

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI-600108.

M.Sc.,BOTANY

(For students admitted in the year 2019-20 onwards)

Year	SEM	Paper	Code	Title of the paper	Credits
I	I	I	19MDA	Plant Diversity-I Algae, Fungi, Lichens and Bryophytes	5
		II	19MDB	Plant Diversity-II Pteridophytes, Gymnosperms and Paleobotany	5
		III	19MDC	Plant Diversity-III Taxonomy and Economic Botany of Angiosperms	5
		I	19MD1	Practical-I (Covering theory papers I, II and III)	4
	II	IV	19MDD	Plant Biochemistry and Biophysics	5
		V	19MDE	Developmental Botany- Plant Anatomy, Embryology and Palynology of Angiosperms.	5
		VI	19MDF	Microbiology	5
		II	19MD2	Practical-II (Covering theory papers IV, V and VI)	4
II	III	VII	19MDG	Plant Metabolism	5
		VIII	19MDH	Cell and Molecular Biology	5
		IX	19MDJ	Molecular Plant pathology	5
		III	19MD3	Practical-III (Covering theory papers VII and VIII)	4
	IV	X	19MDK	Genetics and Plant Breeding	5
		XI	19MDL	Project	6
		IV	19MD4	Practical-IV (Covering theory papers IX and X)	4
				TOTAL	72

CORE ELECTIVES

I	I	I	19ED1	Ecology and Environmental Botany	4
I	I	I	19ED2	Floriculture	4
I	I	I	19ED3	Mushroom cultivation	4
I	II	II	19ED4	Ethnobotany & Pharmacognasy	4
I	II	II	19ED5	Food science and nutrition	4
I	II	II	19ED6	Food processing and preservation	4
II	III	III	19ED7	Algal Biotechnology	4
II	III	III	19ED8	Seed science	4
II	III	III	19ED9	Vermiculture technology	4
II	IV	IV	19ED10	Plant Biotechnology	5
II	IV	IV	19ED11	Applied plant tissue culture	5
II	IV	IV	19ED12	Bioinformatics	5
II	IV	V	19ED13	Plant Research Methodology and Biostatistics	5

II	IV	V	19ED14	Bionanotechnology	5
II	IV	V	19ED15	Biopesticides and Biofertilizers Technology	5
				TOTAL	22

SUPPORTIVE ELECTIVES (SD)

I	II	I	19SD1	Horticulture	3
II	III	II	19SD2	Entrepreneurship Botany	3
				TOTAL	6

SOFT SKILLS

I	I	I	19MS1	Language and communication skill	2
I	II	II	19MS2	Life and managerial skills	2
II	III	III	19MS3	Spoken and presentation skills	2
II	IV	IV	19MS4	Computing skills (advanced)	2
II	IV	V	19MS5	Internship (2 weeks)	2
				TOTAL	10

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M.Sc. BOTANY

**CORE PAPER-I PLANT DIVERSITY I: ALGAE, FUNGI, LICHENS
AND BRYOPHYTES**

(For the students admitted from the academic year 2019- 20 onwards)

HOURS PER WEEK : 6

CREDITS: 5

SEMESTER : I

SUBJECT CODE : 19MDA

OBJECTIVES

- To understand the salient features of Algae, Fungi, Lichens and Bryophytes.
- To study the structure and reproduction and life cycle of various genera mentioned in the syllabus.
- To know the economic importance of different groups mentioned in syllabus.

LEARNING OUTCOME

Upon completion of the course, the student will be able to

- Know the systematic morphology & structure of algae, fungi, lichens and bryophytes
- Will understand the life cycle of algae, fungi, lichens and bryophytes
- Will understand the economic importance of algae, fungi, lichens and bryophytes

UNIT - I

Classification of algae (Fritsch, 1945); General characters-thallus organization, pigmentation, flagellation, lifecycles of Cyanophyceae, Chlorophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae; Detailed study of structure, life cycle of the following genera-*Scytonema*, *Oscillatoria*, *Hydrodictyon*, *Ulva*, *Navicula*, *Codium*, *Dictyota*, *Polysiphonia*; Economic importance of algae.

UNIT – II

Classification of fungi-Alexopoulos and Mims (1996); morphology and reproduction, of Myxomycotina, Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, Deuteromycotina; Heterothallism in fungi – Sexuality in fungi; Parasexuality – Sex Hormones in fungi; Detailed study of structure and life cycle of the following genera-*Plasmodiophora*, *Phytophthora*, *Rhizopus*, *Peziza*, *Pleurotus*, *Pestalotiopsis* and *Fusarium*; Mycorrhizal and Endophytic fungi; Economic importance of fungi.

UNIT-III

Lichen-structure, types, vegetative and sexual reproduction, economic importance; Type study of *Usnea*; Role of lichens in plant succession.

UNIT – IV

Bryophytes-classification (Proskauer, 1957). General characteristics of Hepaticopsida, Anthocerotopsida and Bryopsida; Economic importance.

UNIT – V

Structure and life cycle of following genera - *Marchantia*, *Targionia*, *Porella* and *Funaria*.

REFERENCES

1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. (1996). *Introductory Mycology* (4th edition). John Wiley and Sons (Asia), Singapore.
2. Kumar, H.D. (1999). *Introductory Phycology* (2nd edition). Affiliated East-West Press Pvt. Ltd. Delhi.
3. Pandey, B.P. (2001). *College Botany Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta*. S. Chand & Company Ltd., New Delhi.
4. Sambamurthy, A.V.S.S. (2006). *A Textbook of Algae*. I.K. International Pvt. Ltd., New Delhi.
5. Sethi, I.K. and Walia, S.K. (2011). *Text book of Fungi & Their Allies*. MacMillan Publishers Pvt. Ltd., Delhi.
6. Vashishta, B.R. (1990). *Botany for Degree Students: Fungi*. S. Chand & Company Ltd., New Delhi.
7. Vashishta, B.R., Sinha, A.K. and Singh, V.P. (2008) *Botany for Degree Students: Algae*. S. Chand & Company Ltd., New Delhi.
8. Chopra, R.N. and Kumara, P.K. (1988). *Biology of Bryophytes*. Wiley Eastern Ltd., New Delhi.
9. Prem, P. (1981). *Bryophytes: Morphology, Growth and differentiation*. Atma Ram and Sons, New Delhi.
10. Rashid, A. (1998). *An Introduction to Bryophyta*. Vikas Publishing House (P) Ltd., New Delhi.
11. Smith, G.M. (1955). *Cryptogamic Botany Vol. II Bryophytes and Pteridophytes* (2nd edn.). Tata McGraw Hill Publishing Co., New Delhi.
12. Srivastava, N.N., (1996). *Bryophyta*. Pradeep Prakashan, Meerut.
13. Vashista, B.R. (1983). *Botany for Degree Students – Bryophyta*. S. Chand and Company Ltd., New Delhi.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600 108. M.Sc. BOTANY CORE PAPER-II PLANT DIVERSITY II: PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY. (For the students admitted from the academic year 2019- 20 onwards)	
HOURS PER WEEK : 6 CREDITS: 5	SEMESTER : I SUBJECT CODE : 19MDB

OBJECTIVES

- To provide basic knowledge on morphology and life cycle of Pteridophytes and Gymnosperms.
- To understand types and methods of fossilization.

LEARNING OUTCOME

Upon completion of the course, the student will be able to

- Know the systematic morphology & structure of pteridophytes and gymnosperms
- Understand the life cycle of pteridophytes, and gymnosperms
- Understand the economic importance of pteridophytes and gymnosperms
- Understand the missing link and evolution of plants over era.

UNIT - I

Classification of Pteridophytes (Reimer, 1954); General characteristics features of Psilophytopsida, Psilotopsida, Lycopsidea, Sphenopsida, and Pteropsida; Structure and life cycles of *Psilotum*, *Isoetes*, *Equisetum*, *Pteris*, and *Marsilea*.

UNIT – II

Origin and evolution of stele and soral evolution; Heterospory and seed habit; Telome theory; Evolution of gametophytes in Pteridophytes; Morphogenetic studies; Economic importance of pteridophytes.

UNIT – III

Gymnosperms - classification (Sporne, 1965); General characters of Cycadopsida, Coniferopsida and Gnetopsida; Structure and life cycle of *Cycas*, *Cupressus*, *Ephedra* and *Gnetum*; Economic importance of gymnosperms.

UNIT – IV

Origin and evolution of seed habit; Gondwana flora of India; Contribution of Birbal Sahni to Paleobotany; Age determination and methods of studying fossils; Study on the types of fossils in understanding evolution; Compression, incrustation, casts, moulds, petrification, coal balls and compactions; Geological time scale; Economic importance of fossils- fossils for fuel and as industrial raw material.

UNIT – V

Study of structures of organ genera of the following-*Calamites*, *Sphenophyllum*, *Lyginopteris*, *Medullosa*, *Pentoxylon*, *Lagenostroma*, and *Cardiocarpus*.

REFERENCES

1. V. Singh, P.C. Pande and D. K. Jain. 2017. Archegoniate (Bryophytes, Pteridophytes and Gymnosperm). Rastogi Publications.
2. V. Kumaresan and Annie Raglan. 2011. Pteridophytes, Gymnosperms and Palaeobotany. Saras publications.
3. Vashistha, P.C., Sinha, A.K., Kumar, A. 2010. Pteridophyta. S. Chand. Delhi, India.
4. Bhatnagar, S.P. & Moitra, A. 1996. Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
5. Parihar, N.S. 1991. An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.

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M.Sc. BOTANY

**CORE PAPER-III TAXONOMY AND ECONOMIC BOTANY OF
ANGIOSPERMS**

(For the students admitted from the academic year 2019- 20 onwards)

HOURS PER WEEK : 6

CREDITS: 5

SEMESTER : I

SUBJECT CODE : 19MDC

OBJECTIVES

- To impart knowledge in botanical nomenclature, classification, merits and demerits of various systems of classification.
- To understand the systematics of the selected families of the flowering plants with the economic importance.
- To have knowledge in the economically important plants with their systematic treatment.

LEARNING OUTCOMES

Students are expected to gain theoretical knowledge and acquire basic skills and upon completion of the course, they will be able to

- Illustrate the types, merits and demerits of various systems of classification
- Relate taxonomy and other fields of Botany
- Learn norms of ICN and construction of keys
- Identify the angiosperm family with specific key characters

UNIT - I

Taxonomy and systematics; objectives of plant systematics; hierarchy; concepts of characters - qualitative, quantitative, analytical and synthetic; Good and bad characters; Systems of classification - Artificial system- Linnaeus, Natural system- Bentham and Hooker; Phylogenetic system-Engler and Prantl; APG-IV system of classification.

