

ANNAMALAI UNIVERSITY
BACHELOR OF SCIENCE
B.Sc. BOTANY
UNDER CBCS

(With effect from 2021 - 2022)

The Course of Study and the Scheme of Examinations

The Course of Study and the Scheme of Examinations

S. No.	Part	Study Components		Ins. Hrs / week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
SEMESTER I									
1.	I	Language	Paper-1	6	4	Tamil/Other Languages	25	75	100
2.	II	English (CE)	Paper-1	6	4	Communicative English I	25	75	100
3.	III	Core Theory	Paper-1	6	4	Phycology and Mycology	25	75	100
	III	Core Practical	Practical-1	4	0		0	0	0
4.	III	Allied -1	Paper-1	4	3	Zoology I	25	75	100
	III	Allied- 1	Practical-1	2	0		0	0	0
5.	III	PE	Paper 1	6	3	Professional English I	25	75	100
6.	IV	Environmental Studies		2	2	Environmental studies	25	75	100
		Sem. Total		36	20		150	450	600
SEMESTER II									
7.	I	Language	Paper-2	6	4	Tamil/Other Languages	25	75	100
8.	II	English (CE)	Paper-2	6	4	Communicative English II	25	75	100
9.	III	Core Theory	Paper-2	5	4	Microbiology, Lichens, Bryology and Plant Pathology	25	75	100
10.	III	Core Practical	Practical-1	3	2	Covering Papers 1 and 2	25	75	100
11.	III	Allied-1	Paper-2	4	3	Zoology II	25	75	100
12.	III	Allied Practical - 1	Practical-1	2	2	Zoology	25	75	100
13.	III	PE	Paper 1	6	3	Professional English II	25	75	100
14.	IV	Value Education		2	2	Value Education	25	75	100
15.	IV	Soft Skill		2	1	Soft Skill	25	75	100
		Sem. Total		36	25		225	675	900

S.NO	Part	Study Components		Ins. hrs /week	Credit	Title of the Paper	Maximum Marks		
		Course Title					CIA	Uni. Exam	Total
SEMESTER III							CIA	Uni. Exam	Total
16.	I	Language	Paper-3	6	4	Tamil/Other Languages	25	75	100
17.	II	English	Paper-3	6	4	English	25	75	100
18.	III	Core Theory	Paper-3	4	5	Pteridology, Gymnosperms and Paleobotany	25	75	100
	III	Core Practical	Practical-2	3	0		0	0	0
19.	III	ALLIED-2	Paper-3	4	3	Chemistry I	25	75	100
	III	Allied Practical	Practical-2	3	0		0	0	0
20.	IV	Skill based Subject	Paper-1	2	2	Horticulture	25	75	100
21.	IV	Non-major elective	Paper-1	2	2	Medicinal Botany	25	75	100
				30	20		150	450	600
SEMESTER IV							CIA	Uni. Exam	Total
22.	I	Language	Paper-4	6	4	Tamil/Other Languages	25	75	100
23.	II	English	Paper-4	6	4	English	25	75	100
24.	III	Core Theory	Paper-4	4	5	Plant Cell Biology	25	75	100
25.	III	Core Practical	Practical-2	3	3	Covering Papers 3 and 4	25	75	100
26.	III	ALLIED-2	Paper-4	4	3	Chemistry II	25	75	100
27.	III	Allied Practical-2	Practical-2	3	2		25	75	100
28.	IV	Skill based Subject	Paper-2	2	2	Mushroom Cultivation	25	75	100
29.	IV	Non-major elective	Paper-2	2	2	Horticulture	25	75	100
				30	25		200	600	800
SEMESTER V							CIA	Uni. Exam	Total
30.	III	Core Theory	Paper-5	6	5	Anatomy and Embryology of Angiosperms	25	75	100
31.	III	Core Theory	Paper-6	6	5	Morphology and Taxonomy of Angiosperms & Economic Botany	25	75	100
32.	III	Core Theory	Paper-7	6	5	Genetics, Plant Breeding, Evolution and Biostatistics	25	75	100
	III	Core Practical	Practical-3	3	0		0	0	0
	III	Core Practical	Practical-4	3	0		0	0	0
33.	III	Internal Elective	Paper-1	3	3	A. Tissue Culture B. Mass Cultivation of Algae C. Bio safety and Bioethics	25	75	100
34.	IV	Skill based Subject	Paper-3	3	2	Ethno Botany and Herbal Medicines	25	75	100
				30	20		125	375	500

SEMESTER VI							CIA	Uni. Exam	Total
35.	III	Core Theory	Paper-8	5	5	Plant Physiology and Plant Biochemistry	25	75	100
36.	III	Core Theory	Paper-9	5	5	Ecology, Phytogeography and Toxicology	25	75	100
37.	III	Core Practical	Practical-3	3	3	Covering Papers 5, 6 & 7	25	75	100
38.	III	Core Practical	Practical-4	3	3	Covering Papers 8 & 9	25	75	100
39.	III	Core Project	Project – 1	5	5	(Individual / Group Project)	25	75	100
40.	III	Internal Elective	Paper-2	3	3	(to choose one out of 3) A. Plant Biotechnology B. Bio fertilizers C. Postharvest Technology	25	75	100
41.	III	Internal Elective	Paper-3	3	3	(to choose one out of 3) A. Fermentation Technology B. Computer Application in Botany C. Forestry	25	75	100
42.	IV	Skill based Subject	Paper-4	3	2	Plant and Water Conservation & Management	25	75	100
43.	V	Extension Activities		-	1		100	0	100
				30	30		300	600	900
					140				4300

Part	Subject	Papers	Credit	Total Credits	Marks	Total Marks
Part I	Languages	4	4	16	100	400
Part II	Communicative English & English	4	4	16	100	400
Part III	Allied (Odd Semester)	2	3	6	100	200
	Allied (Even Semester)	2	5	10	100	200
	Allied Practical	2	2		100	200
	Electives	3	3	9	100	300
	Core	9	(3-5)	43	100	900
	Core practical	4	(2-3)	11	100	400
	Professional English	2	3	6	100	200
	Compulsory Project (Group/Individual Project)	1	5	5	100	100
Part IV	Environmental Science	1	2	2	100	100
	Soft skill	1	1	1	100	100
	Value Education	1	2	2	100	100
	Lang. & Others /NME	2	2	4	100	200
	Skill Based	4	2	8	100	400
Part V	Extension Activities	1	1	1	100	100

	Total	43		140		4300
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SEMESTER: I

CORE PAPER - I

PHYCOLOGY AND MYCOLOGY

OBJECTIVES

- ❖ To understand the Salient features and classification of Algae
- ❖ To Study the structure, reproduction and life cycle of various genera
- ❖ To know the importance of Algae
- ❖ To acquire knowledge on general characteristic and classification of fungi
- ❖ To familiarize the structure ,function and economic importance of fungi

UNIT-I

General characters of algae, Classification of algae (Lee, 2008). Distribution of algae, Thallus organization, Structure of algal cell. Significant, Contributions of Important Phycologists (Fritsch, Smith, M.O.P. Iyengar, R. N. Singh, T.V. Desikachary, H.D. Kumar)

UNIT-II

Salient features of Chlorophyceae. Detailed study of structure, reproduction and Life cycle of Chlorella, Oedogonium and Chara. Salient features of Bacillariophyceae Detailed study of structure, reproduction and life cycle of Diatoms.

UNIT-III

Salient features of Phaeophyceae. Detailed study of structure, reproduction and life cycle of Sargassum. Salient features of Rhodophyceae. Detailed study of structure, reproduction and life cycle of Gracilaria. Salient features of Cyanophyceae. Detailed study of structure, reproduction and life cycle of Nostoc. Economic importance of Algae (Eg. Agar, Algicic acid, Diatomite and Spirulina).

UNIT-IV

General characters, mode of nutrition and occurrence of fungi. Classification for Fungi - (Ainsworth, 1973). Detail study of structure, reproduction and life cycle of Myxomycetes and Phycomycetes: Example - *Stemonites* and *Albugo*.

UNIT-V

Detailed study of structure, reproduction and life cycle of Ascomycetes, Basidiomycetes and Deuteromycetes. Example - *Penicillium*, *Cercospora* and *Puccinia*. Economic importance of Fungi.

TEXT BOOKS

Unit-1: Sharma, O.P (2011). Algae, Tata McGraw Hill Education Private limited, New Delhi.

Unit-2: Vashishta, BR, Sinha AK, and SinghVP (2011). Botany For Degree Students Algae, S. Chand. Pub. New Delhi

Unit-3: Pandey, BP (1994). Algae.S. Chand & Company Ltd. New Delhi.

Unit-4: Sharma, OP (2011). Fungi and allied microbes The McGraw –Hill companies, New Delhi

Unit-5: Sharma, PD (2003).The Fungi. Rastogi Publications, Meerut

REFERENCE ITEMS: BOOKS, JOURNAL

1. Bold, HC & Wynne, MJ (1985). Introduction to the Algae. Prentice Hall of India, New Delhi.
2. Fritsch, FE (1945). Structure and reproduction of Algae. Cambridge University press.
3. Round, FE.(1984).The Ecology of Algae. Cambridge University Press.
4. Lee, RD (2008). Phycology 4th Edition, Cambridge University Press, New York
5. Burnett, J.H. (1971).The fundamentals of Mycology. ELBS Publication, London
6. Bessey, E.A (1979). Morphology and Taxonomy of fungi, Vikas publishing House Pvt.Ltd,New Delhi.
7. Mehrotra, RS, Aneja KR (1990).An Introduction to Mycology , New Age International Pub, New Delhi
8. Sundararajan, S. (2004). Practical manual of fungi , Anmol publications Pvt.ltd New Delhi
9. Webster, J (1970) introduction to fungi , Cambridge university press ,London

E-MATERIAL

https://gurukpo.com/Content/B.SC/Algae_Lichens_and_Bryophyta.pdf

<https://www.austincc.edu/ddingley/MLAB1331/LectureGuide/Mycology.pdf>

COURSE OUT COMES

1. To learn about the general characters of algae
2. To impart knowledge on various major groups of algae
3. To understand the life history of various groups of algae
4. To differentiate the various groups of fungi
5. To know the knowledge of general distribution of fungi

ALLIED - 1
PAPER - 1

ZOOLOGY I

Objective;

To acquire knowledge about different kinds of animals species.

