ANNAMALAI UNIVERSITY
MASTER OF SCIENCE
M.Sc. Botany
(2021– 2022)

The Course of Study and the Scheme of Examination

Sl. No.	*Study Components* / *Course Title*		*ins. hrs / week*	*Credit*	*Title of the Paper*	*Maximum Marks*		
						CIA	*Uni. Exam*	*Total*
SEMESTER I								
1	Core	Paper 1	5	4	Phycology and Bryology	25	75	100
2	Core	Paper 2	5	4	Mycology, Lichenology Bacteriology, Virology and Plant Pathology	25	75	100
3	Core	Paper 3	5	4	Pteridophytes, Gymnosperms and Paleo-Botany	25	75	100
	Practical	Practical	5	3	Practical-I, covering Papers I, II & III	0	0	0
Internal Elective for same major students (Choose any one)								
4	**Core Elective**	**Paper-1**	5	3	A. Microbiology B. Pharmacognosy	25	75	100
External Elective for other major students (Inter/multidisciplinary papers)								
5	**Open Elective**	**Paper-1**	5	3	A. Mushroom Cultivation B. Horticulture and Landscaping	25	75	100
			30	**21**		**125**	**375**	**500**
SEMESTER II						*CIA*	*Uni. Exam*	*Total*
6	Core Practical	Paper 4	5	4	Anatomy and Embryology of Angiosperms	25	75	100
7		Paper 5	5	4	Cell and Molecular Biology	25	75	100
8		Paper 6	5	4	Genetics,Plant Breeding and Evolution	25	75	100
9		Practical 1	0	0	Practical-I, covering Theory Papers I, II & III	25	75	100
10		Practical 2	5	3	Practical-II, covering Theory Papers IV, V & VI	25	75	100
Internal Elective for same major students (Choose any one)								
11	**Core Elective**	**Paper-2**	5	3	A.Techniques in Botany B. Industrial Microbiology	25	75	100
External Elective for other major students (Inter/multidisciplinary papers)								
12	**Open Elective**	**Paper-2**	5	3	A. Organic farming B. Herbal Sciences	25	75	100
13	***Field Study**		-	2		100	-	100
14	**Compulsory Paper**		2	2	**Human Rights**	25	75	100
			32	**25**		**300**	**600**	**900**

*** Field Study**

There will be field study which is compulsory in the first semester of all PG courses with 2 credits. This field study should be related to the subject concerned with social impact. Field and Topic should be registered by the students in the first semester of their study along with the name of a mentor before the end of the month of August. The report with problem identification and proposed solution should be written in not less than 25 pages in a standard format and it should be submitted at the end of second semester. The period for undergoing the field study is 30 hours beyond the instructional hours of the respective programme. Students shall consult their mentors within campus and experts outside the campus for selecting the field and topic of the field study. The following members may be nominated for confirming the topic and evaluating the field study report.

(i). Head of the respective department
(ii). Mentor
(iii). One faculty from other department

ANNAMALAI UNIVERSITY

MASTER OF SCIENCE - M.Sc. BOTANY

(2021-2022)

SEMESTER-I
PAPER – 1

CORE PAPER: PHOCOLOGY AND BRYOLOGY

No. of teaching hours: 5
Credits: 4 **Marks (Ex.75+In.25=100)**

Objectives

- To understand the salient features and economic importance of algal diversity
- To study the structure and reproduction of various genera mentioned in the field of lower plants.
- To familiarize the salient features and economic importance of Bryophytes

Unit – I Classification and general characters of Algae

General account of phycology, Contributions of Indian Phycologist, Criteria for algal classification, F.E. Fritch classification of algae, Range of thallus organization, Algae of diverse habitats, Algal pigments and its significance in classification, ultra-structure of flagella, eyespot and pyrenoids, Algal reproduction- (vegetative, asexual and sexual), life cycles and molecular phylogeny of algae, fossil algae.

Unit – II Diversity of Algae

General features, range of vegetative structure, reproduction, life cycle and phylogeny, brief knowledge of the following genera

Chlorophyta : *Chlamydomonas*, *Hydrodictyon, Ulva, Cladophora, Pithophora, Chara*and*Nitella.*
Xanthophyta **:***Botrydium*and*Vaucheria*

Bacillariophyta : *Nitzhia* and *Cyclotella*
Phaeophyta :*Ectocarpus,Dictyota, Padina* and*Sargassum*
Rhodophyta : *Polysiphonia, Ceramium,Gelidium and Gracilaria*
Cyanophyta : *Anabaena, Spirulina. Oscillatoria* and*Lyngbya*

General characteristic of the following divisions Cryptophyceae, Dinophyceae, Euglenophyceae and Chrysophyceae,

Unit – III Useful and harmful aspects of Algae

Algae as source of food for human, animal feed, Nutraceuticals; Pharmaceuticals, biofuel, bio-ethanol, biofertilizers, industrial applications of algae. Role of algae in CO_2 sequestration, pollution indicator, bioremediation and soil fertility. Mass cultivation of algae- seaweed cultivation methods - Rope cultivation, net cultivation and raft cultivation. microalgae Culturing techniques and photo bioreactor-based production; Downstream processing. heterotrophic production. **Algal Bloom** - Bioluminescence, Bloom formation and Eutrophication; Harmful algal blooms and toxin production; Bloom control measures and algal toxins.

BRYOLOGY

Unit IV General Overview on Bryophytes

Bryophytes as Amphibians of the kingdom Plantae, Different theories, Origin and evolution of bryophytes. General characters, habit, habitat, distribution, biogeography, growth forms, life forms colonization, Life cycle, Gametophyte, reproduction, sporophyte, alteration of generations, resemblances and differences of bryophytes with algae and pteridophytes. Watson Classification. Evolution and Ecological significance and distribution of bryophytes. Fossil forms of bryophytes. Economic importance of bryophytes.

Unit V Diversity of Bryophytes

General account of Sphaerocarpales, Marchantiales, Jungermanniales, Calobryales, Anthocerotales, Sphagnales, Funariales and Polytrichales. Range of variation in structure and evolution of gametophytes, sex organs, sexual and vegetative reproductions and sporophytes in Bryophytes mentioned below: *Riccia*, *Targionia, Reboulia, Pellia, Porella, Anthoceros, Sphagnum* and *Funaria.*

Outcome of the course

Students will understand the morphology and organization of the thallus and their role in medicine, industrial and food. Students will understand the interrelationship of algae, bryophytes.

Text Books

1. Fritsch, F.E. 1979. The structure and Reproduction of Algae Vol. I & II. Bishan Singh, Mahendra Pal Singh, Dehradun.
   Delhi.651 pp.1999.
2. O.P. Sharma. 2011, Algae, TATA McGraw-Hill, India.
3. R. N. Chopra. 2005.Biology of Bryophytes. New Age International (P) Ltd. New Delhi.

4. P.R. Yadav, 2015. Text Book of Bryology. Discovery Publishing House Pvt. Ltd.

Reference Books

1. Prescott, G.W. 1984. Algae: A review, Bishan Singh, Mahendra Pal Singh. Dehradun.
2. Kumar, H.D. Introductory Phycology. 2nd Ed. Affiliated East-West Press, New
3. Morris, I. 1986. An introduction of Algae. Cambridge University Press U.K.
4. R. E. Lee. 2008.Phycology, 4th Ed. Cambridge University Press
5. V.J. Chapman. 2015. The algae, Springer
6. Watson, 1975. Bryophytes. Hutchinson Library, Series, London.
7. Pandey, S.N., S.P.Misra and P.S. Trivedi. 2002. A Textbook of Botany Volume II. Vikas Publishing House Pvt Ltd, New Delhi.
8. Rashid, A. An Introduction to Bryophyta. Ist Ed. Vikas Publishing House Pvt. Ltd., New Delhi. 298 pp. 1998.
9. Vashishta. B.R., Sinha, A.K. and Adarsh Kumar, 2005. Botany for Degree students- Bryophyta. S. Chand and Company Ltd., New Delhi.
10. AfrozAlam. 2015. Text Book of Bryology. I K International Publishing House Pvt. Ltd.
11. Alain Vanderpoorten, 2009. Introduction to Bryophytes, 1st Edition, Cambridge University Press.

Semester I
CORE PAPER 2

CORE PAPER:MYCOLOGY, LICHENOLOGY, BACTERIOLOGY, VIROLOGY AND PLANT PATHOLOGY

No. of teaching hours: 5
Credits: 4 **Marks (Ex.75+In.25=100)**

Objectives

- To understand and realize the classification, structure, reproduction and economic importance of Mycology and Lichenology, Bacteriology and Virology.
- To acquire knowledge on pathogen causing diseases in plants and mode of action and its control measures.