UNIT - II

Modern Trends in taxonomy- Numerical taxonomy, Chemotaxonomy and Serotaxonomy; Botanical Survey of India-Its organization and role; ICN- Importance and principles of Binomial Nomenclature; Valid and effective publication, Citation, rejection and retention of names, Typification; Limitation to priority- A general account of keys and types.

UNIT - III

A detailed study of the families and their interrelationships- Menispermaceae, Violaceae, Capparidaceae, Meliaceae, Rhamnaceae, Vitaceae, Anacardiaceae, Combretaceae, Lythraceae, Turneraceae and Apiaceae.

UNIT-IV

A detailed study of the following families and their interrelationships: Oleaceae, Boraginaceae, Bignoniaceae, Pedaliaceae, Acanthaceae, Amaranthaceae, Polygonaceae, Casuarinaceae, Commelinaceae, Arecaceae and Typhaceae.

UNIT-V

Origin, evolution, cultivation and uses of (i) Cereals- Sorghum and Bajra; (ii) Fibre crops -Cotton, jute; (iii) Medicinal plants- *Rauwolfia serpentina*, *Gymnema sylvestre*; (iv) Aromatic plants –*Coleus aromaticus*, *Mentha piperita*; (v) Vegetable oil yielding plants –Sunflower and Coconut; (vi) Spice and Condiments –*Cinnamon* and *Myristica fragrans*; (vii) Wood and timber yielding plants- *Pterocarpus marsupium*, *Santalum album* and Non-wood forest products (NWFPs) -Bamboosa, rattens, gums, tannins, dyes and honey.

REFERENCES

1. Lawrence. G.H.M, 1985- An Introduction to plant taxonomy, Central Book Depot, Allahabad.
2. Porter. C.L 1982- Taxonomy of Flowering Plants, Eurasia Publications House, New Delhi.
3. Rende.A.B 1980- The Classification of Flowering plants (Vol.I and II), Vikas student education.
4. Pandely. B.P 1987- Taxonomy of Angiosperms.
5. Pandely. B.P 1987- Economic Botany.
6. Verma. V 1984- Economic Botany.
7. Hill. A.W 1981- Economic Botany, McGraw Hill Pub.
8. Wills. T.E 1994- Text Book of Pharmacognosy. Tata McGraw Hill Publishers.
9. Gokhale. S.B 1992- Pharmacognosy. S, Chand and Co.
10. Ansari. S.H 1993- Pharmacognosy. S, Chand and Co.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600 108.

M.Sc. BOTANY

PRACTICAL PAPER I – COVERING THEORY PAPERS I,II & III

(For the students admitted from the academic year 2019- 20 onwards)

HOURS PER WEEK:4

SEMESTER:I

CREDITS:4

SUBJECT CODE:19MD1

ALGAE

Study of algal genera in the field and laboratory. Identification at generic level using algal monographs. Study of electro micrographic pictures of some algae. Collection of algae, Herbarium submission.

FUNGI

Study of morphological and reproductive structures of the genera mentioned in the theory. Isolation and identification of fungi from soil and air. Preparation of culture media.

LICHENS

Study of morphological and reproductive structures of the genera mentioned in the theory.

BRYOPHYTA

Morphology and anatomy of the vegetative and reproductive organs of the genera mentioned in the theory.

PTERIDOPHYTA AND GYMNOSPERMS

Morphology and anatomy of the vegetative and reproductive organs of the genera mentioned in the theory.

TAXONOMY

Description of species either based on herbarium or live specimens of the families mentioned in the theory. Identification of Key characters, both qualitative and quantitative. Preparation and use of keys at generic and specific levels.

Diagnostic characters of families and their use in the preparation of key.

Field visits for at least 5-7 days to collect specimens. Submission of not less than 20 herbarium sheets representing the families studied.

Bonafide record of practical work done should be submitted for the practical examination. The practical examination is followed by viva-voce examination.

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CORE ELECTIVE-I ECOLOGY AND ENVIRONMENTAL BOTANY

(For students admitted from the Academic year 2019-2020 onwards)

HOURS PER WEEK:4

SEMESTER : I

CREDITS :4

SUBJECT CODE :19ED1

OBJECTIVES

- To understand ecosystem and community interaction
- To gain knowledge on biodiversity and its management
- To obtain an insight into remote sensing and its applications.

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand ecosystem and its significance.
- Obtain knowledge on values of biodiversity and its management.
- Learn to interpret remote sensing data.

UNIT-I

Ecosystem structure-Abiotic and Biotic factors and function; energy flow and mineral cycling (C,N,P); primary production and decomposition; structure and function of some Indian ecosystems-terrestrial (forest, grassland) and aquatic (fresh water, marine, eustarine).

UNIT-II

Interspecific interactions-Herbivory, Commensalism, Mutualism, Amensalism, Parasitism; Resource partitioning; character displacement; Synecology-Qualitative and Quantitative characters of community; Raunkaier's Life Forms;Key stone species;Edges and Ecotones;Niche-niche width and overlap, fundamental and realized niche;Ecological Succession- hydrosere,mesosere, xerosere; mechanisms-nudation, invasion, competition and reaction, stabilization;concept of climax.

UNIT-III

Major terrestrial biomes-Tundra,Arctic,Alpine,Montane-temperate,subtropical,tropical , grassland and desert; theory of island biogeography; Endemism- Red data book- Continuous and discontinuous distribution of vegetation; Biogeographical zones of India; Types of vegetation in India; Dispersal and migration barriers hypothesis; Continental drift; Land - Bridges, Age and Area hypothesis.

UNIT-IV

Global environmental change; Biodiversity- status, monitoring and documentation; major drivers of biodiversity change; Biodiversity management approaches-Agroforestry, Social forestry, Man and biosphere; Principles of conservation-*insitu* (Sanctuary, Parks, Bioreserves),*exsitu* (Gene banks, Pollen bank, Seed banks, tissue culture).

UNIT-V

Remote sensing-Principles, Photon and radiometric parameters, processing and classification of remote sense data –pattern recognition and interpretation, tools in data sensing-GIS, GPS, Applications of remote sensing in Agriculture and forestry.

REFERENCES

1. S.Ignacimuthu (2013) Environmental studies. MJP Publishers, India
2. Agrawal, K. C. (1987) Environmental Biology. Agro-botanical Publications, India.
3. Ambasht, R. S. (1974) A Textbook of Plant Ecology. 3rd ed. Students' Friends Co.Varanasi, India.
4. Billings, W. B. (1965) Plants and the Ecosystem. Wardsworth Publishing Co. Inc., Belmont.
5. Cain, S. A. (1944). Foundation of Plant Geography. Harper & Brothers, New York.
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7. Good, R. (1953) The Geography of Flowering Plants. 2nd ed. Longmans Green & Co. Inc., London.
8. Heywood, V. H. (1995) Global Biodiversity Assessment. UNEP, Cambridge University Press, London
9. Kershaw, K. A. (1973) Quantitative and Dynamic Plant Ecology. Edward Arnold Publishers Ltd., London.
10. Kormandy, E. J. (1978) Concepts of Ecology. 2nd ed. Prentice Hall of India Pvt. Ltd., New Delhi
11. Krishnan Kannan (1997) Fundamentals of Environmental Pollution. S. Chand and Co. Ltd., New Delhi.
12. Krishnamurthy, K. V. (2004) An Advanced Textbook on Biodiversity: Principles and Practice. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
13. Levitt, J. (1980) Responses of Plants to Environmental Stresses. Acad Press, New York.
14. Mani, M. S. (1974) Ecology and Biogeography of India. Dr. W. Junk Publishers, The Hague
15. Odum, E. P. (1971) Fundamentals of Ecology. W. B. Saunders & Co., PhiladelphiaUSA.
16. Odum, E. P. (1975) Ecology. 2nd ed. Oxford & IBH Publications, New Delhi.
17. Puri, G. S. (1960). Indian Forest Ecology. Vol. I & II. Oxford & IBH Publications, Delhi.
18. Vashista, P. C. (1974) A Textbook of Plant Ecology. Vishal Publications, Jullunder.

Course url

1. <http://nptel.ac.in/courses/122103039/40>
2. <http://b-ok.xyz/book/671429/bc900f>
3. <http://b-ok.xyz/book/2463090/f0ce34>

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(For the students admitted from the academic year 2019- 20)

CORE ELECTIVE I - FLORICULTURE

Hours per week :4

Credits: 4

Semester - I

Subject Code -19ED2

OBJECTIVES

- To understand the scope of floriculture
- To study the process of flower production
- To study about cut flowers .

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Understand the significance of floriculture
- Carry out large scale cultivation of cut flowers
- Market the products of floriculture

UNIT I

Scope of cut flowers in global trade, Global Scenario of cut flower production, Varietal wealth and diversity, area under cut flowers and production problems in India-Patent rights, nursery management, media for nursery, special nursery practices.

UNIT II

Growing environment, open cultivation, protected cultivation, soil requirements, artificial growing media, soil decontamination techniques, planting methods, influence of environmental parameters, light, temperature, moisture, humidity and CO₂ on growth and flowering.

UNIT III

Flower production –water and nutrient management, fertigation, weed management, rationing, training and pruning, disbudding, special horticultural practices, use of growth regulators, physiological disorders and remedies, IPM and IDM, production for exhibition purposes.

UNIT IV

Flower forcing and year round flowering through physiological interventions, chemical regulation, environmental manipulation.

UNIT V

Cut flower standards and grades, harvest indices, harvesting techniques, post-harvest handling, Pre-cooling, pulsing, packing, Storage & transportation, marketing, export potential, institutional support, Agri Export Zones.1.Crops: Cut rose, cut chrysanthemum, carnation, gerbera, gladioli, tuberose, orchids, anthurium, aster, lilioms, bird of paradise, heliconia, alstroemeria, alpinia, ornamental ginger, bromeliads, dahlia, gypsophilla, limonium, statice, stock, cut foliages and fillers.

REFERENCE BOOKS

Arora JS. 2006. Introductory Ornamental horticulture. Kalyani.2.Bhattacharjee SK. 2006.

Advances in Ornamental Horticulture. Vols. I-VI. Pointer Publ.3.Bose TK &Yadav LP. 1989.

Commercial Flowers.Naya Prokash.4.Bose TK, Maiti RG, Dhua RS & Das P. 1999. Floriculture and Landscaping.NayaProkash.

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.ChadhaKL. 1995. Advances in Horticulture. Vol. XII. Malhotra Publ. House.

.Lauria A &Ries VH. 2001. Floriculture –Fundamentals and Practices. Agrobios.

Prasad S & Kumar U. 2003.Commercial Floriculture.Agrobios.

Randhawa GS &Mukhopadhyay A. 1986.Floriculture in India.Allied Publ.

