> ed.), The Benjamin/Cummings Publishing Company Inc., Redwood city, California, U.S.A.
3. Wistreich, G.A. and Lechtman, M.D. 1988. Microbiology (5<sup>th</sup> ed.), Macmillan Publishing Company, New York, USA.

4. Stainer, R.Y., Ingraham, J.L., Wheelis, M.L. and Painter, P.R. 1986. General Microbiology (5<sup>th</sup> ed.), Macmillan Press Ltd., London.
5. Pelczar, M.J., Reid, R.D. and Chan, E.C.S. 1983. Microbiology, Tata McGraw Hill Publishing Co., New Delhi.
6. Sinha, U. and Srinivasa, S. 1983. An Introduction to Bacteria, Vikas Publishing House Pvt. Ltd. New Delhi.
7. Jay, J.M. 1983. Modern Food Microbiology, CBS Publishers, New Delhi.
8. Reed, G. (ed.) 1983. Prescott & Dunn's Industrial Microbiology (4<sup>th</sup> ed.), AVI Publishing Co., Connecticut, USA.
9. Schlegel, H.B. (ed.) 1986. General Microbiology (6<sup>th</sup> ed.), Cambridge University Press, Cambridge.
10. Steindraus, K.H. (ed.) 1983. Hand Book of Indigenous Fermented Food, Parcel Dekker Inc., New York.
11. Sullia, S.B. and Shantharam, S. 1998. General Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

**CORE PAPER**

**CODE: 16 BOT A CO2**

**FIRST SEMESTER**

**PAPER: PLANT DIVERSITY–I (Algae, Fungi and Bryophytes)**

**GOALS:** To define and characterize diversity; to understand the enormous diversity and range of diversity and range of diversification of all species in the world; to understand the composition and levels (ecological, organizational, genetic and cultural) of diversity; to realize the fundamental values of diversity; to evolve strategies for diversity conservation and sustainable use.

**UNIT-1**

Algae in diverse habitats (Terrestrial, Fresh water, Marine); Thallus organization (range of thallus) and reproduction (vegetative, asexual, sexual); Ultrastructure of cell, Flagella, Chloroplast, Pyrenoids and Eye Spot in major groups of algae; Principles of classification, classification of Fritsch; Life cycle patterns in Algae and Algal Blooms; Economic importance of Algae as food, bio-fuels, source of chemicals and drugs; Algal Bioinoculants.

**UNIT-2**

Comparative study of classes of Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae with reference to: Range of structure of plant body including Ultrastructure, Methods of reproduction and Variations in life cycles; Life histories of: *Chlorella*, *Bulbochaete*, *Padina*, *Gelidium*, *Anabaena*, Diatoms and *Vaucheria*.

### UNIT-3

General Characteristics of Fungi; Range of thallus Organization; The architecture of fungal cells, cell walls, cell membrane, cell organelles and cytoskeleton; Nutrition and growth in fungi including factors affecting fungal growth, Types of reproduction in fungi; Fungal Classification (Ainsworth, 1971); Diagnostic features of different classes of fungi; Structure and Life-histories of *Plasmodiophora*, *Penicillium*, *Neurospora*, *Pleurotus*, *Fusarium* and *Cercospora*.

### UNIT-4

Fungal genetic variation and evolution; Heterothallism, Heterokaryosis and Parasexual cycle; Saprotrophs and Ecosystems; Fungi as Parasitic and Mutualistic Symbionts; Economic Importance of Fungi; Mushroom Cultivation; Etiology and control of the following fungal diseases – Soft rot of Fruits and Vegetables, Leaf Blotch of turmeric, Powdery mildew of cereals; Panama disease of Banana, Leaf rust of coffee, Sheath Blight of rice; Fungi as biocontrol agents.

### UNIT-5

Classification of Bryophytes, Origin of Bryophyta, evolution (Proskauer, 1957) structural organization of gametophyte and sporophyte in different classes of Bryophytes, life histories of *Marchantia*, *Porella*, *Fossombronia*, *Anthoceros* and *Polytrichum*. Bryophytes as pollution indicators.

## REFERENCES

### ALGAE

1. Chapman, V.J. and Chapman, D.J. 1962. The algae. ELBS & Macmillan, London.
2. Fritsch, F.F. 1972. The Structure and Reproduction of the Algae Vol. II. Cambridge University Press, UK.
3. Kumar, H.D. 1988. Introductory Phycology. Affiliated East-West Press Ltd. New Delhi.
4. Morris, I. 1986. An introduction to the Algae. Cambridge University Press, UK.
5. Round, F.E. 1986. The Biology of Algae. Cambridge University Press, UK.
6. Smith, G.M. 1938. Cryptogamic Botany. Vol, I. McGraw Hill Book Co., New York.
7. Smith, G.M. 1951. Manual of Phycology: An Introduction to the Algae and their Biology. Chronica Botanica Co., Waltham, Massachusetts.
8. Van Den Hoek, C., Mann, D.G. and Jahns, H.,M. 1998. Algae and Introduction to Phycology, Cambridge University Press, UK.
9. VenkataRaman, G., Goyal, S.K., Kaushik, B.D. and Roychoudhury, P. 1974. Algae: Form and Function. Today and tomorrow's printers and Publishers, New Delhi.

### FUNGI

1. Agrios, G.N. 1997. Plant Pathology. Academic Press, London.
2. Alexopoulos, C.J. and Mims, C.W. 1979. Introductory Mycology. Wiley Eastern Ltd, New Delhi.
3. Ainsworth, G.C. 1971. A Dictionary of the Fungi. Commonwealth Mycological Institute, Kew, Surrey, England.
4. Burnett, J.H. 1971. The Fundamentals of Mycology. ELBS, London.
5. Charlile, M.J., Watkinson, S.C. and Gooday, G.W. 2005. The Fungi. Elsevier, New Delhi.

6. Cooke, R.C. and Rayner, A.D.M. 1984. Ecology of saprophytic fungi. Longman, London and New York.
7. Moore-Landecker, E. 1996. Fundamentals of the fungi, Prentice Hall international, USA.
8. Gilman, J.C. 1957. A manual of soil fungi. Iowa State College Press, Ames, Iowa.
9. Mehrotra, B.S. 1976. The Fungi. Oxford and IBH Publishing Co., New Delhi.
10. Sharma, P.D. 2006. Plant Pathology. Narso Publishing House, New Delhi.
11. Subramanian, C.V. 1983. Hyphomycetes: Taxonomy and Biology. Academic Press, London and New York.
12. Talbot, P.H.B. 1971 Principles of Fungal Taxonomy. Macmillan Press, London.
13. Webster, J. 1970. Introduction to Fungi. Cambridge University Press, UK.

#### **BRYOPHYTES**

1. Puri, P. 1970. Bryophytes- A broad perspective, Atma Ram & Sons, New Delhi.
2. Parihar, N.S. 1967. An Introduction to Embryophyta Vol: I Central Book Depot, Allahabad.
3. Singh, S.K. 2006. Text Book of Bryophyta, Campus Books, New Delhi.
4. Vashishta, B.R., Sinha, A.K. and Kumar, A. 2005. Botany for degree Students, Bryophyta. S. Chand and Co. Ltd, New Delhi.
5. Proskauer, J. 1957. Studies on Anthocerotales. Phytomorphology, International Society of plant morphologists, New Delhi.

**CORE PAPER**

**CODE: 16 BOT A CO3**

**FIRST SEMESTER**

**PAPER: PLANT DIVERSITY –II (Pteridophytes, Gymnosperms and Paleobotany)**

**GOALS:** To define and characterize diversity of lower vascular plants to understand the dynamics of diversity to realize the significance of diversity.

**PTERIDOPHYTES**

**UNIT-1**

Origin, Classification (Sporne); structure and life histories of *Isoetes*, *Selaginella*, *Equisetum*, *Ophioglossum*, *Marselia* and *Adiantum*.