UNIT I Mycology

Classification of fungi proposed by Alexopoulous and Mims(1979). Occurrence and Distribution – mycelial structure and its modification – Chemistry of fungal cell – growth – nutrition – structure – reproduction – life cycle of fungi. Contributions of Indian Mycologists.Phylogeny and Interrelationship of major groups of fungi. Myxomycotina :*Physarum, Stemonites*

Chytrioliomycotina: *Allomyces, Blastocladia, Synchitrium*
Zygomycotina: *Mucor, Rhizopus, Pilobolus*
Ascomycotina: *Aspergillus, Xylaria, Morchella, Taphrina*
Oomycotina: *Cystopus, Phytophthora, Pythium*
Basidiomycotina: *Lycoperdon, Auricularia, Polyporus, Pleurotus*
Deuteromycotina: *Atternaria, Colletotrichum, Fusarium*

UNIT IILichenology

General account of Lichens – classification by Miller (1984), Habit and Habitat – Morphology – structure of lichens. Vegetative and Asexual reproduction by fragmentation – Soredia – Isidia and Sporulation. Sexual reproduction by Spermogonium and Carpogorium, Post plasmogamy changes – Apothecia structure of lichen apothecium. Ecological significance and Economic importance of Lichens – Lichens as pollution indicators. Phycobionts and Mycobionts. Structure associated with the lichen thallus, Nutrition.

UNIT IIIBacteriology

General characteristics – Classification by Bergey's (1994) – Ultrastructure of bacterial cell – gram positive and gram negative – Staining Methods – Reproduction – fission – budding and endospore. Isolation and cultivation of bacteria – Nutritional types. Bacterial growth curve – phase of growth – verities of growth – Measuring bacterial growth –

Spectrophotometric method – Microscopic counting – serial dilution and viable plate count. Effect of physical and chemical factors on growth - P^H, temperature, media components and radiation. Bacterial cultural techniques and Economics importance of bacteria.

UNIT IVVirology

Viruses – General features of virus, Classification and Nomenclature – Morphology and Structure of virus – Properties of viruses – Detection of viruses – Biological activity of viruses. Physical, chemical and structural components of viruses. Transmission of viruses, Multiplication of viruses – Isolation and purification of viruses. Epidemiology of virus infection, Evolutionary importance of viruses. Bacteriophages – Classification – Lytic and lysogenic cycle. Viroid and Prions.

UNIT V Plant Pathology

Concept ofplant diseases – Causes of plant diseases. Types and Symptoms Identification of plant diseases. Host parasite interrelationship and Interactions. Disease control methods – cultural, physical, chemical and biological methods. Legislation and Quarantine measure – eradication – burning – removal of alternate host. Koch's postulate – Environment and Nutrition in disease – development – defense mechanism – Principles of plant disease. Common Plant Diseases: Disease caused by Fungi (Blast of Paddy, White rust of Mustard and Rust of Wheat), Bacteria (Blight of Paddy, Black arm of Cotton and Ring rot of Potato), Virus (Bunchy top of Banana, Yellow – vein mosaic disease and Cucumber mosaic). Mycoplasma (Grassy shoot disease of Sugarcane and Little leaf disease).

Outcome of the course

Students will understand the morphology and organization of the thallus and their role in industrial, medicine and food. Students will understand the interrelationship of amycology, lichenology, bacteriology, virology and plant pathology.

Text Books

1. Gnanamanickam, S.S., 2002. Biological Control of Crop Diseases, CRC. Press. Florida
2. Dube, H.C 2013. An Introduction of Fungi. 4th Edition Scientific Publisher, India.
3. Alexopoulous. C.J. Mims C.H and Black well, M., 2007. Introductory Microbiology. 4th edition John Wiley and Sons, New York.

Reference Books

1. Vashishta, B.R and sinha,A.K., 2011. Fungi. Ist Edition. Published by S. Chand and Company Ltd. New Delhi.
2. Hale, M.E (1983), Biology of Lichens. Clasendon Edward Arnold, Maryland.

3. Salle, A.J., 1997. Fundamental Principles of Bacteriology. 7th Edition. Tata Mc Graw Hill publishing company Ltd, New Delhi.
4. Bates,J.W. and A.M. Farmer, 1992. Bryophtes and Lichens in a changing Environment, 1st Edition, Oxford, Clarendon.
5. Agrios G.N. 2005. Plant Pathology.5th Edition, Elsevier Amsterdam.
6. George, N. Agrios, 2005, Plant Pathology. 5th Edition. Academic Press.
7. Schumann, G.L., 2006. Essential Plant Pathology. APS Press.
8. Pelezar,J.M., chan E.C.S and Kreig, R.N. 2008. Microbiology. 13th Tata Mc. Graw Hill Publishing Company Ltd, New Delhi.

SEMESTER I
CORE PAPER - 3

Core Paper: PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY

No. of teaching hours: 5
Credits: 4 **Marks (Ex.75+In.25=100)**

Objectives

- To understand the enormous, range of diversity and range of diversification of all species in the world.
- To realize the fundamental values of diversity and their importance of human welfare.
- To define and characterize diversity of lower vascular plants to understand the dynamics of diversity to realize the significance of diversity and its fossil forms.

PERIDOPHYTES
Unit I General Topics

General characters - Sporne's classification of Pteridophytes. Range of structure, reproduction and evolution of the gametophytes, Gametophyte types – sex organs. Apogamy and Apospory. Life cycles. Stelar evolution- Protostele – types, Siphonostele, Solenostele and Dictyostele.Detailed account of Soral evolution – soral types, soral characters and phylogeny of ferns.Teleome concepts. Heterospory and seed habit. Economic importance of Pteridophytes.

Unit II Diversity in Pteridophytes

Range of structure, evolution of sporophytes in Pteridophytes of the forms - *Psilotum, Isoetes, Ophioglossum, Angiopteris, Osmunda, Dichranopteris, Alsophila* and *Salvinia.*

General characteristics and life cycle patterns in Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

GYMNOSPERMS
Unit III Diversity in Gymnosperms

Classification of Gymnosperms (Sporne,1967). Economic importance of Gymnosperms.A general account of distribution of gymnosperms. Morphology, anatomy, reproduction, phylogeny and relationship of the following orders with special reference to the genera mentioned against each order.

Cycadopsida :*Cycas,Zamia*
Coniferopsida: *Cupressus ;Podocarpus ; Araucaria*
Gnetopsida :*Gnetum ; Ephedra*

General characteristics of Cycadales, Ginkgoales, Coniferales and Gnetales (Comparative study only).

PALAEOBOTANY

UNIT IV General topics

Geological Scale; Radiocarbon dating; Gondwana flora of India. Contribution of Birbal Sahni to Paleaobotany. Study of fossils in understanding evolution. Fossilization and fossil types. Economic importance of fossils – fossil fuels and industrial raw materials and uses.

UNIT V Fossil forms

Detailed study of the following fossil forms –Fossil Pteridohytes :*Rhynia, Lepidodendron, Lepidocarpon, Sphenophyllum*and *Calamites.*FossileGymnosperms :*Lyginopteris, Heterangium, Laginostoma, Cordaites*and*Welweltschia.*

Outcome of the course

After successfully completing this course, the student will be able to recognize morphological, anatomical and reproductive characteristics of extinct and extant Pteridophytes, Gymnosperms and Paleo-Botany. The student will understand the evolutionary history of plant kingdom.

Text Books

1. Vashishta. P.C., A.K. Sinha and Adarsh Kumar. 2008. Botany for Degree students - Pteritophyta. S. Chand and Company Ltd., New Delhi.
2. Shripad, N.A. 1998. Paleobotany, Oxford and IBH Publishing Co. Pvt Ltd., New Delhi.
3. Vashishta, P.C. 1991. Gymnosperms. S. Chand & Company Ltd., Ram Nagar, New Delhi.
4. Gifford, E.M and Foster, E.S., 1984. Morphology and evolution of vascular plants. 3rd edition, W.E. Freeman and Co, New York.
5. Sporne, K.R. 1962. The morphology of Pteridophytes. Hutchinson Univ. Library, London.
6. Sporne, K.R. 1965. The morphology of Gymnosperms. Hutchinson Univ. Library, London.