To study the systematic and functional morphology of invertebrates and chordates.

UNIT-I

Type study includes life history.

Protozoa – entamoeba, Porifera- Sycon. Coelenterata – Obelia geniculata.

Platyhelminthes - Teania solium.

UNIT II

Annelida – earthworm , Arthropoda – Prawn, Mollusca – Freshwater Mussel, Echinodermata – Sea Star.

UNIT-III

Type study includes morphology, digestive system, respiratory system, circulatory system and urinogenital system of Chordate. Chordate – general characters, Prochordata; morphology of Amphioxus. Vertebrates; Pisces – Shark.

UNIT-IV

Amphibia; Frog, Reptiles; Calotes.

UNIT-V

Aves; Pigeon, Mammalia; Rabbit.

References;

1. Ayyar, E.K. and T.N. Ananthakrishnan. 1992. Manual of Zoology. Volume I & II, S. Viswanathan (printers and publishers) Pvt. Ltd., Madras, 891 p.
2. Kotpal series, 1998 – 1992. Rastogi publications, Meerut.
3. Jordan E.L. and P.S. Verma. 1993. Invertebrate Zoology 12th edition, S. Chand & Co., Ltd., New Delhi.
4. Jordan, E.L. and P.S. Verma. 1995. Chordate Zoology and Elements of Animal physiology , S. Chand & Co., Ltd., New Delhi.

Outcomes;

1. The students will be able to understand the life – cycle to and adaptations of protozoa, porifera coelenterata and platy helminthes.
2. The student will be able to understand the functional morphology of Annelids, Arthropods , Molluscs and Echinoderms.
3. The student will be able acquire knowledge about the functional morphology of chordata, prochordatas and pisces.
4. The student will be able have a thorough knowledge about Frog and Calotes.
5. The student will be able to understand the functional morphology of Aves and Mammals.

SEMESTER: II

CORE PAPER – 2

MICROBIOLOGY, LICHENOLOGY, BRYOLOGY AND PLANT PATHOLOGY

OBJECTIVES:

1. To give an idea of the world of microbes and to evaluate their role in environment and human welfare.
2. To understand the structure, reproduction, classification and economic importance of bacteria viruses and lichens
3. To understand the structure, reproduction, classification and economic importance of Bryophytes with special reference to the life cycles of few Bryophytes.
4. To have knowledge about the causes and preventive measures of diseases of important plants.

UNIT-1

Introduction to Microbiology – Classification - R.H. Whittaker's five kingdom concept, Carl Woese's – three Domain classification. Microscopy - principles and application of Light Microscope, Transmission Electron Microscope (TEM) and Scanning Electron Microscope (SEM), Bacterial Staining (simple and differential) , Study of sub viral particles - viroids, virusoids, prions and satellite viruses. Brief account of special groups of bacteria – Archaeobacteria, Mycoplasma, Chlamydia, Actinomycetes, Rickettsias and Cyanobacteria, Economic importance of micro organisms.

UNIT-2

Bacteria – General characteristics, Classification, Cell structure, Types of flagellation, Nutritional types (based on carbon, nitrogen and energy sources), Respiration, Reproduction – vegetative, asexual and recombination (conjugation, transformation and transduction), Viruses – Classification of viruses, Nature of viruses. Transmission of plant viruses, Structure and replication of plant virus (tobacco mosaic virus); Bacteriophages - Structure and multiplication of T4 bacteriophage (Lytic and Lysogenic cycle).

UNIT-3

Symbiotic Associations - Lichens - General account, classification, occurrence, thallus organization, structure, physiology and reproduction of crustose, foliose and fruticose

lichens, Lichen ecology with particular reference to role in environmental pollution and succession, Economic importance. Mycorrhiza – Types of mycorrhiza - ectomycorrhiza and endomycorrhiza. Significance of mycorrhiza

UNIT-4

Bryophytes - General Characters, Classification of bryophytes (Reimers, 1954). Study of thallus Structure, reproduction and life cycle of the following types. (Excluding the developmental studies) *Marchantia*, *Anthoceros* and *Polytrichum*. Economic importance of Bryophytes.

UNIT-5

Plant pathology – Scope of Plant pathology, classification of plant diseases, Methods of Plant Protection a) Cultural b) Mechanical c) Physical d) Chemical and f) Legal. Study of etiological agent, symptoms, epidemiology, life cycle and management of the following diseases.

- a) Citrus canker
- b) Cauliflower Mosaic Disease
- c) Bunchy top of banana

TEXT BOOKS:

Unit-1: Ananthanaryanan R and Panikar J (2005) Text book of Microbiology, Orient Longmans., and New Delhi. Dubey R.C and Mahewari – (2014) A Text Book of Microbiology – Chand and Co., New Delhi

Unit-2: Dube H.C. (2007) A Text Book of fungi, bacteria and viruses, Student Edition, New Delhi.

Unit-3: Siddiqui K.A. (2013) Text book of Botany-II (Diversity of Algae, Lichens & Bryophytes) – Kitab Mahal Publisher, New Delhi.

Unit-4: Pandey, B.P. (2001). College Botany Vol. I:Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd., New Delhi.

Unit-5: Bilgrami, K.S. and Dubey, R.C. (1985). Text book of Modern Plant Pathology. Vikas Publishing House Private Limited, New Delhi.

REFERENCE ITEMS:

1. Oladele Ogunseitan (2008) Microbial Diversity: Form and Function in Prokaryotes Wiley- Blackwell. New Jersey, United States.
2. Pelczar, M.J. (2001) Microbiology, 5th edition, Tata Mc Graw-Hill Co, New Delhi.

3. Prescott, L. Harley, J. and Klein, D. (2005) Microbiology, 6th edition, Tata Mc Graw-Hill Co., New Delhi.
4. Smith, G.M (1955): Cryptogamic Botany (Vol. I Algae, Fungi, & Lichens) McGraw-Hill Book Co., New York.
5. Tortora, G.J., Funke, B.R., Case, C.L. (2010). Microbiology: An Introduction (10th edition). Pearson Benjamin Cummings, U.S.A.
6. Prescott L.M. Harley J.P. and Klein D.A. (2013) Microbiology Mccrawtill, New York
7. Mehrotra, R.S. (2003). Plant Pathology (Second edition). Tata McGraw-Hill Education, New Delhi.
8. Rangasami, G. and Mahadevan, A. (1998). Diseases of Crop Plants in India. Prentice Hall of India
9. Sharma P.D., (2019), Microbiology and Plant pathology, Rastogi Publication. New Delhi.

E- MATERIALS:

1. General Microbiology at Boundless -<https://bio.libretexts.org>
2. Plant Disease: An Advanced Treatise: How Disease Is Managed edited by James G. Horsfall - <https://books.google.co.in>

COURSE OUT COMES:

1. To understand the diversity of microorganisms, their importance and basics of microscopes.
2. To know about bacteria and viruses and how they are classified.
3. To know about symbionts in botany.
4. To know about bryophytes, the non vascular plants.
5. To understand the concept of plant diseases and protective measures.

CORE PRACTICAL – I

PHYCOLOGY, MYCOLOGY, MICROBIOLOGY, LICHENOLOGY, BRYOLOGY AND PLANT PATHOLOGY

OBJECTIVES

1. To learn practical knowledge of structure and reproduction of algae
2. To know the microscopic structure of various fungi genera.
3. To knowledge the structure of bacteria and virus
4. To learn the thallus and reproduction structure of lichens.
5. To familiarize the detailed internal structure and some bryophytes

I. PHYCOLOGY AND MYCOLOGY

1. A detailed study of structure of thallus and reproductive structure of forms given below *Nostoc*, *Chlorella*, *Oedogonium*, *Chara*, *Diatoms*, *Sargassum* and *Gracilaria*.
2. Observation and recognition of materials and organisms given in fungi. *Stemonites*, *Albugo*, *Penicillium*, *Cercospora* and *Puccinia*.
3. Economic importance of Agar-Agar, Diatomite, Spirulina, Edible Mushroom and Penicillin.

II. MICROBIOLOGY, LICHENOLOGY, BRYOLOGY AND PLANT PATHOLOGY

1. Structure of bacteria (*E. coli*), TMV and T4-Bacteriophage
2. General observation of thallus and reproductive structure of Crustose, foliose and fruticose lichens, *Marchantia*, *Anthoceros* and *Polytrichum*.
3. Recognition of Pathological specimens and control measures of plant diseases given in Unit V.

REFERENCE ITEMS: BOOKS, JOURNAL

1. Bold, HC & Wynne, MJ (1985). Introduction to the Algae. Prentice Hall of India, New Delhi.
2. Burnett, J.H. (1971). The fundamentals of Mycology. ELBS Publication, London
3. Sundararajan, S. (2004). Practical manual of fungi, Anmol publications Pvt.ltd New Delhi
4. Mehrotra, R.S. 2003. Plant Pathology (Second edition). Tata McGraw-Hill Education, New Delhi.
5. Pandey, B.P. (2001). College Botany Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. S. Chand & Company Ltd., New Delhi.

