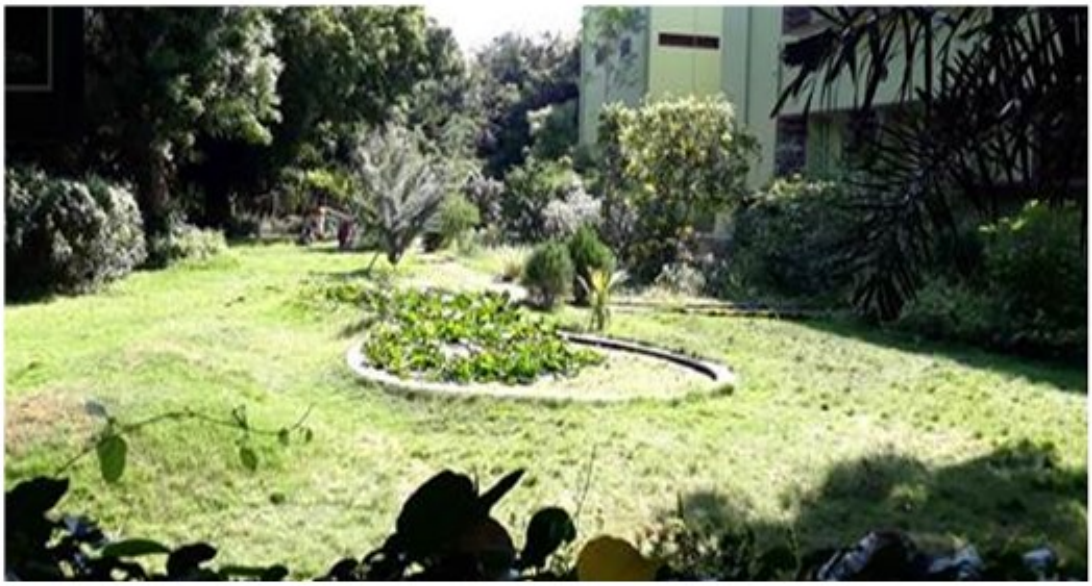
Government of Puducherry

KANCHI MAMUNIVAR GOVT. INSTITUTE FOR POSTGRADUATE STUDIES AND RESEARCH (AUTONOMOUS)

(Autonomous College with Potential for Excellence and Accredited by NAAC 'B++' Grade)

LAWSPET, PUDUCHERRY – 605 008
TEL: 0413-2251687



CBCS-SYLLABUS

M.Sc. BOTANY

2022-2023

Government of Puducherry

KANCHI MAMUNIVAR GOVERNMENT INSTITUTE FOR POSTGRADUATE STUDIES AND RESEARCH (Autonomous)

(Accredited by NAAC B^{++} Grade)

Lawspet, Puducherry-605008

BOARD OF STUDIES MEETING HELD ON 29.07.2022
DEPARTMENT OF BOTANY
MINUTES THE BOARD OF STUDIES MEETING HELD ON 29Th JULY, 2022

Eleventh board of studies meeting was held on 29th July 2022 at 10.30 AM for revising and approving I, II, III and IV semester paper of M.Sc. Botany to be followed from the academic year 2022-2023 onwards. The following members attended the board meeting and the meeting was chaired by the Head of the Department of Botany, KMGIPSR, Puducherry-605008.

Dr. Bijaya Kumar Nayak, Chairman of BOS & Head, Department of Botany, KMGIPSR, Puducherry-605008.

Dr. Kumaresan. V., Assistant Professor, Department of Botany, KMGIPSR, Puducherry-605008.

Dr. M. S. Shekhawat, Assistant professor, Department of Botany, KMGIPSR, Puducherry- 605008.

Dr. Vikrant, Assistant Professor, Department of Botany, KMGIPSR, Puducherry-605008.

Prof. S. Jayakumar, Professor, Department of Ecology & Environmental Science, Pondicherry University, Puducherry- 606014.

Dr. L. Mullainathan, Professor of Botany, Department of Botany, Annamalai University, Annamalai Nagar-608002.

Dr. P. Pugalendhi, Assistant Professor, Department of Biochemistry and Biotechnology, Annamalai University, Annamalai Nagar-608002.

Mr. N. Sundaramurthy, Director, Aurokkiya Mushroom and Seed Farm, Koodapakkam, Villianur Commune, Puducherry – 605502.

Dr. J. Presena, Assistant Professor and Head, Department of Biological Science, Indira Gandhi College of Arts and Science, Kathirkamam, Puducherry – 605009.

Mr. A. Muthukaruppan, parent of II M. Sc. student, No. 18, Kalaimagal St, Nesavalar Nagar, Lawspet, Puducherry

Ms. P. Kanmani, student of II M. Sc. Botany , KMGIPSR, Puducherry.

The chairman welcomed the members and briefed the need for the revision of CBCS system of syllabus. He distributed the schemes and draft syllabi for I, II, III and IV semester papers for M.Sc. Botany. The syllabi of the all the papers for I, II, III and IV of M.Sc. Botany were discussed and approved after the deliberations. Consensus was arrived and the recommendations are given in Annexure I.

Dr. Bijaya Kumar Nayak

Dr. Kumaresan. V

Dr. M. S. Shekhawat

Dr. Vikrant 29/07/2022

Prof. S. Jayakumar 29/07/22

Dr. L. Mullainathan 29/7/2022

Dr. P. Pugalendhi 29/7/22

Mr. N. Sundaramurthy

Dr. J. Presena 29/7/2022

A. Muthukaruppan.
Mr. A. Muthukaruppan

Kanmani. P
Ms. P. Kanmani

Government of Puducherry

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(Accredited by NAAC B^{++} Grade)

Lawspet, Puducherry-605008

BOARD OF STUDIES MEETING HELD ON 29.07.2022
DEPARTMENT OF BOTANY

List of BOS Members

Sl. NO	Status in the Council	Name & Designation	Address with Phone/Mobile Number	Signature
1	Chairman	**Dr. Bijaya Kumar Nayak** Head, Dept of Botany	KMGIPSR, Lawspet, Puducherry-605008	
2	Member	**Dr. Kumaresan. V.**, Assistant Professor, Department of Botany	KMGIPSR, Lawspet, Puducherry-605008	
3	Member	**Dr. M.S. Shekhawat**, Assistant professor, Department of Botany	KMGIPSR, Lawspet, Puducherry-605008	
4	Member	**Dr. Vikrant**, Assistant Professor, Department of Botany	KMGIPSR, Lawspet, Puducherry-605008	29/07/2022
5	Member Experts nominated by Pondicherry University	**Prof. S. Jayakumar**, Professor, Department of Ecology & Environmental Science	Pondicherry University, Puducherry- 606014	29/07/22
6	Member Experts nominated by Director, KMGIPSR	**Dr. L. Mullainathan**, Professor of Botany, Department of Botany	Annamalai University, Annamalai Nagar-608002	29/7/22
7	Member Experts nominated by Director, KMGIPSR	**Dr. P. Pugalendhi**, Assistant Professor, Department of Biochemistry and Biotechnology,	Annamalai University, Annamalai Nagar-608002	P.P. 29/7/22
8	Member Experts nominated by Director, KMGIPSR	**Mr. N. Sundaramurthy**, Director, Aurokkiya Mushroom and Seed Farm	Koodapakkam, Villianur Commune, Puducherry – 605502	
9	Member Meritorious alumnus nominated by Director	**Dr. J. Presena,** Assistant Professor and Head, Department of Biological Science	Indira Gandhi College of Arts and Science, Kathirkamam, Puducherry – 605009	J. Presena 29/7/2022
10	Parent	**Mr. A. Muthukaruppan** F/o M. Soundarya (II M.Sc., Botany)	No. 18, Kalaimagal St, Nesavalar Nagar, Lawspet, Puducherry	A. Muthukaruppan.
11	Student	**Ms. P. Kanmani** II M.Sc. Botany	No 12, New St, Vaithikuppam, Puducherry-12	Kanmani. P

Annexure I

1. Some units were modified in certain papers in the syllabus, especially Genetics, Plant Breeding and Evolution and Angiosperm Systematics and Economic Botany.
2. Objective(s) and Learning outcomes have been added for each paper.
3. Mistakes including typographical errors in the syllabus were corrected.
4. Approximately 5% change has been made in the content of the syllabus.

------End of the statement--------

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CBCS-SYLLABUS

BOTANY

M.Sc. (BOTANY)

(For Semester I - IV)

2022-2023

SCHEME for M. Sc. Botany course offered under CBCS

Semester	Code	Title of Paper	Credits	Total Credits
S-1	BOHT101	MICROBIOLOGY AND PLANT PATHOLOGY	3	18
	BOHT102	PHYCOLOGY, MYCOLOGY AND LICHENOLOGY	3	
	BOHT103	BRYOLOGY AND PTERIDOLOGY	3	
	BOHT104	GYMNOSPERMS AND PALAEOBOTANY	3	
	BOHP105	PRACTICAL-I	3	
	BOSC106	**SOFT CORE: Internal MICROBIAL BIOTECHNOLOGY**	**3**	
S-2	BOHT207	COMPUTER APPLICATIONSIN BIOLOGY ANDBIOSTATISTICS	3	18
	BOHT208	PLANT ANATOMY	3	
	BOHT209	REPRODUCTIVE BIOLOGY OF FLOWERING PLANTS	3	
	BOHT210	BIOINSTRUMENTATION	3	
	BOHP211	PRACTICAL-II	3	
	BOSC212	**SOFT CORE: External MEDICINAL BOTANY**	**3**	
S-3	BOHT313	ANGIOSPERM SYSTEMATICS AND ECONOMIC BOTANY	3	18
	BOHT314	GENETICS, PLANT BREEDING AND EVOLUTION	3	
	BOHT315	CELL AND MOLECULAR BIOLOGY	3	
	BOHT316	PLANT ECOLOGY	3	
	BOHP317	PRACTICAL-III	3	
	BOSC318	**SOFT CORE: Internal MEDICINAL BOTANY**	**3**	
S-4	BOHT419	BIOCHEMISTRY AND PLANT PHYSIOLOGY	3	18
	BOHT420	PLANT BIOTECHNOLOGY	3	
	BOHP421	PRACTICAL-IV	3	
	BOPW422	PROJECT WORK	4	
	BOPV423	PROJECT VIVA	2	
	BOSC424	**SOFT CORE: External MUSHROOM CULTIVATION**	**3**	
		Hard Core 17 x3 = 51 **Softcore 07x3 = 21**		**72**
		Non Audit Credit	10	

Soft core subjects offered to other Departments:

1. Medicinal Botany 2. Mushroom Cultivation

Government of Puducherry

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LAWSPET, PUDUCHERRY – 605 008

TEL: 0413-2251687

CBCS-SYLLABUS

M.Sc. (BOTANY)

(For Semester I and II)

2022-2023

SEMESTER –I

HARD CORE COURSE I

BOHT 101- MICROBIOLOGY AND PLANT PATHOLOGY

Objectives: To acquire knowledge about microbes, their culture techniques, plant diseases caused by bacteria, fungi and viruses

Unit-I

History and Scope of Microbial Diversity; General accounts of Bacteria, Cyanobacteria, Viruses, Mycoplasma, Protozoa and Fungi; Methods of sterilization; Culture and staining techniques; Preservation of microbes. Identification and classification of Bacteria and Fungi. Classification of Bacteria- Bergey's Manual.