Refence Books

7. Banks, H.P,1970. Evolution and Plants of the past. Wadsworth publishing Co, Belmont.
8. Beck,C.B, 1988. Origin and evolution of Gymnosperms. Columbia University press, New Delhi.
9. Bhatnagar, S.P. and Alok Moitre,2003. Gymnosperms, New Age International, New Delhi.
10. Bierhorst, D.W, 1971. Morphology of vascular Plants. Macmillan publishing Co, New York.
11. Biswas,c., B.M.Johri, 1999. The Gymnosperms, Narosa Publishing House, Chennai.
12. Delevoryas, T., 1962. Morphology and evolution of fossil plants. Holt Rinehart and Winston, New York.
13. Gensel, P.G and Andrews, H.N., 1984. Plant life in the Devonian. Preger publications, New York.
14. Graham, L.E., 1993. Origin of land plants. John Wiley & Sons, New York.
15. Mukta Bhargava, 2003. The latest portfolio of theory and practice of Gymnosperms. Dominant Publishers and Distributors, New Delhi.
16. Parihar, N.S., 2005. An introduction to Embryophyta– Pteridophytes – Central Book Depot, Allahabad.
17. Pandey, S.N., S.P.Misra and P.S. Trivedi. 2002. A Textbook of Botany Volume II. Vikas Publishing House Pvt Ltd, New Delhi.
18. Rashid.A. 2007. An Introduction to Pteridophyta – Vikas publications, New Delhi.

Semester I
Core Elective
Paper 1
(Choose either A or B)
A. MICROBIOLOGY

Core Elective Paper **No. of teaching hours: 5**
Credits: 3 **Marks (Ex.75+In.25=100)**

Objectives

- To provide advanced knowledge, understanding, and critical judgment appropriate for the application of microbiology.
- To explain the processes of reproduction, adaptation, survival, and interaction of microorganisms with their associated hosts and environment.
- To explain the theoretical basis of the tools, technologies and methods commonly used in microbiology.
- To develop practical skills in the use microbiological methodologies,tools, techniques and highlight the role microorganisms in the human welfare.

Unit I Microbial Taxonomy

Brief outline of microbial diversity-Microbial taxonomy, Microbial flora of soil. General feature and classification ofmicroorganism like Rickettsia', Mycoplasma, Archaebacteria – Actinomycetes – Protozoa. Brief outline of methods in microbiology for isolation and culture of microorganisms from environment and infected plants, Culture media characterization and preparation – staining of microbes. Estimation of microorganisms in soil, water and air.

Unit II Bacterial Structure

Nutrition and growth curve of Bacteria – measurement of growth. Methods of culturing bacteria - sterilization- kinds of media and preparation techniques- - pure culture-maintenance and preservation. Bacterial staining methods: simple staining, Gram's staining, acid fast staining, staining of flagella and other types of staining.

Unit III Viruses

Morphology of Viruses- Classification of Viruses – transmission of viruses- Virus-Vector relationships- replication of Virus. General account on Mycoplasma and Spiro plasma-

Satellite virus. Bacteriophages- Viroid's and Prions- Isolation and purification of viruses. Uses of virus in Biotechnology.

Unit IV Environmental microbiology

Microbial flora of soil – influence of environmental factors like pH, light, organic matter, moisture and temperature. Role of microbes in cycling of nitrogen, carbon and phosphorus. Microbial control—methods of physical control (heat, cold, desiccation, radiation and sound waves). Microbial leaching of minerals. Sterilization by filtration, chemical agents—disinfectants, antiseptics and antibiotics.

Unit V Industrial microbiology

Role of microbes in waste water treatment, General design and application of biofermentor. Microbes in food spoilage and food poisoning. Food preservation – Microorganisms as food—Probiotics. Genetically modified food. Industrial products of microorganisms. Microbes used as biofertilizers -*Rhizobium, Azospirillum, Acetobacter, Azolla*and blue-green algae. Application of fungal enzymes in different industries—immobilization of enzymes – biofuel, ethanol, biogas and biodiesel production.

Outcome of the Course

Student Learning Outcomes. Upon graduation, Microbiology majors should have a thorough knowledge and understanding of the core concepts in the discipline of Microbiology. Microbiology students will be able to: Describe how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology .

Text Books

1. Dubey, R. C. and D. K. Maheswari. 2012. A text of Microbiology (Revised edition). S. Chand and Company Ltd., New Delhi.
2. Ananthanarayanan, R. and CKJ. Paniker, 2004.Textbook of Microbiology. Orient Longman Pvt. Ltd.,
3. Prescott, L. M., J. P. Harley and D. A. Klein. 2005. Microbiology. Sixth edition, International edition, Mc Graw Hill.
4. Pelczar, T. R. and M. J. Chan and N. R. Kreig. 2006. Microbiology. Fifth edition, Tata Mc Graw-Hill INC. New York.

Reference Books

5. Dubey, R.C. and D.K. Maheswari, 2007. A Textbook of Microbiology, S. Chand & Company, New Delhi
6. Powar, C. B and Daginawala 1991.General Microbiology Vol-I and Vol-II Himalaya publishing house, Bombay.
7. Sullia, S.B and S. Shantharam, 2005. General Microbiology, Oxford & IBH
8. Vasanthkumari.R.2007. A Textbook of Microbiology. BI Publications Pvt. Ltd.

Core Elective
Semester I
(Choose either A or B)
B. PHARMACOGNOSY

Core Elective Paper **No. of teaching hours: 5**
Credits: 3 **Marks (Ex.75+In.25=100)**

Objectives

- To understand and involves the fundamentals of Pharmacognosy like scope, classification of crudedrugs, their identification and evaluation,
- To find out the phytochemicals in the modern extraction techniques. Characterization and identification of the herbal drugs and their applications.
- To reveal the range of herbal products and their novel usage in human life

UNIT1Introduction

Definition. History and scope of Pharmacognosy. Indigenous system of medicine: Ayurveda, Homeopathy, Unani, traditional Chinese Medicine, Naturopathy, Yoga and Siddha. Classification of drug of natural origin. Adulteration/Substitution and drug evaluation. Significance of Pharmacopeial standards.

UNIT 2 Plant constituents

Occurrence, distribution, classification, isolation, identification test and pharmaceutical applications: plant metabolites, carbohydrate lipids, protein and amino acids, nucleic acids, glycosides, terpenoids, volatile oil / essential oil / resin and tannins.

UNIT 3 Therapeutic Uses of Plants and Drugs

Occurrence, distribution, organoleptic evaluation, chemical constituents including tests wherever applicable and therapeutic efficacy of following categories of drugs. (a) Laxatives: Aloes. Rhuburb. Castor Oil. Ispaghula. (b)Cardiotonic- Digitalis Arjuna. (c) Carminatives and G.I. regulators. Umbelliferous fruits, Coriander, Cardamom, Ginger, Black pepper, Asafoetida, Nutmeg and Clove. (d) Astringents: Catechu (e) Drugs acting on nervous systems - Belladonna, Aconite, *Withaniasomnifera*, Ephedra and Opium.(f) Anti diabetics- Pterocarpus, *Gymnemasylvestre*.

UNIT 4 Industrial uses of Medicinal Plants

Perfumes and flavorings agents- peppermint oil, Lemon oil, Orange oil, Lemon grass oil and Sandal wood. Pharmaceutical aids- honey. Arachis oil, Starch, Kaolin, Pectin, Olive oil, Lanolin, Bees wax, Acacia,Sodium alginate, Agar, Guargum and Gelatin.Miscellaneous- liquorice, Garlic, Picrorhiza, Dioscorea, Linseed, Shatavari, Shankhapushpi, Pyrethrum and Tobacco.

UNIT 5 Crude Plant Drugs

Collection and preparation of crude drug for the market as exemplified by ergot, Opium, Rauwolfia, Digitalis and senna.Gross anatomical studies of Senna, Datura, Cinnamon, Cinchona, Fennel, Clove, Ginger, Nuxvomica and Ipecacuanha.

Outcome of the Course

The students are able to identify drug from natural origin and their supply, cultivation,collection, storage along with their special conditions and also define drugs from natural origin.identify the cultivation and collection conditions.identify the storage of drugs.Recall the knowledge about modern concept and scope of Pharmacognosy. To learn the fundamental principles on cultivation, collection processing and evaluation of medicinal plants. Discuss the phyto-chemical screening techniques and able to identify the Phyto-constitutes of plants.

Text Books

1. Trease. G.E. and Evanes W.C. 2009. Pharmacognosy. 16th Edn. Elsevier
2. Wallis T. E. 2005. Textbook of Pharmacognosy, 5th Edn. CBS publishers.
3. S. B. Gokhale. 2008. Pharmacognosy, Pragati Books Pvt. Ltd.
4. C. K. Kokate 2008. Pharmacognosy 53rd Edn. Nirali publisher.
5. Mohammed Ali. 2019. Textbook of Pharmacognosy 2Edn. CBS Publisher.