**UNIT-2**

Heterospory and seed habit, Telome theory, Stellar system in Pteridophytes, Sorus evolution; Apogamy and Apospory, Economic importance.

**GYMNOSPERMS**

**UNIT-3**

Affinities of Gymnosperms with Angiosperms and Pteridophytes; Classification by Sporne; structure and life histories of *Cycas*, *Pinus*, *Araucaria*.

**UNIT-4**

Structure and life histories of *Ginkgo*, *Ephedra*; Phylogenetic considerations: *Ephedra*, *Welwitschia* and *Gnetum*. Economic importance.

**PALEOBOTANY**

**UNIT-5**

Geological Scale; Radiocarbon dating; Fossil Pteridophytes- *Sphenophyllum*, *Lepidodendron*  
Fossil gymnosperms- *Heterangium*, *Lyginopteris*, *Lagenostoma*; Fossil fuels, fossil pollen analysis.



## **REFERENCES**

### **GYMNOSPERMS**

1. Biswas, C. and Johrc, B.M. 1977. The Gymnosperms. Narosa publishing House, New Delhi.
2. Sporne, K.R. 1967. The Morphology of Gymnosperms. Hutchinson & Co., London.
3. Vashishta, P.C. 1991. Gymnosperms. S. Chand & Company Ltd., Ram Nagar, New Delhi.

### **PTERIDOPHYTES**

1. Sporne, K.R. 1965. The Morphology of Pteridophytes. Hutchinson & Co., London
2. Vashishta, P.C. 1991. Vascular Cryptogams. S. Chand & Company Ltd., Ram Nagar, New Delhi.
3. Bower, F.O. 1923-28. The ferns. Vol 1-3; Cambridge University Press, London.
4. Bower, F.O. 1908. The origin of Land Flora. Macmillan Press, London.
5. Eames, A.J. 1936. Morphology of Vascular Plants. Lower groups, New York and London.

### **PALEOBOTANY**

1. Shripad, N.A. 1998. Paleobotany, Oxford and IBH Publishing Co. Pvt Ltd., New Delhi.
2. Karl, J.N. 1981. Paleobotany, Paleoecology & Evolution. Praeger Publishing, New Delhi
3. Waston, R.T., Heywood, V.H., Baste, I., Dias, B., Camez, R., Janetos, T., Reid, W. and Ruark, C. 1995. Global Biodiversity Assessment Summary for Policy Makers. Cambridge University Press, UK.
4. Meyen, S.V. 1987. Fundamentals of Paleobotany. Chapman and Hall, New York.
5. Arnold, C.A. 1947. An Introduction to Paleobotany. Academic Press, New York and London

CORE PAPER

CODE: 16 BOT A CO4

FIRST SEMESTER

PAPER: PRACTICALS : MICROBIOLOGY AND PLANT DIVERSITY I & II

**MICROBIOLOGY**

1. Preparation of non-selective and selective media; enumeration of bacteria, fungi and actinomycetes [plate count] from soil and water.
2. Isolation of pathogenic microorganisms from infected tissue.
3. Observation of morphological characteristics of mould fungi.
4. Purification of mixed cultures.
5. Observation of motility of bacteria [hanging drop technique].
6. Staining methods: Preparation of smears for stains, simple staining, negative staining and Gram staining.
7. Test for Coliform bacteria.
8. Spoilage of milk by microorganisms [methylene blue test].

**PLANT DIVERSITY -I**

**Vegetative and reproductive structures of:**

- (A) **Algae:** *Chlorella, Bulbochaete, Nitella, Padina, Turbinaria, Gelidium, Amphiroa, Anabaena, Nostoc.*
- (B) **Fungi:** *Plasmodiophora, Penicillium, Neurospora, Pleurotus, Fusarium, Cercospora, Polyporus.*
- (C) **Bryophytes:** *Marchantia, Anthoceros, Fossombronia, Polytrichum*

**PLANT DIVERSITY -II**

**Vegetative and reproductive structures of:**

- Pteridophyte** - *Selaginella, Isoetes, Equisetum, Ophioglossum, Adiantum* and *Marselia*.
- Gymnosperms** - *Cycas, Pinus, Araucaria, Ephedra.*
- Paleobotany** - Representatives from Pteridophytes and Gymnosperms.

**ELECTIVE PAPER**

**CODE: 16 BOT A E1**

**FIRST SEMESTER**

**PAPER: PLANT BREEDING**

**GOALS:** To acquire a knowledge on various breeding methods involved in the improvement of crop plants; to explain how far the techniques of plant breeding have become sophisticated and rewarding; to highlight the mission-orientation breeding developing upon production breeding, quality breeding, adaptive breeding and protection breeding regardless of breeding system ; to study the application of induced mutations, induced polyploidy and wide hybridization for crop improvement.

**UNIT-1**

History and objectives of plant breeding; centers of origin, plant introduction – history, agencies, procedure, germplasm collection, merits and demerits. Modes of reproduction; Control of pollination – self incompatibility, male sterility.

**UNIT-2**

Selection – mass selection, pureline selection, clonal selection with reference to methodology, merits and demerits, their application.

**UNIT-3**

Heterosis and Inbreeding depression – effects of inbreeding, genetic basis of heterosis – theories explaining heterosis and inbreeding depression.

**UNIT-4**

Improvement of crop plants by pedigree method, bulk method, backcross method – procedure, merits and demerits of the above breeding methods. Breeding for specific characters.

**UNIT-5**

Improvement of crop plants through Induced mutations, polyploidy and distant hybridization. Molecular Markers in plant breeding, application of genomics in plant breeding.

**REFERENCES**

1. Singh, E.D. 1990. Plant Breeding. Kalyani Publishers, New Delhi.
2. Allard, R.W. 1960. Principles of Plant Breeding, John Wiley and Sons, Inc. New York.
3. Simmonds, N.W. 1979. Principles of Crop improvement. Longman, London.

**ELECTIVE PAPER**

**CODE: 16 BOT A E2**

**FIRST SEMESTER**

**PAPER: FOREST BOTANY**

**GOALS:** To enable the students to understand the importance of forests and to enable them to contribute meaningfully in the conservation of the forest. It also makes them aware of the current global problems in forestry related to human intervention and the need of developing a sustainable way of life. It provides a platform to appreciate bio diversity and the importance of conservation strategies.

**UNIT-1**

General introduction to forests- Natural and Manmade; Tropical, temperate, evergreen, semi evergreen, deciduous; Monoculture, multipurpose, social and industrial. Forest and gene conservation; Forest types in South India with special emphasis to Tamil Nadu.

**UNIT-2**

Silviculture- concept and scope of study of natural and artificial regeneration of forests. Clear felling, uniform shelter, wood selection, coppice and conservation systems. Silviculture of some of the economically important species in India such as *Azadirachta indica*, *Tectona grandis*, *Eucalyptus*, Mahogany (*Swietenia mahagoni*), *Dalbergia sissoo* and *Santalum album*, jack wood (*Cryptocarya glaucescens*), Rubber (*Hevea brasiliensis*), Sal (*Shorea robusta*), Paduok (*Pterocarpus*). Wood: Homogenous and heterogenous- spring and autumn wood- Porous and non porous wood- Heart and sap wood. Relevance of wood anatomical studies - Identification of wood - preparation of key and their uses.

**UNIT-3**

Social and agro forestry: Selection of species and role of multipurpose trees. Food, fodder and energy. Social forest- Avenue plantation. Sacred plants- definition, importance of sacred trees like *Ficus religiosa*, *Emblica officinalis*, *Aegle marmelos*.

**UNIT-4**

Seed orchards, seed dormancy - Types of dormancy, physical and chemical methods to overcome seed dormancy. Forest laws- necessity, General principles, Indian forest act 1927 and their amendment.