Unit – II

Microbial Nutrition: nutritional types- autotrophy, heterotrophy-Growth of Bacteria-Growth cycle- Archaea and types, Cultural characteristics of bacteria and fungi. Bacteriological and Fungal Media. Microbial fermentation, Generation time production of Antibiotics, organic acids and vitamins; General design and applications of a Biofermentor. Nitrogen fixation – Symbiotic, non-symbiotic.

Unit – III

Microbial Genetics: Mechanism of gene transfer -Vertical and horizontal gene transfer, homologous recombination. Conjugation - Types; transformation; Transduction – Types, Lysogeny and lytic cycle in bacteriophages.

Unit – IV

Plant diseases: Distribution, disease cycle, symptoms and control measures of Bacterial diseases (Citrus canker, BLB of Paddy), Viral diseases (TMV, YMV), Fungal diseases (Red rot of sugarcane, Tikka disease) and Mycoplasma disease (Little leaf of Brinjal, Yellow Dwarf Disease of Rice).

Unit –V

Host parasite interaction in Plants: Recognition and entry processes of different pathogens, defence mechanism- molecular and morphological, biochemical changes. Integrated Pest Management. Antagonism, Biological control, Bioformulations and application of biopesticides.

Practicals:

1. Preparation of culture media – sterilization techniques- Plating technique.
2. Isolation of bacteria and fungi from air, water and soil.
3. Staining techniques (Gram staining, Negative Staining and Capsule Staining).
4. Wet mounts (hanging drop) method.
5. Estimation of acidity in milk.
6. MPN analysis of different water bodies.
7. Isolation of genomic and Plasmid DNA from fungi and bacteria.
8. Isolation and culture of *Trichoderma* and *Bacillus* sp.
10. Industrial visit to waste water treatment plant, dairy, food industry.
11. Study on Tikka disease/Red rot
12. Study on Citrus canker/BLB

Learning Outcomes: Students will

1. Understand principle and types of sterilization methods.
2. Know the culture techniques.
3. Know the importance of Plant Pathology.
4. Know the prevention and control measures of various plant diseases.
5. Application of instruments viz. laminar air flow, pH meter, centrifuge.

TEXT BOOKS:

1. Ananthanarayan and Paniker. 2017. Textbook of Microbiology. University Press.
2. Bilgrami. K. S. and Dube, H. C. 1976. A Text Book of Modern Pathology. Vikas Publications, New Delhi.
3. Darwin Henry. 2008. Illustrated Plant Pathology, New India Publishing Agency
4. Dubey, R. C. and Maheswari, D. K. 1999. A Text Book of Microbiology, S. Chand & Company ltd., New Delhi
5. Mehrothra, R. S. and Ashok Agarwal. 2010. Plant Pathology. Tata Mc Graw Hill Publishing Co. New Delhi.
6. Pelczar M. J., Reid, R. D., and Chan, E. C. S. 1983. Microbiology, Tata Mc Graw Hill Publishing Co. New Delhi.
7. Prescott, L.M., J.P. Harley, and D.A .Klein. 2002. Microbiology, McGraw -Hill Publishing Company, New Delhi.
8. Rangasamy, C. Diseases of Crop Plants of India, Prentice-Hall, 1972.
9. Sanjeev Singh. 2016 Plant Pathogens and Principles of Plant Pathology. New India

Publishing Agency, New Delhi

10. Sanjeev Singh. 2016. Plant Pathogens and Principles of Plant Pathology. New India Publishing Agency, New Delhi
11. Sullia, S. B. and Shantharam, S. 1998. General Microbiology, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. Agrios, G. N.1978. Plant Pathology, 2nd Ed. Academic Press, New York.
2. Aneja K R. 1993. Experiments in Microbiology, Plant pathology and Tissue culture. Wishwa Prakashan, Wiley Eastern Ltd., New Delhi.
3. Christophe Lacomme. 2015. Plant Pathology: Techniques and Protocols. Humana Press Inc.
4. Gerard J. Tortora, Berdell R. Funke, Christine L. Case, Derek Weber, Warner Bair. 2018. Microbiology: An Introduction. Pearson.
5. Gerard J. Tortora. 2006. Microbiology: An Introduction. Benjamin-Cummings Publishing Company
6. Jacquuelyn G. Black. 2004. Microbiology: Principles and Explorations. Wiley
7. Lippincott's Illustrated Reviews: Microbiology. 2012. Kluwar Academic Press
8. Marjorie Kelly Cowan. 2011. Microbiology: A Systems Approach. McGraw-Hill
9. Matthew Dickinson. 2003. Molecular Plant Pathology. Garland Science Press, London, England, United Kingdom
10. Reed, G. 1986. General Microbiology (6th Ed), Cambridge University Press, Cambridge.
11. Stainer, R. Y., Ingraham, J. I., Wheelis M. L. and Painter, P.R. 1986. General Microbiology (5th Ed.), Macmillan Press Ltd., London, pp. 689.
12. Steindraus, K. H. (Ed) 1983.Hand Book of Indigenous Fermented Food, Parcel Dekker Inc., New York.
13. Thomas D. Brock, Michael T. Madigan, John M. Martinko. 2005. Brock Biology of Microorganisms. Benjamin-Cummings Publishing Company.
14. Tomos Webb. 2017. Plant Pathology. Larsen and Keller Education
15. Tortora, G. J., Funke, B. R. and Case, C.L 1995, Microbiology- An Introduction (5 th Ed.), The Benjamin/ Cummings Publishing Company Inc., Redwood city, California, U. S. A., pp.801.

SEMESTER – I

HARD CORE COURSE II

BOHT 102- PHYCOLOGY, MYCOLOGY AND LICHENOLOGY

Objectives: To acquire knowledge on the structure, reproduction and life cycle of Algae, Fungi and Lichens

Unit-I

General characters of Algae. Classification of Algae- Fritsch (1935) classification, Criteria for algal classification. Cell structure, EM studies of algal cell, cell wall, flagella, chloroplast, pigments- their importance in classification. General account of thallus structure, reproduction, relationship and life cycle of important groups- Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae, Rhodophyceae, Charophyceae

Unit-II

Economic importance of algae: Algal biofertilizers and its role in soil fertility, algae in industry (Bio-fuel and Bio-pigments), algae as food and medicine. Biological importance of phytoplanktons and water blooms, Diatomaceous earth.

Unit-III

General characters of fungi. Classification of fungi. Alexopolous, Mims and Blackwell (1996), ultra structure of cell, cellular organization, hyphal growth, cell wall, nutrition, reproduction, heterothallism, parasexuality. General account of Myxomycota, Mastigomycota, Zygomycota, Ascomycota, Basidiomycota and Mitosporic fungi. Kinds of spores and their dispersal.

Unit-IV

Economic importance of fungi. Decomposition of organic matter, coprophilous fungi, lignin degrading fungi, degradation of pesticides. Role of fungi as symbionts- Lichens, Mycorrhiza- ectotrophic, orchidaceous and Ericoid mycorrhiza- their distribution and significance, Fungal Endophytes. Edible fungi.

Unit-V

History of lichenology, lichens distribution and habitat, lichen classification, types of lichens, components and nature of lichen thallus, specialized structure of lichen thallus, reproduction, economic importance of lichens.

Practicals:

1. Collection and study of algae:

   Spirulina, Anabaena, Hydrodictyon, Chlorella, Enteromorpha, Closterium, Zygnema, Nitella/Chara, Pinnularia, Padina, Gracilaria. Gelidium, Sargassum , Ulva Culture of some importantalgae
2. Study of the morphological characteristics and reproductivestructure:
   Albugo, Peronospora, Rhizopus, Penicillium, Alternaria, Lycoperdon, Ganoderma, Peziza, Curvularia, Aspergillus, Puccinia, Colletotrichum, Mucor
3. Study of the morphological characteristics and reproductive structure of lichens.
4. Field visit to study the diversity of Algae, Fungi and Lichens (Preparation & submission of tour report).

Learning Outcomes: Students will

1. Know the morphology of Algae, Fungi and Lichens.
2. Understand the lifecycle patterns of Algae, Fungi and Lichens.
3. Understand the useful and harmful activities of Algae, Fungi and Lichens.

TEXT BOOKS

1. Dube H.C. 2012. An Introduction to Fungi. Scientific Publishers
2. Dubey H.C. 2005. An Introduction to Fungi, (3rd Ed), Vikas Publishing House P. Ltd., New Delhi.
3. Fritch EF. 1935. The Structure and Reproduction of Algae. Tata McGraw Hill. New Delhi.
4. Kumar, H.D. 1989. Introductory Phycology- East-West press, New Delhi.
5. Sambamurty A. V. S. S. 2005. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt. Ltd
6. Sharma O P. 2002. Text book of Fungi (9th Ed), Tata McGraw-Hill Publishing Co Ltd., Delhi.
7. Sharma, O.P. 1986. Text book of Algae- TATA McGraw-Hill New Delhi.
8. Singh V, Pande P C and Jain D K. 2008-09. A Text Book of Botany, Rastogi Publication, Meerut.
9. Smith GM 1971. Cryptogamic Botany Vol. I & II Tata McGraw Hill, New Delhi.
10. Vashishta B R and Sinha A K. 2007. Botany for Degree student-Bryophyta S Chand & Company Ltd., New Delhi

11. Vasishtha B R , Sinha A K and Singh V P. 2007, Botany for degree students-Algae (5th Ed), S. Chand & Co. Ltd., New Delhi

REFERENCE BOOKS:

Phycology:

1. Ahluwalia Amrik Singh. 2003. Phycology: Principles, Processes and Applications. Daya Publishing House.
2. Bold HC and Wynne MJ. 1985. Introduction to Algae- Structure and reproduction.
3. Chapman VJ and Chapman. 1973. The Algae. ELBS and Macmillan, London.
4. Ian Morris. 1967. -An introduction to the Algae, Hutchinson Press, London.
5. James E. Graham, Lee W. Wilcox, Linda E. Graham. 2008. Algae. Pearson Prentice Hall, New Jersey.
6. Prescott GW. 1969. The Algae: A Review. Nelson.
7. Robert Edward Lee. 2018. Phycology. Cambridge University Press
8. South G. R. 2012. An Introduction to Phycology. John Wiley and Sons Ltd.

Mycology:

1. Alexopolous CJ and Mims CW. 1979. Introductory Mycology. Wiley Eastern Ltd, New
2. Bessey EA. 1971. Morphology and Taxonomy of Fungi. Vikas Publishing House Pvt Ltd,
3. Bold H.C. & others. 1980. – Morphology of Plants & Fungi – Harper & Row Public, New Delhi.
4. Burnet JH. 1971. Fundamentals of Mycology. ELBS Publications, London
5. Dorian Snyder. 2019. Introductory Mycology. Larsen & Keller Educ.
6. Frederic Edward Clements. 2018. The Genera of Fungi. Forgotten Books
7. Gwynne-Vaughan B. 2018. Fungi. Biotech Books
8. John Webster, Roland W. S. Weber. 2007. Introduction to Fungi. Cambridge University Press
9. Marcela C. Pagano. 2016. Recent Advances on Mycorrhizal Fungi (Fungal Biology).Springer
10. Michael J. Carlile, Sarah C. Watkinson. 2000. The Fungi. Academic Press New Delhi.