Reference Books

6. Horborne. J.B. 1983. Phyto chemical methods. Chapman and Hall. London.
7. Biren Shah and A.k. Seth 2010. Textbook of pharamcognosy and Phytochemistry. 8th Edn. Reed Elsevier India Pvt. Ltd.
8. Pharmacopoeia of India. Govt. of India. Ministry of health 1955 and 1966.

Semester I
Open Elective
PAPER – 1
(Choose either A or B)
A. MUSHROOM CULTIVATION

OpenElective Paper **No. of teaching hours: 5**
Credits: 3 **Marks (Ex.75+In.25=100)**

Objectives

- To create awareness about the Mushroom among the people.
- To strengthen the promotion of mushroom cultivation by establishing a well-equipped laboratory and offices.
- To know and explore the cultivation in Tamil Nadu
- To understand and provide the Unit with appropriately trained personnel for the promotion of mushroom production in the country.
- To increase the production and consumption of mushrooms.
- To develop new products for food, and assist in managing biological resources
- To make our economy strongly by exporting Mushroom product

UNITI Introduction

Mushroom – introduction, Life cycle of Mushrooms. Types and identification - edible and poisonous Mushrooms - external factors for growth. Economic importance of Mushrooms as food.

UNIT-II Mushroom Cultivation Methods

History and scope of mushroom cultivation-early cultivation- domesticated mushrooms today- other domesticated fungi. - selection - 'starter' - preparation of spawn - preparation of Compost (outdoor and indoor beds) - incubation - Harvesting and marketing

UNIT-III Spawn preparation

Spawn production - grain, powder and granular spawn - mother spawn - planting spawn - spawn preparation-spawning techniques-environmental conditions for spawn run-preparation of culture (Tissue culture and spore culture), preservation and storage of culture - various media (PDA, malt extract, Wheat extract, compost extract)

UNIT-IV Different types of Mushrooms

Cultivation of white Button Mushrooms (*Agaricusbisporus*) and Oyster Mushrooms (*Pleurotus*spp) – materials – sterilization – spawning and fruiting – house design for *Pleurotus* – preservation, canning drying, Cultivation of paddy straw Mushrooms –

Preparation, Spawn making – Methods of Cultivation.Mushrooms are different types in Tamil Nadu: a) Button Mushroom b) Oyster Mushroom c) Milky Mushroom about 70% of its population living in the rural areas and their main income source is agriculture. Primary data was collected through questionnaires and secondary data from online.

UNIT-V Mushroom harvesting technology

Mushroom technology – nutritive value of edible MushroomsProtein, carbohydrate, fat, mineral, and vitamin - Medicinal value of Mushrooms, Advantages of Mushrooms Cultivation – Harvesting & Marketing (Local, National and International level).

Outcome of the Course

The students are able to specify in the Marketing aspects-make profit with consumer satisfaction, financial aspects-arrange the financial support, and Socio-economic aspects-make people aware about good or bad products with reasonable price.

Text Books

1. Shubhrata R.Mishra,2014. Techniques of Mushroom Cultivation. Discovery Publuishing House Pvt. Ltd.New Delhi.
2. Kannaiyan.S and Ramasamy, K, 1980. A Handbook of Edible Mushroom. Today andTomorrows. Printers and Publishers, New Delhi, 104 p.
3. Tewari,S.C.and Pankaj Kapoor,2018, Mushroom Cultivation Mittal Publication New Delhi.

Refences Book

1. Pathak V.N, Nagendra Yadav and Maneesha Gaur. 1998.
2. Mushroom Production and Processing Technology. Agrobios (India) Jodhpur, 179 p.
3. Suman, B.C. and Sharma, V.P.2007, Mushroom cultivation in India. Daya Publishing House New Delhi.
4. Chauhan,M., Gajre.K. and Prajapati.P.2013, Scientific Cultivation of Mushroom. Biotech Books New Delhi

Semester I
OPEN ELECTIVE
PAPER – 1
(Choose either A or B)
B. **HORTICULTURE AND LAND SCAPING**

OpenElective Paper **No. of teaching hours: 5**
Credits: 3 **Marks (Ex.75+In.25=100)**

Objectives

- To understand horticulturists, apply their knowledge, and technologies used to grow intensively produced plants for human food and non-food uses and for personal or social needs.
- To real their work involves plant propagation and cultivation with the aim of improving yields, diseases, plant growth, nutritional value, quality, and resistance to insects, and environmental stresses.
- To the students also work as gardeners, therapists, designers, growers, and technical advisors in the food and non-food sectors of horticulture.

Unit I Introductions

Garden Design and Landscaping Garden and Garden design. Knowledge of plants – Soils- Irrigation – Transplanting Potting- Soil less culture. Lawn – Rock garden – Rosary – water garden – terrace garden – Kitchen garden –Landscaping Fences for utility and beauty – Archers and pergolas – Green house and glasshouse – summer house.

Unit II Propagation Methods

Propagation techniques – Vegetative Propagation, Sexual propagation – Seed Germination techniques– Seed dormancy – Seedling raisings – Vegetative cuttings – Layering – grafting – Budding – Stocks – Scion relationships – micro propagation.

Unit III Nutrition and Diseases Management

Nutrition and Diseases Manures and Manuring – Training and pruning – Irrigation techniques. Classification of Irrigation, Methods of Irrigation. Applications and use of plant growth regulators in horticulture – Some important diseases of Horticultural plants and its plant protection.

Unit IV Floriculture and Pomology

Floriculture and Pomology Culture of Economically important flowers: Jasmine – Rose – Cut flowers. Fruit culture: Mango – Guava – Banana - Papaya.

UnitV Post-Harvest Techniques

Post-harvest technology Flower arrangements and decorations- harvesting – Marketing - post harvest Storage of fruits and vegetables – Preservation of fruits and vegetables.

Outcome of the Course

The students will be able to recognize the major areas of Horticulture and Landscape horticulture includes the production, marketing and maintenance of landscape plants. Olericulture includes the production and marketing of vegetables. Pomology includes the production and marketing of fruits. The career in the field of horticulture is the best career choice for students. Horticultural crops i.e. fruit and vegetable acquire a place of important as protective food. They provide much needed health supporting vitamins, minerals. Besides, their value in human consumption, horticultural crops play an important role in commerce, particularly in export trade and processing industry.

Text Books

1. Bose T.K. 1990. Fruits of India. Tropical and subtropical, Naya Prakash, Calcutta.
2. A.K. Tiwari., 2012. Fundamentals of Ornamentals Horticulture and Landscape Gardening. Publisher: Nipa (2012) ISBN-10: 9381450072; ISBN-13: 978-9381450079.
3. Bose .T.K. Som. M.G. and Katrir. J. 1993. Vegetable Crops, Naya Prakash, Calcutta.
4. Bose .T.K. and D.Mukherjee. 1987. Gardening in India, Naya Prakash, Calcutta.
5. Bose .T.K.. and C.P. Yadav. 1989. Commercial flowers, Naya Prakash, Calcutta.

Reference Books

6. Edman, J.B. T.L. Senn, F.S. Andrews and R.G. Halfacre, 1988. Fundamentals of Horticulture, Tata MacGraw Hill Publishing house company, New Delhi.
7. Hartman. H.T. and Kester D.E . 1986. Plant propagation principles and practices Prentices Hall of India Ltd., New Delhi.
8. Janick. J.W.H. 1988. Horticulture Science. Freeman and Co., Sanfrancisco.

9. Nambisan .K.M.P. 1992. Design Elements of Landscape Gardening- Oxford and IBH Publications.
10. Prasad,S and U.Kumar, 1999. Principles of Horticulture. Agrobotanica, bikaner
11. Shanmugavelu K.G. 1989. Production Technology of vegetable Crops. Oxford India. Publication, New Delhi.

SEMESTER II
CORE PAPER 4

Core Paper: ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

No. of teaching hours: 5
Credits: 4 **Marks (Ex.75+In.25=100)**

Objectives

- To understand and provide an insight into the internal structure and reproduction of the most evolved group of plants, the Angiosperms.
- To understand the origin, structure, growth, development and reproduction of angiosperms through anatomy and embryology.
- To get an insight in to the histochemistry with special reference to various stains and staining procedures

ANATOMY OF ANGIOSPERMS

Unit – I Tissue system

Xylem and Phloem and their elementsPrimary and Secondary structures, differentiationpatterns of secondary wallsstructural variation and characteristics of phloem componentphylogenetic trends and specialization of xylem and phloem. Periderm - Structure anddevelopmentprotective tissue in monocots. Wound healing and grafting, tyloses and lenticels. Growth ringsheart and sap wood, porous and non-porous wood.