ALLIED 1
PAPER 2
ZOOLOGY II

Objective;

- To study the principles of Cell biology and Genetics.
- To study the principles of Developmental Biology and Physiology.
- To have a complete knowledge about circulatory systems and excretory system.
- To create awareness towards recent changes in the environment and preventive measures.
- To understand the concepts of origin of life.

UNIT-I

Cell Biology – structure of animal cell, Genetic; molecular structure of gene – gene function, sex linked inheritance. Genetic engineering and its application.

UNIT-II

Embryology – cleavage and gastrulation of Amphioxus.

Human Physiology; Digestion, circulation – blood components, structure of heart, heart function.

UNIT-III

Disease of Circulatory system – blood pressure, heart disease – Ischemia, Myocardial infarction, Rheumatic heart disease, stroke.

Excretion – structure of kidney and mechanisms of urine formation.

UNIT-IV

Environmental Biology – Biotic factors and Abiotic factors, food chain and food web. Pollution – Environmental Degradation, (Air, Water and Land) – Green house effect – Bioremediation, - Global warming – acid rain.

UNIT-V

Evolution; Theories of Lamarkism & Darwinism.

Reference;

1. Ekambaranatha Ayyar, and Ananthkrishnan, T.N. 1993. Outlines of Zoology, Vol I & II, Viswanathan and Co, Madras.

2. Sambasiviah, I, Kamalakara Rao, A.P., Augustine Chellappa, S. 1983. Text book of Animal Physiology, S. Chand & Co., New Delhi.
3. Verma and Agarwal. 1983. Text book of animal Ecology, S. Chand & Co., New Delhi.
4. Verma and Agarwal and Tyagi. 1991. Chordate Embryology, S. Chand & Co., New Delhi.
5. Rastogi and Jayaraj. 2000. Text book of genetics. Rastogi publications, Meerut.
6. Verma and Agarwal. 2000. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology, S. Chand & Co., New Delhi.

Outcomes;

1. The student will acquire knowledge about cell structure, gene function and Genetic engineering.
2. The student will be able to understand the cleavage pattern and gastrulation in Amphioxus.
3. The students will have a thorough knowledge about the diseases of circulatory systems and urine formation.
4. The student will be have an awareness about the environment.
5. The student will understand the basic concepts of evolution.

ALLIED PRACTICAL

ZOOLOGY

I MAJOR PRACTICAL

DISSECTIONS

Cockroach; Digestive and nervous system

Prawn; nervous system

II MINOR PRACTICAL

MOUNTING

1. Mouth parts of Mosquito and Honey bee
2. Earthworm – Body setae
3. Placoid scales of Shark

III SPOTTERS

Entamoeba, Sycan, Obelia, Taenia solium (entire, scolex) earthworm (entire, Pineal setae) Prawn (entire), Fresh water mussel, Sea star, Amphioxus – Entire, Amphioxus – T.S. through pharynx, Shark, Frog, Calotes, Pigeon, feathers of pigeon and Rabbit.

Sphygnomanometer, Stethoscope, Rain gauge.

References;

- 1.verma. P.S. 2011. A manual of practical Zoology – INVERTEBRATES. Chand & Co., Ltd., Ram Nagar, New Delhi.
2. Verma. P.S. 2011. A manual of practical Zoology – CHORDATES. Chand & Co., Ltd., Ram Nagar, New Delhi.

SEMESTER: III

CORE PAPER- 3

PTERIDOLOGY, GYMNOSPERMS AND PALEOBOTANY

COURSE OBJECTIVES :

- ❖ To understand the distribution and classification of pteridophytes.
- ❖ To study the structure and life cycle of various groups of pteridophytes.
- ❖ To provide information to characteristics, classification ,economic importance and life cycle of various groups of gymnosperms.
- ❖ To understand the importance of fossils and fossilization process in tracing evolution.
- ❖ To impart knowledge on various types of fossil plants.

UNIT - I

General characters, Distribution, Classification of Pteridophytes (Reimer 1954). Stelar evolution. Homospory and Heterospory. Origin of seed habits. Apogamy and Apospory.

UNIT - II

Structure and life cycle of the following types (Excluding developmental studies) *Lycopodium*, *Selaginella*, *Equisetum*, *Gleichenia*, *Adiantum* and *Marselia*.

UNIT - III

General characters of gymnosperms, Distribution of gymnosperms, Classification of gymnosperms by K.R. Sporne (1965). Economic importance - Detailed study of the following types: *Cycas*, *Pinus* and *Gnetum*

UNIT - IV

Geological time scale. Radio carbon dating. Types of fossilization - Impressions, compressions, casts, molds, petrifications, and coal balls. Importance of the study of paleobotany.

UNIT - V

Nomenclature of fossil plants. Detailed study of the following fossils: *Rhynia*, *Lepidodendron*, *Lepidocarpon*, *Calamites* and *Williamsonia*

TEXT BOOKS

Unit - I: Vashishta , P.C , Sinha and Anilkumar (2010). Pteridophytes, S.Chand &company Ltd, New Delhi

Unit - II: Sharma, O.P. (2012). Textbook of Pteridophyta, TATA MacMillan India Ltd., New Delhi

Unit - III: Johri , RM, Lata S , Tyagi K (2005), A text book of Gymnosperms , Dominate pub and Distributer, New Delhi

Unit - IV: Atchley W.R & Woodnuff DS. (1981). Evolution and speciation, Cambridge University Press, Cambridge.

Unit - V: Kirkaldy, J.E. (1963). The study of Fossils. Hutchinson Educational, London

REFERENCE ITEMS: BOOKS, JOURNAL :

1. Eames, A.J.(1936). Morphology of Vascular Plants - Lower groups, Tata Mcgraw Hill Publishing company Ltd., New Delhi.
2. Sporne,K.R. (1972) . The Morphology of Pteridophytes, B.I. Publications, Madras
3. Sporne, KR. (1970). The morphology of Pteridophytes (The structure of Ferns and Allied Plants) Hutchinson University, London.
4. Chamberlain, C.J. (1934). Gymnosperms: Structure and Evolution. Chicago Reprinted 1950) New York.
5. Delveloryas, T. (1962). Morphology and evolution of fossil plants.
6. Doyle, W.T. (1970). Non Vascular Plants: Form and function. Belmont, California.
7. Kimura, M. (1983). The natural theory of molecular evolution, Cambridge University Press, Cambridge.
8. Arora M.P. (1990). Evolutionary biology, Himalaya Publication House, Delhi.

E- Materials :

[https://bio.libretexts.org/Bookshelves/Botany/Book%3A_Introduction_to_Botany_\(Shipunov\)/06%3A_A_Growing_Diversity_of_Plants/6.02%3A_Pteridophyta_-_the_Ferns](https://bio.libretexts.org/Bookshelves/Botany/Book%3A_Introduction_to_Botany_(Shipunov)/06%3A_A_Growing_Diversity_of_Plants/6.02%3A_Pteridophyta_-_the_Ferns)

<http://www.auburn.edu/academic/classes/biol/1030/rajamani/topic5%20BIOL1030NR.pdf>

<http://www1.biologie.uni-hamburg.de/b-online/palbot/teach/palbotteach.html>

<http://www1.biologie.uni-hamburg.de/b-online/ibc99/pbio100/lec19.html>

<http://www1.biologie.uni-hamburg.de/b-online/palbot/teach/palbotteach.html>

Course Out Comes:

1. To discuss the general Characteristic of pteridophytes
2. To differentiate the various genera in pteridophytes.
3. To learn the salient features and importance of gymnosperms
4. To acquire knowledge on fossils and fossilization
5. To know on various groups of fossil plants

ALLIED - 2
PAPER - 3
CHEMISTRY - I

OBJECTIVE:

- Basic knowledge on Metallurgy, Cycloalkanes, Polarising Effects, Stereochemistry, Chemical Kinetics, Catalysis, Photochemistry, VSEPR Theory, Fuels, Osmosis, Nuclear Chemistry, Petroleum Chemistry, Chemistry of Naphthalene, Conductors and Applications wherever necessary are to be taught for I- Semester.

UNIT – I

1.1 General Metallurgy - Extraction of Metals - Minerals and Ores- Difference between Minerals and Ores – Minerals of Iron, Aluminum and Copper - Ore Dressing or Concentration of Ores - Types of Ore Dressing- Froth Floatation process, Gravity separation and Magnetic separation.

1.2 Calcination, Smelting, Roasting, Flux, Slag - Definition - Reduction methods - Goldschmidt Aluminothermic process and Carbon Reduction method - Refining of Metals - Electrolytic, Van Arkel and Zone Refining.

1.3 Ores of Titanium and Cobalt - Extraction of Titanium and Cobalt.

UNIT – II

1. Cycloalkanes - Preparation – Wurtz reaction and Dieckmann's condensation - Properties of Cycloalkanes – Substitution and Ring opening reactions.

2.2 Polarisation - Inductive effect, Mesomeric effect and Steric effect (Acid and Base Strength).

2.3 Stereoisomerism – Types - Cause of Optical Activity – Enantiomers - Diastereomers - Meso form - Optical Activity of Lactic acid and Tartaric acid - Racemisation and Resolution – Definition and Methods - Geometrical isomerism – Definition and example - Maleic and Fumaric acid – Differences.