Reddy S, Janakiram B, Balaji T, Kulkarni S &Misra RL. 2007. Hightech Floriculture. Indian Society of Ornamental Horticulture, New Delhi.

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(For the students admitted from the academic year 2019- 20)

CORE ELECTIVE I- MUSHROOM CULTIVATION

Hours per week : 4

Credits: 4

Semester - I

Subject Code -19ED3

OBJECTIVES

- To understand the basics of mushroom cultivation
- To study the principles of mushroom cultivation
- To study the nutritional aspect of mushrooms.

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Identify edible and poisonous mushrooms
- Carry out mushroom cultivation as entrepreneurs
- Produce various products from mushroom.

UNIT-I

Mushroom –Introduction-Taxonomical rank -History and Scope of mushroom cultivation -Edible and Poisonous Mushrooms-Vegetative characters.

UNIT -II

Structure and key for identification of edible mushrooms-Button mushroom (*Agaricusbisporus*), Milky mushroom (*Calocybeindica*), Oyster mushroom (*Pleurotussajorcaju*) and paddy straw mushroom (*Volvariellavolvcea*).

UNIT- III

Structure and key for identification of poisonous mushrooms–Truffles (*Tuber elanosporum*), *Ammanitasp* ,*Galerinamarginata*, and *Chlorophyllummolybdites*.

UNIT -IV

Principles of mushroom cultivation-Sterilization and disinfections of substrates. -Pasteurization of different substrates –spore printing, pure culture, spawn production and theirmaintenance.

UNIT- V

Nutritional and medicinal values of mushrooms-value added products of mushrooms soup, cutlet, vegetable curry, samosa, omelette, pickle etc.

REFERENCE

- 1.NitaBhal. (2000). Handbook on Mushrooms.2nd ed. Vol.I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
- 2.V.N. Pathak, NagendraYadav and Maneesha Gaur, Mushroom Production and Processing Technology/ VedamsEbooksPvt Ltd., NewDelhi (2000)
3. TewariPankajKapoor, S. C. (1988). Mushroom Cultivation. Mittal Publication, New Delhi.
- 4.Tripathi, D. P. (2005). Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt.ltd., New Delhi.

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M.Sc. BOTANY

CORE-IV PLANT BIOCHEMISTRY AND BIOPHYSICS

(For the students admitted from the academic year 2019- 20 onwards)

HOURS PER WEEK : 5

SEMESTER : II

CREDITS: 5

SUBJECT CODE : 19MDD

OBJECTIVES

- To provide basic knowledge about molecules and their interactions
- To understand Enzymes and Laws of energy

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Learn various chemical bonds and its importance in biomolecules.
- Understand the classification of biomolecules.
- Know basics of enzymes in industrial applications.
- Learn about the importance of thermodynamics.

UNIT - I

Structure of atom and molecule; Chemical bonds – Ionic, covalent, hydrogen bond; Hydrogen ion concentration (pH), buffers.

Carbohydrates – properties of mono, oligo and polysaccharides; Structure and functions of triose, tetrose, pentose, hexoses-maltose, sucrose, starch and pectin; glycosidic linkage; deoxy sugars; glycoproteins; amino sugars; isomerism and mutarotation.

UNIT – II

Lipids-structure of fatty acids and glycerol; phospholipids, glycolipids and steroids; Biosynthesis and oxidation of fatty acids-Glyoxalate pathway; Gluconeogenesis.

UNIT – III

Amino acids and proteins-Ionic forms of aminoacids-zwitterion, isoelectric pH,optical isomers of amino acids; Formation of peptide bond-peptides; Structure of proteins-primary, secondary, tertiary and quaternary; Ramachandran's plot-denaturation of proteins; Protein purification-ion exchange and affinity chromatography.

UNIT – IV

Enzymes-Nomenclature and classification; Properties, apoenzyme; cofactors; metallic activators and coenzymes; concept of active sites;Enzyme kinetics-Michaelis-Menton equation; Enzyme regulation-inhibition; Enzyme immobilization;Application of enzymes in industry and medicine.

UNIT – V

Bioenergetics-Law of thermodynamics-enthalpy, entropy and free energy; Exergonic and endergonic reactions. Redox potential. Photosynthetic-oxidative phosphorylation; respiratory energy production-Structure and hydrolysis of ATP; high energy compounds-NADH₂, NADPH₂, FADH₂ and GTP; Structure of ATP synthase; Bioluminescence.

REFERENCES

1. A. L. Lehninger, D. L. Nelson and M. M. Cox. 1993. Principles of Biochemistry. Worth Publishers, New York.
2. F. M. Harold. 1986. The vital force: A study of Bioenergetics. Freeman & Co, New York.
3. G. Zubay.1988. Biochemistry. Macmillan Publishing Co., New York.
4. L. Stryer . 1999. 4th Edition. Biochemistry. W. H. Freeman & Co, New York.
5. Voet, Voet and Pratt. 2012. Principles of Biochemistry. Wiley Publications.
6. P. Narayanan. 2007. Essentials of Biophysics. New Age International Publishers.

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M.Sc. BOTANY

**CORE PAPER V – DEVELOPMENTAL BOTANY-PLANT ANATOMY,
EMBRYOLOGY AND PALYNOLOGY OF ANGIOSPERMS.**

(For the students admitted from the academic year 2019- 20 onwards)

HOURS PER WEEK : 5

SEMESTER : II

CREDITS: 5

SUBJECT CODE : 19MDE

OBJECTIVES

- To inculcate the basics of tissues and anatomical features of plants.
- To impart the knowledge about the various aspects of morphogenesis.
- To understand the key aspects of embryology of angiosperms.

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand the scope and importance of anatomy and embryology.
- Know various tissue systems.
- Understand normal and anomalous secondary growth in plants and their causes.
- Understand micro & megasporogenesis, male & female gametophytes, fertilization & embryogeny.

UNIT-I

Organization and theories regarding shoot, root and reproductive meristem; Vascular cambium- origin, development and types; cambial activity- normal and anomalous; cork cambium, periderm, polyderm, rhytidome, lenticels; Xylem- differentiation, xylary elements- parenchyma, fibre, tracheid, and vessels; patterns of secondary wall; tyloses; reaction wood, heart wood and sap wood; growth rings-Dendrochronology; Phloem-primary and secondary elements-Phloem parenchyma, Phloem fibre, sieve tube and companion cells; Ontogeny- differentiation, structural variations and characteristics of phloem components; Anomalous secondary thickening in Dicotyledons-*Bignonia*; Monocotyledons- *Dracaena* stem.

UNIT-II

Secretory cells and tissues-classification, structure and significance; types-external and internal secretory structures; Epidermal cells; Nodal anatomy-uni, tri and multi-lacunar; Ontogeny and histogenesis of bifacial leaf- Hibiscus, unifacial leaf- grass; Stomata-Development and types; Kranz anatomy.

UNIT-III

Microsporogenesis-Morphology, cytology and physiology of tapetum; Microgametogenesis- microspore, division of generative cell, pollen wall morphogenesis and structural variability, pollen fertility and sterility; pollen germination and storage; Ovule-types, megasporogenesis; megagametogenesis; embryo sac types; ultrastructure of egg, synergids and antipodals.

UNIT-IV

Fertilization; Heterospermy; discharge and movement of sperms; syngamy and triple fusion; post-fertilization changes; Heterofertilization; Endosperm-types-Nuclear, Cellular and Helobial, haustoria; Embryogeny-Laws of Embryogeny-Classification- mono and dicot embryos-variations and differences in development; Apomixis; Parthenocarpy; Polyembryony, Embryology in relation to Taxonomy.

UNIT-V

Introduction and scope of Palynological science- Acetolysis methods; Pollen identification-size, shape, aperture numbers and types, surface, exine ornamentation; Aero palynology- pollen allergy, Melittopalenology; Application of paleontology; Pollen calendar.

REFERENCES

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3. Davies .P.H and Heywood. V.H 1967 Principles of Angiosperms taxonomy. Oliver and Byod. Edinburgh.
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8. Johri. B.M 1984 Embryology of Angiosperms. Springer Verlaug.
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BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI-600108

M.Sc. BOTANY

CORE PAPER VI- MICROBIOLOGY

(For the students admitted from the academic year 2019-20 onwards)

HOURS PER WEEK: 5

SEMESTER: II

CREDITS : 5

SUBJECT CODE :19MDF

OBJECTIVES

- To understand the developments in the field of microbiology.
- To study about the structure of bacteria and virus.
- To understand the fermentation process
- To study the role of microbes in food industry

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- know the classification of bacteria and viruses.
- Understand the significance of microbes in environment.
- Understand the importance microbes in food industry.

UNIT- I

Bacteria-Classification (Bergey's,1923); General characteristics, Occurrence, Ultrastructure of bacterial Cell;Gram positive and Gram negative, Endospore, Staining methods – Gram, Acid fast and Endospore staining,Growth kinetics, asexual and sexual reproduction, modes of genetic recombination-conjugation, transformation and transduction. Phytoplasma-role in causing plant diseases. Mycoplasma.

UNIT -II

Classification of plant and animal viruses; viroids, virions and prions, general properties of viruses, Virus structure-TMV and T4, Ultrastructure of virions. Modes of replication, Transmission of viruses. Phages- types.

UNIT -III

Microbes in terrestrial and aquatic habitats-microbes in extreme environments and their adaptations; methods to determine microbial numbers and biomass; significance of microbial activities in the environment- microbial degradation of pesticides, petroleum and hydrocarbons. Rhizobium, PSM, BGA-Algalization. Microbial herbicides and toxin producing microbes. Microbial inoculants in agriculture; microbes as biological control agents.

UNIT- IV

Introduction to industrial microbiology; suitability of microbes in industrial processes and their source; types of fermentation- solid and submerged state; Bioreactors –parts and design of stirred tank; Fermented products-Beer, Cheese, Amylase and Citric acid.

UNIT-V

Brief history of microorganisms in food stuffs; source, types and role of microorganisms in foods; Food spoilage – fruits, vegetables, fresh and processed meat and poultry, bakery and dairy products, alcohol, fermented foods and canned foods. Food borne infections and intoxications- Mycotoxin and food preservation.