#### **UNIT-5**

Forest resources and utilization: Forest products- timber, pulp wood, secondary timbers, non timber forest products (NTFPs). Definition and scope (brief outline) - Gums, resins, fibers, oil seeds, nuts, rubber, canes and bamboos, medicinal plants, charcoal. Lac collection and marketing.

#### **REFERENCES:**

1. Dhiman, A.K. 2003. Sacred plants and their medicinal uses. Daya publishing house, New Delhi.
2. Chundawat, B.S. and Gautham, S.K. 1996. Text book of Agroforestry. Oxford and IBH publisher, New Delhi.
3. Kollmann, F.F.P. and Cote, W.A. 1988. Wood science and Technology. Vol. I & II Springer Verlag, New York.
4. Mehta, T. 1981. A handbook of forest utilization. Periodical Expert Book Agency, New Delhi.
5. Nair, N.C. and Henry, A.N. 1983. Flora of Tamilnadu, India. Series: 1, Analysis, Vol.1. BSI, Coimbatore, India.
6. Rao, K.R. and Juneja, J.D. 1971. A handbook for field identification of fifty important timbers of India. The Manager of Publications, Govt. of India, New Delhi.
7. Sagreiya, K.P. 1994. Forests and Forestry (Revised by S.S. Negi). National Book Trust. New Delhi.
8. Sharma, P.D. 2004. Ecology and Environment. Rastogi Publications, Meerut.
9. Singh, M.P. and Vishwakarma, V. 1997. Forest environment and Biodiversity. Daya Publishing House, New Delhi.
10. Tiwari, K.M. 1983. Social forestry in India. Nataraj Publishers, Dehra Dun.
11. WWF. 2007. Timber identification manual. TRAFFIC, New Delhi.

**SUPPORTIVE**

**CODE: 16 BOT A S1**

**FIRST SEMESTER**

**PAPER: MAN AND MICROBES**

**GOALS:** To understand the techniques involved in the culturing of microbes; to emphasize the role of microbes in food, agricultural and pharmaceutical industries; to assess the role of microbes in environment biotechnology.

**UNIT-1**

Culturing and maintenance of microorganisms: Glassware used in microbiology laboratory, media preparation (PDA and nutrient agar), sterilization, isolation of microorganism, their purification and maintenance. Staining of microorganisms (simple and Gram staining).

**UNIT-2**

Food microbiology: Microbial spoilage of food, food preservation, fermented food, Microbiology of milk, single cell protein; Mushroom cultivation.

**UNIT-3**

Agricultural microbiology: Nitrogen fixing microorganisms, mycorrhizae, microbial biopesticides, microbes causing important crop diseases.

**UNIT-4**

Environmental microbiology: Microbiology of potable water, water purification, role of microorganisms in sewage treatment, processing of solid waste, oil eating bugs.

**UNIT-5**

Industrial microbiology: Selection and improvement of industrially useful microorganisms, fermentation process and recovery of end product, Industrial production of alcohol, Vinegar, antibiotic (penicillin), and enzymes (cellulase).

**REFERENCES**

1. Sullia, S.B. and Shantharam, S. 1998. General Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
2. Pelczar, M.J., Reid, R.D. and Chan, E.C.S. 1983. Microbiology, Tata McGraw Hill Publishing Co., New Delhi.
3. Jay, J.M. 1983. Modern Food Microbiology, CBS Publishers, New Delhi.
4. Reed, G. 1983. Prescott & Dunn's Industrial Microbiology (4<sup>th</sup> ed.), AVI Publishing Co., Connecticut, USA.
5. Schlegel, H.B. 1986. General Microbiology (6<sup>th</sup> ed.), Cambridge University Press, UK.
6. Steindraus, K.H. 1983. Hand Book of Indigenous Fermented Food, Parcel Decker Inc, New York.

**CORE PAPER**

**CODE: 16 BOT A CO5**

**SECOND SEMESTER**

**PAPER: PLANT PHYSIOLOGY**

**GOALS:** To understand the concepts involved in the function of plants and study the recent aspects of various physiological processes in plants.

**UNIT-1**

Solute transport: Properties of water, Diffusion, Osmosis and Water potential. Translocation of water and solutes through cells, xylem and phloem. Mechanisms of loading and unloading of photo-assimilates. Transpiration and stomatal movement.

**UNIT-2**

Photosynthesis: Principles of light absorption, energy transfer and electron transfer; CO<sub>2</sub> fixation - C<sub>3</sub>, C<sub>4</sub> and CAM pathway. Respiration: Glycolysis, TCA cycle and Photorespiration.

**UNIT-3**

Bioenergetics: Laws of thermodynamics, concepts of free energy, oxidation reduction reaction. Mitochondrial electron transport and ATP cycle. Electron transport inhibitors.

**UNIT-4**

Plant Hormones: Biosynthesis and transport of Auxins, Gibberellins, Ethylene and Abscisic acid. Nitrogen metabolism: Nitrogen cycle, Biological Nitrogen fixation. Photobiology: Functions of Phytochrome, Photoperiodism and Biological clocks. Plant Movements

**UNIT-5**

Stress Physiology: Physiological responses of plants to biotic (insects and pathogens) and abiotic stresses (water, temperature and salt). Mechanism of resistance to biotic stress and tolerance to abiotic stress. Free Radicals and Antioxidants.

**REFERENCES**

1. Devlin, R.M. and Baker, N.R. 1973. Photosynthesis, Reinhold Affiliated East-West Press Pvt. Ltd, New Delhi.
2. Jain, V.K. 2000. Fundamentals of Plant Physiology (5<sup>th</sup> ed.), S. Chand & Co Ltd; New Delhi.
3. Pandey, S.N. and Sinha, B.K. 2010. Plant Physiology, Vikas Publishing, New Delhi.
4. Hewitt, E.J. and Cutting, C.V. 1979. Nitrogen metabolism of plants, Academic Press, London.
5. Peach, K. and Tracey, M.V. 1955. Modern methods of plant analysis (1<sup>st</sup> ed.), New Delhi.
6. Machlis, L. and Torrey, J.G. 1956. Plant in action: Laboratory manual of plant physiology. W.H. Freeman publisher, San Francisco.
7. Moore, T.C. 1979. Biochemistry and physiology of plant hormones. Narosa book Distributors, New Delhi.

8. Roberts, E.A. 1987. Plant growth regulators. Kluwer Academic publishers, London.
9. Nelson, D.L. and Cox, M.M. 2012. Lehninger's Principles of biochemistry. (6<sup>th</sup> ed.), W. H. Freeman Publishers, New York.
10. Berg, J.M., Tymoczko, J.L. and Stryer, L. 2002. Biochemistry (5<sup>th</sup> ed.), WH Freeman & Co., New York.
11. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. 2003. Harper's Illustrated Biochemistry (26<sup>th</sup> ed.), The McGraw-Hill Companies, Inc., USA.

**CORE PAPER**

**CODE: 16BOT A CO6**

**SECOND SEMESTER**

**PAPER: EMBRYOLOGY AND TISSUE CULTURE**

**GOALS:** To know the mechanism underlining the shift from vegetative to reproductive phase; to trace the development of male and female gametophyte; to understand the incompatibility barriers and evolve methods to overcome it at the time of breeding; to highlight the physiological role of endosperm in the morphogenesis of embryo; to assess the process of seed setting. Application of various tools and techniques of *in vitro* methods in plant improvement.

**UNIT-1**

A brief historical account, microsporangium and male gametophyte-structure and development; incompatibility-types, mechanism and methods to overcome incompatibility.

**UNIT-2**

Megasporogenesis, development of female gametophyte (3 types), organization and ultra structure of mature embryo sac, nutrition.

**UNIT-3**

Post pollination events: Fertilization - germination of pollen, path of pollen tube; Endosperm – types and function; Embryogenesis-development of a typical monocot and dicot embryo, polyembryony.

**UNIT-4**

Plant tissue culture - history, concept of totipotency, callus induction, organogenesis, somatic embryogenesis and synthetic seeds; Basics of suspension culture, production of secondary metabolites.