Unit II Meristems

Meristem and Differentiation - Classification of Meristems - Growth Patterns – ApicalMeristem- Theories of Apical Meristem - organization – Pro-meristem shoot apex and rootapex. Vascular Cambium - Origin, Structure, and types. Cambial activity Normal and anomalous -- (Anomalous secondary thickening in dicots and monocots).

Unit III Nodal and Leaf anatomy

Nodal anatomy – uni, tri and multi-lacunar nodes and their phylogenetic relationshipsSecretory structures – external and internal. Leaf anatomy:Types of stomata,Ontogeny and histogenesis of bifacial and unifacial leaf-kranz anatomy. Wood anatomy: Physical, Chemical and Mechanical properties of wood.

EMBRYOLOGY

Unit IV Sporogenesis and Fertilization

Microsporogenesis: Morphology, cytology, development and formation of microspores and male gametes – role of tapetum male gametophytes development pollen structure.

Pollen sterility and fertility and role of palynology.Megasporogenesis: Types and structure of ovules. Megasporogenesis – Special structures of ovules. Organization of the embryo sac, types of embryo sac, role of synergids and Antipodal haustoria, nutrition of embryo sac.

Unit V Endosperm and Embryo Development

Pollen – pistil interactions and fertilization: barriers of fertilization, control of fertilization and current concept of fertilization heterospermy, polyspermy and heterofertilization. Endosperm: classification and endosperm types, Endosperm haustoria – Embryogenylaws of embryogeny - development of dicot and monocot embryo –nutrition of embryo.Polyembryony: classification and types. Apomixis: Parthenogenesis and Parthenocarpy.

Outcome of the Course

The students will be able to recognize the anatomical differences between monocotyledons and dicotyledons of roots, stems, leaves, bark and wood. In addition, they will clearly understand the seed-to-seed developmental aspects of angiosperms.

Text Books

1. Bhojwani, S.S. and Bhatnagar, S.P. 1981. Embryology of angiosperms. Vikas PublicationPvt.Ltd. New Delhi.
2. Eames, A.J and Mac Daniel, 1975. An introduction to Plant Anatomy. TMH edition, TataMacGraw Hill, New Delhi.
3. Pandey.S.N. and Ajanta Chandha. 2006. Plant Anatomy and Embryology. Vikas Publishinf House Pvt.Ltd , New Delhi.
4. Esau, K. 1989. Anatomy of seed plants. John Wiely& Sons, Newyork
5. Maheshwari, P. 1963. An Introduction to embryology of Angiosperms. Tata Mc GrowHill. Newyork.

Reference Books

6. Pandey, P.B. 2000. Plant Anatomy. S.Chand& Co.,
7. Esau, K. 1972. Plant anatomy. John Wiely& Sons, Newyork.
8. Shivanna.K.R. 2003. Pollen biology and biotechnology. Oxford IBH, New Delhi
9. Singh.V., P.C. Pandey and D.K.Jain. 2003. Embryology of Angiosperms. Rastogi Publications. Meerut.

SEMESTER II
CORE PAPER –5

Core Paper: CELL AND MOLECULAR BIOLOGY

Core Paper **No. of teaching hours: 5**
Credits: 4 **Marks (Ex.75+In.25=100)**

Objective

- To understand the structure and function of basic components of prokaryotic and eukaryotic cells, especially its membrane organization and organelles.
- To introduce to rapid contemporary changes witnessed in plant molecular biology.
- To analysis the basic organization of genetic material and the realms of events associated with replication and gene expression will be examined.
- To understand the molecular mechanism of gene regulation and gene expression.

UNIT I Cell and Cell organelles

General account of Prokaryotic and Eukaryotic Cell, Cell wall, plasma membrane. Ultrastructure, Chemistry and Functions of mitochondria, Dictyosomes, lysosomes, endoplasmic reticulum, ribosomes, peroxisomes, Glyoxysomes, vacuoles, chloroplast, mitochondria, Nucleus – history, Ultrastructure, chemistry and functions of cytoskeleton andits role in motility. Structure and functions of Nucleolus—importance of nucleolus in cell division.

UNIT II Chromosomes and Cell Cycle

Chromosomes: Types, Fine structure of eukaryotic chromosome, chemistry – Kinetochore, chromomeres, satellite chromosome, Euchromatin and Heterochromatin-special types of chromosomes – lamp brush chromosome, polytene chromosome. Architectural changes of chromosomes: detailed study of chromosomal deficiency, duplication, inversion and translocation and their role in evolution. Karyotype analysis – Importance of Cytotaxonomy. Cell reproduction, events of the eukaryotic cell cycle, variations in cell-cycle organization, cell cycle control system. Model organisms in cell-cycle analysis.Mitosis, cytokinesis and Meiosis. Mitotic inducers and inhibitors, variations in mitosis and meiosis.

UNIT III Cell Signaling

Hormones and their receptors, Cell surface receptors, signalingthrough G – Protein, coupled receptors, signal transduction pathways, secondmessengers, regulation of signaling pathways, Light signaling in plants. Ion Channel –Leaked receptors, Enzyme linked receptors, Cytoplasmic and Nuclear receptors.

UNIT IV DNA Replication

DNA Replication: Methods of replication, various enzymes involved, Replication origin andreplication fork, Fidelity of replication, extra-chromosomal replicons. Repair andRecombination: DNA damage and repair mechanisms.RNA synthesis and processing – Transcription mechanism - Factors - Formation ofinitiation complex, Transcription activator and repressor, RNA polymerases, Capping,Elongation.RNA processing - RNA editing, Splicing and polyadenylation, structure and functionof different types of RNA, RNA transport, Transcription inhibitors, Post-transcriptional modification of gene.

UNIT V Transcription and Gene Regulation

Protein synthesis and processing – Genetic code, Ribosome, Formation of initiationcomplex, Initiation factors and their regulation complex, Elongation and elongationfactors, Termination, Amino acylation of tRNA, tRNA idendity, tRNA synthetase,Proof reading, Translational inhibitors, Post-translational modification of proteins.Gene Regulation – Operon concept: TrpOperon and Ara Operon.

Outcome of the course

Students will gain knowledge about the basic and fundamental organization of life and genetic material and their applications in molecular aspects.

Text Books

1. David R Hyde. 2010. Genetics and Molecular biology. Special Indian edition, Tata Mc Graw Hill P.Ltd., New Delhi.
2. Gerald Karp. 2010. Cell and Molecular Biology (6thedn). John Wiley and Sons Inc. ISBN – 13 978-0-470-48337-4.
3. Klein Smith, L. J. and V. M. Kish. 1995. Principles of Cell and Molecular Biology (2nd edition). Harper Collins College Publishers, New York, USA.
4. Peter H. Raven, George B. Johnson Jonathan B. Losos, Kenneth A. Mason and Susan R. Singer. 2008. Biology. (8th Edition).

References Books

1. Alberts, B. and D. Bray, J. Lewis, M. Raff, K. Roberts and J. D. Watson. 1999. Molecular Biology of Cell. Garland Publishing, Inc., New York.
2. David Freifelder. 2008. Essentials of Molecular Biology. Narosa Publishing house. New Delhi.
3. Krishnamurthy, K. V. 2000. Methods in Cell Wall Cytochemistry. CRC Press, Boca Raton, Florida.
4. Lewin, B. 2000. Genes VII. Oxford University Press, New York.
5. Lodish, H. and A. Berk, S. L. Zipursky, P. Matsudaira, D. Baltimore, J. Darnell. 2000. Molecular Cell Biology. 4th Edition. WH Freeman and Co., New York.
6. Wolfe. S. L. 1993. Molecular and Cellular Biology. Wadsworth Publishing Co., California, USA.