REFERENCE

1. G.Tortora, B. Funke and C. Case. Microbiology : An introduction. 5th ed. Menlo Park, CA: Benjamin Cummings, 1995.
2. J. Ingraham and C. Ingraham. Introduction to Microbiology: Belmont, CA: Wadsworth, 1995.
3. T.D. Book, M.T. Madison, J.M. Martinko and J. Parker. Biology of Microorganisms. 7th ed. Englewood Cliffs, NJ: Prentice-Hall, 1994. Pelczar J.M., Chan E.C.S. and Kreig. R.N. 2008. *Microbiology*. 13th Reprint Tata Mc Graw Hill Publishing Company Ltd, New Delhi
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9. Prescott L.M., Harley J.P. and Klein D.A. 1996. *Microbiology*. 3rd Edition, W.M.C. Brown Publishers, Chicago.
10. Salle A.J. 1997. *Fundamental Principles of Bacteriology*. 7th Edition, Tata Mc Graw Hill Publishing Company Ltd, New Delhi

Web resources:

1. <http://www.microbiologyonline.org.uk/links.html>
2. <http://www.bac.wise.edi/microtextbook/index.php>
3. <http://www.microbeworld.org.uk>
4. <http://www.staff.ncl.ac.uk/n.y.morris/lectures/class2007.html>

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI – 600 108.
M.Sc. BOTANY

PRACTICAL PAPER II – COVERING THEORY PAPERS IV,V& VI
(For the students admitted from the academic year 2019- 20 onwards)

HOURS PER WEEK:4

SEMESTER:II

CREDITS:4

SUBJECT CODE:19MD2

PLANT BIOCHEMISTRY AND BIOPHYSICS

1. Basic biochemistry: Preparation of different types of solutions.
2. Principles of photometry: Colorimeter and Spectrophotometer – Principles and applications.
3. To find complimentary colour for different coloured solutions by using colorimeter.
4. Preparation of standard graph for potassium dichromate ($K_2Cr_2O_7$) by using colorimeter (or) Verification of Beer-Lambert law by using colorimeter.
5. Principles of pH meter and applications.
6. Determination of neutralization point of acid – base mixture by titration method.
7. Estimation of glucose colorimetrically.
8. Estimation of aminoacids by Ninhydrin method using TLC.
9. Estimation of proteins (Lowry's method).

ANATOMY

Laboratory work on the basis of topics listed under angiosperm anatomy theory.

Techniques in making temporary and permanent microscopic preparations – free hand, peeling, clearing, maceration and wood section.

EMBRYOLOGY AND PALYNOLOGY

Preparation of dissected whole mounts of embryo. Study of pollen (Acetolysis and nonacetolysis). Collection and identification of local aerospora. Study from permanent preparations.

Development and structure of anther, pollen, ovule, megasporogenesis, embryosac, endosperm and embryo.

MICROBIOLOGY

1. Sterilization methods.
2. Preparation of growth media
3. Isolation of microorganism from air/ phylloplane / rhizosphere
4. Isolation of microbes by serial dilution techniques.
5. Isolation of single cell using Z streak and quadrant streak.
6. Preparation of slant culture.
7. Identification of bacteria using Gram stain
8. Wine preparation from Grapes.

Bonafide record of practical work done should be submitted for the practical examination. The practical examination is followed by viva-voce examination.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI- 600108

M.Sc. BOTANY

CORE ELECTIVE-II-ETHNOBOTANY AND PHARMACOGNOSY

(For the students admitted from the academic year 2019-2020 onwards)

HOURS PER WEEK: 3

CREDITS: 3

SEMESTER: II

SUBJECT CODE:19ED4

OBJECTIVES

- To learn about various tribes of India and Tamil Nadu
- To learn about their culture, values and norms
- To learn about the therapeutic values of plant parts
- To learn about the phytochemicals present in the medicinal plants

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Know the scope and importance of ethnobotany.
- Understand basic knowledge on various tribes of Tamil Nadu.
- Learn various phytochemicals and its significance.

UNIT - I

Ethnobotany-History, concepts and definitions; Subdisciplines of ethnobotany; Knowledge of the following sociological and anthropological terms-culture, values and norms, culture diffusion, ethnocentrism and institutions.

UNIT - II

Distribution of tribes in India; Basic knowledge of following tribes of Tamil Nadu- Irulas, Kanis, Paliyars, Gypsies, Kattunayakan and Malayalis; Folk Taxonomy-Plants associated with socio-religious activities; Non-Timber Forest Produce (NTFP).

UNIT – III

Pharmacognosy-History, Definition, Scope and importance; Classification of Crude drugs- Taxonomical, Morphological, Chemical and Pharmacological; Holistic medicine-AYUSH; Cultivation and utilization of Medicinal and Aromatic plants In India-CIMAP.

UNIT - IV

Biological and Geographical source, Morphology, Cultivation, Collection of medicinal plants; Phytochemicals and Medicinal properties of the following-*Abutilon indicum*, *Aloe vera*, *Catheranthus roseus*, *Digitalis purpurea*, *Gymnema sylvestres*, *Papaver somniferum*, *Phyllanthus amarus* and *Rauwolfia serpentina*.

UNIT- V

A detailed account on various types of phytochemicals and their importance in the field of medicine -Alkaloids, Glycosides, Glucosides, Tannins, Flavonoids and Terpenoids; Anticancer drugs; Poisonous plants of India; Medicinal properties of Non- flowering plants; Adulteration of Crude drugs –Common adulterants and its method of detection.

REFERENCES

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- 14.Subramaniam, S.V., AND V.R. Madhavan,(Eds.). 1983. Heritage of the Tamil Siddha Medicine. International Institute of Tamil Studies. Madras.

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**BHARATHI WOMEN'S COLLEGE (AUTONOMOUS),
CHENNAI – 600 108.**

M.Sc. BOTANY

**(For the students admitted from the academic year 2019- 20)
CORE ELECTIVE II - FOOD SCIENCE AND NUTRITION**

Hours per week : 4

Credits: 4

**Semester - II
Subject Code -19ED5**

OBJECTIVES

- To know to various cooking and processing methods
- To understand the nutritional importance of macromolecules
- To be aware of the various food toxicants and its effects.

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Know the methods of food processing
- Understand Various food macromolecules.
- Know the methods of combating food toxicants

UNIT-I

Different food groups and planning diets to meet the requirements of different social economic levels. Recommended allowances for Indians – basis for requirement, computation of the allowances, comparison of Indian recommended allowances with that of FAD/WHO standards.

UNIT-II

Pulses, grams, dhal and nuts, processing, composition, methods of cooking. Effect of processing such as soaking, roasting, germination and fermentation.

UNIT-III

Nutritional importance of carbohydrates, proteins, lipids, minerals and vitamins. Role of dietary fiber – digestion and utilization, protein, energy malnutrition, iron malnutrition. Strategies for combating malnutrition (role of novel protein and vegetable protein mixtures).

UNIT-IV

Proteins and lipids, amino acid requirements, and amino acid pattern, essential amino acids and fatty acids. Indices of protein quality evaluation, role of essential fatty acids in the body effects of deficiency and excess of fat, role of fats in the etiology of athrosclerosis.

UNIT-V

Naturally occurring food toxicants, protease inhibitors, haemoagglutinins, cyanogens, saponins, allergens and toxic amino acids and naturally occurring carcinogen – their physiological role and prevention of toxicity.

REFERENCE BOOKS:

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**BHARATHI WOMEN'S COLLEGE (AUTONOMOUS),
CHENNAI – 600 108.
M.Sc. BOTANY**

**(For the students admitted from the academic year 2019- 20)
CORE ELECTIVE II - FOOD PROCESSING AND PRESERVATION**

**Hours per week : 4
Credits:4**

**Semester - II
Subject Code -19ED6**

OBJECTIVES

- To understand the methods of food preservation
- To understand the sterilization process
- To study the various food additives.

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Gain knowledge of food sterilization and preservation
- Gain insight into Processing of fruits and fruit product .
- Develop Skills to detect Food adulteration.

UNIT-I

Food Preservation: Principles and methods - Perishable, semi-perishable and nonperishable foods - Methods of preservation - Temporary preservation - Asepsis, low temperature, antiseptics, pasteurization, electromagnetic radiation - Permanent

UNIT-II

preservation – Sterilization processing by heat, effect of acidification and antiseptics. Preservation by salting, Preservation by sugar syrup – Preservation by concentration –Preparation of Jam Jelly – Role of pectin in Jam – Preservation by chemicals: Benzoic acid, parabenzene, sulphur-di-oxide, sulphites, nitrites diethylpyrocarbonates (DEPC), hydrogen peroxide, chlorine and CO₂.

UNIT-III

Processing - Methods - Wet heating method by cookers.Microwave heating method -Processing of fruits and fruit products - Canning of fruits - Preparation of fruit juices -Squashes - Cordials - Preservation by antibiotics and irradiation.

UNIT-IV

Vegetable and vegetable products – Canning of vegetables and pickles. Baked products:Classification of wheat – hard wheat, soft wheat, durum wheat, flour preparation, baking formulation, processing. Milk and milk products: butter, ghee, lassi, unfermented milk products, condensed milk, cheese, ice-cream and milk powder.

UNIT-V

Food additives: Definitions, preservatives, antioxidants - colouring agents, emulsifier, stabilizers and thickening, bleaching and maturing agents, clarifying agents, anti-foaming agents, function of additives. Food adulteration - Adulterants and simple detection techniques - Food grades - Standards, laws and regulations.

REFERENCE BOOKS

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- Frazier, W. C. and Westhoff, D. C. (1988). Food Microbiology. 3rd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
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- Ranganna, S. (1986). Handbook of Analysis and Quantity Control for Fruit, Vegetable Products. CFTRI, Mysore.

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI- 600108

M.Sc. BOTANY

SUPPORTIVE ELECTIVE-I – HORTICULTURE

(For the students admitted from the academic year 2019-2020 onwards)

HOURS PER WEEK: 3

SEMESTER: II

CREDITS: 3

SUBJECT CODE:19SD1

OBJECTIVES

- To understand the importance of Horticulture.
- To study the garden design and prerequisites.

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand the role of horticulture in economy.
- know the techniques of nursery management and garden designing

UNIT-I

Scope and importance of Horticulture; Divisions of horticulture-Olericulture, Pomology, Floriculture, Silviculture ; Role in rural economy and employment generation; Importance in food and nutritional security; Urban horticulture and ecotourism.

UNIT-II

Nursery management-Importance and its role; components of a good nursery-layout, inputs-containers- types, soil mixtures, propagules, tools and labour; Nursery beds –types; Plant propagating structures-shade net house and glass house, potting, repotting and transplantation.

UNIT-III

Garden Design-Types of gardens-formal- Mughal, informal-Japanese; Components of garden-shrubs, trees, climbers and creepers, fence, edges , hedges, borders, carpet beds, trophy, pergola and arches, path; Lawns – types of grasses, methods of lawn making and its maintenance; Pest management.

UNIT IV

Outdoor gardens-Residential, Roof Garden, Terrace Garden, Industrial garden;Indoor gardening-factors affecting culturing indoor plants-light, temperature, humidity, watering and nutrition; Indoor plants; Bonsai; Terrarium; bottle and dish garden; Hanging baskets; Hydroponics- types, Advantages and disadvantages.