SEMESTER-I

HARD CORE COURSE III

BOHT 103-BRYOLOGY AND PTERIDOLOGY

Objectives: To acquire knowledge on the structure, reproduction and life cycle of Bryophytes and Pteridophytes

Unit I

Introduction, General characteristic features of Bryophytes. Origin of Bryophytes. Range of thallus structure, Reproduction and life cycle. Evolution of sporophytes in bryophytes.

Unit II

Classification of Bryophytes- by Proskauer (1957.General account of major groups of bryophytes (Hepaticopsida, Anthoceratopsida and Bryopsida). Economic importance of Bryophytes.

Unit III

General characteristic features of Pteridophytes and Classification up to order level (Smith 1955) – Study of vegetative and reproductive characters: Psilophytales, Psilotales, Lycopodiales, Selaginellales, Equisetales and Filicales.

Unit IV

Origin of land flora, colonization in terrestrial environment, Telome theory and its significance, Evolutionary trends in stelar organization and soral organization, apogamy, apospory; embryogeny.

Unit V

Homospory, heterospory and origin of seed, fossil record and heterospory, environmental factors and heterospory, life cycle patterns. Economic importance of Pteridophytes.

Practicals

1.Study of morphology and anatomy of vegetative and reproductive characters using whole mount preparations, dissections and sections or from permanent slides of the following plants:

Bryophytes: *Riccia, Marchantia, Lunularia, Anthoceros, Funaria* and *Sphagnum.*

Pteridophytes: *Lycopodium, Selaginella, Equisetum, Adiantum* and *Marsilea.*

2.A field trip to places of botanical interest to familiarize the students with different types of vegetation and fossils.

Learning Outcomes: Students will

1. Know the diversity and classification of Bryophytes and Pteridophytes.
2. Understand the economic importance of Bryophytes and Pteridophytes.
3. Understand the stelar organization in Pteridophytes.

TEXT BOOKS:

Bryology

1. Andrew J Wood M J Oliver and David J Cove 2009. New Frontiers in Bryology. Springer-Verlag New York Inc.
2. Prem Puri 1973. Bryophytes- A Broad Perspective, Atma Ram & Sons, New Delhi.
3. Rejila S 2014. Bryophytes. LAP Lambert Academic Publishing
4. Schofield W. B. 2010. Introduction to Bryology. The Blackburn Press
5. Watson EV 1971. The structure and life of Bryophytes. Hutchinsons publications, London.

Pteridophytes

1. Gangulee H C and Kar A K. 1993. New Print. College Botany Vol II. New Central Book Agency, Kollatta.
2. Parihar N. S. 2019. An Introduction to Embryophyta - Pteridophytes. Surjeet Publication
3. Sambamurty A. V. S. S. 2005. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt. Ltd
4. Sharma O.P. 2008. Pteridophyta. McGraw Hill
5. Stewart. 2005. Paleobotany and the Evolution of Plants. Cambridge University Press
6. Vasistha P C, Sinha A K and Anil Kumar 2009. Botany for Degree students-Pteridophyta. Chand S & Company Ltd., New Delhi
7. Vasistha P C, Sinha A K and Anil Kumar 2009. Botany for Degree students-Gymnosperm. S Chand & Company Ltd., New Delhi.
8. Veer Bala Rastogi 2017. Organic Evolution (Evolutionary Biology). Medtech.

REFERENCE BOOKS:

1. Andrews, H.N. 1961. Studies in Palaeobotany. John Wiley & Sons, New York.
2. Arnold, C.A. 1947. An introduction to Palaeobotany. McGraw-Hill, New York.
3. Bierhost, D.W. 1947. Morphology of Vascular Plants. The Mac Million, New York, London.
4. Bower, F.O. 1908. The Origin of Land flora. The Mac Million, New York.
5. Chamberlain, C.J. 1934. Gymnosperms – Structure and Evolution, Chocago.
6. Coulter, J.M. and Chamberlain, C.J. 1917. Morphology of Gymnosperms, Chicago.
7. Devevoryas, T. 1962. Morphology and evolution of fossil plants. Holt, Rinchart &Winston, New York.
8. Eames, A.J. 1936. Morphology of Vascular Plants – Lower groups. McGraw Hill, New York, London.
9. Smith, G.M. 1955. Cryptogamic Botany Vol. II McGraw-Hill, New York, London.
10. Sporne, K.R. 1962. The Morphology of Pteridophytes Hutchinson University Library, London.
10. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson Univ. Library, London.
11. Sporne K. R. 2018. The Morphology of Pteridophytes; The Structure of Ferns and Allied Plants (New Edition). Franklin Classics
12. Watson, J. 1953. An Introduction to the study of fossil plants, London.

SEMESTER-I

HARD CORE COURSE III

BOHT 104- GYMNOSPERMS AND PALAEOBOTANY

Objectives: To acquire knowledge on the structure, reproduction and life cycle of Gymnosperms and to study the plant fossils.

Unit I

General characteristic features of Gymnosperms and Classification up to order level (Sporne 1965). Origin and evolution of Gymnosperms. Distribution of gymnosperms in India.

Unit II

Study of vegetative and reproductive characters of plants belonging to following orders: Cycadales, Coniferales, Taxales, Ginkgoales and Gnetales.

Unit III

Biotic interactions (algae, microbes and insects) of Gymnosperms, Endangered and endemic taxa and their conservation**.** Economic importance of gymnosperms.

Unit IV

Fossilization and types of fossils – changes in organic and vegetation profile through the ages (geological time scale), Palaeopalynology and Carbon dating. Factors affecting fossilization, objectives of palaeobotanical studies, Contributions of Indian Paleontologist – Birbal Sahni.

Unit V

A detailed study of the following fossils: *Psilophyton, Lepidodendron, Heterangium, Lagenostoma, Lyginopteris* and *Cordaites*.

Practicals

1. Study of morphology and anatomy of vegetative and reproductive characters using whole mount preparations, dissections and sections of the followingplants:

Cycas, Pinus, Ephedra, Gnetum, Ginkgo, Lepidodendron, Cordaites. Lagenostoma, Heterangium.

2. Types of fossils (Impression, Compression, Petrification)

3. A field trip to places of botanical interest to familiarize the students with different types of vegetation and fossils.

Learning Outcomes: Students will

1. Know the systematic, vegetative and reproductive characteristics of Gymnosperms.
2. The evolution of gymnosperms.
3. The scope of Palaeobotany, type of fossils and its role in geological time scale.

TEXT BOOKS:

1. Gangulee H C and Kar A K. 1993. New Print. College Botany Vol II. New Central Book Agency, Kollatta.
2. SambamurtyA. V. S. S. 2005. A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I K International Publishing House Pvt. Ltd.
3. Stewart. 2005. Paleobotany and the Evolution of Plants. Cambridge University Press
4. Vasistha P C, Sinha A K and Anil Kumar 2009. Botany for Degree students-Gymnosperm. S Chand & Company Ltd., New Delhi.
5. Veer Bala Rastogi 2017. Organic Evolution (Evolutionary Biology). Medtech.

REFERENCE BOOKS:

6. Andrews, H.N. 1961. Studies in Palaeobotany. John Wiley & Sons, New York.
7. Arnold, C.A. 1947. An introduction to Palaeobotany. McGraw-Hill, New York.
8. Bierhost, D.W. 1947. Morphology of Vascular Plants. The MacMillan, New York, London.
9. Bower, F.O. 1908. The Origin of Land flora. The MacMillan, New York.
10. Chamberlain, C.J. 1934. Gymnosperms – Structure and Evolution, Chicago.
11. Coulter, J.M. and Chamberlain, C.J. 1917. Morphology of Gymnosperms, Chicago.
12. Devevoryas, T. 1962. Morphology and evolution of fossil plants. Holt, Rinchart & Winston, New York.
13. Eames, A.J. 1936. Morphology of Vascular Plants – Lower groups. McGraw Hill, New York, London.
14. Smith, G.M. 1955. Cryptogamic Botany Vol. II McGraw-Hill, New York, London.
15. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson Univ. Library, London.
16. Watson, J. 1953. An Introduction to the study of fossil plants, London.

SEMESTER 1

SOFT CORE COURSE 1

BOSC 106 MICROBIAL BIOTECHNOLOGY

Objectives: Students will be able to gain knowledge about the bioactive potential of microbes.

Unit- I

Fermentation process: Fermentation media; inoculum preparations; scale up of fermentation, submerged and solid state fermentation; continuous fermentations, fermentor design.

Unit- II

Microbial Products: Antibiotics viz,.production of penicillin fermentation; anaerobic fermentation; alcohol production, Baker's yeast & probiotics.

Unit -III

Biomolecules: vitamins viz., Vitamin B_{12}, Riboflavin, vitamin A; Plant hormone (Gibberellin) production.

Unit-IV

Biopesticides & biofertilizers- production and applications, use of algal & fungal inoculants to improve crop growth. Sewage treatment and Biogas production.

Unit -V

Enzymes and acid products: Production of amylases, proteolytic enzymes, pectinase; production of acetic acid, citric acid and alpha-ketoglutaric acid fermentation.

Practicals:

1. Preparation of fermentation media – sterilization techniques.
2. Screening and Identification of Antibiotic producing microbes.
3. Demonstration of different types of bio-fermentor.
4. Staining techniques for fungi and bacteria.
5. Production of alcohol from yeast and grape.
6. Production of organic acid viz., acetic acid.
7. Production of metallic nanoparticles from fungi.

8. Visit to wine, pharmaceutical and food industries.

Learning Outcomes: Students will

1. Screen and identify the antibiotic producing microbes.
2. Know the different types and functions of Bio-fermenter.
3. Extracellular enzyme production by microbes.

TEXT BOOKS:

1. Anandan A. 1989. An Introduction to Industrial Microbiology.
2. Casida Jr L. E. 1996. Industrial Microbiology, New Age International (P) Ltd., New Delhi.
3. Patel, A. H. 2005. Industrial Microbiology. Macmillan India Limited, New Delhi.
4. Ratul Saikai. 2008. Microbial Biotechnology. New India Publishing Agency.
5. Singh B. D. 2015. Biotechnology: Expanding Horizons. Kalyani Publications.
6. Verrall, M. S. and Hudson M. J. 1990. Separation for Biotechnology, Ellis Horwood Ltd.

REFERENCE BOOKS:

1. Elsa Cooper. 2019. Microbial Biotechnology: Methods and Applications. Callisto Reference.
2. Lee Yuan Kun. 2006. Microbial Biotechnology: Principles and Applications. World Scientific Publishing Co Pvt. Ltd.
3. Neha Srivastava. 2019. New and Future Developments in Microbial Biotechnology and Bioengineering: From Cellulose to Cellulase: Strategies to Improve Biofuel Production. Elsevier.
4. Peppler, H. J. and Pertman, D. 1979. Microbial Technology. Vols. 1 and 2, Academic Press, New York.
5. Prescott, L. M., J. D. Hardley and D. A. Klein, 1990. Microbiology, WEB McGraw Hill.
6. Thatoi H N. 2019. Microbial Biotechnology. Alpha Science International, Ltd.
7. Thoma G. T. 1977. Industrial Microbiology. Dowden Hutchinson & Ross Inc., Pennsylvania.