UNIT – III

3.1 Chemical Kinetics – Rate of a reaction – Definition of Order and Molecularity – Distinction between Order and Molecularity - Derivation of First order rate equation - Half Life Period of first order reaction.

3.2 Catalysis - Catalyst - Autocatalyst - Enzyme catalyst - Promoters - Catalytic poisons – Active Centre - Differences between Homogeneous and Heterogeneous Catalysis - Industrial Applications of Catalysts.

3.3 Photochemistry – Grothus-Draper's law – Stark-Einstein's law - Quantum yield – Photosynthesis - Phosphorescence – Fluorescence.

UNIT – IV

4.1 VSEPR Theory – Hybridisation and Shapes of simple molecules BF_3 , PCl_5 , SF_6 and XeF_6 .

4.2 Fuels – Classification of Fuels - Calorific value of Fuels – Water gas, Carbureted Water gas and Producer gas – Composition and Uses - Non-Conventional fuels - Need of Solar Energy - Applications - Biofuels – Oil gas, Natural gas and LPG – Uses.

4.3 Osmosis - Osmotic pressure - Reverse osmosis – Definition - Desalination of Sea water.

UNIT – V

5.1 Nuclear Chemistry – Atomic number, Mass number - Isotopes, Isobars and Isotones – Definition and Examples - Definition of Half life period - Nuclear Binding Energy, Mass Defect and N/P ratio - Nuclear Fission and Nuclear Fusion (Elementary idea) - Applications of Radioisotopes in Medicine, Agriculture and Industries – Carbon Dating.

5.2 Crude Oil - Petroleum - Petroleum Refining - Cracking - Applications of Cracking – Naphthalene – Preparation – Haworth's method – Properties – Oxidation, Reduction and Uses of Naphthalene - Structure of Naphthalene (Structural elucidation not necessary).

5.3 Conductors, Insulators, Semiconductors, N- and P- Type Semiconductors – Definitions and Examples.

SKILL BASED SUBJECT

PAPER -1

HORTICULTURE

Course Objectives :

- ❖ To promote the profession of Horticulture and the professionalism of those working in the industry
- ❖ To act as an authoritative body; consulting with Government and other policy making bodies on matters of interest or concern to professional horticulturists
- ❖ To confer recognized status upon professionally qualified and experienced horticulturists.
- ❖ To promote educational and training opportunities and encourage the development of all disciplines within horticulture
- ❖ To improving the environment

UNIT - I

Introduction, Divisions of horticulture, Importance and scope of horticulture, Principles of garden making, Types of pots and containers, Potting mixture and potting media – soil, sand, peat, sphagnum moss, vermiculite, Soil types, Soil preparation, Irrigation methods, Hydroponics

UNIT - II

Propagation methods, Cuttings, Layering – Air layering, Ground layering (Tip, Trench and Compound), Budding – T- budding, Grafting – Approach grafting, Bridge grafting, whip and tongue grafting, Garden tools and implements, Manures and fertilizers, Farmyard manure, compost, vermi compost and biofertilizers- Chemical fertilizers – NPK. Time and application of manures and fertilizers. Foliar sprays

UNIT - III

Components of Garden, Lawns and landscaping Trees, shrubs and shrubberies, climbers and creepers, Flower beds and borders, ornamental hedges, edges Drives, roads, walks and paths, Carpet beds, topiary, trophy, rockery. Conservatory or green houses, Indoor garden, Roof garden, Bonsai.

UNIT - IV

Flower Arrangement, Containers and requirements for flower arrangements Free style, Shallow and Mass arrangement, Japanese – Ikebana, Bouquet and garland making, Dry flower arrangement, Harvesting Methods, Storage, Marketing of Fruits, vegetables and flowers, Preservation and processing of fruits and vegetables.

UNIT - V

Growth regulators in horticulture, Rooting hormones , Growth promoters, Flower induction, Parthenocarpy, Plant protection, Common diseases of fruits and vegetable crops (Mango, Tomato). Weedicides, Fungicides, Pesticides

Field Study: Visit to a Botanical garden under the guidance of the teacher is encouraged.

Text Books:

Unit - I: Kumar, N., (1997). Introduction to Horticulture, Rajalakshmi Publications, Nagercoil.

Unit - II: Edmond Musser & Andres (1994) Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.

Unit - III: Manibhushan Rao, K. Text book of Horticulture. Macmillan India Ltd. Chadha K.L.(2003). Hand book of Horticulture, ICAR publication , New Delhi.

Unit - IV: Randhava, GS (1973). Ornamental horticulture in India. Today and Tomorrow Printers and Publishers, New Delhi.

Unit - V: Edmond Musser & Andres (1994) Fundamentals of Horticulture, McGraw Hill Book Co., New Delhi.

Reference Items: books, Journal:

1. Williams, CN., Uzo, JO , Peregrine, WTH (1991). Vegetable production in Tropics. Longman Scientific & Technical, Essex (UK).
2. Yawalkar, KS (1961). Vegetable crops of India. Agri-Horticultural Publishing House, Dharmapath, Nagpur.

E- Materials:

<http://ecoursesonline.iasri.res.in/course/index.php?categoryid=89>

Course Out Comes :

1. To increase food and ornamental plant production
2. To providing employment, often in rural areas
3. To improving the environment and management
4. To creating and managing valuable sports and recreation facilities as one of the main leisure pursuits - gardening
5. To gain knowledge of growth regulators, promoters and common diseases of horticultural crops.

NON MAJOR ELECTIVE

PAPER-1

MEDICINAL BOTANY

Course Objectives :

- ❖ To support the education of healthcare professionals in phytotherapy.
- ❖ To promote the production of medicinal plants as an alternative for diversification and the generation of income for family farms.
- ❖ To stimulate agro ecological practices.
- ❖ To support research and the implementation of medicinal plant programmes and projects in the municipalities
- ❖ To educate, study, develop, cultivate, benefits of medicinal plants

UNIT - I

Pharmacognosy - Definition and History. A general account of different survey of Different systems of Medicines - Indian systems of medicine – Siddha, Ayurveda and Unani systems. Classification of drugs (elementary).

UNIT - II

Morphological studies - Chemical constituents. Therapeutic and other Pharmaceutical uses of Bark - Cinchona, Leaves - Adathoda and Eucalyptus, Flower - Clove.

UNIT - III

Fruits and seed - Wood apple, Goosberry and Poppy seed, Underground stem - Ginger, Unorganized drugs. Gum - Acacia, Resin - Turpentine, Fixed oil - Castor oil.

UNIT - IV

A brief account of the following: a) Drugs acting on the Central Nervous system b) Drugs used in the disorders of the Gastro Intestinal tract and c) Cardio Vascular drugs. (Five Plant examples for each mentioned above)

UNIT - V

Cultivation of medicinal plants in India. Medicinal plants . Breeding methods applied to medicinal herbs. Drug Adulteration. Methods of Drug evaluation.

Text Books

Unit - I: John Jothi Prakash, E. (2003). Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor, Tirunelveli.

Unit - II: Gokhale, SB., Kokate, CK. and Purohit, AP (1995). Pharmacognosy. Nirali Prakashan, pune

Unit - III: Prajapathi, Purohit, Sharma and Kumar. (2003). A Hand book of Medicinal plants. Agrobios Publications, Jodhpur.

Unit - IV: Kumar,NC (1993). An Introduction to Medical Botany and Pharmacognosy

Unit - V: John Jothi Prakash, E. (2003). Medicinal Botany and Pharmacognosy. JPR Publication, Vallioor, Tirunelveli.

Reference Items: books, Journal:

1. Kanny, Lall, Dey and Raj Bahadur, (1984). The indigenous drugs of India, International Book Distributors.
2. Sivarajan V.V and Balachandran Indra (1994). Ayurvedic drugs and their plant source. Oxford IBH Publishing Co.
3. Wallis,T.E (2005) Text Book of Pharmacognosy by CBS Pub. Delhi.
4. Kirthikar and Basu.(2012) Indian Medicinal Plants
5. Mohammed Ali, (2008–Vol-1). Pharmacognosyby CBS Publishers andDistributors
6. Ashutosh Kar, (2007). Pharmacognosy and Pharmaco Biotechnology - New Age. Publisher New Delhi.

E- Materials:

<https://science.umd.edu/classroom/bsci124/lec29.html>

Course Out Comes:

1. To discuss the various systems of medicines
2. Promotion of cultivation and conservation of medicinal plants.
3. To identify the plants to be conserved
4. To gain knowledge about the drugs process
5. To provide information to cultivate drug adulteration and evaluation

SEMESTER IV

CORE PAPER - 4

PLANT CELL BIOLOGY

Course Objectives:

- ❖ Students will understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, especially macromolecules, membranes, and organelles
- ❖ Students will understand how these cellular components are used to generate and utilize energy in cells
- ❖ Students will understand the cellular components underlying mitotic cell division.
- ❖ Students will apply their knowledge of cell biology to selected examples of changes or losses in cell function.
- ❖ To learn environmental or physiological changes, or alterations of cell function brought about by mutation.

UNIT - I

History and progress of cell biology- Prokaryotic and Eukaryotic cell. Ultra structure of plant cell, Cell wall with chemistry and function. Structure, Chemistry and function of Cytoplasm and plasma membrane.

UNIT - II

Cell Organelles: Structure and origin of the following: Endoplasmic Reticulum, Golgi complex, Lysosomes, Vacuole, Peroxisomes, Mitochondria, Plastids and Ribosomes. Structure and Functions of Nucleus, Nucleoplasm, Nucleolus and Chromatin.