7. Wayne M Becker, Lewis J Kleinsmith, Jeff Hardin (2007). *The world of the cell* (VI Edn). Pearson.
8. Geoffrey M Cooper, Robert E Hausman (2009). *The Cell: A molecular approach* (V Edn). Sinaeur.
9. Gerald Karp (2008). *Cell and Molecular biology: Concepts and experiments* (V Edn). John Wiley &Sons.
10. Allison.A. 2007. Fundamental Molecular Biology. Blackwell Publishing, UK.
11. H. Lodish et al. 2012. Molecular Cell Biology, 7th Ed. W.H Freeman and Company,
12. De Robertis& De Robertis, 2004. Cell and Molecular Biology. Williams and Wilkins. USA.
13. Freifelder, 1990. Molecular Biology, Narosa Publishing House, New Delhi.
14. Mary A. Schuler Raymond and E.Zrelinski, 2005. Methods in Plant Molecular Biology, Academic Press an imprint of Elsevier.
15. Peter Porella, 1998. Introduction to Molecular Biology, Mc Graw – Hill, New York.
16. Rastogi, S.C. 2010. Cell Biology. New age International Pub. New Delhi.
17. Watson Baker Bell, Gana Levine Losick, 2004. Molecular Biology of the gene, Pearson Education.
18. William D. Stansfield. Jaine S. Colone Raul J. Chand, 2004. Molecular and Cell Biology, Tata Mc Graw-Hill Publishing company, New Delhi.
19. Daniel L Hartl, Elizabeth W Jones (2012). *Genetics: Analysis of genes and genomes* (VII Edn). Jones and Bartlett publishers.
20. Geoffrey M. CooperandRobert E. Hausman2015. The Cell: A Molecular Approach. 7thedn. Sinauer Associates is an imprint of Oxford University Press.

SEMESTER II
CORE PAPER 6

Core Paper: GENETICS, PLANT BREEDING AND EVOLUTION

Core Paper **No. of teaching hours: 5**
Credits: 4 **Marks (Ex.75+In.25=100)**

Objective

- To acquire a knowledge on features of sexual reproduction and understand the basic principles of genetics applied to plant breeding procedures.
- To provide students advanced knowledge on microbial and plant genetics and its applications.
- To familiarize students on the various types of genetical techniques and procedures.
- Understanding of how genetic concepts affect broad societal issues including health and disease, food and natural resources, environmental sustainability, etc
- To highlight the breeding developing upon production breeding, quality breeding, adaptive breeding and protection breeding regardless of breeding system.
- Evolutionary biology is to teach past history & origin of living organisms.

UNIT1 Principle of Genetics

Laws of inheritance, modified Mendelian – mono-hybrid; dihybrid- test cross, back cross- alleles epitasis- nitration of genes-complementary genes - dominance - segregation independent assortment-gene mapping methods. linkage maps-sex determination. Extrachromosomal inheritance– inheritance of mitochondrial and chloroplast genes; maternal inheritance, polygenic inheritance,

UNIT2 Molecular Genetics

Non-Mendelian Inheritance - cytoplasmic inheritance – chloroplast – Mitochondrial genome in higher plants. Microbial genetics: Algal, Fungal, bacterial and viral genetics. Molecular genetics: Nucleic acids as genetic material – types of nucleic acids – replication of DNA – methods and models in DNA repair mechanism – enzymes – split genes – jumping and mobile genes (Transposable) – concepts of gene – cistron – muton-

recon.Mutation– types, causes and detection, mutant types – lethal, conditional, biochemical loss of function, gain of function, germinal verses somatic mutants, insertional mutagenesis. – physical and chemical mutagens, molecular basis of gene mutation, point and frame shift and suppressor mutation. Gene regulatory mechanisms – Genetic disorders in human.

UNIT 3 Plant Breeding Methods

History and objectives of plant breeding; centers of origin, plant introduction – history, agencies, procedure, germplasm collection, merits and demerits.Modes of reproduction; Control of pollination – self incompatibility, male sterility.Selection – mass selection, pureline selection, clonal selection with reference to methodology, merits and demerits, their application.Heterosis and Inbreeding depression – effects of inbreeding, genetic basis of heterosis – theories explaining heterosis and inbreeding depression.

UNIT4 Plant Breeding Techniques

Selection in segregating populations – Pedigree method, bulk method and back cross method. Hybridization: Inter and Intra-varietal, inter and intra-specific and inter and tra-generic hybridization –Hybrid vigour. Numerical changes of chromosomes – haploids, aneuploids, secondary polyploids, euploids – auto and allopolyploids, role of polyploids and Mutation in plant breeding. Molecular mechanism of crossing over gene conversion, ordered and unordered tetrad analysis somatic cell hybridization-mutation. Special breeding techniques- Mutation breeding; Breeding for abiotic and biotic stresses. Cultivar development- testing, release and notification, maintenance breeding,Participatory Plant Breeding, Plant breeders‟ rights and regulations for plant varietyprotection and farmers rights.

UNIT5 Evolution

The modern evolutionary theory in relation to the origins and dynamics of genetic diversity in time and space, reproductive isolation and evolutionary relationships among organismal groups. Natural selection; levels of selection. Darwin and the theory of evolution, quantitative traits. Types of selection; sexual selection; genetic drift; gene flow; adaptation; convergence; species concepts;life history strategies; adaptive radiation; biogeography. Origin of genetic variation; polygenetic traits, linkage and recombination; epistasis, gene-environment interaction; heritability; population genetics; molecular

evolution - cladistics.phylogenetic analysis and comparative methods; Speciation; extinction and biodiversity.

Outcome of course

Students will know the principle of genetics value and the importance on improving the molecular genetics. On the successful completion of the course, the student will be able to: Comprehensive, detailed understanding of the basis of heredity. Understanding the role of genetic mechanisms in evolution. The ability to evaluate conclusions that are based on genetic data. Understanding the role of genetic technologies in industries related to biotechnology, pharmaceuticals, energy, and other fields.

Text Books

1. Gardner EJ &Snustad DP. 1991. Principles of Genetics. John Wiley & Sons.
2. Klug WS & Cummings MR. 2003. Concepts of Genetics. Peterson Edu.
3. Lewin's Genes XII Hardcover-2 March 2017. J. E. Krebs et al.,
4. Russell PJ. 1998. Genetics. The Benzamin/Cummings Publ. Co.
5. Snustad DP & Simmons MJ. 2006. Genetics. 4th Ed. John Wiley & Sons.
6. Strickberger MW. 2005. Genetics (III Ed). Prentice Hall, New Delhi, India
7. Tamarin RH. 1999. Principles of Genetics. Wm. C. Brown Publs.
8. Uppal S, Yadav R, Subhadra& Saharan RP. 2005. Practical Manual on Basic and Applied Genetics.Dept. of Genetics, CCS HAU Hisar.

Reference books

1. Plant breeding with farmers requires testing the assumptions of conventional plant breeding: Lessons from the ICARDA barley program. p. 297-332.
2. David A. Cleveland, and Daniela Soleri (ed.). Farmers, scientists and plant breeding: integrating knowledge and practice. CABI Publishing International, Wallingford, Oxon, UK.Ceccarelli S., Grando S., 2007. D
3. Denis, J.C. and Adams, M.W. (1978). A factor analysis of plant variables related to yield in dry beans. I. Morphological traits. Crops Science, 18:74–7

4. L. Skot AFRCIGER, Plant Breeding Station PlasGogerddan, Near Aberystwyth SY23 3EB Dyfed, UK

5. A.P.M. den Nijs, Centre for Plant Breeding and Reproduction Research (CPRO-DLO) Droevendaalsesteeg 1 PO Box 16 6700 AA Wageningen THE NETHERLANDS

6. Sinha V and Sinha S: 1998 Cytogenetics plant Breeding and Evolution, Vikas Publishing house Pvt ltd , Newdelhi

7. Swaminathan ,M.S.Gupta , P.K and Singa U-1974 Cytogenetic to crop plants , Macmillan Ltd Newdelhi

E-Materials

GENETICS &PLANT BREEDING

List of Journals

- Australian Journal of Biological Sciences, Australia
- Australian Journal of Agricultural Research, Australia
- Biometrics, UK
- Bio-Techniques
- Cereal Research Communication, Hungary
- Crop Improvement, Ludhiana, India
- Crop Science, USA
- Czech Journal of Plant Breeding Genetics, Prague,
- Plant Breeding, Germany •Plant Molecular Biology, The Netherlands •
- Sorghum and Millet Newsletter, ICRISAT
- Theoretical and Applied Genetics, Germany
- Wheat Research, Japan

Semester II
Core Elective
PAPER – 2
(Choose either A or B)
A. TECHNIQUES IN BOTANY

Core Elective Paper **No. of teaching hours: 5**
Credits: 3 **Marks (Ex.75+In.25=100)**

Objectives

- To understand and familiar with modern instruments used in plant science field.
- To Understand Principle, working, ray diagram and application of advance microscopes
- The students are able to stain the bacteria with differential staining techniques.
- To understand bio-analytical methods used in various molecular biology.

UNIT I Microscopy

Structure, working principle and applications of Light, Dark field, Bright Field, Phase Contrast, Confocal, Fluorescence, Scanning and Transmission Electron microscopy, Material preparation for Electron microscopy. Microscopic measurements: Micrometers – Ocular and Stage; Haemo-cytometer and Camera Lucida.