**UNIT 5**

Micropropagation- methods and application, androgenesis and gynogenesis for haploid production, protoplast culture and somatic hybridization, somaclonal variation and conservation of germplasm.



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**CORE PAPER**

**CODE: 16 BOT A CO7**

**SECOND SEMESTER**

**PAPER: CYTOLOGY AND ANATOMY**

**GOALS:** To understand the structure of cells in relation to the functional aspects. To study the structural and functional aspects of various tissue systems and organs of dicots and monocots

**UNIT- 1**

Cell and the Cell theory – Cell structure in prokaryotes and eukaryotes, Ultra structure of Cell Wall and cell organelles (nucleus and nucleoli, mitochondria, plastids, cytoplasm, endoplasmic reticulum, ribosomes, chromatin and chromosomes). Cytoskeletal proteins. Cell division –Mitosis and meiosis and their significance: Synoptemal complex.

**UNIT - 2**

Plasma membrane – Ultra structure, Models of plasma membrane, membrane proteins, Properties and functions of plasma membrane; Passive and Active transport across cell membrane, sodium and potassium pumps, Ca<sup>2+</sup> ATPase pumps; Co-transport symport, Antiport; Endo and Exo cytosis.

**UNIT - 3**

Cell Signalling – Cell surface receptors; General principles of cellular communication; Role of G-protein, Cyclic AMP, Calcium ion flux in signal transduction; Bacterial chemotaxis and quorum sensing.

**Unit – 4**

Meristems – Classification, structure and functions, Cambium and seasonal Activities, Cambium in monocotyledons.

**Unit – 5**

Stem – Secondary structure, Anomalous secondary growth in Dicots and monocots.

Wood – sap wood and heartwood, Reaction wood, growth rings and Nodal anatomy.

**REFERENCES**

1. Faweett, D.W. 1979. The Cell – Its Organelles and inclusions, (2<sup>nd</sup> ed.), W.B. Saunders Co. Philadelphia, USA.
2. Swanson, P. and Webster, P. 1977. The Cell. Prentice Hall, Inc. Englewood Cliffs, New Jersey, USA.
3. Baker, J.R. 1966. Cytological Techniques (5<sup>th</sup> ed.), Methuen, London.
4. Raghuvanshi, R.K., Chauhan, A.K.S. and Siddiqui, B.A. 1995. Practical exercises in Cytology, genetics, Plant Breeding and Biostatistics. CBS Publishers & Distributors, New Delhi.
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7. Pandey, B.P. 1993. Plant anatomy, S. Chand & Co, New Delhi.

**CORE PAPER**

**CODE: 16 BOT A CO8**

**SECOND SEMESTER**

**PAPER: PRACTICALS: PLANT PHYSIOLOGY, EMBRYOLOGY AND TISSUE CULTURE & CYTOLOGY AND ANATOMY**

**PLANT PHYSIOLOGY**

1. Rate of photosynthesis under varying CO<sub>2</sub> concentration in water plants.
2. Separation of plant pigments by Thin Layer Chromatography.
3. Separation of plant pigments by Column Chromatography.
4. Estimation of Chlorophyll and Carotenoid pigments.
5. Determination of Total Antioxidant activity by phosphomolybdenum reduction method.
6. Determination of Superoxide radical scavenging activity
7. Estimation of Nitrate reductase activity.
8. Calculation of stomatal index of upper and lower epidermal peelings of *Moringa*.

**EMBRYOLOGY**

1. Anther development
2. Female gametophyte
3. Endosperm-types and haustoria
4. Dissection of embryos

**TISSUE CULTURE**

1. Sterilization of ex-plants, preparation of media.
2. Callus induction and organogenesis.
3. Preparation of artificial seed.
4. Demonstration of androgenesis in *Datura*.
5. Isolation of protoplast from various plant tissues and testing their viability

**ANATOMY**

1. Anomalous secondary thickening (Monocot and Dicot)
2. Microtomy
3. Maceration
4. Slide submission (Microtomy – 5 nos. free hand sections – 5 )

**CYTOLOGY**

1. Study of cells and chromosome morphology
2. Banding pattern of chromosomes
3. Specialized chromosomes
4. Mitotic and meiotic divisions
5. Fixatives and staining methods; Preparation of temporary and permanent slides.
6. Preparation of sections of stem, root, and leaf
7. Staining of various plant tissues

**ELECTIVE PAPER**

**CODE: 16 BOT A E3**

**SECOND SEMESTER**

**PAPER: ECONOMIC BOTANY**

**GOALS**

1. To understand the utility of different plant families.
2. To have a first-hand knowledge on economic Botany.

**UNIT-1**

Origin and History, Botanical description, Cultivation, Harvesting and uses of Cereals and Legumes: Wheat, Rice, Maize, Sorghum, Barley, Black gram, Red gram, Chick pea, Pigeon pea and Broad beans.

**UNIT-2**

Origin and History, Botanical description and economic importance of Vegetables and Fruits: Banana, Grapes, Citrus, Mango, Jack fruit, Potato, Cassava, *Dioscorea* and Tomato.

**UNIT-3**

Origin and History, Botanical description, Cultivation and uses of Spices and Condiments: Ginger, Pepper, Cardamom, Clove, Nut-Meg, Chilly, *Coriandrum*, Turmeric and All-spice.

**UNIT-4**

Origin and History, Botanical description, Cultivation, Processing and uses of Beverages plants: Tea, Coffee and Cocoa. *Sugars and Starch*: Sugarcane and *Manihot*. Fibers and Timber: Cotton, Jute, Sunhemp, Teak, Rosewood, Ebony, Sal and Mahogany.

**UNIT-5**

Origin and History, Botanical description, Harvesting, Extraction and uses of Fatty oils and Vegetable Fats: Sun flower, Soya bean, Peanut, Palm Oil, Coconut and Gingelly. Medicinal Plants: *Rauwolfia*, *Aconitum*, Jatamansi, Sathavari, Goggul, Basil, *Saraca* and Neem.

**REFERENCES**

1. Vardhana, R. 2009. Economic Botany (1<sup>st</sup> ed.), Sarup Book Publishers Pvt. Ltd., New Delhi.
2. Hill, A.F. 1952. Economic Botany; A Textbook of Useful Plants and Plant Products (2<sup>nd</sup> ed.), McGraw- Hill Book Co., Inc., New York.
3. Thompson, H.C. 1949. Vegetable Crops (4<sup>th</sup> ed.), McGraw- Hill Book Co., Inc., New York.
4. Wallis, T.E. 1946. Text book of Pharmacognosy. J. & A. Churchill Ltd, London.
5. Pandey, B.P. 1990. Economic Botany (4<sup>th</sup> ed.), S. Chand & Company Ltd, New Delhi.
6. Verma, V.A. 1980. Textbook of Economic Botany (3<sup>rd</sup> ed.), Emkay Publications, New Delhi.
7. Maheshwari, P. and Singh, U. 1965. Dictionary of Economic plants in India. I.C.A.R. New Delhi.

**ELECTIVE PAPER**

**CODE: 16 BOT A E4**

**FIRST SEMESTER**  
**PAPER: PLANT GENETICS**

**GOALS:** Plant genetics is the branch of biology that deals with heredity, especially the mechanisms of hereditary transmission and the variation of inherited characteristics among similar or related organisms. Genetics is the process of trait inheritance from parents to offspring, including the molecular structure and function of genes, gene behavior in the context of a cell or organism, gene distribution, and variation and change in populations. Given that genes are universal to living organisms, genetics can be applied to the study of all living systems, including bacteria, plants, animals, and humans. The observation that living things inherit traits from their parents has been used since prehistoric times to improve crop plants and animals through selective breeding. Genetics acts in combination with an organism's environment and experiences to influence development and behavior. Genes may be activated or inactivated, as determined by a cell's or organisms intra- or extra-cellular environment.