REFERENCE

1. Arora, J. S. (1992) Introductory Ornamental Horticulture. Kalyani Publishers, New Delhi.
2. Edmond, J. B. et al. (1977) Fundamentals of Horticulture. Tata McGraw Hill Publishers Co. Ltd., New Delhi.
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BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI- 600108 M.Sc. BOTANY CORE PAPER -VII PLANT METABOLISM (For the students admitted from the academic year 2019-2020 onwards) HOURS PER WEEK: 5 CREDITS:5		SEMESTER: III SUBJECT CODE:19MDG
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OBJECTIVES

- To understand plant and water relations, photosynthesis and respiration.
- To know the nitrogen metabolism and its effect on the growth .
- To study the role of hormones in plant growth and stress physiology.

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand mechanisms of water uptake
- Understand photosynthesis and respiration
- Know nitrogen metabolism and its role in secondary metabolites
- Understand growth and development in plants

UNIT I

Water and plant relations; Soil-plant-atmosphere continuum concept; Mechanism of water uptake and transport-path of translocation of water, ions, solutes and macromolecules;Transpiration-movement and loss of water in plants; evapotranspiration- stomatal physiology and mechanism of stomatal movement; Mechanism of organic solute transport-pressure flow mechanism, phloem loading and unloading.

UNIT II

Photosynthesis-Red drop and Emerson effect; Light harvesting complexes -Structure and function of chlorophylls-mechanism of light absorption- photosystem I and II -light reaction - electron transport chain and Photophosphorylation; Photo protective mechanisms; CO₂ fixation; C₃, C₄ and CAM pathways- Photorespiration and its significance; Biochemistry and molecular biology of RUBISCO.

UNIT III

Respiration- Glycolysis and Citric acid cycle; plant mitochondrial electron transport and ATP synthesis, alternate oxidase; energetics of respiration; Respiratory inhibitors – Cyanide resistant respiration; amphibolic role of respiration.

UNIT IV

Nitrogen metabolism -source of nitrogen in soil, nitrogen fixing organisms; biochemistry and physiology of nitrogen fixation; Legume -*Rhizobium* symbiosis; Nitrogenase; characteristics and functions of Leghaemoglobin; genetics of nitrogen fixation; Nitrate reduction-biochemistry and characteristics of NR and NIR; assimilation of ammonia; GDH and GS-GOGAT pathways-Transamination; Reductive amination; Aminoacid-Synthesis of amino acids; aspartate synthesis; aromatic amino acid synthesis; Interaction between photosynthesis and nitrogen metabolism. Secondary metabolites-Biosynthesis and functions of flavonoids, phenols, terpenoids, alkaloids, steroids, anthocyanin, lignin and nitrogenous compounds; role of secondary metabolites in plant.

UNIT V

Growth and development-Growth kinetics; biosynthesis and mode of action of phytohormones-auxins, gibberellins, cytokinins, ethylene, abscissic acid, Brassinosteroids; Phytochrome-properties and photochemical transformation; Movement-nastic and tropic movements; Seed dormancy-causes and methods to break seed dormancy; physiology of seed germination; Fruiting-mechanism and hormonal control; Abscission and Senescence; Stress physiology-biotic and abiotic factors.

REFERENCES

1. Bidwell. R. G. S. 1979 Plant Physiology. Macmillon Delhi.
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15. Postgate. J. 1987. Nitrogen Fixation 2 nd Edition Cassel, London
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BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI-600108

M.Sc. BOTANY

CORE PAPER VIII – CELL & MOLECULAR BIOLOGY

(For the students admitted from the academic year 2019-20 onwards)

HOURS PER WEEK: 5

SEMESTER: III

CREDITS : 5

SUBJECT CODE : 19MDH

OBJECTIVES

- To know the detailed structure and composition of Nucleic acids.
- To know the replication, repair and recombination of DNA.
- To study the detailed mechanism of transcription of RNAs and its modifications.
- To know the basics of cell signaling and its importance in the maintenance of cell in a normal condition.

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand nucleic acid, its role and functions
- Know protein synthesis and its machinery
- Understand cell signaling and its transduction

UNIT – I

Nucleic acids-Base pairing and variations in base composition; Types of DNA and RNA; Chargaff's rule; DNA size-fragility-melting curves-hydrophobic interactions, denaturation, renaturation, Cot value, Rot value and its significance; Circular and supercoiled DNA; repeated sequence-single stranded DNA; DNA methylation.

UNIT – II

DNA replication-Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, extrachromosomal replicons; DNA damage and repair mechanisms; homologous and site-specific recombination.

UNIT – III

RNA synthesis and processing in prokaryote and eukaryotes-transcription factors and machinery; formation of initiation complex; transcription activator and repressor; RNA polymerases; capping, elongation, and termination; RNA processing; RNA editing; splicing and polyadenylation; RNA transport.

UNIT – IV

Protein synthesis and processing-Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination; genetic code; aminoacylation of tRNA; tRNA-identity; aminoacyl tRNA synthetase and translational proof-reading; translational inhibitors; Post- translational modification of proteins.

UNIT – V

Cell signaling-hormones and their receptors; cell surface receptors; signaling through G-protein coupled receptors; signal transduction pathways; secondary messengers; regulation of signaling pathways; bacterial chemotaxis and quorum sensing; programmed cell death; role of oncogenes and tumour suppressor genes in cancer biology.

REFERENCES

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2. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology, W.H. Freeman and Co., New York, USA.
3. Richard, M., Twyman and Wisden, W. 1999. Advanced Molecular Biology, Viva Books Pvt. Ltd.
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6. Robert H. Tamarin. Principles of genetics, Tata McGraw Hill Company.
7. Benjamin Lewin. Genes VIII, Printice Hall.
8. Westhead, D.R.J.H.Parish & R.M.Twyman. Bioinformatics, Viva Books

BHARATHI WOMEN'S COLLEGE (AUTONOMOUS), CHENNAI-600108

M.Sc. BOTANY

CORE PAPER IX– MOLECULAR PLANT PATHOLOGY

(For the students admitted from the academic year 2019-20 onwards)

HOURS PER WEEK: 5

SEMESTER: III

CREDITS : 5

SUBJECT CODE : 19MDJ

OBJECTIVES

- To introduce the subject of Plant Pathology, its concepts and principles.
- To impart training on various methods/techniques/instruments used in the study of plant diseases/pathogens.
- To acquaint with different strategies for management of plant diseases.
- To acquaint with disease resistance mechanisms in plants

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand plant disease symptomatology and its molecular basis
- Acquire knowledge on common plants diseases and its management
- Know the forecasting systems and its significance

UNIT- I

Importance, definitions and concepts of plant diseases; biotic and abiotic causes of plant diseases; Pathogenesis-Host parasite interaction, recognition concept and infection, symptomatology, disease development-role of enzymes, toxins, growth regulators; defence strategies-oxidative burst; Phenolics; Phytoalexins; PR proteins; Elicitors; altered plant metabolism by plant pathogens; programmed cell death; viral induced gene silencing; molecular basis of gene-for-gene hypothesis-R-gene expression and transcription profiling; mapping and cloning of resistance genes and marker-aided selection; pyramiding of R genes.

UNIT- II

Diseases of Common plants-Cereals-Black rust of wheat, Blast of rice, Smut of maize; Pulses-Wilt of pigeon pea, Leaf spot of green gram; Oil crops- Tikka disease of groundnut, Blight of sesamum; Vegetables-Little leaf of brinjal, Anthracnose of chilli; Fruits-Scab of Apple, Powdery mildew of grapes, Bunchy top of banana; Cash crops-Red rot of sugarcane, Angular leaf spot of cotton, Stem rot of jute. Important insect vectors-beetles, aphids, grass hoppers, leaf hopper, white flies and their characteristics; mouth parts and feeding processes; transmission of plant viruses and fungal pathogens; relation between viruses and their vectors.

UNIT-III

Principles of plant disease management-cultural, physical, chemical, organic amendments and botanicals; integrated control measures of plant diseases; mode of action of antifungal, antibacterial and antiviral chemicals; handling, storage and precautions to be taken while using chemicals.

UNIT- IV

Concept of biological control, definitions, importance; principles of plant disease management with bioagents; history of biological control-merits and demerits; types of biological interactions-competition, mycoparasitism, exploitation for hypovirulence, rhizosphere colonization, competitive saprophytic ability, antibiosis; Induced resistance; mycorrhizal associations; operational mechanisms and its relevance in biological control; factors governing biological control.

UNIT-V

Epidemic concept and historical development-survey, surveillance and vigilance, crop loss assessment and models; principles and pre-requisites of forecasting-systems and factors affecting various components of forecastings -early forecasting- procedures based on weather and inoculum potential; modelling disease growth and disease prediction.

REFERENCES

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3. Deverall BJ. 1977. Defence Mechanisms in Plants. Cambridge Univ. Press, Cambridge, NewYork.
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6. Singh BD. 2005. Plant Breeding . Principles and Methods. 7th Ed. Kalyani Publ., Ludhiana
7. Basu AN. 1995. Bemisia tabaci (Gennadius) - Crop Pest and Principal Whitefly Vector ofPlant Viruses. Oxford & IBH, New Delhi.
8. Youdeovei A & Service MW. 1983. Pest and Vector Management in the Tropics. EnglishLanguage Books Series, Longman, London.
9. Gnanamanickam SS (Eds). 2002. Biological Control of Crop Diseases. CRC Press, Florida.
10. Heikki MT & Hokkanen James M (Eds.). 1996. Biological Control - Benefits and Risks. Cambridge Univ. Press,
11. Nagarajan S & Murlidharan K. 1995. Dynamics of Plant Diseases. Allied Publ., New Delhi.
12. Thresh JM. 2006. *Plant Virus Epidemiology*. Advances in Virus Research 67, AcademicPress, New York.