UNIT II Micro-techniques and Culture Techniques

Sectioning of Biological specimens - Free hand, staining of the sections, Mounting and mountants, Fixing coverslips and ringing. Collection and Preservation of plant material. Cryopreservation.Culture Technique: Principles, types (Bacteria, Fungi, Algae, Plant) media preparation, sterilization, inoculation, Equipment – Laminar air flow, thermobath, shaker, stirrer, hot airOven.

UNIT III Histochemical and Spectroscopic techniques

Introduction to Histochemical techniques – staining of Proteins, Carbohydrates, and Lipids. Microslide preparation—Whole mounts, Smears and Squashes. Maceration technique.Colorimetry, UV-Visible and Atomic Absorption Spectrophotometry, IR, NMR and Mass Spectrophotometry and X-Ray Diffraction analysis. Flow Cytometry, Autoradiography: Isotopes used in Biology

UNIT IV Molecular and separation Techniques

Blotting techniques- Southern, Northern and Western; ELISA; RIA and PCR (Thermocycler and Real Time PCR). DNA finger printing; RFLP; RAPD, MALDI and FISH techniques. Electrophoresis – General principles – Electrophoresis- Agarose gel; SDS –PAGE. Chromatography – Principles and applications of Paper, Thin layer, Column, Ion exchange, affinity, Gel permeation, Adsorption and Partition chromatography. HPLC and FPLC. HPTLC and GC. Centrifugation: Basic principles of Sedimentation; Preparative Ultracentrifugation.

UNIT V Tissue culture techniques

Introduction - tissue culture techniques - laboratory organization – preparation of nutrient media. Methods of sterilization – Chemical and Physical methods. Preparation of explants – callus initiation, subculture and hardening. Concepts of totipotency and redifferentiation. Cell suspension culture – callus culture, Anther and pollen culture – haploids and their significances. Embryo culture - Meristem culture for virus-free clones.

Text Books

1. Ananta Swargiary. 2017. Biological tools and Techniques. Kalyani Publishers, New Delhi.
2. Prasad and Prasad, 2000. Outlines of Micro technique. Emkaypubl, New Delhi.
3. Practical Biochemistry: Principles and Techniques. Ed. E. Wilson and J. Walker (2000) Cambridge Publ.
4. Chawla, H.S. 2000. Introduction to biotechnology. Oxford and IBH publishing Co.,
   New Delhi.
5. Johannson DA. 1975. Plant Microtechnique. McGraw Hill.

Reference Books

6. Nagarajan, P. and Senthilkumar, N. 2001. Molecular biology principles and methods a practical approach, SreeNarmatha Printers,Coimbatore.
7. Sharma, R.K. and S.P.S. Sangha. 2009. Basic Techniques in Biochemistry and Molecular Biology. I.K. International Pvt. Ltd, New Delhi.
8. Keith Wilson and John Walker.2010. Principles and Techniques of Biochemistry and Molecular biology. Cambridge University Press, New York.

9. Palanichamy, S. and M. Shunmugavelu. 1997. Research methods in Biological Sciences. Palani Paramount Publications, Palani.
10. P.R. Yadav and Rajiv tyagi, 2006. Biological Techniques, Discovery Publishing House, New Delhi.
11. Susan carson, Heather B. Miller and D. Scott, 2012. Molecular biology techniques, Elesiver.
12. Bajpai P.K. 2006. Biological instrumentation and Methodology. S Chand Publishers, New Delhi.
13. Sabari Ghosal and Srivastava A. K. 2009. Fundamentals of Biological Techniques and Instrumentation. PHI Learning Private Ltd. New Delhi.

Semester II
Core Elective
PAPER – 2
(Choose either A or B)
A. INDUSTRIAL MICROBIOLOGY

Core Elective Paper **No. of teaching hours: 5**
Credits: 3 **Marks (Ex.75+In.25=100)**

Objectives

- To understand the importance of microbes, basics of a sterilization, fermenter design and types.
- To study the avenues of exploiting microbes in bioconversion technology.
- To study the industrial production, product recovery and commercial application in fermentation.

UNIT – I Industrial Biotechnology

Introduction - Historical account – development – scope of industrial microbiology, source and characters of industrially important microbes – Microorganisms in industry – Sterilization – preparation of media – isolation methods for microorganisms – culture and preservation and stability. Principles of storage of microbes at low temperature in liquid nitrogen, Preparation of inoceleem – Screening methods and methods for strain improvement.

UNIT – II Industrial Fermentations Techniques

Types of fermentation – components of fermentation process – factors involved in fermenter design, differences between biochemical and chemical processes; biochemical reactions, operational consideration. Fermenter configuration and different types of fermentors; Principle of operation characteristics of fermentors, Methods used for down – stream processing and product recovery – filtration, centrifugation, cell disruption, extraction, dialysis, purification, drying, packing and labeling, Manufacturing practices and Fermentation economics.

UNIT – III Methylotrophs

Methanogens and methylotrophs, Mechanism of methane production – Economic importance of methylotrophs. Hydrogen fuel, Microbial leaching. Sulphur utilizing, sulphate reduction pathway – use of nucleotides as nitrogen source for growth of certain microorganisms (pathway of nucleic acid breakdown). Immobilization of microbial cells

and enzymes methods and applications – Biofuel, ethanol, biogas, biodiesel and hydrogen production, Microbial polyesters, biosurfactants and recombinant products.

UNIT – IV Microbial production of food

Microbes in food production and food poisoning, microbial single cell protein (SCP). Fermented dairy products, fermented meats, leavening of breads, microbiology and production of ethanol and alcoholic beverages – beer, manufacturing and production of distilled beverages, wines, vinegar, Baker's yeast production – food and fodder yeast production, fermented vegetables, pickles, olives, soy source, mushroom, algae and cheese.

UNIT – V Microbial production of Metabolites

Microbial production of primary and secondary metabolite, commercial production of antibiotics with special reference in penicillin, streptomycin and their derivatives. Vitamins and growth stimulants – Vitamin A, Vitamin B12; Organic acids – citric acid, fumaric acid, Bacterial gluconic acid and ∝ - Ketoglutaric acid. Amino acid – L – glutamic acid, Lysine. Enzymes – Amylase and proteases. Microbial transformation of steroids and alkaloids production. Large scale production of recombinant molecules interferon, human protein, insulin, somatostation, vaccines and anticancer agents.

Outcome of the Course

The students are able to clarify scope of Industrial and Pharmaceutical Microbiology. Industrial microbiology may be defined as the study of the large-scale and profit motivated production of microorganisms or their products for direct use, or as inputs in the manufacture of other goods.Know various Culture media and their applications and also understand various physical andchemical means of sterilization. Know General bacteriology and microbial techniques for isolation of pure cultures of bacteria, fungiand algae. Master aseptic techniques and be able to perform routine culture handling tasks safely andeffectively

Text Books

1. Nduka okafor, 2007. Modern Industrial Microbiology and Biotechnology. Ist Editions. Science Publishers.
2. Waiter, M.J., organ, N.I., Rockey., I.S and Higton, G., 2002. Industrial Microbiology – An Introduction, Black well science Publisher.

Reference Books

1. Patel, A.H., 2010. Industrial Microbiology 4th edition. Macmillan Publisher, India.
2. Casida, JR L.E., 2009. Industrial Microbiology. New Age International (P) Ltd., Publishers, New Delhi.
3. Okafor, 2007. Modern industrial microbiology and Biotechnology. Scientific publisher. Enfield, USA.
4. Demain, A.I, 2001. Industrial Microbiology and Biotechnology. 2nd Edition, ASSI Press, Washington.
5. Danial Forciniti. 2008. Industrial Bioseparations – principles and practice, Wiley – Black well.
6. Richard, H., Batlz, Julian, E., Davis and Arnold, I. Demain., 2010. Manual of Industrial Microbiology and Biotechnology, 3rd edition, ASM Press.
7. Stanbury, P., F., Whitekar, A and Hall. 2000. Principles of fermentation technology. Butterworth, Heinemann.

Semester II
Open Elective
PAPER – 2
(Choose either A or B)
A. ORGANIC FORMING

Open Elective Paper **No. of teaching hours: 5**
Credits: 3 **Marks (Ex.75+In.25=100)**

Objective

- The Students are able to identify and conserving environment and natural resources, re-establishing ecological balance, encouraging sustainable agriculture, improving soil fertility, conserving flora and fauna.
- To increase genetic diversity and promote more usage of natural pesticides.Control pests, diseases and weeds
- To encourage production and use of organic and biological sources of nutrients like biofertilizers, organic manure, compost for sustained soil health and fertility and improving soil organic carbon and to promote production and use of biopesticides, bio-control agents etc as alternative inputs in organic farming.
- To facilitate, encourage and promote development of organic agriculture in the country

UNIT I Importance of organic farming

Introduction: Farming, organic farming, concept and development of organic farming. Historical development of Organic Agriculture in India, Present status of Organic Agriculture. Types of organic farming, Benefits of organic farming. Conventional farming v/s organic farming, Scope and Present state of organic farming, national and international status.