**UNIT-1**

Mendelian principles – dominance, segregation, independent assortment; Co-dominance, incomplete dominance.

**UNIT-2**

Extensions of Mendelian principles- gene interactions, pleiotropy, genomic imprinting, penetrance and expressivity, phenocopy, linkage and crossing over, Theories of sex determination, sex linkage, sex limited and sex influenced characters.

**UNIT-3**

Extrachromosomal inheritance– inheritance of mitochondrial and chloroplast genes; maternal inheritance

**UNIT-4**

Microbial genetics– methods of genetic transfers, transformation, conjugation, transduction and sexduction, mapping genes by interrupted mating, fine structure analysis of genes  
Recombination – homologous and non-homologous recombination including transposition

**UNIT-5**

Quantitative genetics– polygenic inheritance, heritability and its measurements, QTL mapping.

Mutation– types, causes and detection, mutant types – lethal, conditional, biochemical loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis.

**REFERENCES**

1. Gupta, P.K. 1994. Genetics, Rashtogi Publication, Meerut, India
2. Gardener, E.J. 1975. Principles of Genetics (5<sup>th</sup> ed.), John wiley, New York.
3. Gilber, N.W. 1978. Organellar heredity, Revan press, New York.
4. King, R.C. 1975. A Hand book of Genetics, Plenum Press, New York.
5. Strickboarger, M.V. 1977. Genetics, Macmillan publishers, New York.
6. Maloy, S.R., Cronan, J.E. and Freifelder, D. 1994. Microbial Genetics (2<sup>nd</sup> ed.), Jones and Bartlett Publisher, Inc., Sudbury, Massachusetts, USA.

**SUPPORTIVE**

**CODE: 16 BOT A S2**

**SECOND SEMESTER  
PAPER: BIODIVERSITY CONSERVATION**

**GOALS:** To plan and co-ordinate conservation efforts; to sustainability use biodiversity within management systems such as forestry, fisheries and agriculture; to protect and restore ecosystems, species and genetic diversity using a variety of *in situ* and *ex situ* methods; to equitably share the benefits of biodiversity through social and economic instruments ; to provide a legal basis for conservation and sustainable use and to build human and institutional capacity to integrate measures at bioregional scales.

**UNIT-1**

Historical account of conservation of flora in India: Phytogeographical regions and agro - climatic regions of India; Plants as protectors of environment. Principles of conservation.

**UNIT-2**

Plant Biodiversity: Role of wildlife sanctuaries, biosphere reserves, national parks and sacred groves in plant biodiversity conservation. Role of GIS in plant conservation

**UNIT-3**

Plant genetic resources: Endangered and threatened plant species-conservation strategies [*in-situ*, *ex situ* and community conservation]-Red data book.

**UNIT-4**

Indian Forest Act, Rio earth summit [1992]-role of WWF, UNDP and FAO in forestry programs in India; Biodiversity Act (2004).

**UNIT-5**

Predominant ethnic communities of India in general and Tamil Nadu in particular and their distribution – ethnomedicine – role of traditional knowledge for therapeutic purposes.

**REFERENCES**

1. Doshi, S.L. 1997. Emerging Tribal Image. Rewat Publication, Jaipur, New Delhi.
2. Khan, T.I. and Shishoda, Y.S. 1998. Biodiversity Conservation and Sustainable Development. Pointer Publishers, Jaipur, India.
3. Chires, D.D. 1987. Environment Science. Prentice-Hall Inc., Englewood Cliffs, New Jersey.
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5. Agarwal, K.C. 1996. Biodiversity. Agrobotanical Publishers, India.
6. Jain, S.K. 1994. A Manual of Ethnobotany (2<sup>nd</sup> ed.), Scientific Publishers, Jodhpur, India.
7. Sinha, K.R. 1996. Global Biodiversity. INA Shree Publishers, Jaipur, India.
8. Sharma, P.D. 1975. Ecology and Environment. Rastogi Publications, Meerut, India.
9. Mukharjee, B. 1997 Environmental Biology. Tata McGraw Hill Publishing Company Ltd., New Delhi.
10. 10. Frame, B., Victory, J. and Joshi, Y. 1994. Biodiversity Conservation: Forests, Wetlands and Deserts. Tata Energy Research Institute, New Delhi.

**CORE PAPER**

**CODE: 16 BOT A CO9**

**THIRD SEMESTER**

**PAPER: PLANT BIOCHEMISTRY**

**GOALS:** To understand the structure and function of various biomolecules in plant cells.  
To elucidate the interrelationships of the cellular components.

**UNIT-1**

Basic principles: Structure of atoms, molecules and chemical bonds. Van der waal forces, Hydrogen bonding, Electrostatic. Buffer solutions, pH, concentration of solutions and colligative properties.

**UNIT-2**

Carbohydrates: Classification, structure and properties. Metabolism - Gluconeogenesis, Glycogenolysis and Glycogenesis. Lipids: Classification, structure and properties. Biosynthesis and Oxidation of fatty acids. Plant waxes, cholesterol and lecithin.

**UNIT-3**

Proteins: Structure, classification and properties. Amino acids: Structure, classification and properties. Biosynthesis and Degradation of amino acids. Mineral nutrition and deficiencies.

**UNIT-4**

Enzymes: Nomenclature and properties. Apo-enzymes, co-enzymes and co-factors. Mechanism of enzyme action and Enzyme inhibition; Michaelis-Menten equation and Line waver – burk plot of enzyme activity. Vitamins: Classification, Functions and Deficiencies.

**UNIT-5**

Secondary metabolites: Classification, functions and biosynthesis of Alkaloids, Phenols, Terpenoids and Flavonoids.  
Plant Pigments - Structure, Classification and functions of chlorophyll, anthocyanins, carotenoids and antho-xanthins.

**REFERENCES**

1. Nelson, D.L. and Cox, M.M. 2012. Lehninger's Principles of biochemistry (6<sup>th</sup> ed.), W. H. Freeman Publishers, New York.
2. Berg, J.M., Tymoczko, J.L. and Stryer, L. 2002. Biochemistry (5<sup>th</sup> ed.) WH Freeman & Co., New York.
3. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. 2003. Harper's Illustrated Biochemistry (26<sup>th</sup> ed.), The McGraw-Hill Companies, Inc., USA.
4. Zubay, G. 1988. Biochemistry. Macmillan Publishing Co., New York.

5. Harold, F.M. 1986. The vital force: A study of bioenergetics. Freeman & Co., New York.
6. Murray, R.K., Mayes, P.A., Granner, D.K. and Rodwell, V.W. 1990. Harper's Biochemistry Lange Medical Book. Connecticut Mc Graw hill, Stanford.
7. Conn, E.E., Stumpf, P.K., Bruring, G. and Doi, R.H. 1998. Outline of Biochemistry (5<sup>th</sup> ed.) John Wiley & Sons, N-Y-Singapore, Toronto.
8. Wey, P.M. and Harbone, J.B. 2000. Plant biochemistry. Panima Educational Book agency, New Delhi.

**CORE PAPER**

**CODE: 16 BOT A CO10**

**THIRD SEMESTER**

**PAPER: MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY**

**GOALS :** To know molecular structure and function of chromosomes, genes and mutations. To explain how genetic engineering involves the use of recombinant DNA technology for crop improvement and to identify the molecular markers for selection of superior genotypes. To acquire fundamental knowledge on the application of various molecular tools and techniques for improvement of microbes and higher plants

**UNIT-1**

Chromosomes and their structure – Euchromatin and heterochromatin; role of chromatin in gene expression and gene silencing; banding pattern for identification of chromosomes; B-chromosomes. Chromosomal aberrations–duplications, deficiencies, inversions and translocations.

**UNIT-2**

Mutations – types of mutagens and mutations, effects of mutagens on chromosomes and genes at molecular level, Identification of mutations in plants; *in vitro* methods for crop improvement.