UNIT - III

Chromosome, special types of chromosomes - Polytene and Lambrush chromosomes, Variation in Chromosome number (Numerical aberrations)- aneuploidy and Euploidy- haploidy, polyploidy- significance. Variation in Chromosome structure (Structural aberrations) - deletion, duplication, inversion and translocation- significance

UNIT - IV

Central Dogma, Semi conservative DNA replication – mechanism, enzymes involved in DNA replication- DNA polymerase, DNA gyrase, Helicase, Ligase, primase and other accessory proteins, Eukaryotic replication with special reference to replication licensing factor, assembly of new nucleosome, replication at the end chromosome telomere, telomerase concept.

UNIT - V

RNA processing, Aminoacylation of tRNA, Translation. Cell inclusions (Non living): Cystolith, crystals, raphids, starch grains. Cell divisions – Amitosis, Mitosis and Meiosis and their significances. Gene regulation – Lac operon.

Text Books:

Unit - I: Turner, P.C. A.G. MC Lennan. A.D. Bates And M.R.H. White. 1998. Instant Notes in Molecular. Biology. Viva Books Pvt. Ltd. Chennai.

Unit - II: Verma.P.S and Agarwal, V.K. 2007. Cytology. S. Chand & Co. Chennai.

Unit - III: Wolfe, S.L. 1993. Molecular and Cellular Biology. Wadsworth Publishing Co, Clifornia.

Unit - IV: Rastogi, SC (1992) .Cell biology , Tata McGrew-Hill,New Delhi

Unit - V: Sundararajan ,S (2000). Cytology , Anmol publication (P) ltd, New Delhi

Reference Items: books, Journal:

1. Dyansager, V.R (1986).Cytology and Genetics.Tata McGrew-Hill,New Delhi.
2. Karp,G (1995)Cell and Molecular Biology,John Wiley and Sons,New York

E- Materials :

https://cellbiology.med.unsw.edu.au/cellbiology/index.php/2010_Lecture_1

https://cellbiology.med.unsw.edu.au/cellbiology/index.php/2010_Lecture_2

<https://employees.csbsju.edu/ssaupe/biol327/Lecture/cell-wall.htm>

Course Out Comes:

1. Compare and contrast animal and plant cells and be able to distinguish each type under the microscope.
2. Identify the following structures on the slides and explain the functions of plasma membrane, cytoplasm, nucleus, nucleolus, cell wall, and plastids
3. To gain knowledge structure and functions of chromosomes.
4. To knowledge of DNA structure and replication
5. To gathering knowledge of RNA functions and their properties.

CORE PRACTICAL - II

PTERIDOLOGY, GYMNOSPERMS, PALEOBOTANY AND PLANT CELL BIOLOGY

Course Objectives :

- ❖ To learn practical knowledge of internal structures of pteridophytes
- ❖ To know Morphological characters and reproductive parts.
- ❖ To gain knowledge of structure and reproductive parts of gymnosperms
- ❖ To study the fossil plants
- ❖ To know detailed study of cell and cell division.
- ❖

PTERIDOLOGY

1. Study of morphology, internal structure and reproductive parts of *Lycopodium*, *Selaginella*, *Equisetum*, *Gleichenia*, *Adiantum* and *Marselia*.

GYMNOSPERMS

1. Study of morphology, internal structure and reproductive parts of *Cycas*, *Pinus* and *Gnetum*

PALEOBOTANY

1. Study of *Rhynia*, *Lepidodendron*, *Lepidocarpon*, *Calamites* and *Williamsonia*.

CELLBIOLOGY

1. Study of structure of plant cell and organelles by electron microscopy pictures from standard books.
2. Study of Cell inclusions (non living)- cystolith, crystals, raphids, starch grains.
3. Study of Mitosis by Squash technique (Onion root tip)
4. Study of Meiosis (Demonstration only)

ALLIED - 2
PAPER - 4
CHEMISTRY – II

OBJECTIVE:

- Basic knowledge on Coordination Chemistry, Industrial Chemistry, Carbohydrates, Aminoacids, Proteins, Electrochemistry, Paints and Pigments, dyes, Vitamins, Medicinal Chemistry, Corrosion and Applications wherever necessary are to be taught for II- semester.

UNIT – I

1.1 Coordination Chemistry - Nomenclature of Coordination Compounds - Ligands, Central Metal Ion and Complex Ion – Definition and Examples – Coordination Number - Werner’s Theory of Coordination Compounds - Chelates - Functions and Structure of Haemoglobin and Chlorophyll.

1.2 Industrial Chemistry - Fertilisers and Manures – Biofertilisers - Organic Manures and their importance - Role of NPK in plants - Preparation and Uses of Urea, Ammonium Nitrate, Potassium Nitrite and Super Phosphate of Lime.

1.3 Contents in Match Sticks and Match Box - Industrial making of Safety Matches – Preparation and Uses of Chloroform, DDT, Gammexane and Freons.

UNIT – II

2.1 Carbohydrates - Definition and Examples - Classification – Oxidation and Reduction Reactions of Glucose - Structure of Glucose (Structural elucidation not necessary) - Uses of Starch - Uses of Cellulose Nitrate and Cellulose Acetate.

2.2 Amino Acids – Definition and Examples - Classification of Amino Acids - Preparation - Gabriel Phthalimide Synthesis – Properties – zwitterion and Isoelectric point - Structure of Glycine.

2.3 Proteins – Definition - Classification of Proteins based on Physical properties and Biological functions - Primary and Secondary Structure of Proteins (Elementary Treatment only) – Composition of RNA and DNA and their Biological role - Tanning of Leather - Alum (Aluminum chloride tanning) - Vegetable tanning – Chrome

Tanning.

UNIT – III

3.1 Electrochemistry - Electrolytes – Definition and Examples – Classification - Specific and Equivalent Conductance - their determination – Variation of Specific and Equivalent conductance with Dilution – Ostwald's Dilution Law and its Limitations.

3.2 Kohlrausch's Law - Determination of Dissociation Constant of weak Electrolytes using Conductance measurement - Conductometric titrations.

3.3 pH – Definition and pH determination by indicator method - Buffer solutions - Buffer action - Importance of buffers in the living systems.

UNIT – IV

4.1 Paints - Components of Paint – Requisites of a Good Paint - Pigments – Classification of Pigments on the basis of Colour – Examples - Dyes – Definition – Chromophores and Auxochromes – Examples - Colour and Dyes - Classification based on Constitution and Application – Examples.

4.2 Vitamins – Definition – Classification – Water Soluble and Fat Soluble – Occurrence - Biological Activities and Deficiency Diseases caused by Vitamin A, B, C, D, E and K - Hormones – Definition and Examples – Biological Functions of Insulin and Adrenaline.

4.3 Chromatography - Principles and Applications of Column and Paper chromatography- R_f value.

UNIT – V

5.1 Drugs - Sulpha Drugs – Preparation and Uses of Sulphapyridine and Sulphadiazine - Mode of Action of Sulpha Drugs - Antibiotics - Uses of Penicillin, Chloramphenicol and Streptomycin - Drug Abuse and Their Implication - Alcohol – LSD.

5.2 Anaesthetics - General and Local Anaesthetics - Antiseptics - Examples and their Applications - Definition and One Example each for Analgesics, Antipyretics, Tranquilizers, Sedatives - Causes, Symptoms and Treatment of Diabetes, Cancer and AIDS.

5.3 Electrochemical Corrosion and its Prevention – Electroplating – Applications.

ALLIED PRACTICAL

CHEMISTRY

VOLUMETRIC ANALYSIS

1. Estimation of HCl – Standard sulphuric acid.
2. Estimation of Borax - Standard Sodium Carbonate.
3. Estimation of NaOH – Standard Oxalic Acid.
4. Estimation of FeSO₄ – Standard FAS.
5. Estimation of Oxalic acid – Standard FeSO₄.
6. Estimation of FAS – Standard Oxalic Acid.
7. Estimation of Oxalic acid – Standard Oxalic Acid.
8. Estimation of Fe²⁺ using Diphenylamine / N- Phenyl Anthranilic acid as indicator.

ORGANIC ANALYSIS

Systematic Analysis of Organic Compounds containing One Functional Group and Characterisation by Confirmatory Tests.

Reactions of Aromatic Aldehyde, Carbohydrates, Mono and Dicarboxylic acids,
Phenol, Aromatic Primary Amine, Amide and Diamide.

REFERENCE BOOKS

- ❖ Inorganic Chemistry - P. L. Soni - Sultan Chand (2006).
- ❖ Inorganic Chemistry - B. R.. Puri, L. R. Sharma and K. C. Kallia – Milestone Publications (2013).
- ❖ Selected Topics in Inorganic Chemistry - W. U. Malik, G. D. Tuli and R. D. Madan - S. Chand Publications (2008).
- ❖ Text Book of Inorganic Chemistry – R. Gopalan, Universities Press – 2012.
- ❖ Text Book of Organic Chemistry - P. L. Soni - Sultan Chand & Sons - 2007.
- ❖ Advanced Organic Chemistry - Bahl and Arun Bahl - Sultan Chand and Co. Ltd – 2012.
- ❖ Organic Reaction Mechanisms - Gurdeep Chatwal- Himalaya Publishing House.
- ❖ A Text Book of Organic Chemistry K. S. Tewari, N. K. Vishol, S. N. Mehrotra-Vikas Publishing House – 2011.
- ❖ Principles of Physical Chemistry - B. R. Puri, Sharma and Madan S. Pathania, Vishal Publishing Company – 2013.
- ❖ Text Book of Physical Chemistry - P. L. Soni, O. P. Dharmarha and U. N. Dash - Sultan Chand & Co – 2006.
- ❖ Understanding Chemistry – C. N. R. Rao, Universities Press – 2011.