Unit II Organic manure

Organic Manure, advantages of organic manure, Farm Yard Manure /Rural compost, City compost, Oil cakes, Animal wastes, etc. Green Manure – Green Manure with Leguminous crops in crop rotation. In-situ incorporation of crop residues –Benefits. Preparation of Compost- Different Methods, Enrichment of compost and Nutrient composition. Preparation of vermin compost.

Unit III Bio-fertilizer

Fertilizer, chemical fertilizer, Bio-fertilizers, types of Bio-fertilizer, advantages and disadvantages. Study of growth characteristics of various microbes used in biofertilizers production. Storage, shelf life, quality control and marketing. Types of biofertilizer –

Bacteria (*Azospirillum*), Cyanobacteria (*Nostoc*), Fungi (*Glomus*) Nitrogenous Biofertilizers (*Rhizobium*) phosphate and Seaweed Liquid Fertilizer.

Unit IV Bio-pesticides

Biological control, History and concept of biopesticides. Importance, scope and potential of biopesticide. classification of biopesticides, botanical pesticides and biorationales. Mass production technology of bio-pesticides. Major classes-Properties and uses of Fungicides, Bacteriocide and Herbicides. Importance of Neem in organic Agriculture.

Unit V Standards for organic products

Organic crop management, quality of organic foods and Human Health, Organic Standard, Organic Certification Process, Operational Structure of Organic Certification, Farm inspection and certification, Marketing of Organic Products. Conversion to organic farming, Process, Income generation activities: Apiculture, Mushroom production, Terrace farming. Organic Farming and national Economy Socio Economic impacts.

Outcome of the Course

The Students are able to appreciating in Organic farming is a farming method that involves growing and nurturing crops without the use of synthetic based fertilizers and pesticides.Organic farming uses method like green manure and composting which replaces nutrients taken from the soil from the previous crops, organic farming relies on natural breakdown of organic matter and hence allows the production of nutrients in the soil. It improves soil fertility and feeds nutrients to the soil to feed the plant. Organic farming is one of the effective methods for soil management.Organic Farming also controls other organisms with the help of methods such as biological pest control and Integrated Pest Management.

Text Books

1. Joshi, M., Setty, T.K.P. and Prabhakarasetty 2006. Sustainability through Organic farming.1st Edition.Kalyani Publishers, Ludhiana, India.
2. Bavec, F. and Bavec, M. 2007. Organic Production and Use of AlternativeCrops. CRC Press, Boca Raton, FL.
3. Sarath Chandran Unni M.R Sabu Thomas, 2019. Organic Farming, 1st Edn. Global Perspectives and Methods, Elsevier.

4. Niir Board 2004. The Complete Technology Book On Bio-Fertilizer And Organic Farming, National Institute Of Industrial Re.

References Books

5. A C Gaur, 2011Handbook of Organic Farming and Biofertilizers
6. Shalini Suri. 2011. Biofertilizers and Biopesticides, Aph Publishing Corporation
7. H.C. Lakshman and A. Channabasava 2o14 Vedams eBooks (P) Ltd (New Delhi, India)
8. NPCS Board of Consultants & Engineers2008, the Complete Book on Organic Farming and Production of Organic Compost, Asia Pacific Business Press Inc.
9. Ahmad Mehraban. 2013. The Basis of Organic Fertilizers, LAP LAMBERT Academic Publishing.
10. S M Singh, 2018. Organic Manure: Sources Preparation and Usage in Farming Lands,Siya Publishing House

Semester II
Open Elective
PAPER – 2
(Choose either A or B)
B. HERBAL SCIENCE

Open Elective Paper **No. of teaching hours: 5**
Credits: 3 **Marks (Ex.75+In.25=100)**

Objectives:

- To study the importance of herbal medicine in India
- To identify the herbal medicine uses plant
- To cultivation medicinal plants
- To understand the morphological characters of medicinal plants

UNIT I Introduction of Herbal Sciences

Role of plants in naturopathy- A historical perspective of medicinal plants in India.Importance and relevance of medicinal drugs in India. Indian system of medicineviz, Siddha, Ayurveda,Allopathy, Unani and Homeopathy. Study of Phytochemicals—reserve materials, secretory materials and excretory materials.Indian Systems of Medicine (Ayurveda, Siddha, Unani, Tibetan, Yoga and Naturopathy) Ayurveda: Historical perspective, Swasthavritta (measures to be adopted for maintaining the health of healthy person in a positive way through prevention, promotion and correction).

UNIT II Medicinal Plants Therapeutic Compounds

Chemical constituents. Therapeutic and other Pharmaceutical uses of Root - *Withanaisomnifera, Hemidesmus indicus*. Stem –*Tinsoporacordifolia,Ephedra gerardiana*. Underground stem – Zingeberofficinale, Curcuma longa, Wood -*Santalum album*, Bark - *Saracaasoca, Terminalia arjuna.* Leaves- *Ocimumsantum, Adathodavasica*. Flower- *Syzyginumaromaticum, Crocus sativus*. Fruit- *Termianliabellirica, Emblica officinalis*. Seeds- *Strychnosnuxvomica*. Whole plants- *Phyllanthus amarus*.

UNIT III Gardening Medicinal Plants

Medicinal gardening – garden in the hills and plains, house gardens, important plants for gardening. Poisonous plants of India—Types of Plant poison- active plant poison-

treatment for plant poisons, Some important poisonous plants, their toxicity and action. Adulteration of crude drugs and its detection—methods of adulteration, types of adulteration. Medicinal plants of export values. Rejuvenating herbs—role of non flowering plants in the field of medicine.

UNITIV Cultivation of Medicinal Plants

Cultivation of medicinal plants in India. Breeding methods applied to medicinal plants. Herbal medicine preparation: Decoction, infusion, syrup, tincture and poultice. Food: herbal salad, chutney, soup and Tea. Exports values of medicinal plants- Bark - Cinchona, Leaves – Adathoda and Eucalyptus, Flower - Clove. Fruits and seed - Wood apple, Gooseberry and Poppy seed, Underground stem - Ginger, Unorganized drugs. Gum - Acacia, Resin - Turpentine, Fixed oil - Castor oil

UNITV Conservation of Medicinal Plants

Study of some common plants of medicinal value Binomial, common name, part of uses, active principles and medicinal uses. *Azadirachtaindica*, *Acalyphaindica, Achyranthes aspera, Aloe vera, Alternanthera sesselis, Cinnamomumzeylanicum,Centellaasiatica, Digitalis purpurea,Emblica officinalis, Ocimum sanctum, Phylanthusamarus, Solanum trilobatum, Syzygiumcumini*. The endemic medicinal plants of India. Conservation of existing and endangered medicinal plants.

Outcomes of the Course

The students are able to learnt the major use of herbal medicines is for health promotion and therapy for chronic, as opposed to life-threatening, conditions. However, usage of traditional remedies increases when conventional medicine is ineffective in the treatment of disease, such as in advanced cancer and in the face of new infectious diseases.

Text Books

1. Agarwal, O.P,1985.Vol-II. Chemistry of of organic – natural products.
2. Chopra,R.N., Chopra,I.C ., Handa, K.L.,and Kapur,L.D.1994.Indigenous drugs of India.
3. Tilgner, SharolMarie . 2018. Herbal ABC's: The Foundation of Herbal Medicine.
4. Bhagwan Das—Fundamentals of Ayurveda.
5. Kandasamy Pillai,1972. History of Siddha medicine. Govt. of Tamilnadu.

Reference Books

6. Krup,P.V. Handbook of medicinal plants Vol I &II, CCRIMH, NewDelhi.
7. Nadkarni,K.M.,1976.Indian Materia Medica Vol I &II, Popular Prakashan Pvt. Ltd.
8. Wallis,T.E.,1967. Text book of Pharmacognosy, J.A. Churchill Ltd.
9. C.K. Kokale, C.K. Kokate& Purohit – Pharmacognosy, NiraliPrakasan, New Delhi.
10. E.Edwin Jerald &Sheeja Edwin Jerald – Text Book of Pharmacognosy and Phytochemistry, CBS Publishers & Dist., NewDelhi.