**UNIT-3**

Chemistry of the gene – composition and structure, function, metabolism of nucleic acids; Nucleic acids as genetic material; replication of DNA, models of DNA replication with experimental evidences. Organization of genetic material - nucleosome concept, techniques involved in nucleosome discovery, Chromosomal DNA content and C-Value paradox; repetitive DNA, satellite DNA; selfish DNA.

**UNIT-4**

Genetic code – properties, codon assignments, mutations in genetic code, new genetic code in mitochondria and ciliate protozoa.; Gene expression – protein synthesis in prokaryotes and eukaryotes – transcription and translation; Post transcriptional modification; regulation of gene expression – induction and repression systems, the operon model (lac, try).



#### **UNIT-5**

Biotechnology-basic concepts and scope, Methods of gene transfer to plants: Direct gene transfer methods – *Agrobacterium* mediated method – biolistic methods; Genetic engineering: Restriction Enzymes- plasmid and phage vectors – artificial chromosomes; Gene cloning: Principles and techniques; Construction of genomic and cDNA libraries. Transgenic plants- pros and cons

#### **REFERENCES**

1. Stickberger, M.W. 1977. Genetics (2<sup>nd</sup> ed.), Macmillan, New York.
2. Swanson, C.P., Mertz, T. and Young, W.J. 1988. Cytogenetics (2<sup>nd</sup> ed.), Englewood Clifa, New Jersey.
3. Watson, J.P. 1975. Molecular Biology of the Gene (3<sup>rd</sup> ed.), Benjamin, New York.
4. Darlington, C.D. 1985. Cytology, Churchill, London.
5. Henry, R.J. 1997. Practical Applications of Plant Molecular Biology. Chapman & Hall, London, UK.
6. Old, R.W. and Primrose, S.B. 1989, Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford, UK.
7. Chawla, H.S. 2002. Plant biotechnology (2<sup>nd</sup> ed.), Oxford IBH Publishing Co. Pvt. Ltd., New Delhi.
8. Primrose, S.B. 1995. Principles of Genome Analysis. Blackwell Science Ltd., Oxford, UK.
9. Raghavan, V. 1997. Molecular Biology of Flowering Plants. Cambridge University Press, UK.

**CORE PAPER**

**CODE: 16 BOT A CO11**

**THIRD SEMESTER**

**PAPER: PLANT SYSTEMATICS**

**GOALS:** To acquire the fundamental values of plant systematics; to know about the basic concepts and principles of plant systematics; to establish a suitable method for correct identification and adequate characterization of plants; to be aware of the importance of taxonomic relationships in plant systematic studies.

**UNIT-1**

Taxonomy and systematics– Basic components and goals of systematics; Advancement levels in systematics and systematics in internet revolution.

Historical background of plant classification: Classification based on gross morphology, sexual system (Carlos Linnaeus), natural system and phylogenetic system (transitional systems, intentional and contemporary). Major systems of classification: Bentham & Hooker, Engler & Prantl, John Hutchinson. Outline of APG-III plant classification

**UNIT-2**

Botanical nomenclature : Need for scientific names , history of botanical nomenclature , principles of ICBN , the type method, author citation, publication of names, principles of priority, names of hybrids, names of cultivated plants and draft biocode. Process of Identification: Specimen preparation, herbarium methods, and identification methods (taxonomic literature, taxonomic keys and computers in identification); Botanical library; Botanical gardens. Hierarchical classification: taxonomic groups, categories and ranks, utilization of categories (speeds concept, intraspecific ranks, genus and family).

**UNIT-3**

Phylogeny of Angiosperms: Important phylogenetic terms and concepts; origin and evolution of angiosperms; Taxonomic evidence: Morphology, anatomy, embryology, chromosomal, chemotaxonomy and serotaxonomy. Phenetic and phylogenetic methods: Phenetic- numerical taxonomy, phylogenetic – cladistics. Variation and speciation.

**UNIT-4**

Study of the diagnostic characters, economic importance, systematics and phylogeny of: Menispermaceae, Papaveraceae, Capparidaceae, Polygalaceae, Caryophyllaceae, Meliaceae, Oxalidaceae, Rhamnaceae, Vitaceae, Sapindaceae, Combretaceae, Passifloraceae, Lythraceae.

**UNIT-5**

Study of the diagnostic characters, economic importance, systematics and phylogeny of: Asteraceae, Sapotaceae, Bignoniaceae, Chenopodiaceae, Podostemonaceae, Loranthaceae, Casuarinaceae, Orchidaceae, Scitaminae, Commelinaceae, Areaceae, Typhaceae, Cyperaceae, Poaceae.

## **REFERENCES**

1. Darlington, C.D. and Wylie, A.P. 1955. Chromosome Atlas of Cultivated Plants. Allen and Unwin, London.
2. Hutchinson, J. 1973. The Families of Flowering Plants (3<sup>rd</sup> ed.), Oxford University Press, UK.
3. Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants. Macmillan publishers, New York.
4. Rendle, A.B. 1904. Classification of Flowering plants (2<sup>nd</sup> ed. Vol.1), Cambridge University Press, England.
5. Stace, C.A. 1989. Plant Taxonomy and Biosystematics (2<sup>nd</sup> ed.), Edward Arnold. London.
6. Takhtajan, A.L. 1997. Diversity and Classification of Flowering Plants. Columbia University Press, New York.
7. Woodland, D.W. 1991. Contemporary Plant Systematics. Prentice Hall. New Jersey.
8. Bensen, L.D. 1957. Plant Classification. Oxford & IBH Publishing Co., New Delhi.
9. Cronquist, A. 1968. Evolution and Classification of Flowering Plants. Thomas & Nelson (Pvt.) Ltd., London.
10. Davis, P.H. and Heywood, V.M. 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd, London.
11. Henry, A.N. and Bose, C. 1980. An aid to the International Code of Botanical Nomenclature, Today & Tomorrow's Printers & Publishers, New Delhi.
12. Lawrence, G.H.M. 1961. Taxonomy of Vascular Plants. MacMillan and Co., New Delhi.
13. Street, H.E. 1978. Essay in Plant Taxonomy, Academic press, London.
14. Nalk, V.N. 1984. Taxonomy of Angiosperms. Tata McGraw-Hill Publishing Company Ltd., New Delhi.
15. Singh, G. 1999. Plant Systematics- Theory and Practice. Oxford and IBH Publishing Co. Pvt Ltd., New Delhi.
16. Sharma, O.P. 1958. Plant Taxonomy. Tata McGraw Hill Publishing Company Ltd., New Delhi.
17. Bentham, G. 1988. Handbook of British Flora. (7<sup>th</sup> ed., revised by Rendle A.B. in 1930). Ashford, Kent.
18. Cronquist, A. 1988. The Evolution and Classification of Flowering Plants. (2<sup>nd</sup> ed.), New York Botanical Garden, NY, USA.
19. Pullaiah, T. 2007. Taxonomy of Angiosperms. Regency Publications, New Delhi.

**CORE PAPER**

**CODE: 16 BOT A CO12**

**THIRD SEMESTER**

**PAPER: PRACTICALS: PLANT BIOCHEMISTRY, MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY & PLANT SYSTEMATICS**

**BIOCHEMISTRY**

1. Estimation of total soluble carbohydrates (Anthrone reagent method).
2. Estimation of total proteins (Lowry's method).
3. Estimation of total free amino acids (Ninhydrin reagent method).
4. Estimation of total free fatty acids (Titration method).
5. Estimation of total phenolics (Folin-Ciocalteu reagent method).
6. Estimation of flavonoids by colorimetric method.
7. Separation of proteins by sodium dodecyl sulfate polyacrylamide gel electrophoresis (SDS-PAGE).