SKILL BASED SUBJECT PAPER - 2

MUSHROOM CULTIVATION

Course Objectives :

- ❖ To strengthen the promotion of mushroom cultivation practices.
- ❖ To understand the techniques involved in the cultivation of edible mushrooms.
- ❖ To study the different preparation in pure culture methods.
- ❖ To create awareness the production and consumption of mushrooms.
- ❖ To explain the food types prepared from mushrooms and export value.

UNIT - I

Introduction - history - scope of edible mushroom cultivation - Types of edible mushrooms available in India - temperate mushroom, sub-tropical mushroom and tropical mushroom. Detail study of *Pleurotus citrinopileatus*, *Agaricus bisporus*.

UNIT - II

Pure culture - preparation of medium (PDA and Oatmeal agar medium) sterilization - preparation of test tube slants to store mother culture – culturing of *Pleurotus* mycelium on Petri plates, preparation of mother spawn in saline bottle and polypropylene bag and their multiplication.

UNIT - III

Cultivation Technology : Infrastructure: substrates (locally available) Polythene bag, vessels, Inoculation hood, inoculation loop, low cost stove, sieves, culture rack, mushroom unit (Thatched house), water sprayer, tray, small polythene bag. Mushroom bed preparation - paddy straw, sugarcane trash. Factors affecting the mushroom bed preparation - Low cost technology.

UNIT - IV

Storage and nutrition: Short-term storage (Refrigeration - upto 24 hours) Long term Storage (canning, pickles, papads), drying, storage in salt solutions. Nutritional value of Proteins and amino acids, mineral elements - Carbohydrates, Crude fibre content - Vitamins. Medicinal values of mushrooms

UNIT - V

Food Preparation: Types of foods prepared from mushroom; Soup, Cutlet, Omelets, Samosa, Pickles, Curry. Value added products of mushroom. – mushroom soup powder, mushroom biscuit, mushroom nuggets, mushroom ketchup, candy, murabba, chips etc.,. Research Centers - National level and Regional level. Cost benefit ratio - Marketing in India and abroad, Export Value.

Text Books:

Unit - I: Marimuthu, T, Krishnamoorthy, AS, Sivaprakasam, K. and Jayarajan. R (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.

Unit - II: Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and

Publishing Co. Ltd., Bangalore.

Unit - III: Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi

Unit - IV: Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition, Vol. I & Vol.II.

Unit - V: Manjit singh, Bhuvnesh vijay, Shwet kamal, GC Wakchaure (Eds.) (2011).

Mushrooms - cultivation, marketing and consumption. Directorate of
Mushroom research, ICAR, Chambaghat, Solan , HP-173213.

Reference Items: books, Journal:

1. Manjit singh, Bhuvnesh vijay, Shwet kamal, GC Wakchaure (Eds.) (2011) Mushrooms - cultivation, marketing and consumption. Directorate of Mushroom research, ICAR, Chambaghat, Solan , HP-173213.
2. Marimuthu, T, Krishnamoorthy, AS, Sivaprakasam, K. and Jayarajan. R (1991). Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.

E- Materials:

https://www.academia.edu/11324578/Mushroom_Production_and_Processing_Teaching_Note
<https://www.agrimoon.com/mushroom-culture-horticulture-icar-pdf-book/>

Course Out Comes :

1. To gain knowledge about edible mushrooms
2. To state the culture and methods of edible mushrooms
3. To know the cultivation technology and their factors affecting the mushrooms.
4. To state the different process of storing , nutrition and medicinal values of mushrooms
5. To understand the food preservation and processing techniques.

NON MAJOR ELECTIVE

PAPER - 2

HORTICULTURE

Course Objectives :

- ❖ To promote the profession of Horticulture and the professionalism of those working in the industry.
- ❖ To act as an authoritative body; consulting with Government and other policy making bodies on matters of interest or concern to professional horticulturists
- ❖ To confer recognized status upon professionally qualified and experienced horticulturists.
- ❖ To promote educational and training opportunities and encourage the development of all disciplines within horticulture
- ❖ To improving the environment

UNIT- I

Importance and scope of Horticulture. Types of Gardens – Public Garden, Kitchen Garden, Indoor Garden – Potted Plants, Hanging Baskets, Cut Flowers, Bonsai, Hydroponics and Soilless Production. Garden Components - lawn, trees, shrubs, climbers and creepers, flower beds and borders, hedge and edges, paths, rockery, Water garden and Topiary.

UNIT - II

Plant Propagation Methods – Cutting, Layering, Grafting, Budding, Stock – Scion Relationship. Use of Plant Hormones in Plant Propagation.

UNIT - III

Manures, Role, advantages and disadvantages of important types of fertilizers. Time and Application of Manures, Fertilizers and Plant Regulators. Foliar application of Nutrients. Drip irrigation – Fertigation.

UNIT - IV

Cultivation of Vegetables – Brinjal, Tomato and Onion. Cultivation of Fruits – Banana, Mango and Apple. Cultivation of Flowers – Jasmine, Rose and Orchid. Cultivation of Medicinal Plants – Nilavembu, Sarpagandha and Pepper. Organic Cultivation. Green House – Cultivation of Vegetables, Fruits and Flowers.

UNIT - V

Plant Protection and Weed control. General account of insecticides, fungicides, Pesticides and Biocontrol. Common Diseases of Fruits and Vegetable crops (Apple Scab, Blight of Potato and Bunchy top of Banana)

Text Books

Unit - I: Bose T.K. & Yadaw, C.P. (1989) commercial flowers, naya prokash Calcutta - India.

Unit - II: Edmond. J.B. Senn. T.L. Andrews - F.S. and Halfacre. R.G. (1988) Fundamental of Horticulture, Tata MacGraw - Hill Publishing Company Ltd., New Delhi-110 006.

Unit - III: Bose. T.K. and Mukerijee. D (1987 Gardening in India, Oxford Book house, 66, Janapath, New Delhi-110 001.

Unit - IV: Prasad. S and Kumar U. (1999) Principal of Horticulture, Agrobotanica, 4E/176 J.N. Vyasnagar, Bikaner, India-334 003.

Unit - V: Chardha K.C. & Pareek (1993) Advance in Horticulture, Vol: 1 - XII Malhotra Publishing House, New Delhi – India.

Reference Items: books, Journal:

1. Prasad. S and Kumar U. (1999) Principal of Horticulture, Agrobotanica, 4E/176 J.N. Vyasnagar, Bikaner, India-334 003.
2. Edmond. J.B. Senn. T.L. Andrews - F.S. and Halfacre. R.G. (1988) Fundamental of Horticulture, Tata MacGraw - Hill Publishing Company Ltd., New Delhi-110 006.

E- Materials:

<http://ecoursesonline.iasri.res.in/course/index.php?categoryid=89>

Course Out Comes :

1. To increase food and ornamental plant production
2. To providing employment, often in rural areas
3. To improving the environment and management
4. To creating and managing valuable sports and recreation facilities as one of the main leisure pursuits - gardening
5. To gain knowledge of growth regulators, promoters and common diseases of horticultural crops.

SEMESTER V

CORE PAPER-5

ANATOMY AND EMBRYOLOGY OF ANGIOSPERMS

Course Objectives :

- ❖ To study the basis of tissues in plants
- ❖ To knowledge the complex tissues and stomata types
- ❖ To understand various aspects of anatomical features of plants.
- ❖ To create knowledge of structure and development of anther, male and female gametophytes
- ❖ To study of pollination, types of endosperm and polyembryony.

UNIT - I

Meristems: Classification, distribution, structure and function. Shoot apex and Root apex organization. Theories: Histogen, Tunica – Corpus and quiescent center. Simple permanent tissues: Parenchyma, Collenchyma, Sclerenchyma. (Fibers and Sclereids)

UNIT - II

Complex tissues: Xylem – Tracheids, Vessels, Xylem fibres and Xylem parenchyma. Secondary Xylem, Annual rings, Heart wood and Sap wood, Tyloses. Phloem: Sieve elements, companion cells, phloem fibre and phloem parenchyma. Secondary phloem. Stomatal types: Anomocytic, Anisocytic, Paracytic, Diacytic and Graminaceous. Trichomes- Types.

UNIT - III

Nodal anatomy – Uni, tri and multilacunar node. Primary and secondary structure of Dicot Stem & Root. Anomalous secondary growth in stems of *Bignonia*, *Nyctanthes*, *Dracaena*. Primary structure of monocot stem and root. Structure of Dicot and Monocot leaf.

UNIT - IV

Structure and development of Anther. Development of male gametophyte. Types of ovules. Nucellus. Development of Female gametophyte: Monosporic (*Polygonum*).

UNIT - V

A brief account on pollination, Fertilization, Double fertilization and Triple fusion. Endosperm: Nuclear, Cellular, Helobial and Ruminant. Endosperm haustoria. Development of Embryo in Dicot (*Capsella-bursa pastoris*). Polyembryony.

Text Books:

Unit - I: ESAU, Plant Anatomy, 1965 Wiles Eastern, New Delhi.

Unit - II: Eams A.J. and Mac Daniel. An Introduction to Plant Anatomy. TMH Edition. Tata MC. Graw Hill Publishing Co.ltd. Bombay - New Delhi.

Unit - III: Pandey, B.P. 1979. Plant Anatomy. S. Chand & Co, Ram Nagar, New Delhi.