SEMESTER-II

HARD CORE COURSE

BOHT 207- COMPUTER APPLICATIONS IN BIOLOGY AND BIOSTATISTICS

Objectives: Student will be able to

- Use of computational approach to analyze, manage and store biological data
- Use of bioinformatics tools in biological databases.
- Know to work with statistical tools in Biology

Unit 1

Fundamental knowledge of computers – Basic components of computers – CPU, Input – Output devices, keyboard, mouse and scanner, printers, data storage and retrieval, hard disc, floppy disk, CD ROM, Types of computers, Hardware and Software

Unit II

Operating systems: Introduction to operating systems – Windows/Linux; concept of data, types of data and data structures. **Computer Networking**: Fundamentals of networking: OSI reference model, TCP/IP, topologies and protocols. Network security.

Unit III

Introduction to Bioinformatics; Overview of Bioinformatics resources on the web – NCBI/EBI/EXPASY. Biological databases: Nucleic acid sequence databases, Genbank/EMBL/DDBJ; Protein sequence databases – UniProtKB. BLAST, Multiple sequence alignment – CLUSTAL W and Phylogenetics. Database on bibliography. Application of software with special reference to Taxonomy.

UnitIV

Biostatistics: Measures of Central Tendency- Mean, Median, Mode- Measures of Dispersion- Quartile deviation, Mean deviation, Standard deviation-Variance, Coefficient of Variation. Probability distributions: Binomial distribution, Poisson distribution, Normal distribution.

Unit V

Correlation and Regression: Definition, types and significance. Chi-square test: Characteristics and applications. Tests of significance: Null hypothesis and alternate hypothesis, Student's t- test, X^2- test; ANOVA – one way and two way analysis of variance. Basics of SPSS, applications of SPSS.

Practicals:

1. Windows utilities
2. Computer presentation with graphics, working with formulae and functions, graphs, (SPSS).
3. Browsers and various search engines
4. E-mail, designing and creation of webpages.
5. Genbank databases using ENTREZ search engine.
6. Preparation of power point presentation.
7. NCBI-BLAST Sequence analysis.

Learning Outcomes: Student will

1. Know to use of computational approach to analyze, manage and store biological data.
2. Solving practical problems using statistical packages and databases.
3. Use of bioinformatics tools in biological databases.
4. Know to work with formulae in MS excel.

TEXT BOOKS:

1. Alexis Leon, Mathews Leon. Fundamentals of Information Technology. Leon Press, Chennai & Vikas Publishing House Pvt Ltd. Delhi.
2. Baxevanis A. D. et al. 2005. Current Protocols in Bioinformatics, Wiley Publishers
3. Bryan Bergeron. 2015. Bioinformatics Computing. Pearson Education India
4. Cynthia Gibas, Per Jambeck. 2001. Developing bioinformatics computer skills
5. David W. Mount, 2001. Bioinformatics Cold Spring Harbor Laboratory Press.
6. Education ISBN81-297-0044-1
7. Krane D.E. and Raymer M.L, 2003. Fundamental concepts of Bioinformatics, Pearson O'REILLYpublication.16
8. Pevzner P. A. 2004. Computational Molecular Biology, Prentice Hall of India Ltd.
9. Rajaraman. Fundamentals of Computer. 4th Edition. Prentice Hall India.
10. Sandhu S G. 2012. Bioinformatics and its Applications. Pragun Publications

REFERENCE BOOKS:

1. Bernhard Haubold. 2009. Introduction to Computational Biology: An Evolutionary Approach. Springer
2. Gibas Cynthia, Jambeck P. 2001. Developing bioinformatics in computer skills. Oreilly & Associates Inc. Shroff Publishers,
3. Ka-Chun Wong. 2016. Computational Biology and Bioinformatics. Taylor &Francis
4. Kutti, C and Tata McGraw Hill, 1995. Unix programming: a conceptual perspective.
5. Mount David W. Bioinformatics: Sequence and Genome analysis: Cold Spring Harbor
6. Regan Knight. 2017. An Introduction to Bioinformatics. Larsen and Keller Education
7. Tanenbaum Andrew S. 2003. Computer Networks 4th edition; Prentice Hall.

SEMESTER- II

HARD CORE COURSE II

BOHT 208-PLANT ANATOMY

Objectives: To acquire the knowledge about anatomical structure and developmental patterns of Angiosperms.

Unit I

Basic Concepts of Anatomy- Theories of Meristem organization of meristems in stem and root, Differentiation of Xylem and Phloem Tissues; Structure and Function of Vascular Cambium and Cork-cambium; Cambial activity and wound healing.

Unit II

Primary, Secondary and Anomalous Secondary growth in stem and root of plants (Monocot and Dicot); Wood types and structures.

Unit III

Morphogenesis in Stem and Root: Organization of Shoot and Root Apical meristems (SAM and RAM); Nodal anatomy; Shoot and Root developments in plants; Development of lateral roots and root hairs.

Unit IV

Morphogenesis in Leaf- Leaf development, Phyllotaxy, Epidermis Development- Trichomes and Stomata Development; Leaf anatomy (Dicot and Monocot)

Unit V

Floral anatomy- Organization of Floral meristems, origin and development of floral parts (*Arabidopsis and Antirrhinum*). Fruit wall and seed coat.

Practicals

1. Micro-preparation of SAM in Dicot and Monocot.
2. Micro-preparation of RAM in Dicot and Monocot.
3. Anomalous structure of stem of *Boerhaavia, Nyctanthes, Achyranthes*

4. TS / LS showing initiation of lateral roots.
5. T.S. of dicot and moocot leaf.
6. Observation of permanent slides/micropreparations/photographs/charts/specimens etc. of the following, SAM, RAM.

Learning Outcomes: Students will

1. Know about plant anatomical structure and their developmental patterns.
2. Know the plant mechanical tissues.
3. Knowledge about normal and abnormal secondary growth.

TEXT BOOKS:

1. Annie Ragland . 2014. Plant Anatomy & Microtechniques. Saras Publication
2. Hema Sane. 2014. Plant Anatomy and Embryology. Vision publications
3. Pandey B. P. 2006. Plant Anatomy. S. Chand and Company
4. Pandey S N. and A Chadha A. 2007. Plant Anatomy and Embryology, Vikash Publishing House Pvt. Ltd. New Delhi.

REFERENCE BOOKS:

1. Annie Ragland. 2010. Developmental Botany & Experimental Embryology. Saras Publication
2. Hennig, Lars; Köhler, 2010. Plant Developmental Biology: Methods and Protocols", Claudia (Eds.), 1st Edition., Humana Press
3. Katherine Esau. 2006. Anatomy of Seed Plants. Wiley
4. Lyndon R. F. 1990. " Plant Development the cellular basis" Unnin Hyman, London,
5. Pua, Michael R. Davey, 2009. Plant Developmental Biology - Biotechnological Perspectives: Volume 1", Eng Chong Publisher: Springer.
6. Roy. 2010. Plant Anatomy. New Central Book Agency
7. Sachs T. 1991. Patterns formation and plant tissue" Cambridge University Press.
8. Stephen H. Howell; Molecular genetics of Plant Development" Cambridge University Press.

SEMESTER- II

HARD CORE COURSE II

BOHT 209-REPRODUCTIVE BIOLOGY OF FLOWERING PLANTS

Objectives: Students will be able to know the mechanism of fertilization and development of embryo in flowering plants.

Unit I

Basic Plant Embryology-Parts of a flower, structure of an anther, Microsporogenesis and Development of Male gametophyte; Megasporogenesis and structure of ovary, Development of Female gametophyte, Ovules and types.

Unit II

Pollination, types, agents and significance, Double fertilization in plants; Development of Monocot and Dicot embryo and Endosperm in plants and types.

Unit III

Polyembryony, Apomixis, Sexual incompatibility in plants; Cellular Totipotency and Regeneration;

Unit IV

Embryology related to taxonomy- embryological characteristics use in taxonomical identification, significance of embryology in taxonomy.

Unit V

Experimental embryology- Production of Somatic embryo and haploid embryos; Synthetic Seed production; Genetics of Zygotic and Somatic embryogenesis.

Practicals

1. Isolation and microscopic examination of pollen grains and pollinium.
2. Isolation and dissection of embryo.
3. Pollen Germination and Test- *Datura* sp., *Catharanthus* sp.
4. Observation of permanent slides/micropreparations/photographs/charts/specimens etc of the following Anthers, Ovules, Embryo-sacs, different stages of embryo, Endosperms, Seeds.

Outcomes: Students will

1. Know the mechanism of fertilization and development of embryo in plants.
2. Understand Apomixis and Polyembryiony
3. Understand the mechanism of seed germination and seed growth.

TEXT BOOKS:

1. Bhatnagar. 2014. The Embryology of Angiosperms. Vikas Publishing Company
2. Bhojwani S S. and Bhatnagar S P. 1999. The Embryology of Angiosperms, (4th revised and enlarged Ed) Vikash Publishing House Pvt, Ltd. New Delhi
3. Hema Sane. 2014. Plant Anatomy and Embryology. Vision publications
4. Maheswari P. 1997. An Introduction to the Embryology of Angiosperms, Tata McGraw Hill Publishing company Ltd., New Delhi.
5. Pandey S N. and A Chadha A. 2007. Plant Anatomy and Embryology, Vikash Publishing House Pvt. Ltd. New Delhi.
6. Sharma H P. 2009. Plant Embryology (Classical and Experimental) Narosa Publishing House Pvt. Ltd. India

REFERENCE BOOKS:

1. Annie Ragland. 2010. Developmental Botany & Experimental Embryology. Saras Publication
2. Hennig, Lars; Köhler, 2010. Plant Developmental Biology: Methods and Protocols", Claudia (Eds.), 1st Edition., Humana Press
3. Katherine Esau. 2006. Anatomy of Seed Plants. Wiley
4. Lyndon R. F. 1990. " Plant Development the cellular basis" Unnin Hyman, London,
5. Pua, Michael R. Davey, 2009. Plant Developmental Biology - Biotechnological Perspectives: Volume 1", Eng Chong Publisher: Springer.
6. Roy. 2010. Plant Anatomy. New Central Book Agency
7. Sachs T. 1991. Patterns formation and plant tissue" Cambridge University Press.
8. Stephen H. Howell; Molecular genetics of Plant Development" Cambridge University Press.

STER – II HA

SEMESTER II

HARDCORE COURSE IV

BOHT 210- BIOINSTRUMENTATION

Objectives: Students will able to understand the principles of and working of various instruments used in biological research.

Unit I

Microscopy: Principles of Light Microscopy, Magnification, Resolving power. Phase Contrast Microscopy, Fluorescence Microscopy. Electron Microscopy: TEM and SEM. Foldscope. Camera Lucida, Ocular and Stage micrometer. Photomicrography. Microtechniques: Microtomes – Rotary and Sledge, Fixatives (FAA) and Staining (single, double).Types of mounting media.

Unit II

Centrifuge – Basic principles of sedimentation, RCF, Sedimentation coefficient. Types of Centrifuges – Analytical and Ultracentrifuges. pH meter – principle, electrodes, working of a pH meter.

Unit III

Chromatography – paper, TLC, column, GLC, HPLC. Electrophoresis –Gel electrophoresis, Agarose/SDSPAGE. Immunoelectrophoresis – applications.

Unit IV

Spectrophotometer – Absorbance and Transmittance, Beer-Lambert's Law, Visible and UV spectrophotometers. Atomic Absorbance Spectrometer, Flame photometer.

Unit V

Radio isotopic techniques – radioisotopes, Half-life, Applications of tracer techniques in Biology, Measurement of radioactivity – GM and Scintillation counters. Autoradiography.