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M.Sc. BOTANY

PRACTICAL PAPER-III(COVERING THEORY PAPERS VII AND VIII)

(For students admitted from the Academic year 2019-2020 onwards)

HOURS PER WEEK:4

SEMESTER : III

CREDITS :4

SUBJECT CODE:19MD3

PLANT METABOLISM

1. Extraction and separation of photosynthetic pigments of C₃ and C₄ plants by paper chromatographic method, thin layer chromatographic (TLC) method.
2. Extraction and separation of photosynthetic pigments of C₃ and C₄ plants by column chromatographic method.
3. Extraction and separation of photosynthetic pigments by Chemical method
4. Estimation of Carotenoids by using colorimeter.
5. Estimation and determination of absorption spectra of chlorophyll a and b using colorimeter .
6. DPD by weighing method.
7. Determination of Effect of chemicals on membrane permeability (colorimetrically).
8. Determination of Effect of temperature on membrane permeability (colorimetrically).
9. Effect of varying intensities of light on the rate of photosynthesis of an aquatic plant by using Wilmotts bubbler .
10. Effect of varying concentrations of CO₂ on the rate of photosynthesis of an aquatic plant by using Wilmotts bubbler.
11. Determination of rate of respiration of different respiratory substances by using titration method.
12. Dye reduction test
13. Measuring the production of O₂ by Baryta water.
14. Determination of rate of respiration by using different substrate by titration methods.
15. Effect of calcium chloride and sodium chloride on membrane permeability in beet root by using colorimeter.
16. Effect of pH on membrane permeability in beet root by using colorimeter
17. Effect of temperature on rate of photosynthesis using aquatic plant.
18. Seed Viability test

CELL AND MOLECULAR BIOLOGY

1. Squash preparation of onion root tip for Mitosis
2. Smear preparation of *Tradescantia* flower bud for Meiosis
3. Study of induced aberrations in onion tips employing chemicals and plant extract.
4. Study of subcellular organelles from electron micrographs
5. Nuclear stains
6. Demonstration of salivary gland chromosomes from *Chironomus* larva.
7. Photographs of ECORI, Bam HI , PUC Plasmid ,PCR flow chart , SDS, Southern blotting, Ethidium bromide.

Bonafide record of practical work done should be submitted for the practical examination. The practical examination is followed by viva-voce examination.

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M.Sc. BOTANY

CORE ELECTIVE -III ALGAL BIOTECHNOLOGY

(For the students admitted from the academic year 2019-2020 onwards)

HOURS PER WEEK: 4

CREDITS : 4

SEMESTER: III

SUBJECT CODE: 19ED7

OBJECTIVES:

- To study the cultivation and preservation techniques of Algae
- To know the Industrial and Therapeutic applications of Algae
- To understand the Bioremediation potency of Algae

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Learn the techniques of small and large scale algal cultivation
- Know the therapeutic and industrial applications of algae
- utilize algae in waste disposal

UNIT – I

Objectives of algal biotechnology; resource potential of algae; Algal production systems-strain selection, culture media, indoor cultivation methods and scaling up; growth kinetics and measurement of algal growth; large scale cultivation of algae-harvesting, drying, cryopreservation of algae; algal collection centers in India.

UNIT – II

Industrial production and application of algae-Biofuel; Biofertilizers- seaweed liquid fertilizer; Production of pigments- β -carotene; algae as a food for fish, poultry and animals.

UNIT – III

Therapeutic uses; remedial compounds-antioxidants, antithrombotic agents, anticoagulant, wound healing, skin disease, anti-ulcerogenic, antifungal, antibiotic, antitumor and antiviral compounds.

UNIT – IV

Tissue culture of macroalgae-isolation, fusion and regeneration of protoplast; immobilization of algae-methods of immobilization- alginate, glass, silica and chitosan beads; Recombinant DNA technology in algae; Transformation systems in algae.

UNIT – V

Role of algae in environmental health- phytoremediation; sewage disposal and waste water treatment of industrial effluent; algae as an indicator in assessing water quality and pollution; algal control methods- algicide preparation and application; role of algae in Nanobiotechnology.

REFERENCES

1. Baddiley, S. Carey, N.H. Higgins, I.J. and Portter, W.G. 1974. Microalgae: Biotechnology and Microbiology. Cambridge University Press. Cambridge.
2. Becker, E.W. 1994. Micro algae Biotechnology and Microbiology. Cambridge University Press. Cambridge.
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(For the students admitted from the academic year 2019- 20)

CORE ELECTIVE III - SEED SCIENCE

Hours per week : 4

Credits: 4

Semester - III

Subject Code -19ED8

OBJECTIVES

- To understand the basics of seed science
- To study the germination ecology
- To study seed viability and storage

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Understand seed dormancy
- Produce viable seeds for cultivation
- Carry out seed certification and seed testing

UNIT- I

Classification of seeds, Recalcitrant seeds , Dicot and Monocot seeds- Morphology and types, seed reserves. External and internal structures of seed- their functional significance. Albuminous and Exalbuminous seeds

UNIT -II

Types of dormancy- physical, chemical, morphological, chemical and mechanical, Primary and secondary dormancy, photo and skoto dormancy. Methods to overcome dormancy. Ecological significance of seed dormancy.

UNIT -III

Seed maturation and germination- metabolism during germination. Epigeal and hypogeal germination, germination mechanism. Brief account of germination value, germination rate, germination percentage. Germination ecology: environmental factors and germination behaviour.

UNIT -IV

Seed production in self and cross pollinated plants, classes of seed- traditional, breeder, foundation and certified seeds. Viability tests- their significance and importance. Seed harvesting , processing,

treatments, testing and seed sampling, viability and vigour. Critical role of seed moisture content and environmental factors on viability. Viability period of Indian forestry species.

UNIT -V

Effect of storage on seed longevity, seed germ plasm and storage in different conditions. Cryopreservation, static conservation of seed, seed born pathogens and pests-seed treatments. Seed certification, standard inspection, registration and seed law enforcement. Clonal seed orchards, seed banks.

REFERENCE

- Agarwal RL. 1997. Seed Technology. 2nd Ed. Oxford & IBH. Chhabra AK. 2006. Practical Manual of Floral Biology of Crop Plants. Dept. of Plant Breeding CCS HAU, Hisar.
- Desai BB. 2004. Seeds Handbook. Marcel Dekker.
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- Poehlman JM & Sleper DA. 2006. Breeding Field Crops.
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- Tunwar NS & Singh SV. 1985. Handbook of Cultivars. CSCB, GOI

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(For the students admitted from the academic year 2019- 20)

CORE ELECTIVE III - VERMICULTURE TECHNOLOGY

Hours per week : 4

Credits: 4

Semester - III

Subject Code -19ED9

OBJECTIVES

- To understand the taxonomy and diversity of earthworms
- To study the applications of vermicomposting
- To study the breeding techniques of earthworm .

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Understand the importance of earthworm
- Carry out breeding of earthworms
- Market the products of vermiculture

UNIT-I:

Earthworms: Taxonomic position and diversity -Types: morphological and ecological grouping - Ecological roles and economic importance of earthworms -need for earthworm culture.

UNIT-II:

Vermiculture: definition, scope and importance -common species for culture -Environmental requirements -culture methods -wormery breeding techniques -indoor and out door cultures - monoculture and polyculture -relative merits and demerits.

UNIT-III:

Applications of vermiculture -Vermiculture Bio-technology: vermin-composting, use of vermicastings in organic farming / horticulture -earthworms for management of biomedical solid wastes -feed / bait for capture / culture fisheries -forest regeneration.

UNIT-IV:

Marketing the products of vermiculture -quality control, market research, marketing techniques -creating the demand by awareness, demonstration, and advertisements -packaging and transport -direct marketing.

UNIT-V:

Future perspectives -Predator / pathogen control in wormeries -Cost-benefit analysis of vermicomposting -Potentials and constraints for vermiculture in India.

REFERENCES:

- 1.Sultan Ahmed Ismail, 2005, The Earthworm Book, Second Revised Edition. Mother India Press, Goa.
- 2.Edwards, C.A. and Bohlen, P.J 1996, ecology of earthworms -3rdEdition, Chapman and hall.
- 3.Jsmaail, S.A., 1970, Vermicology, The biology of earthworms, Orient Longman, London.
- 4.Lee, K.E., 1985. Earthworms -Their ecology and Relationship with Soil and Land use, Academic Press, Sydney.

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SUPPORTIVE ELECTIVE-II ENTREPRENEURIAL BOTANY

(For students admitted from the Academic year 2019-2020 onwards)

HOURS PER WEEK :3

SEMESTER:III

CREDITS :3

SUBJECT CODE:19SD2

OBJECTIVES

- To gain basic knowledge of entrepreneurship
- To develop entrepreneurial and marketing skills

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- acquire entrepreneurial skills to begin startups
- Learn the techniques of producing supplementary food , cosmetic products and floral cultivation

UNIT-I

Concept, structure and types of entrepreneurship; entrepreneurial characteristics; entrepreneurship development program- need and importance; types of start-ups; entrepreneurship opportunities in green industry-diversification; organic farming; food preservation-processing and packaging; production of agro inputs; floriculture; entrepreneurship funding agencies-state and national.

UNIT-II

Supplementary food-mushroom cultivation-process, challenges- diseases; postharvest technology- packing, storage and marketing; cultivation and harvesting of *Spirulina* and *Dunaliella*; biofertilizer production- *Rhizobium*, *Azotobacter*, *Azospirillum*, VAM, *Trichoderma* and BGA; biocompost-vegetable waste, bioslurry, biogas and vermicompost process.

UNIT-III

Techniques for extraction of natural dyes- henna and indigo; Biodiesel extraction from *Jatropha*; Preparation of Herbal cosmetics- soap, oil ,shampoo, perfume (essential oils), facepack, facecreams; Preparation of jam , jelly, squash and pickles.

UNIT-IV

Cultivation,packaging and marketing of cut flowers-carnation, chrysanthemum; Flower arrangement-Types-fresh and dry; process of drying fresh flowers;cut flowers-methods to prolong vase life; bouquet making.

REFERENCES

1. Burch JG 1986. Entrepreneurship. Wiley, USA.
- 2.Des R. 2013 Floriculture at glance. Kalyani Publ., New Delhi
- 3.Gupta CB and Srinivasan NP 2001.Entrepreneurship in India. S. Chand and Sons, New Delhi

4. Randhwa GS and Mukhopadhyay A 1986. Floriculture in India. Allied Publ., New Delhi
5. Singh B. 2012. Horticulture at glance. Kalyani Publ., New Delhi.
6. Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.

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M.Sc. BOTANY

CORE PAPER X–GENETICS & PLANT BREEDING

(For the students admitted from the academic year 2019-20 onwards)

HOURS PER WEEK: 6

SEMESTER:IV

CREDITS : 5

SUBJECT CODE:19MDK

OBJECTIVES:

- To know the classical genetics and its variation
- To study about the sex determination and sex linkage
- To know about the mutation, transposons and bacterial genetics
- To study the population genetics and eugenetics
- To know the process of plant breeding and its variation and applications

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand concepts of Mendelism, linkage and crossing over
- Understand population genetics and eugenics
- know techniques of plant breeding and crop improvement

UNIT – I

Mendelian and Non Mendelian inheritance-monohybrid, dihybrid, complementation, supplementary and epistasis; Linkage and crossing over-aspects of linkage, types of crossing over, chiasma frequency, chromosome mapping, tetrad analysis; Multiple alleles-blood groups, Rh factors; pseudoalleles; isoalleles-eye colour in *Drosophila*.

UNIT – II

Sex determination in plants; Sex linkage- dominant, recessive, sex linked genes-holandric genes; Sex linked diseases- haemophilia, thalassemia, coat colour in mice; pedigree analysis.