**MOLECULAR BIOLOGY AND PLANT BIOTECHNOLOGY**

1. Study of mitosis and meiosis in different plant materials.
2. Estimation of chiasma frequency.
3. Banding techniques – C and N banding techniques.
4. Photomicrography, Camera Lucida utility.
5. Methods for induction of mutations and polyploidy.
6. Demonstration of gene transfer methods; genetic engineering; vectors.
7. GUS assay

**PLANT SYSTEMATICS**

1. Study of the morphological and floral characteristics and economic importance of Menispermaceae, Papaveraceae, Cappariaceae, Plogalaceae, Caryophyllaceae, Meliaceae, Oxalidaceae, Rhamnaceae, Vitaceae, Sapindaceae, Combretaceae, Passifloraceae, Lythraceae, Asteraceae, Sapotaceae, Bignoniaceae, Chenopodiaceae, Podostemonaceae, Loranthaceae, Casuarinaceae, Orchidaceae, Scitamineae, Commelinaceae, Arecaceae, Typhaceae, Cyperaceae, Poaceae.
2. Preparation of artificial keys:
3. Preparation and submission of 25 herbarium.

**ELECTIVE PAPER**

**CODE: 16 BOT A E5**

**THIRD SEMESTER**

**PAPER: HORTICULTURE**

**UNIT -1**

Definition; Brief History; Divisions of Horticulture; Classification of horticultural plants; Structure of Horticultural Plants – Cell and Tissue systems, Anatomy of stem root and leaf, Morphological structures; Plant growth processes- A brief account of Photosynthesis, Respiration, Transpiration and Translocation; Stages of plant growth.

**UNIT -2**

Plant Growth Environment: Abiotic factors; Soil – Profile structure; Primary and Secondary nutrients and their functions; Organic matter; Fertilizers – organic, Inorganic and Potting Media; Bioinoculants; Methods of fertilizer application; Directing Plant growth- Training - Pruning and thinning.

**UNIT -3**

Plant propagation: Seeds – Advantages, Viability, Mechanism of Dormancy and Dormancy Breaking: Methods of Direct and Indirect Seedling Production in Nurseries and Transplantation; Propagation through specialized underground structures – Corm, Tuber, Sucker, Bulb, Bulbil, Rhizome; Vegetative Propagation – Cutting, Layering, Grafting and Budding.

**UNIT -4**

Micropropagation Techniques: Stages, multiplication by shoot tip, Nodal culture and Callus culture- Application and Limitations; Somatic embryogenesis; Synthetic seeds – Preparation and Potential uses of artificial seeds; Embryo Rescue, Soil-less Production of Horticultural crops – Hydroponics, sand culture, gravel culture.

**UNIT -5**

Esthetics of Horticulture- Design; Elements and Principles of Design; Flower Arrangement; Terrarium Culture; Bonsai; Growing Plants Indoors; Turf Production; Landscaping- Principles, Types of Parks; Xeriscaping.  
Post harvest handling of Horticultural Products – Harvesting; Storage; Processing; Elements of Marketing

**REFERENCES**

1. Acquaah, G. 2002. Horticulture principles and practices (2<sup>nd</sup> ed.), Pearson Education (Singapore) Pvt. Ltd.

2. Ashman, M.A. and Puri, G. 2002. Essential soil science- A clear and concise introduction to soil science. Blackwell scientific publishers, London.
3. Bose, T.K., Maiti, R.G., Dhua, R.S. and Das, P. 1999. Floriculture and Landscaping. Naya Prokash, Calcutta.
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5. Janik, J. 1972. Horticultural Science. W.H. Freeman & Company, San Francisco.
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7. Millar, C.E. 2004. Soil fertility. Delhi Biotech Books, New Delhi.
8. Rai, M.K. 2006. Handbook of Microbial Biofertilizers. The Haworth Press Inc.
9. Subba Rao, N.S. 1997. Biofertilizers in Agriculture and Forestry. India Book House Limited, Oxford and IBH publishing Co. Pvt. Ltd, New Delhi.
10. Thomson, L.M. and Troen, F.R. 1975. Soils and soil fertility Tata, McGraw Hill Publication Co. Ltd. New Delhi.
11. Tisdale, S.L., Helson, W.L. and Beaton, J.D. 1990. Soil fertility and Fertilizers (5<sup>th</sup> ed.), The MacMillan Publishing Co., New York.
12. Tolanus, S. 2006. Soil fertility, Fertilizer and Integrated Nutrient management. International Book Distributory Co.
13. Trivedy, P.P. 1987. Home gardening. ECA Publication, New Delhi.
14. White, R.E. 2005. Principles and practice of soil science (4<sup>th</sup> ed.), Blackwell publishers, Oxford.

**ELECTIVE PAPER**

**CODE: 16 BOT A E6**

**THIRD SEMESTER**

**PAPER: APPLIED BOTANY**

**APPLIED BOTANY**

**GOALS:** It provides a solid foundation for post graduate students to help them understand modern botanical advancement and its diverse applications. In addition, it also provides a broad, sound and balanced knowledge in a range of areas of applied botany and biotechnology in a stimulating and supportive environment that could be enriched by research. It also inculcate in students knowledge and skills needed for self employment

**UNIT-1**

Microbial growth – Quantification of microbial rates - Stoichiometry of microbial growth and product formation- Application of fermentation: Microbial biomass, Microbial metabolites – Microbial enzymes – Transformation process – Recombinant products – The fermentation process- Mode of operation of fermentation process - Design and operation of Fermenters: Packed bed reactor, Fluidized bed reactor, Trickle bed reactor, Bubble column reactor, Scale up of Bioreactor - Down Stream processing - Recovery of product.

**UNIT-2**

Biosensors: General principle - Catalytic biosensors: monoenzyme electrodes: Bi-enzyme electrodes: enzyme sequence electrodes and enzyme competition electrodes. Affinity-based biosensors, Inhibition based biosensors, Cell-based biosensors, Biochips and biosensor arrays, Problems and limitations - Application of modern sensor technologies: Drug development and detection; Environmental monitoring; Technological process control; Food quality control; Problems and limitations.

**UNIT-3**

The immune system: Cells of the immune system – Types of immunity: Active, Innate, Adaptive – Antibodies: Classification and function – Immunizing agents: Passive and Active, Replicating and non-replicating vaccines – Vaccine immune response: Antibody response to vaccine, Factors influencing the vaccine immune response – Capacity of the immune system - Vaccine antigen load – Immunogenic proteins and polysaccharides in vaccines - Immunodiagnosics: ELISA. Application of genomics. Plant improvement through transgenic technology

**UNIT-4**

Bioremediation of Polluted sites: Role of microbes and plants; microbial degradation of environmental pollutants; Bioremediation practices and technologies - Molecular basis of bioremediation process, molecular research techniques, biomarkers - Biosorption; Microbial biosorption; Mechanisms of biosorption and bioaccumulation; Chemical and physical aspects of sorption process - Phytoremediation: Mechanisms and techniques of Phytoremediation - Degradation of ligno cellulosic compounds, anaerobic treatment for biogas generation - Waste Water Treatment: Aerobic and Anaerobic.

### UNIT-5

Concept of biodiversity (components and levels) - Values of biodiversity - Biodiversity assessment: Dickson and Sherman (1990), Winpenny (1991), Pearson and Moran (1994), UNEP (1995) - Valuation methods. Bioindicators: pollution indicators, microbial indicators for oil and gas exploration, plant indicators. Loss of biodiversity - Conservation strategies (*in-situ* and *ex-situ*)- Concept of sustainable development - International conventions and treaties for conservation of bio-resources: WCS, CBD, CITES, IPCC, Ramsar Convention, UNCLOS, Montreal Convention - National Laws, policies and action plans for conservation (forests, wildlife, biodiversity, marine resources) - People's participation in conservation efforts.