Practicals:

1. Separation of proteins by gel electrophoresis.
2. Estimation of proteins by Lowry's et al method.
3. Preparation of a standard curve for protein (BSA).
4. Preparation of buffers using a pH meter.
5. pH of various soil and water samples.
6. Training the students to use UV-VIS Spectrophotometer.
7. Demonstration of Column Chromatography.
8. TLC – separation of pigments and amino acids.
9. Calibration of a microscope using ocular and stage micrometers.

Learning Outcomes: Students will

1. Understand the principles of microscopy, staining techniques.
2. Know the different fixatives.
3. Principles of instruments: Chromatography, electrophoresis techniques, spectrophotometer.

TEXT BOOKS:

1. Arumugam and Kumaresan V. 2015.Biophysics and Bioinstrumentation. Saras Publications
2. Gurumani N. 2011. Research methodology: For Biological Sciences, MJP Publishers, New Delhi.
3. Jain J L. 2005. Fundamentals of Biochemistry, 6th Ed. S Chand & Co Ltd. New Delhi.
4. Jeyaraman, J. 1972. Techniques in Biology, Higginbothams Pvt. Ltd, Madras.
5. Prasad and Prasad , Outlines of Microtechnique, Emkay Publications, Delhi.
6. Rastogi S C. 2003. Biochemistry, Tata McGraw Hill Pvt. Ltd. New Delhi.
7. Reddy. 2017. Instrumentation and Control Systems. McGraw Hill Education
8. Sabari Ghosal. Anupama Awasthi. 2018. Fundamentals of Bioanalytical Techniques and Instrumentation. PHI Learning
9. Satyanarayan V and Chakrapani. 2006. Biochemistry. Books and Allied (p) Ltd. Kolkata.
10. Veerakumari L. 2009. Bioinstrumentation. MJP Publishers, New Delhi.

REFERENCES:

1. Dennis, D.T., Turpin, D.H.., Lefebvre, D.B. and Layzell, D.B. 1997. Plant Metabolism (2nd Edn.) Longman, Essex, England.
2. Khandpur R S. 2015. Handbook of Analytical Instruments. McGraw Hill Education
3. Moore, T. C. 1989. Biochemistry and Physiology of Plant Hormones, Springer Verlag, New York, USA.
4. Philip Sheeler and Bianchi – Cell and Molecular Biology.
5. Veerakumari, L. 2009. Bioinstrumentation,www.mjpublishers.com
6. Voet and Voet. 1992. Biochemistry, John Wiley and Sons, New York, USA.
7. Webster. 2007. Bioinstrumentation. Willy

SEMESTER II

SOFTCORE COURSE I

BOSC 212 – MEDICINAL BOTANY

Objectives: Students will be able to acquire knowledge about

- The traditional botanical knowledge and folklore medicines.
- Cultivation aspects of medicinal plants
- Crude drugs

Unit I

Pharmacognosy - Definition and scope — History – Scheme for pharmacognostic studies of a natural drug – Indian Systems of medicine: Ayurveda, Siddha, Yoga, Unani, Homeopathy (AYUSH), Naturopathy Traditional botanical knowledge, Ethnobotany and Folklore medicines.

Unit II

Medicinal plants – Methods of cultivation, factors affecting cultivation, use of biofertilizer, pest control. Collection, Harvesting, Drying, Packaging and storage of crude drugs. Cultivation and utilization of medicinal and aromatic plants in India. Methods of cultivation of *Aloe vera* and *Ocimum* (Tulsi).

Unit III

Tissue culture of endangered medicinal plants- Role of tissue culture in the multiplication of medicinal plants – Different types of drug adulteration and substitution – Microscopic analysis and phytochemical evaluation of crude drugs.

Unit IV

Biological source, geographical distribution, morphology of useful part, active principles and therapeutic value of the following drugs: Fox glove (*Digitalis purpurea*), Myrobalan (*Terminalia chebula)*, Neem (*Azadirachta indica*), Turmeric (*Curcuma longa),* Asafoetida (*Ferulla asafoetida*), Ginger (*Zingiber officinale),* Lemon grass (*Cymbopogon citratus*), Clove (*Eugenia caryophyllata*), Vinca (*Catharanthus roseus*).

Unit V

Extraction of Bioactive compounds, (Solvent extraction and microwave assisted extraction), Isolation and Characterization of bioactive compounds by Chromatographic techniques (TLC and HPLC), FTIR and NMR.

Practicals:

1. Identification and morphological study of drugs included in the syllabus.
2. Determination of Epidermal cell number, Epidermal cell size.
3. Determination of stomatal number, stomatal size, stomatal index, vein islet number, vein termination number and study of trichomes.
4. Determination of Vein islet Number and Vein termination number.
5. Microscopic study of Trichomes.

Learning outcomes: Students will

1. Understand the traditional botanical knowledge and folklore medicines.
2. Know to identify the local medicinal plants by using floras.
3. Know the cultivation and utilization of medicinal and aromatic plants in India.
4. Study of crude drugs.
5. Compound from crude drugs.

TEXT BOOKS:

1. Ansari S H. 2006. Essentials of Pharmacognosy, Birla Publications Pvt. Ltd. Delhi.
2. Chaudhuri B C. 2004. Megadiversity Conservation: Flora, Fauna & Medicinal Plants in India's Hot Spots. Daya Publishing House
3. Khandelwal K R. 2008. Practical Pharmacognosy-Techniques & Experiments (19^{th} Ed), Nirali Prakashan, Pune.
4. Kolate C K, Purohit a P and Gokhale S B. 2008. Pharmacognosy (42^{nd} Ed), Nirali Prakashan, Pune.
5. Mohammed ali. 2008. Text Book Of Pharmacognosy (2^{nd}Ed), CBS Publishers & Distributors, New Delhi.
6. Neeru Mathur. 2010. Medicinal Plants of India. RBSA Publishers
7. Prajapnati N D. 2013. A Handbook of Medicinal Plants: A Complete Source.Agro-Bios

8. Shah C S and Qadry J S, Shah Prakasha B S, Amdavad. 2005. A Text Book of Pharmacognosy,
9. Sunita Singh, Subhalaxmi. 2013. Medicinal Plants. Kalpaz Publications
10. Trivedi P C. 2016. Medicinal Plants: Traditional Knowledge. I K International Publishing House Pvt. Ltd.

REFERENCE BOOKS:

1. Chopra R.N. 1958. Indigenous Plants of India.
2. Chopra, R.N., Nayar S.L. and Chopara I.C. 1956. Glossary of Indian Medicinal plants. CSIR, New Delhi, India.
3. Iyengar, M.A. 1975. A hand book of Pharmacognosy, Manipal.
4. Iyengar, M.A. 1978. Powered drugs of India, Manipal.
5. Kokate, C.K. 1988. Practical Pharmacognosy.
6. Kokate, C.K., Purohit A.P. and Gokhale S.B. 1995. Pharmacognosy. Furia, Narali Prakashan, Jageshwari Mandir Lane, Pune.
7. Nadkarni, K.M. 1976. Indian Materia Medica, Vol I & II. Popular Prakashan Pvt. Ltd., Bombay.
8. Nitish Kumar. 2018. Biotechnological Approaches for Medicinal and Aromatic Plants: Conservation, Genetic Improvement and Utilization. Springer Verlag
9. Olayiwola Akerele Vernon Heywood Hugh Synge. 2009. Conservation of Medicinal Plants. Cambridge University Press.
10. Wallis, T.E. 1985. Test book of Pharmacognosy. CBS Publications and distributers, Bholonath Nagar, Shhadara, Delhi.
11. William Charles Evans. 1989. Trease and Evans Pharmacognosy. 14thEdition.

Government of Puducherry

DEPARTMENT OF BOTANY

KANCHI MAMUNIVAR GOVT. INSTITUTE FOR POSTGRADUATE STUDIES AND RESEARCH

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CBCS-SYLLABUS

M.Sc. (BOTANY)

(For Semesters III and IV)

2022-2023

SEMESTER III

HARD CORE COURSE I

BOHT 313 - ANGIOSPERM SYSTEMATICS AND ECONOMIC BOTANY

Objectives: To acquire knowledge on morphology, taxonomy and the economic importance of Angiosperms

Unit I

Comprehensive view of various approaches of plant classification: Artificial (Linnaeus), Natural (Bentham & Hooker), Phylogenetic (Cronquist). Introduction to APG system of classification. Taxonomic hierarchy. Keys: single access or sequential keys, multi-access keys, indented keys; ICN: rules of nomenclature, typification; Effective and valid publication.

Unit II

Tools of Taxonomy- herbarium, floras, monographs, manuals and revisions. Techniques in Taxonomy- Numerical, Cytotaxonomy, Chemotaxonomy, Modern plant systematic-molecular approaches in plant systematic.

Unit III

Detailed study of the following families: Annonoaceae, Menispermaceae, Nymphaeaceae, Sterculiaceae, Sapindaceae, Meliaceae, Rhizophoraceae, Combretaceae, Myrtaceae, Lythraceae, Cactaceae.

Unit IV

Detailed study of the families: Rubiaceae, Asclepiadaceae, Convolvulaceae, Bignoniaceae, Verbenacae, Amaranthaceae, Moraceae, Casuarinaceae, Zingiberaceae, Arecaceae, Araceae, Cyperaceae, Poaceae.

Unit V

World centres of origin of domesticated plants and uses of (Three species each)

i) Cereals, ii) Pulses, iii) Nuts, iv) Vegetables: underground and Leaf , v) Fruits: Tropical and Temperate fruits, vi) Spices and condiments obtained from : Stem, leaves, flowers, seeds, vii) Oils (Edible and Essential), viii) Commercial crops Textile fibre, ix) Timbers, x) Drug yielding plants: obtained from roots, stem, bark leaves, fruits and seeds, xi) Forage/ fodder crops.

Practicals

1. Binomial identification of local plants by using flora.
2. Study of Families mentioned in the syllabus – at least two local taxa from each family may be dissected and sketched in record sheets.
3. Construction of artificial key for any six plants.
4. Field visits (local / interstate) for 3 to 7 days and submission of 30 herbarium sheets of wild plants along with the field book.
5. Food plants: Morphology, Anatomy, histochemical tests for wheat, rice & Bengal gram.
6. Study of any locally available fodder / forage plant.
7. Identification of fibers yielding plants.
8. Study of any three medicinal plants included in the syllabus.

Learning Outcomes: Students will

1. Preparation of botanical keys at family level by locating key characters.
2. Study of locally available families of flowering plants.
3. To develop a basic knowledge of taxonomic diversity and know their uses.
4. Learn various advanced tools to study Plant Taxonomy.

TEXT BOOKS:

1. Amal Kumar Mondal. 2016. Advanced Plant Taxonomy. New Central Book Agency
2. Bharat Bhattacharia. 2005. Systematic Botany, Narosa publishers, New Delhi.
3. Chopra, G.L. 1982. Angiosperms (Systematics & Life Cycle) Pradeep publishers, Jullander, Punjab.
4. Gurucharan Singh. 2005. Plant Systematics (Theory & Practice), Oxford & IBH publishers, New Delhi.
5. Kocchar, S. L, 1998. Economic Botany of the Tropics II edition, Macmillan India Ltd, New Delhi.
6. Kochhar S. L. 2016. Economic Botany: A Comprehensive Study. Cambridge University Press India Pvt. Ltd.
7. Lawrence, H.M. 1971. Taxonomy of Vascular Plants, Oxford and IBH publishers, New Delhi.
8. Pandey, B.P. 2004. Angiosperms, S. Chand publishers, New Delhi.