UNIT – III

Mutation-classification, detection, characterization of mutagens-chemical and physical mutagens, clastogenes; Transposons-AC-DS elements in Maize; Extranuclear inheritance-mitochondrial genome, male sterility in corn; Bacterial genetics-transformation, transduction and conjugation; Biochemical genetics-in *Neurospora*, Beadle and Tatum experiment-one gene one enzyme.

UNIT – IV

Population genetics- gene frequency and gene pool; Hardy-Weinberg law, genetic drift-factors affecting genetic drift-mutation, selection, migration; eugenetics and eugenics- types-positive and negative; euphenics-phenylketonuria, anaemia; karyotypes- variation-syndromes-polycystic kidney;genetic counselling and prenatal genetic testing; cystic fibrosis; gene therapy- patient and embryo therapies.

UNIT – V

Objectives of plant breeding; polyploidy and its types; breeding methods-self and cross pollinated plants, vegetatively propagated and apomictic plants; heterosis and inbreeding depression-genetic basis, use of polyploidy and mutant varieties in the improvement of crop plants; germplasm-collection and conservation in rice and sugarcane.

REFERENCES

1. Snustad Peter, D. Michael J. Simmon, Principles of Genetics, John Wiley Sons.
2. Robert H. Tamarin. Principles of genetics, Tata McGraw-Hill Company.
3. Benjamin Lewin. Genes VIII, Printice Hall.
4. Gardner, E.J. 1972. Principles of Genetics.
5. Stansfield, W.D. 1969. Theory and Problems of Genetics, McGraw-Hill Book Co. Ltd, New York, London.
6. Sinnott, E.W. Dunn, L.C and Dobzhansky, T. 1950. Principles of Genetics, McGraw-Hill Book Co. Ltd, New York, London.
7. Chaudhari, H.K. 1984. Elementary Principles of Plant Breeding,
8. Haup, K.K., Immer, F.R. and Smith, D.C. 1985. Methods of plant Breeding.

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**M.Sc. BOTANY
RESEARCH PROJECT**

(For the students admitted from the academic year 2019- 20 onwards)

HOURS PER WEEK : 6

SEMESTER – IV

CREDITS: 6

SUBJECT CODE:19MDL

Research project is offered to the II year M.Sc., students in the IV semester for 6 credits . It is intended to give hands on experience and practical knowledge to the students. It would help the student to obtain awareness, exposure and updating knowledge in the field of biological research. The student would complete the project work and submit the dissertation for evaluation.

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M.Sc. BOTANY

PRACTICAL PAPER-IV (COVERING THEORY PAPERS IX AND X)

(For students admitted from the Academic year 2019-2020 onwards)

HOURS PER WEEK:4

SEMESTER:III &IV

CREDITS :4

SUBJECT CODE:19MD4

PLANT PATHOLOGY

1. Identification of common vectors of plant pathogen –aphids,leafhopper,whiteflies
2. Detailed study of symptoms,causative organism and control measure of important plant Diseases studied in theory.
3. Preparation of herbarium of Five plant diseases.
4. Study of Five common chemical fungicide , pesticides.
5. Comparison of protein and DNA of healthy and diseased plant samples.

GENETICS AND PLANT BREEDING

1. Genetics problems based on theory
2. Chromosome mapping
3. Calculation of variation pattern in samples- chi square, Student T test and ANOVA
4. Hybridization technique-emasculation-tagging-bagging.
5. Plant breeding spotters taken from standard text books.

Bonafide record of practical work done should be submitted for the practical examination. The practical examination is followed by viva-voce examination.

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CORE ELECTIVE IV- PLANT BIOTECHNOLOGY

(For the students admitted from the academic year 2019-20 onwards)

HOURS PER WEEK: 5

SEMESTER: IV

CREDITS : 5

SUBJECT CODE: 19ED10

OBJECTIVES

- To provide sound theoretical knowledge on recombinant DNA technology and gene transfer techniques.
- To provide an insight into transgenic plants and their applications.
- To understand the basics of bioinformatics and applications of biological software in biotechnology

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand and utilize recombinant DNA techniques
- Understand the role of Biotechnology in transgenic production
- Learn to utilize various databases and gene banks for research purpose

UNIT- I

Recombinant DNA technology; Gene cloning-principles and techniques; vectors-plasmid, bacteriophage and other viral vectors- cosmids; Ti plasmid; Yeast Artificial Chromosome; restriction endonucleases; ligases; construction of genomic libraries; cDNA libraries; PCR; Southern, Northern and Western blotting; RFLP; RAPD and AFLP based DNA finger printing.

UNIT -II

Methods of crop improvement-gene transfer-direct method-liposome mediated gene transfer, biolistic gun (shot gun method); electroporation; silicon carbide method; microinjection and *Agrobacterium* mediated gene transfer.

UNIT – III

Biotechnology and transgenics; herbicide resistance -glyphosate and Basta; resistance against pests and insects-*Bacillus thuringiensis*-*Bt* genes; endotoxins- resistance against pathogens; transgenic crops with improved quality traits- ‘Flavr Savr’ tomato.

UNIT-IV

Transgenic plants as bioreactors-transgenic plants as vaccine production systems; Transgenics for phytoremediation of contaminated soils; regulation and release of genetically modified organism in India-recombinant DNA guidelines-1990; guidelines for research in transgenic crops; 1998-regulation of GM food-Status of development of GM food in India;biosafety and bioethetics; Farmer's rights;patenting and IPR.

UNIT-V

Bioinformatics-Introduction to bioinformatics; biological database of genomics-DNA sequence data base, structure database, literature database (Pubmed, NCBI, Medline); sequence alignment; database similarity searching; FASTA; BLAST; proteomics-protein structure prediction-primary, secondary & tertiary-SWISS-PROT; Human Genome Project.

REFERENCES

1. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
2. Stewart, C.N. Jr. (2008). Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A.
3. Ignacimuthu, S.J. (2012) Biotechnology –An introduction. Narosa Publishing House, New Delhi.
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9. Gupta, P.K. (1994) Elements of Biotechnology. Rastogi Publications, Meerut.
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11. Kumar H.D. (1993) Molecular Biology and Biotechnology. Vikas Publishers, New Delhi.
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15. Purohit, S.S. (2003) Biotechnology: Fundamentals and Applications. Agrobios, New Delhi.
16. Singh, B.D. (2003) Biotechnology. Kayani Publishers, New Delhi.
17. Revised guidelines for research in Transgenic plants (August 1998), Department of Biotechnology, Ministry of Science & Technology, Government of India, New Delhi.

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**(For the students admitted from the academic year 2019- 20)
CORE ELECTIVE IV -APPLIED PLANT TISSUE CULTURE**

Hours per week : 5

Credits: 5

**Semester - IV
Subject Code -19ED11**

OBJECTIVES

- To understand the design of laboratory and media
- To understand the techniques of propagation
- To study the methods of cryopreservation and its application.

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Gain knowledge of Tissue culture
- Gain insight into factors that affect drug production.
- Develop Skills to apply in the field of Horticulture and forestry.

UNIT-I

Laboratory Organisation – Design of different laboratories and management. Methodologies – Aseptic techniques – Composition of Culture Media – MS Medium – B5 Medium– methods of sterilization – basic procedure for Aseptic transfer – Incubation of culture.

UNIT-II

General Techniques of – Micropropagation, Initiation of Culture, Multiplication, Rooting – Hardening. Callus Culture – establishment – Organisation – Embryogenesis.Somaclonal&Gametoclinal variation, - Uses in crop improvement. Synthetic Seeds – Practical applications.

UNIT-III

Shoot Tip / Meristem Culture for Virus free plants. – Chemotherapy – Thermotherapy – Virus indexing – Initiation – multiplication – Rooting – Hardening – Anther culture – Production of Haploids – Utilization of Haploids in Agriculture. Protoplast Culture – Protoplast isolation, purification, viability test – culture – regeneration.Somatic Hybridization – Protoplast fusion techniques – Chemical fusion – Electrofusion selection of fusion products.

UNIT-IV

Approaches and factors affecting the production of secondary metabolites, production of pharmaceutically important drugs – alkaloids – food additives and insecticides in invitro system.

UNIT-V

Cryopreservation & Germplasm storage, Bioreactor – Types of bioreactors – Stirred tank, air lift – its uses in various fields – Application of Tissue Culture – Techniques in Agriculture, Horticulture & Forestry.

REFERENCE BOOKS :

Trigiano, R.N., and D.J. Gray (eds.). 2000. Plant tissue culture concepts and laboratory exercises. CRC Press.(Textbook).2nd Edition.Kyte, M., and Kleyn, J. 1996.Plant from test tubes. Timber Press. Auge, R. et al., 1995. In vitro culture and its applications in horticulture. Science Publishers, Inc.

Crispeels, M.J. and D. E. Sadava. 2003. Plants, genes and agriculture. Jones and Bartlett Publishers.

Gamborg, O.L. and G. C. Phillips (eds). 1995. Plant cell, tissue and organ culture. Springer Lab Manual.

Potrykus, I, and G. Spangenberg (eds.). 1995. Gene transfer to plants. Springer Lab Manual.

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Bhojwani, S.S. and Razdan, M.K. 1996. Plant Tissue Culture: Theory and Practice (revised edition). Elsevier Science Publishers, New York, USA.

Bojwani, S.S. 1990. Plant Tissue Culture: Applications and Limitations, Elsevier Science Publisher, New York, USA.

Collins, H.A. and Edwards, S. 1998. Plant Cell Culture, Bios Scientific Publishers, Oxford, UK.

Hall, R.D. (Ed.) 1999. Plant Tissue Culture: Techniques and Experiments, Academic Press, New York.

Kartha, K.K. 1985. Cyropreservation of plant cells and organs.CRC Press, Boca Raton, Florida.

Khasim, S.M. 2002. Botanical Microtechnique: Principles and Practice, Capital Publishing Company, New Delhi.

Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture, Kluwer Academic Press, The Netherlands.

**BHARATHI WOMEN'S COLLEGE (AUTONOMOUS),
CHENNAI – 600 108.**

M.Sc. BOTANY

(For the students admitted from the academic year 2019- 20)

CORE ELECTIVE IV - BIOINFORMATICS

Hours per week : 5

Credits: 5

Semester – IV

Subject Code -19ED12

OBJECTIVES

- To understand the basics of Bioinformatics and databases
- To study the principles of multiple sequence alignment
- To study the comparative genome analysis.

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Access the databases
- Carry out sequence alignment
- Construct the phylogenetic tree.

UNIT-I

Bioinformatics -definition, history, web servers, computer systems, languages -machine, high level and assembly. Internet basics -internet connection, web browsing and URL. Role of bioinformatics in Human Genome Project.