Unit - IV: Singh.V., P.C. Pandey and D.K.Jain. 2003. Embryology of Angiosperms. Rastogi Publications. Meerut.

Unit - V: Bhatnagar,SP, Dantu P.K, Bhojwani SS (2014) The Embryology of Angiosperms 6th edition Vikas Publishing House. Delhi

Reference Items: books, Journal:

1. Bhojwani, S.S. and Bhatnagar, S.P. (2011). The Embryology of Angiosperms, 5th Edition, Vikas Publishing House. Delhi.
2. Pandey, AK (2000). Introduction to Embryology of Angiosperms 1st Edition :CBS; New Delhi
3. Maheswari, P.(1976). An introduction to the Embryology of Angiosperms.TATA McGraw-Hill Publishing Co., Ltd., New Delhi.
4. Johri, B.M. I (1984). Embryology of Angiosperms, Springer-Verlag
5. Swamy ,B.G.L and Krishnamurthy ,K.V From flower to fruit .Tata McGraw Hill Co.Pvt. Ltd, New Delhi
6. Davis, G.L. (1966). Systematic Embryology of the Angiosperms.
7. Bhojwani, S.S. and Bhatnagar, S.P. 1981. Embryology of angiosperms. Vikas Publication Pvt.Ltd. New Delhi.

E- Materials:

<http://www-plb.ucdavis.edu/courses/bis/1c/text/Chapter25nf.pdf>

https://archive.org/stream/introductiontoem00mahe/introductiontoem00mahe_djvu.txt

Course Out Comes :

1. To learn the structure and function, types of simple tissues.
2. To have knowledge on complex tissues and stomata types
3. Gathering knowledge of nodal anatomy and internal structures of primary and secondary growth.
4. To know the male and female gametophytes
5. To explain the types of endosperm and development of embryo.

CORE PAPER-6**MORPHOLOGY, TAXONOMY OF ANGIOSPERMS AND
ECONOMIC BOTANY****Course Objectives :**

- ❖ To study the morphological features of vegetation and types of inflorescence.
- ❖ To understand the characters of androecium, gynoecium, fruits and seeds.
- ❖ To impart knowledge on botanical nomenclature, merits and demerits of systems of classification
- ❖ To learn systematic selected families of the plants.
- ❖ To gather knowledge on the economically important plants.

UNIT - I

Morphology – Root System - Modification of Roots, Shoot System - Modification of Stem, Leaf – Structure of a Leaf, Phyllotaxy, Leaf shape, leaf margin, leaf venation, types of leaves, Inflorescence – Types of inflorescence, Flower parts, symmetry, position of the ovary, Prianth - calyx, corolla, forms of corolla, Aestivation.

UNIT - II

Androecium – attachment of anthers, dehiscence of anthers, union of Stamens, length of stamens and Pollen, Gynoecium – Types, Placentation, Ovule types. Types of Pollination. Fruits types, Dispersal of Fruits and seeds.

UNIT - III

Aims and significance of Taxonomy, ICBN principles.- Author citation, Type concept, Brief knowledge about Botanical Survey of India (BSI), Brief study on herbarium techniques, Chemotaxonomy, Numerical taxonomy and Molecular Taxonomy. Outline and classification of Bentham and Hooker (Natural), Linnaeus(Artificial).

UNIT - IV

Detailed study of the following families with special features and economic importance of Annonaceae, Capparidaceae, Tiliaceae, Rutaceae, Caesalpinaceae, Oleaceae, Asclepiadaceae, Convolvulaceae, Verbenaceae, Nyctaginaceae, Amaranthaceae, Liliaceae and Poaceae.

UNIT - V

Brief study of the following economic products with special reference to the Botanical name, family, morphology and useful part and also the uses of the following commercial products. Cereals –Wheat and Ragi, Pulses – Green gram and Bengal gram, Spices–Cardamom and Pepper, Oils- Sesame and Groundnut, Dyes – Saffron and Indigo, Fibres – Cotton, Resins & Gum– Canada balsam and Turpentine.

Text Books

Unit - I: Lawrence, GHM. (1995). The Taxonomy of vascular Plants (Vol I-IV) ,Central Book, Dept., Allahabad

Unit - II: Pandey, B.P.(1997).Taxonomy of Angiosperms , S.Chand & Co., New Delhi.

Unit - III: Singh, V. & Jain, K.K. (1989). Taxonomy of Angiosperms – Rastogi, Meerut

Unit - IV: Sharma, O.P. (1996). Plant Taxonomy. TATA McGraw Hill, New Delhi Gurcharan Singh Plants Systematics 3 edition

Unit - V: Vashista, P.C. (1990). Taxonomy of Angiosperms S. Chand & Co.,New Delhi.

Reference Items: books, Journal:

1. Hutchinson, J. (1973). The Families of Floweing plants , Oxford University press, London.
2. Gamble,J.S , Fisher,L.E.F .(1967). The Flora of The presidency of madras (Vol- III) BSI, Calcutta
3. Davis , P.H and Heywood ,V.M. (1965). Principles of Angiosperm Taxonomy, Oliver and Boyd

Edinburgh

4. Simpson M.G.(2006). Plant systematics, Elsevier Academic Press,USA
5. Takhtajan, A.L. (1969). Flowering Plants – Origin and dispersal – Oliver & Boyd
6. Gangulee H.C ., Das ,K.S and Datta C.T (1964) college Botany –Vol I , basant Panchami ,Calcutta
7. Narayanaswamy R.V and Rao ,K.N (1976) . Outline of botany. S .Viswanthan printer and publisher ,Chennai

E- Materials

<http://webapp1.dlib.indiana.edu/inauthors/view?docId=VAC0868&doc.view=print>
<http://www.auburn.edu/academic/classes/biol/1030/rajamani/topic7%20BIOL1030NR.pdf>
<https://www.eeob.iastate.edu/classes/bio366/notes.html>

Course Out Comes:

1. Graduates will easily identify common and economically important plants.
2. To knowledge about special features and economically important plants.
3. To acquire knowledge on significance of taxonomy and herbarium technique.
4. To provide information pertaining to fruits and seed characters.
5. To understand the key aspects of morphology.

CORE PAPER-7

GENETICS, PLANT BREEDING, EVOLUTION AND BIOSTATISTICS

Course Objectives :

- ❖ To study Mendel's inheritance.

- ❖ To understand recombination of chromosomes, determination and inheritance in plants.
- ❖ To study the structure and functions of genes and their various units.
- ❖ To provide information on methods and role of crop improvements in plant breeding.
- ❖ To impart knowledge on mechanism of evolution and biostatistics

UNIT - I

Mono hybrid and Dihybrid Cross, test cross, back cross, Mendel's Laws. Deviation from Mendelian ratio – incomplete dominance, lethal factor, complementary factor, supplementary factor, duplicate, epistasis and inhibitory factor. Polygenic inheritance – Inheritance of Wheat Kernal and hair length in Maize.

UNIT - II

Linkage – Crossing over and recombination. Gene Mapping, Chromosome theory of inheritance. Sex determination in plants, Sex Linked Inheritance- Types, sex linked diseases- hemophilia, colour blindness, Sex limited Genes. Extra nuclear inheritance - male sterility in corn, population genetics, Hardy - Weinbergs principles.

UNIT - III

Gene concept: Biochemical mutant in *Neurospora*, split gene, exon, intron, cistron, recon, muton, gene regulation, operon concept, control system in lac, (lac operons), gene expression in eukaryotes.

UNIT - IV

Plant Breeding: Objectives, Plant introduction, selection, hybridization techniques, Hybrid Vigor, heterosis, Interspecific and intergeneric. Polyploidy and its applications in plant breeding. Breeding for crop improvement for paddy, *Gajanus gajan* and Sugarcane.

UNIT - V

Evolution: Origin of life, Evolutionary theories of Lamarck, Drawin, De Vries, Modern synthetic theory of evolution.

Biostatistics: Mean, median, mode and standard deviations.

Text Books

Unit - I: Gupta, P.K, 2000. Genetics. Rasatogi publications, Meerut.

Unit - II: Vijendra Das, L.D. 2005. Genetics and Plant Breeding, New Age International (P) Ltd., New Delhi.

Unit - III: Strickberger, M.W (1999). Genetics. Prentice Hall of India Pvt Ltd. New Delhi

Unit - IV: Singh, B.D. 2005. Plant Breeding, Principles and Methods. Kalyani Publications, New Delhi

Unit - V: Mandal & Nambiar : Agricultural Statistics, Agrobios Publications, Jodhpur.

Reference Items: books, Journal:

1. Gunther S. Stent, 1986, Molecular Genetics, Macmillan Publishing Co,
2. Karp, G (1995) Cell and Molecular Biology, John Wiley and Sons, New York
3. Lewin (2007). Gene IX. Jones and Barlett Pub.
4. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons Inc., India. .
5. Meyyan RP (2000) genetics, Saras Publication, Nagercoil.

E- Materials:

<http://ecoursesonline.iasri.res.in/course/view.php?id=134>

<https://www.southalabama.edu/geology/haywick/GY112/112lect41.pdf>

<http://www.auburn.edu/academic/classes/biol/1020/bowling/lecturenotes/chapter22activity.pdf>

<https://www.ohio.edu/plantbio/staff/showalte/PBIO%203300%20&%205300/>

Course Out Comes :

1. To apply basic principles of genetics and Mendel's inheritance.
2. To understand the recombination and chromosome theory of inheritance and sex Determination.
3. To explain the importance of gene concepts and gene expression in plant cell.
4. To state the improvement of crop plants and describe the basic principles of hybrid vigor.
5. To know the theory of evolution and biostatistics problems.