9. Sharma O P. 2017. Plant Taxonomy. McGraw Hill Education.
10. Sivarajan, V.V. 1991. Introduction to the principles of Plant Taxonomy, Oxford and IBH publishers, New Delhi.
11. Subramanium, N.S. 1996. Laboratory manual of Plant Taxonomy, Vikas publishers, New Delhi
12. Subramanium, N.S. 1996. Modern Plant Taxonomy, Vikas publishers, New Delhi

REFERENCE BOOKS:

1. Austin Balfour. 2016. Plant Taxonomy. Syrawood Publishing House.
2. CSIR – 1948-1976. 2000. The Wealth of India: A dictionary of Indian raw material & Industrial production, New Delhi, Raw materials XII Revision Vol. I-II (1985 – 1992). Supplement.
3. Davis, P.H and Heywood, V. H. 1973. Principles of Angiosperm Taxonomy. Oliver and Boyd Ltd.UK.
4. Franker, O. H., Brown, A. H and Burdon, J.J. 1995. The conservation of plant diversity. Cambridge University Press, Cambridge, UK.
5. Heywood, V. H. 1984. Modern methods in Plant Taxonomy, Academic Publishers, USA.
6. John Gonsalves . 2016. Economic Botany and Ethnobotany. Mittal Publications
7. Jones, S.B, Jr. and Luchsinger , A.E. 1986. Plant Systematics, 2nd Edn. Mc Graw Hill, New York.
8. Mabberley, David J.2013. Mabberley's Plant-book: A Portable Dictionary of Plants, their Classifications, and Uses. Cambridge University Press.
9. Michael G. Barbour and C. Stocking. 2005. Plant Biology, International Edition. Publisher: Brooks/Cole
10. Miolini. 2016. Textbook of Economic Botany ABS Book
11. Nels R. Lersten. 2013. Flowering Plant Embryology. Wiley
12. Simpson Beryl. 2013. Plants in our World: Economic Botany. McGraw-Hill Education
13. Stace, C. A. 1989. Plant Taxonomy and Biosystematics (2nd Edn.) Edward Arnold Ltd, London.
14. Takhtajan, A. 1995. Flowering Plants – Origin & Dispersal, Oliver and Boyd.UK.

SEMESTER III

HARD CORE COURSE II

BOHT 314 - GENETICS, PLANT BREEDING AND EVOLUTION

Objectives:

- To acquire knowledge in concepts of Mendelian and Non-Mendelian Inheritance
- Know to construct chromosome maps
- Modern techniques involved in crop improvement and plant breeding.

Unit I

Mendelian Genetics, Incomplete dominance, interaction of Genes (non-epistasis, dominant and recessive epistasis complementary genes), Multiple factor inheritance, Linkage and Crossing over, Cytoplasmic inheritance: Plastidal inheritance in *Mirabilis*.

Unit II

DNA as a genetic material, Sex determination in plants, Sex linked inheritance, Mutation: Chromosomal aberration, Chromosomal variation, and Quantitative genetics.

Unit III

Transposable elements: Insertion sequences, Complex transposons, Genetic mapping. Transposons of *E. coli*, bacteriophage Mu and Yeast Ty elements.

Unit-IV

Plant Breeding: Introduction, principles, Plant selection methods (Mass selection, Pureline selection, Clonal selection). Hybridization: Techniques, Interspecific hybridization, Heterosis.

Unit V

Origin of basic biological molecules: Abiotic synthesis of organic monomers and polymers, Concepts of Oparin and Haldane; experiment of Miller (1953). Origin of major group of plants. Molecular divergence and theory of endosymbiosis.

Practicals

1. Interaction of Genes.
2. Sex linked inheritance.
3. Construction of chromosome/genetic maps.
4. Linkage maps of *Drosophila* and Maize.
5. Photographs / diagram / models of Structural changes in chromosome (deletion,

duplication, inversion and translocation) and Numerical changes in the chromosome (Euploidy and Aneuploidy).

6. Incomplete dominance.
7. Polygenic inheritance or multiple alleles.
8. Trihybrid Test cross.

Learning Outcomes: Students will

1. Gain knowledge about Mendian and Non-Mendelian Genetics
2. Know to construct chromosome maps.
3. Modern techniques involved in crop improvement and plant breeding.
4. Understand the molecular tools in phylogeny

TEXTBOOKS:

1. Ajoy Paul, 2007. Text Book of Cell and Molecular Biology. Books and Allied (P)Ltd. Kolkatta.
2. Brian K. Hall, Benedikt Hallgrimsson. 2013. Strickberger's Evolution. Jones &Bartlett Learning
3. Gupta P.K. 1996. Genetics, Rastogi Publications. Meerut.
4. Philip Sheeler and Donald E. Bianchi. 2004. Ed. Cell and Molecular Biology III Ed. Replica Press Pvt. Ltd., India.
5. Sarin C. 1990 Genetics. Tata Mc Graw Hill Publication Co. Ltd. New Delhi.
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REFERENCE BOOKS:

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2. Atherly, A.G. Girton, J.R and McDonald, J.F. 1999. The Science of Genetics. Saunders College Publishing, Fort Worth, USA.
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8. John E. Bradshaw. 2016. Plant Breeding: Past, Present and Future. Springer Nature
9. Jones and Bartlett Publishers, Inc.
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13. Peter J. Russell. 2009. Genetics: A Molecular Approach - International Edition. Pearson
14. Ram M. 2014. Plant Breeding Methods. Prentice Hall India Learning Private Limited
15. Russel, P.J. 1998. Genetics. Benjamin Publishing Company Inc.,USA
16. Shabir H. Wani C. P. Malik. 2014. New Plant Breeding Techniques. Pointer Publishers

SEMESTER III

HARD CORE COURSE III

BOHT 315 - CELL AND MOLECULAR BIOLOGY

Objectives:

- To acquire the knowledge about structure and function of cell organelles.
- Understand various molecular mechanisms taking place in a cell

Unit I

Cell: Ultra structure, of Plant Cell, structure and function of Cell wall, Plasma membrane, Cytoplasm. Structure and functions of cell organelles. Endosymbiont hypothesis on the evolution of mitochondria and chloroplast.

Unit II

Control mechanism of cell cycle, Role of retinoblastoma and E_2f proteins in cell cycle, Mechanism of programmed cell death, Initiation of cancer at cellular level, Proto-oncogenes and tumor suppressor genes.

Unit III

Structure of chromatin- histones and non-histone proteins, Nucleosomal organization of chromatin. Heterochromatin and Euchromatin, Chromosomal packing and structure of metaphase chromosome. Molecular structure of the Centromere and Telomere.

Unit IV

Watson and Crick model of DNA structure, Different types of DNA. DNA replication in prokaryotes and eukaryotes: enzymes and proteins involved in replication. Replication in the telomere and telomerase. DNA damage and repair mechanisms.

Unit V

Gene expression: Concept of gene; Features of the genetic code. mRNA transcription and processing, mRNA transport and stability. Mechanism of translation; Protein sorting, Post-translational modification of proteins. Protein folding – Self assembly, role of chaperones in protein assembly. Regulation of gene expression in prokaryotes and Eukaryotes. Organisation of rRNA and tRNA genes, Significance of introns, Organellar genome organisation.

Practicals

1. Acetocarmine root tip squash technique – Observation of chromosomes during mitotic stages.
2. Anther smear techniques for meiosis – Observation of chromosomes during meiotic stages.
3. Identification of chromosomes by Banding techniques – Giemsa, Quinacrine, Reverse, Centrometric.
4. Isolation of plant DNA and its quantification by a spectrophotometric method.
5. Isolation of plant RNA and its quantification by a spectrophotometric method.

Learning Outcomes: Students will

1. Understand the role of various cell organelles.
2. Develop knowledge about cell division: Mitosis, Meiosis.
3. Understand the regulation of gene expression.

TEXT BOOKS:

1. Ajoy Paul, 2007. Text Book of Cell and Molecular Biology. Books and Allied (P) Ltd., Kolkata.
2. Archana Sharma. Chromosomes, Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Arumugam N. Cell biology, genetics and molecular Biology, Saras Publications, Nagercoil.
4. Gupta P K. Cell and Molecular Biology, Rastogi Publications, Meerut.
5. Rastogi V.B. 2008. Fundamentals of Molecular Biology, Rastogi Publications, Meerut.
6. Sumita Sen, Dipak Kumar Kar. Cytology and Genetics, Narosa, New Delhi
7. Venki Ramakrishnan. 2017. Gene Machine: The Race to Decipher the Secrets of the Ribosome. Harper Collins Publishers India.

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1. Bob B Buchanan, Wilhelm Gruissem, Russel L Jones. 2000. Biochemistry and Molecular biology of plants. I K International Pvt. Ltd.
2. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. 2002. Molecular biology of the cell (IV Edn). Garland Science, Taylor and Francis group.
3. Bruce Alberts, Dennis Bray, Karen Hopkin, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. 2010. Essential Cell Biology. Garland Science.
4. Daniel L Hartl, Elizabeth W Jones. 2012. Genetics: Analysis of genes and genomes (VII Edn). Jones and Bartlett publishers.
5. David P Clark. 2010. Molecular biology. Elsevier.
6. Firdos Alam Khan . 2016. Biotechnology Fundamentals. CRC Press
7. Gerald Karp. 2008. Cell and Molecular biology: Concepts and experiments (V Edn). John Wiley &Sons.
8. Harvey Lodish, Arnold Berk, Chris A. Kaiser, Monty Krieger, Matthew P. Scott, Anthony Bretscher, Hidde Ploegh, Paul Matsudaira. 2007. Molecular cell biology (VI Edn). W H Freeman &Company.
9. Harvey Lodish, Arnold Berk, Lawrence Zipursky, Paul Matsudaira, David Baltimore, James Darnell. 2000. Molecular cell biology (IV Edn). W H Freeman &Company.
10. James D Watson, Tania A Baker, Stephen P Bell, Alexander Gann, Michael Levine, Richard Losick. 2009. Molecular biology of the gene (V Edn).Pearson.
11. James D. Watson, Tania A. Baker. 2013. Molecular Biology of the Gene. Pearson
12. Muhammad Sohail. 2017. Gene Silencing by RNA Interference: Technology and Application. CRC Press
13. Paul F. Kisak. 2017. Crispr Technology: The Revolutionary Breakthrough for Genetics & Evolution. Createspace Independent Publications
14. Phillip Sheeler, Donald E. Bianchi. 2009. Cell and Molecular Biology. Wiley
15. Robert F Weaver. 2002. Molecular biology (II Edn). McGraw Hill.
16. William H Elliott, Daphne C Elliott. 2001. Biochemistry and molecular biology (II Edn).Oxford.

SEMESTER –III

HARDCORE COURSE

BOHT 316 – PLANT ECOLOGY

Objectives:

- To understand ecosystem ecology and population ecology
- To understand various environmental laws.

Unit I

The Environment: Physical environment; biotic environment; biotic and abiotic interactions. Species Interactions: Types of interactions, interspecific competition, herbivory, carnivory, pollination, symbiosis.

Habitat and Niche: Concept of habitat and Niche; niche width and overlap; fundamental and realized niche; resource partitioning; character displacement.

Unit II

Community Ecology: Nature of communities; community structure and attributes; levels of species diversity and its measurement; edges and ecotones. Ecological Succession: Types; mechanisms; changes involved in succession; concept of climax.