### REFERENCES

1. Alexander, M. 1999. Biodegradation and Bioremediation (2<sup>nd</sup> ed.), Academic Press, London.
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4. Reed, G. and Rehm, H.J. (ed.), Biotechnology, Vol 1-2, Weiheim: Verlag chemie.
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11. Pirt, S.J. 1975. Principles of Microbial and Cell Cultivation. Blackwell Scientific Publication, London.
12. Singh, A. and Ward, O.P. 2004. Biodegradation and Bioremediation. Springer-Verlag, New York.
13. Sinha, J.K. and Bhattacharaya, S. 2006. A text book of immunology. Academic Publishers, Kolkata.
14. Stanbury, P.E. and Whitaker, A. 1984. Principles of Fermentation Technology Pergamon Press, Oxford.
15. Wilson, E.O. 2003. Biodiversity. National Academy of Sciences. USA.



**SUPPORTIVE**

**CODE: 16 BOT A S3**

**THIRD SEMESTER**

**PAPER: PLANTS AND MEDICINE**

**GOALS :** To study the habit and habitat of medicinal plants; to know their scientific names; to acquire knowledge of their chemical composition in relation to environmental factors; to understand the medicinal value of plants and their use in various components of Ayurvedic, Siddha, Homeopathy and Unani systems of medicine; to understand their importance in commercial market.

**UNIT-1**

Plants in 'allopathic' and 'herbal medicines'; historical account of medicinal plants in India and their availability in the past, cultivation, medicinal plant gardens, sacred plants for medicine, trade in raw drugs, local health traditions and household remedies.

**UNIT-2**

Distribution of Indian medicinal plants; Eco-distribution, mapping distribution in different bio-geographic zones, natural distribution of Indian medicinal plants included in the CITES' appendices.

**UNIT-3**

Industrial uses of medicinal plants; Processing of medicinal plants, constraints associated with medicinal plants; process technology [modern and traditional], value added products.

**UNIT-4**

Trade in Medicinal plants: Medicinal Plants demand and supply, channels of supply, major importing countries and regions.

**UNIT-5**

Protection of plant varieties bill [PPV bill]; The provisions of PPV bill, suggestions for the proposed PPV bill, elements of PPV bill, community based enterprise in medicinal plants sector-medicinal plant enterprise for the benefit of the stakeholders.

**REFERENCES**

1. Amruth, 1994. The Medicinal Plants Magazine-all volumes. Medplant Conservatory Society, Bangalore.
2. Guha Bakshi, D.N., Sen Sharma, P. and Pal, D.C. 1996. A Lexicon of Medicinal Plants in India. Naya Prokash, Calcutta.
3. Joshi, S.G. 2000. Medicinal Plants. Oxford and IBH publishing company Pvt. Ltd., New Delhi.
4. Lindley, J. 1984. Medical and Economical Botany. Bishen Singh Mahendra Pal Singh publisher, 23-A New Connaught Place, India.

5. Medicinal Plants for Forest Conservation and Health Care. 1997. Non-wood Forest Products Series 11, FAO, Rome.
6. Medicinal Plants Source Book India. 1996. International Library Association, Switzerland.
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10. Sharma, O.P. 1996. Hill's Economic Botany. Tata McGraw Hill Publishing Company Ltd., New Delhi.
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13. Pullaiah, T. 2005. Medicinal plants in India. Regency Publications, New Delhi.
14. Pullaiah, T. 2006. Encyclopedia of World Medicinal Plants. Regency Publications, New Delhi.

**CORE PAPER**

**CODE: 16 BOT A CO13**

**FOURTH SEMESTER**

**PAPER: ECOLOGY AND PHYTOGEOGRAPHY**

**GOALS:** To understand the basic and applied aspects of environmental botany; and the levels of organization and basic divisions of biology.

**UNIT-1**

History and Scope of Ecology. Concept of Ecosystem, its structure and function, Ecological factors; Edaphic, Climatic, Topographic, Biotic and Abiotic factors. Water: Importance of water in plant distribution, Adaptation of plants, Energetics: Productivity, Food chains, Food webs and Tropic levels and energy flow, Ecological pyramids.

**UNIT-2**

Synecology: Methods and purpose of studying plant communities, quadrat, transects frequency, abundance, density cover, ecotone, community, species diversity and dominance, community dynamics. Autecology: Ecological life cycle – ecotypic differentiation study of populations.

### **UNIT-3**

Ecological succession – Seral and Climax communities – Hydrosere, Xerosere. Bog succession, sand dune succession. Plant indicators. Terrestrial ecosystems, Fresh water ecosystem, Marine ecosystem. Biodiversity and Conservation Biology: Types, benefits, and conservation of Biodiversity, Biodiversity Hotspots.

### **UNIT-4**

Environmental pollution - Air, Water, Soil, Thermal, Radiation, Noise, E-waste; Cumulative effect of Pollution on global environment; Global warming, climate change and its consequences; Environmental Impact Assessment (EIA).

### **UNIT-5**

Phytogeography - Principles and importance of plant geography- Phytogeographic regions of India. Patterns of distribution – Disjunction and Variance- Theories of present day distribution of plants- Continental drift hypothesis-Factors involved in distribution – Endemism, Age and Area hypothesis; Dispersal and Migration and their aims and methods.

### **REFERENCES**

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24. Margalef, R. 1968. Perspective in Ecological Theory, University of Chicago Press, Chicago.

**CORE PAPER**

**CODE: 16 BOT A CO14**

**FOURTH SEMESTER**

**PAPER: RESEARCH METHODOLOGY**

**GOALS:** To introduce the students to various techniques and methods involved in plant science which will enable them to pursue various research activities.

**UNIT- 1**

Principles, methodology and the types of spectrophotometer (UV, NMR and IR); Lyophilization; Centrifugation – principles and different types; Chromatography – TLC, GLC and HPLC; Electrophoresis- Agarose electrophoresis and PAGE.

**UNIT-2**

Microbial techniques: Types of media for microbes, sterilization techniques; Isolation of microbes; Pure culture techniques – maintenance and preservation of cultures and staining methods.

Plant Tissue Culture techniques: Aseptic manipulation, media preparation (MS and B<sub>5</sub> media); Isolation and culture of protoplasts; Preparation of synthetic seeds.

**UNIT-3**

Cytological techniques-pretreatment, fixatives and stains; Nucleic acids-Isolation and purification; Southern, Western and Northern hybridization techniques, colony hybridization, PCR & RAPD.

**UNIT-4**

Bio statistics – definition – basic principles – variables – Collection of data, sample, population and sampling techniques – Primary and secondary data – Tabulation and presentation of data - Measures of central tendency – Mean, Mode, Median and Geometric mean - Measures of dispersion – Range, standard deviation and standard error - Hypothesis testing – test of significance – test in large and small sample – t-test, F-test and Chi square test - Correlation and Regression analysis.

## **UNIT-5**

Dissertation writing – objectives and planning of study, review of literature, presentation and interpretation of results; paper presentation (oral/poster).

## **REFERENCES**

1. Wilson, K. and Walker, J. 2006. Principles and techniques of Biochemistry and molecular Biology, Cambridge University Press, Cambridge, UK.
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## **CORE PAPER**

**CODE: 16 BOT A CO15**

### **FOURTH SEMESTER**

#### **PAPER: PRACTICALS: ECOLOGY AND PHYTOGEOGRAPHY & RESEARCH METHODOLOGY**

#### **ECOLOGY AND PHYTOGEOGRAPHY**

Sampling methods, different types of quadrat, line and belt transects zonation: stratum transect, charting and mapping vegetation, Importance Value Index (Abundance).

#### **RESEARCH METHODOLOGY**

1. Preparation of buffers.
2. Staining techniques for microbes
3. Tissue culture media preparation, sterilization techniques.
4. Pretreatment, fixatives and stains used in chromosomal studies.
5. Protein extraction.
6. Demonstration of PCR & RAPD.
7. Guidelines in dissertation preparation and paper presentation.
8. Solving biostatistical problems: Standard deviation and standard error; Chi-square test; F-test; Correlation and Regression.