UNIT-II

Introduction to biological databases -sequence databases, structural databases, specialized databases, sequence retrieval system from net -SRS, ENTREZ

UNIT-III

Protein structure prediction -gene and protein expression data, protein interaction data, similarity and database searching tools -FASTA, BLAST.

UNIT-IV

Sequence analysis and phylogeny -sequence and similarity, sequence alignment -local, global, pairwise and multiple sequence, introduction to scoring matrices -PAM and BLOSSUM, introduction to phylogenetic trees.

UNIT-V

Introduction to drug discovery -history of drug discovery, analogue and structural drug discovery, ligand designing and optimization, docking, applications of molecular modeling in drug discovery.

REFERENCE BOOKS

- 1.Introduction to computers by Alexis leon and Mathews Leon
- 2.Fundamentals of computers, Rajaraman, V.
- 3.Bioinformatics for the beginners, Mani and Vijayaraj.
- 4.Bioinformatics basic skills and applications by Rastogy.
- 5.Introduction to bioinformatics, AH wood, T.K. Parry Smith DJ, Pearson education Asia, 2001.
- 6.Developing bioinformatics in computer skills, Gibas C, Jambeek P., 2001. Oreilly& associates inc.Shrott publishes.

BHARATHI WOMENS COLLEGE (AUTONOMOUS),CHENNAI-600108.

M.Sc. BOTANY

CORE ELECTIVE -V PLANT RESEARCH METHODOLOGY AND BIOSTATISTICS

(For students admitted from the Academic year 2019-2020 onwards)

HOURS PER WEEK:5

SEMESTER:IV

CREDITS :5

SUBJECT CODE:19ED13

OBJECTIVES

- To obtain an insight into basic instruments used in research
- To develop statistical, thesis and manuscript writing skills.

LEARNING OUTCOME:

Upon completion of the course, the student will be able to

- Understand the principles and applications of instruments used in research
- utilize biostatistics in research data analysis
- acquire knowledge on manuscript writing

UNIT-I

Microscopy-Principle, working mechanism and applications of Compound microscopy; Micrometry -ocular and stage; Camera lucida-Prism and Mirror; Principle, working mechanism and applications of fluorescence microscopy, polarizing microscopy. scanning tunnelling microscopy; microtomy- types-rotary-wood and cryo types; techniques of microtomy- fixative -types, fixation, dehydration, clearing reagents,embedding with wax-resins, sectioning, natural and synthetic stains; mountants–DPX; maceration techniques.

UNIT-II

Spectroscopy-principle, working mechanism and applications of UV/VIS, IR-Spectroscopy, circular dichroism, NMR, ESR, X-ray diffraction, Mass spectroscopy-LC-MS, Atomic Spectroscopy; Chromatographic techniques-column and gas chromatography, High Pressure Liquid Chromatography.

UNIT-III

Centrifugation-principles of sedimentation; types-refrigerated, high speed, ultracentrifuge-preparative and analytical, density gradient Centrifugation-types-rate zonal and isopycnic; detection of molecules using ELISA, RIA, immunoprecipitation and flow cytometry; *In-situ* localization-FISH and GISH; radioisotopes used in biology, autoradiography.

UNIT-IV

Probability distributions (Binomial, Poisson and normal); sampling , levels of significance, test of significance-T test, standard error; regression-types, uses, regression line and equation; correlation-types, uses; analysis of variance (ANOVA) – one way and two way and ChiSquare test.

UNIT-V

Preparation of thesis-identifying a research problem, review of literature – primary, secondary and tertiary sources, materials and methods, results and discussion, bibliography; reporting research in

conference-oral and poster presentation; manuscript writing-newsletters; short communication proceedings; full length paper and review paper; indexing, citation index, web of science, impact factor, H-Index.

REFERENCES

1. Connor and Peter Woodford (1979) Writing Scientific Paper in English Pitman. Medical Publishing Co. Ltd., England.
2. Gupta, S. P. (1990) Statistical Methods. S. Chand & Co. Ltd., New Delhi.
3. Gurumani N. (2013). Research methodology . MJP Publishers, New Delhi.
4. Gurumani N. (2009). An Introduction to Biostatistics,MJP Publishers, New Delhi.
5. Jayaraman, J. (1972) Techniques in Biology. Higginbothams Pvt. Ltd., Madras.
6. Khan, I. A. and Khanum, A. (1994) Fundamentals of Biostatistics. Vikas Publishing, Hyderabad.
7. Kothari, C. R. (1991) Research Methodology: Methods and Techniques. Wiley Eastern Ltd., New Delhi.
8. Rastogi, V. B. (2006) Fundamentals of Biostatistics. Ane Book India, New Delhi.
9. Sree Ramulu, V. S. (1988) Thesis Writing. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
10. Veera kumari L. (2006). Bioinstrumentation . MJP Publishers,New Delhi.

Web resources

- 1.nu.libguides.com/biostatistics
- 2.https://newonline courses.sciences.psu.edu/
3. http://nptel.ac.in/syllabus.php?subject Id= 102107028.
4. <http://b-ok.xyz/book/674611/288bc3>
5. http://www.researchgate.net/publication/317181728- Lecture Notes on Laboratory Instrumentation and Techniques.
6. iiscs.wssu.edu/drupal/node/4673
7. http://www.studocu.com/en/search/research methodology?languages =language_en&type=document *(NPTEL)- National Programme on Technology Enhanced Learning.

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(For the students admitted from the academic year 2019- 20)

CORE ELECTIVE V- BIONANOTECHNOLOGY

Hours per week : 5

Credits: 5

Semester - IV

Subject Code -19ED14

OBJECTIVES

- To understand the basics of nanotechnology
- To understand synthesis of nanomaterials
- To study the techniques of studying nanomaterial.

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Gain knowledge on nanotechnology.
- Understand preparation, properties and applications of nanoparticles
- Obtain Knowledge of application of nanomaterials in medicines

UNIT-I

Evolution of science and technology, Introduction to Nanotechnology –Definition, Difference between Nanoscience and Nanotechnology, Bottom up and top down approaches, challenges in Nanotechnology.

UNIT-II

History of materials, Nanomaterials-Definition, Classification of Nanostructured materials, causes of interest in nanomaterials, some present and future applications of nanomaterials. Processes for producing ultrafine powders-mechanical grinding, wet chemical synthesis of nanomaterials. Gas phase synthesis of nano materials, gas condensation processes, chemical vapour condensation, laser ablation.

UNIT-III

Carbon nanotubes, nano composites, nano fluids-An overview over preparation, properties, applications. Electron Microscopy Techniques: Scanning Electron Microscopy, Transmission Electron Microscopy, Scanning Tunneling Microscopy, Atomic Force Microscopy, Scanning Probe Microscopy– X ray methods – Fluorescence Microscopy and Imaging.

UNIT-IV

Solar energy conversion and catalysis, Molecular electronics and printed electronics Nanoelectronics, Polymers with a special architecture, Liquid crystalline systems, Linear and nonlinear optical and electro optical properties, Applications in displays and other devices, Advanced organic materials for data storage, Photonics, Plasmonics ,Chemical and biosensors, Nanomedicine and Nanobiotechnology.

UNIT-V

Implications of nanoscience and nanotechnology on society, Issues- an outlook, Nano policies and institutions, public perception and public involvement in the nano discourse, harnessing nanotechnology for economic and social development.

REFERENCES

1. A.Nabok, “Organic and Inorganic Nanostructures”, Artech House, 2005
2. C.Dupas, P.Houdy, M.Lahmani, Nanoscience: “Nanotechnologies and Nanophysics”, Springer-Verlag Berlin Heidelberg, 2007.
3. Hari Singh Nalwa, “Nanostructured Materials and Nanotechnology”, Academic Press, 2002.
4. Pradeep, T. Nano: The Essentials. MvGraw-Hill Education.2007.

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M.Sc. BOTANY

(For the students admitted from the academic year 2019- 20)

CORE ELECTIVE V- BIOPESTICIDES AND BIOFERTILIZERS TECHNOLOGY

Hours per week : 5

Credits:5

Semester - IV

Subject Code- 19ED15

OBJECTIVES

- To understand the basics of biopesticides and biofertilizers
- To study the fungal, bacterial and nematocidal, biopesticides
- To study the mass production of biofertilizers and pesticides

LEARNING OUTCOMES

Upon completion of the course the student will be able to

- Gain knowledge of biofertilizers and biopesticides.
- Develop skill of Mass production of biofertilizer and biopesticides
- Obtain knowledge of quality control and marketing .

UNIT- I

History and concept of biopesticides.Importance,scope and potential of biopesticide. Definitions, concepts and classification of biopesticides viz. pathogen, botanical pesticides and biorationals.

UNIT -II

Bio insecticides: Bt, NPV- Fungal bioinsecticides (Beauveria, Metarhizium, Verticillium, Paecilomyces). Biobactericide: Bacillus thuringiensis, Radiobacter. Bionematicides: Nematophagous fungi (general account),Bioherbicides: Phytophthora- Colletotricum. Mass production technology of bio-pesticides.Virulence, pathogenicity and symptoms of entomopathogenic pathogens and nematodes.

UNIT -III

Biofertilizers: Definition and types, importance of biofertilizers in agriculture. Characteristics of biofertilizers: Rhizobium, Azotobacter, Azospirillum, Phosphate solubilizing microorganisms, cyanobacteria,Azolla.

UNIT - IV

Mass production – formulation- application for the control insect pests. Importance of biofungicides;

UNIT-V

Application technology: Standards and quality control, application for field and tree crops, nursery plants and seedlings. Extension, promotion and marketing: Extension strategies, diagnosis for the effectiveness of inoculation, improvement in distribution system

REFERENCES:

1. Soil microorganisms by N.S. Subbarao, Oxford and IBH Publication Co. New Delhi.
2. Advances in Agril. Microbiology by N.S. Subbarao, Oxford and IBH Publication Co, New Delhi
3. Bergy's manual of systematic bacteriology by Krieg N.R. and J.G. Holt, 1984, Williams and Wilkins, Baltimore, U.S.A
4. Agricultural Microbiology by Rangaswamy G. and D.J. Bhagyaraj 1988, Oxford and IBH Publication Co. New Delhi.
5. New direction in biological control by Baker, R.R and P.E. Dann (eds) 1990, Wiley-Liss, New York.
6. Biological control by Natural enemies by Debach, P and Rosen, D, 1991, Cambridge University Press, Cambridge, U.K.
7. Principles of Insect Pest Management by Dhaliwal, G.S and Arora, R. 2006, Kalyani Publisher, New Delhi.
8. Botanicals and Biopesticides by Parmar, B.P and C. Devakumar, 1993, Westview Publishing House, New Delhi.
9. Principles of Insect Pest Management by Dhaliwal, G.S and Arora, R. 2006, Kalyani Publisher, New Delhi.