Unit III

Ecosystem Ecology: Ecosystem structure; ecosystem function. Energy flow and mineral cycling (C.N.P.); primary production and decomposition; structure and functions of ecosystems; terrestrial (forest, grassland) and aquatic (fresh water, marine and eustarine).Environmental pollution, global environmental change.

Unit IV

Population Ecology: Characteristics of a population; population growth curves; population regulation; life history strategies; concept of metapopulation- demes and dispersal, interdemic extinctions, age structured populations.

Unit V

Biodiversity and Conservation: Principles of conservation, Indian case studies on conservation/management strategy (Project Tiger, Biosphere reserves). Biodiversity: status, monitoring and documentation, major drives of biodiversity change; Biogeography: Major terrestrial biomes; theory of island biogeography; biogeographical zones of India.

Practicals

1. Qualitative and quantitative analysis of vegetation.
2. Anatomical adaptation.
3. Analysis of soil samples (pH, EC, organic Carbon).
4. Analysis of water samples (pH, dissolved Oxygen).
5. Visit to places of ecological importance, submit a report (12pages)

Learning Outcomes: Students will

1. Understand plant communities and ecological adaptations in plants.
2. Learn about conservation of biodiversity.
3. Understand global warming and climate change.
4. Understand various environmental laws.

TEXT BOOKS:

1. Jonathan Turk and Amos Turk. 1984. Environmental Science IIIrd Ed, CBS College Publishing, USA.
2. Madhab Chandra Dash and Satya Prakash Dash, 2009. Fundamental of Ecology IIIrd Ed, McGraw hill Publishing Company Ltd, New Delhi.
3. Michael J. Crawley. 2013. Plant Ecology. Wiley India Pvt Ltd Shukla R.S.Chandel P.S. 2010. Ecology and Utility of Plant. S Chand and company
4. Prithipal Singh. 2010. An Introduction of Biodiversity. Ane Books Pvt. Ltd., New Delhi.
5. Subrahmaniam N S & Sambamurthy A.V.S.S., 2006. Ecology. II Ed, Narosa Publishing House Pvt. Ltd. New Delhi, India
6. Trivedi R N, 2001. A textbook of Environmental Sciences, Anmol Publications Pvt. Ltd. New Delhi.

REFERENCE BOOKS:

1. Agarwal K. 2001. Environmental Biology. Nidhi Publications. Bikaner.
2. Chapman and Reeis. 1988. Ecology, Principles and Applications, Cambridge University Press,UK.
3. Clive Koelling. 2016. Functional Plant Ecology. Syrawood Publishing House
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5. Jadhav and Bhosale 1995. Environmental Protection and Laws. Himalaya Pub. House, NewDelhi.
6. Jude Boucher. 2010. Plant Ecology: Concepts and Applications. Syrawood Publishing House
7. Keddy Paul A. 2017. Plant Ecology. Cambridge University Press
8. Lydia Cervantes. 2010. Plant Ecology. Apple Academic Press Inc.
9. Miller TG. Environmental Science, Wadsworth Publishing Co.
10. Odum, EP. 1971. Fundamentals of Ecology, Saunders, Philadelphia.
11. Trivedi and Goel. Introduction to air pollution. Techno-Science Publication.
12. Wanger. Environmental Management. W.B. Saunders Co .Philadelphia.

SEMESTER –III

SOFTCORE COURSE I

BOSC 318 – MEDICINAL BOTANY

Objectives: Students will be able to acquire knowledge about

- The traditional botanical knowledge and folkfore medicines.
- Cultivation aspects of medicinal plants
- Crude drugs

Unit I

Pharmacognosy - Definition and scope — History – Scheme for pharmacognostic studies of a natural drug – Indian Systems of medicine: Ayurveda, Siddha, Yoga, Unani, Homeopathy (AYUSH), Naturopathy. Traditional botanical knowledge, Ethnobotany and Folklore medicines.

Unit II

Medicinal plants – Methods of cultivation, factors affecting cultivation, use of Biofertilizer, pest control. Collection, Harvesting, Drying, Packaging and storage of crude drugs. Cultivation and utilization of medicinal and aromatic plants in India. Methods of cultivation of *Aloe vera* and *Ocimum* (Tulsi)

Unit III

Tissue culture of endangered medicinal plants- Role of tissue culture in the improvement of medicinal plants – Different types of drug adulteration and substitution – Microscopic analysis and phytochemical evaluation of crude drugs

Unit IV

Biological source, geographical distribution, morphology of useful part, active principles and therapeutic value of the following drugs: Fox glove (*Digitalis purpurea*), Myrobalan (*Terminalia chebula)*, Neem (*Azadirachta indica*), Turmeric (*Curcuma longa),* Asafoetida (*Ferula asafoetida*), Ginger (*Zingiber officinale)*, Lemon grass (*Cymbopogon citratus*), Clove (*Syzygium aromaticum*), Vinca (*Catharanthus roseus*)

Unit V

Extraction of Bioactive compounds, (Solvent extraction and microwave assisted extraction), Isolation and Characterization of bioactive compounds by Chromatographic techniques (TLC and HPLC), FTIR and NMR.

Practicals:

1. Identification and morphological study of drugs included in the syllabus.

2. Determination of Epidermal cell number, Epidermal cell size.

3. Determination of stomatal number, stomatal size, stomatal index, vein islet number, vein termination number and study of trichomes.

4. Determination of Vein islet Number and Vein termination number.

5. Microscopic study of Trichomes

Learning Outcomes: Students will

1. Understand the traditional botanical knowledge and folklore medicines.
2. Know to identify the local medicinal plants by using floras.
3. Know the cultivation and utilization of medicinal and aromatic plants in India.
4. Study of crude drugs.
5. Compound from crude drugs.

TEXT BOOKS:

1. Ansari S H. 2006. Essentials of Pharmacognosy, Birla Publications Pvt. Ltd. Delhi.
2. Khandelwal K R. 2008. Practical Pharmacognosy-Tehcniques & Experiments (19th Ed), Nirali Prakashan, Pune.
3. Kolate C K, Purohit A P and Gokhale S B. 2008. Pharmacognosy (42nd Ed), Nirali Prakashan, Pune.
4. Mohammed ali. 2008. Text Book Of Pharmacognosy (2ndEd), CBS Publishers & Distributors, New Delhi.
5. Shah C S and Qadry J S, Shah Prakasha B S, Amdavad.. 2005. A Text Book of Pharmacognosy.

REFERENCE BOOKS:

1. Chopra R.N. 1958. Indigenous Plants of India.
2. Chopra, R.N., Nayar S.L. and Chopara I.C. 1956. Glossary of Indian Medicinal plants. CSIR, New Delhi, India.
3. Iyengar, M.A. 1975. A hand book of Pharmacognosy, Manipal.
4. Iyengar, M.A. 1978. Powered drugs of India, Manipal.
5. Kokate, C.K. 1988. Practical Pharmacognosy.

6. Kokate, C.K., A.P. Purohit and S.B. Gokhale. 1995. Pharmacognosy. Furia, Narali Prakashan, Jageshwari Mandir Lane, Pune.
7. Nadkarni, K.M. 1976. Indian Materia Medica, Vol I & II. Popular Prakashan Pvt. Ltd., Bombay.
8. Wallis, T.E. 1985. Test book of Pharmacognosy. CBS Publications and distributers, Bholonath Nagar, Shhadara, Delhi.
9. William Charles Evans. 1989. Trease and Evans Pharmnacognosy. 14thEdition.

SEMESTER IV

HARD CORE COURSE I

BOHT 419 - BIOCHEMISTRY AND PLANT PHYSIOLOGY

Objectives:

- To understand the structure and role of various biomolecules.
- To understand the metabolic process taking place in plants

Unit I

Monosaccharides and the glycosidic bond. Structure of starch and cellulose. Protein and non-protein amino acids – reductive amination and transamination – glutamate pathway; Molecular configuration and conformation of proteins – primary, secondary, tertiary and quaternary structures – properties and types of proteins –simple, complex and derived proteins.

Unit II

Enzymes: Classification, kinetics, mechanism of enzyme action – enzyme inhibition-enzyme regulation-allosteric enzymes-isoenzymes-coenzymes-ribozymes. Structure of Chlorophyll, Carotenoids, phycobilins, anthocyanins and betacyanins. Plant lipids: Fatty acids, phospholipids structure of Ergosterol and cholesterol. β–Oxidation of fatty acid. Structure and properties of cutins, suberins and waxes.

Unit III

Water absorption system in Plants – Mechanism of Asent of Sap. Kinds of transpiration, Guttation and Exudation. Mechanism of stomatal movement. Mechanism of mineral absorption: Passive (Diffusion, Ion Exchange, Donnan Equilibrium and Mass Flow Hypothesis) and Active (Carrier Concept and Electro-Chemical) Theory. Mechanism of Phloem translocation: Pressure flow mechanism, phloem loading and unloading. Root – Microbe interaction in facilitating nutrient uptake.

Unit IV

Organization of Pigment system I and II, Absorption Spectrum, Action spectrum, Red drop and Emerson effect. Fluorescence and Phosphorescene. – Hill reaction - Non-cyclic and Cyclic Electron Tansport, Photophosphorylation – C_3 and C_4 pathways; CAM pathway. Significance of Photorespiration. Mechanism of Aerobic respiration: Glycolysis and Krebs Cycle, Oxidative phosphorylation. Factors affecting Photosynthesis and Respiration. Symbiotic and asymbiotic nitrogen fixation. Nitrate assimilation.

Unit V

Physiological role and mechanism of action of Auxins, Gibberellins, Cytokinns, Abscisic acid and Ethylene. Photoperiodism and Vernalizaiton. Response of plants to salt, drought, freezing, heat, oxidative and UV stresses-mechanism of stress resistance. Circadian rhythm in plants. Signal transduction: receptors and G-Protiens, phospholipid signaling, calcium- calmodulin cascade.

Practicals

1. Measurement of stomatal index and frequency.
2. Determination of water potential.
3. Determination of solute potential.
4. Estimation of total acidity in CAM plants.
5. Estimation of photosynthetic pigments – a, b, total chlorophyll and carotenoids by standard procedures.
6. Separation of photosynthetic pigments by paper chromatography.
7. Estimation of total nitrogen by Nesslerization method (or) Microkjeldhal method.
8. Extraction of amylase and determination of its activity.

Learning outcomes: Students will

1. Understand the mechanism and importance of photosynthesis, transpiration and respiration in plants.
2. Role of C3, C4, Nitrogen cycle in plants.
3. Secondary metabolites of plant.
4. Understand the role of enzyme in plant metabolism and in environment.
5. Growth and Development in plants.

TEXT BOOKS:

1. Bhattacharya A, Vijaya Luxmi. 2015. Methods and Techniques in Plant Physiology. New India Publishing Agency
2. Devlin and Witham, 1986. Plan Physiology, CBS Publishers and Distributors, New Delhi.
3. Jain V K. 2017. Fundamentals of Plant Physiology (Latest edition). S Chand Publishing Comp.
4. Noggle, G.R. and Fritz, G.J. 1976. Introductory Plant Physiology. Prentice Hall, India, New Delhi.

5. Salisbury F.B and Ross C.W. 1992. Plant Physiology (Fourth Edition) Wordsworth Publishing Company, California, USA.
6. Sinha, R. K. 2004. Modern Plant Physiology, Narosa Publishing House, New Delhi.
7. Verma V. 2016. Plant Physiology. Athena Academic
8. Voet and Voet, 1992. Biochemistry, John Wiley and Sons., New York, USA.

REFERENCE BOOKS:

1. Bray, C.M. 1983. Nitrogen metabolism in plants. Longman, England.
2. Casey, E. J. 1962. Biophysics: Concepts and mechanisms. East West Press, New Delhi.
3. Dennis, D.T., Turpin, D.H., Lefebvre, D.B. and Layzell, D.B. 1997. Plant Metabolism (2nd Edn.) Longman, Essex, England.
4. Girma Mekonnen. 2015. Basic Concepts in Plant Physiology. LAP Lambert Academic Publishing
5. Hopkins, W.G. 1995. Introduction to Plant Physiology, John Wiley and Sons., New York, USA.
6. Kramer, P. J. 1969. Plant and soil water relationships. McGraw Hill Book Company, NewYork.
7. Lincoln Taiz, Eduardo Zeiger, Ian M. Møller. 2018. Plant Physiology and Development. OUP USA
8. Moore, T.C. 1989. Biochemistry and Physiology of Plant Hormones, Springer Verlag, New York, USA.
9. Steward, F.C. 1956. Plant Physiology (Vol. I-VID). Addition Clowes & Sons, Limited, London.
10. Taiz, L. and Zeiger, E. 2003. Plant Physiology (Indian Edn.), Panima Publishing Corporation, New Delhi.

SEMESTER IV

HARD CORE COURSE II

BOHT 420 – PLANT BIOTECHNOLOGY

Objectives: To acquire knowledge on Plant Tissue Culture Techniques and Genetic Engineering

Unit I

Introduction to Plant Biotechnology. Concept of cellular differentiation and totipotency. Tissue culture media (composition, preparation). Types of cultures. Sterilization of explants. Initiation and maintenance of callus and cell suspension culture, organogenesis.

Unit II

Micropropagation, Callus regeneration, Axillary shoot induction. Somatic embryogenesis and artificial seeds synthesis. Production of haploids, Somaclonal variations, Protoplast isolation culture and fusion. Cybrids. Germplasm storage, Cryopreservation.

Unit III

Technology of plant cell culture for production of bioactive compounds. Bioreactors systems and models for mass cultivation of plant cells. The production of secondary metabolites from plant cell culture.

Unit IV

Cell culture as biofactories. *Agrobacterium* mediated gene transfer; *Agrobacterium* based vectors, Viral vectors and their application, Application of CRISPR/Cas 9 and RNAi technology in crop improvement.

Unit V

Direct gene transfer methods; chemical methods, electroporation, microinjection, particle bombardment. Biotransformation using plant cell cultures.

Practicals

1. Plant tissue culture techniques (media preparation, culture of explants).
2. Callus culture.
3. Cell suspension culture.

4. Plant transformation system (demonstration).
5. Study of the design and components of bioreactor and its working principle.
6. Co-culture of *Agrobacterium* with leaf disc method.

Learning Outcomes: Students will

1. Know different culture techniques.
2. Know about root, shoot regeneration.
3. Growing disease free plant by tissue culture techniques.
4. Principles of gene transfer methods in plants.

TEXT BOOKS:

1. Ashwani Kumar, Sopory S K. 2016. Advances in Plant Biotechnology and it applications. I K International Publishing House Pvt. Ltd
2. Bhojwani, S.S. and Rajdan. 2004. Plant Tissue Culture: Theory and Practice.
3. Ignacimuthu, S. 1997. Applied Plant Biotechnology. Tata McGraw Hill.
4. Krishna G.K. A. Elangovan, S. Devika. 2016. Plant Biotechnology. New Vishal
5. Peter M. Gresshoff. 1994. Plant Genome Analysis: Current Topics in Plant Molecular Biology. CRC Press.
6. Roberta Smith. 2000. Plant Tissue Culture: Techniques and Experiments. 2nd ed., Academic Press.
7. Shekhawat MS and Vikrant. 2011. Plant Biotechnology. M.J.P. Publishers, India.
8. VasilIK.1988.Cellcultureandsomaticcellgeneticsofplants,Vol.1-6.

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1. Ava Freeman. 2019. Plant Biotechnology: Principles and Future Prospects. Callisto
2. Bernard R. Glick and John E. Thompson. 1993. Methods in Plant Molecular Biology and Biotechnology, CRC Press.
3. Bhowjwani, S.S. 1990. Plant Tissue Culture: Application and Limitations. Amsterdam, Elsevier.
4. Charles Cunningham and Andrew J.R. Porter. 1997. Recombinant Proteins from Plants: Production and Isolation of Clinically Useful Compounds (Methods in Biotechnology), Humana Press.

5. Crispeels, M.J. and Sadava, D.E. 2003. Plants, Genes and Crop Biotechnology, Jones and Bartlett Publishers (2ndEdition).
6. Isabel Nelson. 2019. Plants, Genes and Crop Biotechnology. Callisto Reference
7. John Hammond, Peter McGarvey, Vidadi Yusibov. 1999. Plant Biotechnology: New Products. And Applications, Springer Verlag.
8. Potrykus I. and Spangenberg. 1997. Gene Transfer to Plants (Springer Lab Manual), Springer Verlag.
9. Purohit SS. 2014. Principles of Plant Biotechnology. Agrobios Reference
10. Roberta Smith. 2000. Plant Tissue Culture: Techniques and Experiments, Academic Press; 2nded.
11. Slater. 2012. Plant Biotechnology. Oxford University Press.

SEMESTER IV

SOFT CORE COURSE I

BOSC 424 – MUSHROOM CULTIVATION

Objectives: To acquire the skill of cultivating edible mushrooms

Unit I

History and importance of mushrooms; Taxonomic rank of mushrooms; vegetative characters, development of basidiocarp, structure of basidiocarp (*Agaricus*). Mushroom research centres in India and in local environments.

Unit II

Isolation and culture of spores, media preparation for culture. Production of mother spawn, bed spawn, multiplication of spawn - Inoculation Technique - Cultivation technology - Substrates, composting technology, bed, polythene bag preparation, spawning - casing – Cropping.

Unit III

Mushroom production, Do's and Don'ts in mushroom cultivation, Harvest - Storage methods and marketing. Nutritional value of mushrooms. Value addition in mushrooms. Use of spent Mushroom in vermicomposting and in organic farming.

Unit IV

Edible, Poisonous and medicinal Mushrooms. Management of fungal, bacterial, and viral diseases of mushroom, Health hazards associated with mushroom cultivation

Unit-V

Cultivation of button mushroom (*Agaricus bisporus*), milky mushroom (*Calocybe indica*), oyster mushroom (*Pleurotus florida*) and paddy straw mushroom (*Volvariella volvcea*).

Learning outcomes:

1. Preparation of spawn from mother culture.
2. Know the cultivation procedures for various mushrooms.
3. Know the storage methods and marketing.
4. Nutritional value of mushrooms.

TEXT BOOKS:

1. Alice, D., Muthusamy and Yesuraja, M. 1999. Mushroom Culture. Agricultural College, Research Institute Publications, Madurai.
2. Marimuthu, T. et al. 1991. Oyster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
3. Nita Bhal. 2000. Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Pathak, V. N. and Yadav, N. 1998. Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5. Tewari Pankaj Kapoor, S. C. 1988. Mushroom Cultivation. Mittal Publication, New Delhi.
6. Tripathi, D. P. 2005. Mushroom Cultivation. Oxford &IBH Publishing Co. Pvt. Ltd., New Delhi.

REFERENCE BOOKS:

1. Alexander Schwab. 2007. Mushrooming without Fear : The Beginner's Guide to Collecting Safe and Delicious Mushrooms. Skyhorse Publishing
2. Bob Harris. 2003. Growing Wild Mushrooms : A Complete Guide to Cultivating Edible and Hallucinogenic Mushrooms. Ronin Publishing
3. Nikulsinh M. Chauhan. 2013. Scientific Cultivation of Mushroom. Biotech Books
4. Robin Gogoi Yella Rathaiah T R Borah. 2006. Mushroom Cultivation Technology. Scientific Publishers
5. Singh R. 2017. Modern Mushroom Cultivation and Recipes. Agrobios (India)
6. Tradd Cotter. 2014. Organic Mushroom Farming and Mycoremediation: Simple to Advanced and Experimental Techniques for Indoor and Outdoor Cultivation. Chelsea Green Publishing Co.

M.Sc. BOTANY

MARKS FOR THEORY PAPER

- Each Paper Maximum Marks = 100 Marks
- CIA = 40 Marks
- End Semester Examination = 60 Marks

QUESTION PAPER PATTERN

Kanchi Mamunivar Govt. Institute for Postgraduate Studies and Research (Autonomous), Lawspet, Puducherry

M.Sc. BOTANY

Time: 3Hours **Maximum: 60 Marks**

SEMESTER-I-IV

Hard Core Course I-BOHT 101-Title of the paper Section-A (10 X 1 = 10 Marks)

Questions 1-10 (Two Question from each Unit)

Answer all question; Each answer should not exceed 50 words

Section-B (5 X 4 = 20 Marks)

Questions 11-15 with internal choice

Answer all the questions; Each answer should not exceed 200 words

11. (a) or(b)

12. (a) or(b)

13. (a) or(b)

14. (a) or(b)

15. (a) or(b)

(One Question from each Unit)

Section-C (3 X 10 = 30 Marks)

Questions 16-20

Answer any three questions; Each answer should not exceed 600 words

One Question from each Unit.

Maximum two subdivisions in a Question.

M.Sc. BOTANY

INSTRUCTIONS TO QUESTION PAPER SETTERS

Time: 3 Hours **Maximum: 60 Marks**

Section-A = 10 Questions

Choose two questions from each Unit

Section-B = 5 Questions with internal choice

Choose one question from each unit

Section- C = 5 Questions

One from each unit

Model theory question paper for Hard core and Soft core
Kanchi Mamunivar Government Institute for Postgraduate Studies and Research (Autonomous), Puducherry - 8
M. Sc. Botany
Semester –I, Hard Core Course - I
Paper I: BOHT 101 – Microbiology and Plant Pathology

Time: 3 hours **Max. Marks: 60**

Section – A (10x1=10 marks)
Answer all the questions
Each answer should not exceed 50 words

1.Pasteurization
2.*Azospirillum*
3.Bacteriophage
4.Pathogen
5.Gyrases

1.Lyophilization
2.Bioreactor
3.cDNA
4.Apoptosis
5.Nitrification

Section – B (5x4=20 marks)
Answer all five questions
Each answer should not exceed 200 words

11.(a) Write notes on gram staining technique.
OR
(b) Describe the various methods of preservation of microbes
12.(a) Briefly describe the positive interactions of microbes in soil.
OR
(b) Describe the design and application of a biofermentor.
13.(a) Write notes on bacterial transformation.
OR
(b) Describe about genomic library.

14.(a) Write briefly on cell to cell fusion in plant cells.
OR
(b) Describe the pathogen induced diseases in plants.

15.(a) Write a note on lytic cycle in bacteriophage.
OR
(b) Describe the methods of sterilization.

Section – C (3x10=30 marks)
Answer all three questions
Each answer should not exceed 600 words

16. Write in detail about the culture techniques in microbiology.
17. Write explanatory notes on air borne diseases.
18. Discuss about the sexual reproduction in bacteria.
19. Write an essay on Host- Parasite interactions at whole plant, cellular and molecular level.
20. Describe in detail about the programmed cell death.