**INTERNAL ELECTIVE
PAPER - 1
(to choose one out of 3)**

A. TISSUE CULTURE

Course Objectives :

- ❖ To incubate the basics principles and cell differentiate of plant tissue culture.
- ❖ To study the sterilization, plant cell culture methods and culture media.
- ❖ To understand the various culture techniques and their morphogenesis.

- ❖ To assess the process of seeds and various tools and techniques of culture methods.
- ❖ To trace the crop improvements and gene transfer technology in plant tissue culture.

UNIT - I

History of plant tissue culture research - Basic principles of plant tissue - Totipotency of cells, differentiation, dedifferentiation and redifferentiation.

UNIT - II

Methodology - Sterilization (physical and chemical methods), Plant cell culture methods, Culture media MS and B5, Phytohormones, Callus induction

UNIT - III

Organ culture, Shoot tip Culture, Apical Meristem culture, Ovary Culture, Ovule Culture, Endosperm Culture, Embryo culture – application of Embryo rescue technique. Callus subculture maintenance, Metabolic patterns in callus culture, Harvesting and measurements, Morphogenesis in callus culture.

UNIT - IV

Synthetic Seeds – Limitation of synthetic seeds, production of synthetic seeds, artificial seeds, use of artificial seeds (Commercial production and Uses) Protoplast isolation and purification and culture, media (F5- Medium Frearson et. Al. 1973 Nagata and Takeba 1971, Modified B5 Medium), Methods of isolation (Enzymatic Isolation), Isolation from leaves, shoot and root apex, root storage organs, Pollen grain etc, Protoplast fusion.

UNIT - V

Tissue culture and crop improvement - Agro bacterium mediated gene transfer technology - microinjection - particle bombardment; Bioreactors in plant tissue culture.

Text Books:

Unit - I: Kalyankumar De (2008). Plant tissue culture. New Central Book Agency, Calcutta.

Unit - II: Sathyanarayana BN and Vergheese DB (2000). Plant tissue culture - Practices and new experimental protocols, ILK Publ. New Delhi.

Unit - III: Bhojwani, SS. and Razdan, MK. (2004). Plant Tissue Culture, Read Elsevier India Pvt.Ltd.

Unit - IV: Islam, AS (1996). Plant tissue culture. Oxford & IBH Publ.

Unit - V: Purohit SS (2010). Plant tissue culture, Student edition, Jodhpur

Reference Items: books, Journal:

1. Dubey, R.C., (2001). A text book of biotechnology. S. Chand & Co., New Delhi.
2. Gupta, P.K. (1994). Elements of Biotechnology. Rastogi Publications, Meerut.
3. Ignacimuthu, S.J.(2003). Plant Biotechnology. Oxford & IBH Publishing, New Delhi.
4. John Jothi Prakash, E. (2005). Outlines of Plant Biotechnology. Emkay Publishers, New Delhi.
5. Dix, PJ (1990). Plant cell line and selection. VCH Publ.
6. Hammond, J.C. McGarvey and V. Yusibov, (2009). Plant Biotechnology, Springer Verlag. New York.

E- Materials:

<https://nptel.ac.in/courses/102/106/102106080/>

Course Out Comes :

1. To gain knowledge about principles, to tipotancy of cell and differentiation in plant tissue culture.
2. To acquire knowledge on physical and chemical methods and media.
3. To impart knowledge about the various aspects of tissue culture and their applications.
4. Employ various techniques in seeds and to describe the methods, isolation and purification of tissue culture
5. To gain information about tissue culture and gene transfer techniques.

INTERNAL ELECTIVE

PAPER - 1

B. MASS CULTIVATION OF ALGAE

Course Objectives :

- ❖ To study of morphology and history of mass culture.
- ❖ To understand the values of algal plants.
- ❖ To know the various marine macroalgae.
- ❖ To gain information of economic importance of algae.
- ❖ To know the method of preparation and application of biodiesel.

UNIT - I

Morphology, life history and mass culture of microalgae: *Spirulina*, *Chlorella*, *Dunaliella*, *Haematococcus* and *Botryococcus*.

UNIT - II

High value products - SCP, phycocyanin, β -carotene, astaxanthin – biofuel, media composition - scale up - lab to land - raceway ponds, photobioreactor.

UNIT - III

Marine macroalgae: Morphology, life history and mass cultivation of *Hypnea*, *Gracilaria*, *Gelidiella*, *Kappaphycus*, *Porphyra*, *Laminaria*, *Enteromorpha*, *Ulva* and *Sargassum*.

UNIT - IV

Polysaccharides - agar, carrageen, alginate. economic importance - seaweed as food, feed, Environment Impact Assessment of algal cultivation.

UNIT - V

Liquid seaweed fertilizer: Method of preparation and application. Biodiesel from algae: algae producing biodiesel; Advantages over other sources of biodiesel.

Text Books:

Unit - I: BARSANTI, LAURA AND PAOLO GUALTIERI 2005 *Algae-Anatomy, Biochemistry and Biotechnology*. Taylor & Francis, London, New York.

Unit - II: BECKER, E.W. 1994 *Microalgae-Biotechnology and microbiology*. Cambridge University Press.

Unit - III: CHANDRAMOHAN, D. 2007. Prospects of Biodiesel from marine microorganisms. Proceedings of the National Workshop on BIODIESEL, Organised by School of Energy, Environment & Natural Resources, Madurai Kamaraj University, Madurai and Ahimsa Agri division, Chennai, 17th and 18th October, 2007.

Unit - IV: TRIVEDI, P.C. 2001 *Algal Biotechnology*. Pointer publishers, Jaipur, India.

Unit - V: VENKATARAMAN, L.V. AND E.W. BECKER 1985. *Biotechnology and Utilization of Algae – The Indian Experience*. Dept. Science and Technology, New Delhi and Central Food Research Institute, Mysore, India.

Reference Items: books, Journal:

1. BECKER, E.W. 1994 *Microalgae-Biotechnology and microbiology*. Cambridge University Press.
2. BARSANTI, LAURA AND PAOLO GUALTIERI 2005 *Algae-Anatomy, Biochemistry and Biotechnology*. Taylor & Francis, London, New York.

Course Out Comes:

1. To study of morphology and history of mass culture.
2. To understand the values of algal plants.
3. To know the various marine macroalgae.
4. To gain information of economic importance of algae.

5. To know the method of preparation and application of biodiesel.

**INTERNAL ELECTIVE
PAPER - 1**

C. BIOSAFETY AND BIOETHICS

Course Objectives:

1. To understand the need of biosafety
2. To understand the guidelines and policies of biosafety
3. To have knowledge about patenting
4. To have knowledge about ethics in scientific development.

UNIT - I

Biosafety Introduction- Historical perspective, objectives, Introduction to the concept of containment level, health hazards concerning biotechnology, risk assessment in biotechnological research, physical and biological contaminants, bio-safety concerns at the level of individuals, institutions, society, region, country and world with special emphasis on Indian concerns. Biosafety levels for plant and microbial research.

UNIT - II

Biosafety Guidelines– Operation of biosafety guidelines and regulations of Government of India; Definition of GMOs & LMOs. Roles of Institutional Biosafety Committee, RCGM, GEAC etc. for GMO applications in food and agriculture. Environmental release of GMOs - Risk - Analysis, Assessment, management and communication. Laboratory biosafety Guidelines.

UNIT - III

Intellectual Property Right - Introduction , definition and types, patent, copyright, trademarks, design registration, trade secret, geographical indicators - International position, multilateral treaties, national level, Indian position; plant variety protection. Rights of Plant Breeders, farmers and researchers, advantage and limitations of IPRs. Introduction to IPR, WTO, GATT, TRIPS, WIPO – Establishment and function.

UNIT - IV

Patents and patent processing: Introduction, Objectives of the patent system - Basic, principles and general requirements of patent law. Essential requirements, International scenario of patents, patenting of biological materials, Patent application, Procedures and granting, protection of biotechnological inventions, Patent Act (1970), Patent (Amendments) Act (2002). Patenting in India: Indian patent act.

UNIT - V

Bioethics: Introduction, Ethical issues related to biotechnology, legal and socioeconomic impacts of biotechnology, Ethical concerns of gene cloning, hazards of environmental engineering, Ethical issues in Human Cloning and stem cell research. National & International issues on Genetic modification & recombinant DNA technologies, Human embryonic cloning & stem cell research, transgenic plants and animals.

Text Books:

1. H.K.Das (2007). Text book of biotechnology 3rd Edition, Ailey India Private Ltd.,
2. Diane O. Fleming and Debra L. Hunt (2006) Biological Safety: Principles And Practices 4th Edition,ASM Press, American Society of Microbiology, Washington.
3. Dawn P. Wooley; Karen B. Byers (2017). Biological Safety: Principles and Practices, 5th Edition, ASM Press, Washington, DC, USA.
3. Rajmohan Joshi , (2006). Biosafety and Bioethics. Gyan Publishing House, Delhi
4. Deepa Goel and Shomini Parashar IPR, Biosafety and Bioethics 1st Edition, Pearson Publications, New Delhi.

Reference Items:

1. Senthil Kumar Sadasivam and Mohammed Jaabir M. S. (2008). IPR, Biosafety and Biotechnology Management, Jasen Publications, India.
2. Singh BD. (2007). Biotechnology: Expanding Horizon. Kalyani Publisher, New Delhi.
3. Beier F.K, Crespi R.S and Straus T. (1985). Biotechnology and Patent protection, Oxford and IBH Publishing Co. New Delhi.
4. Jeffrey M. Gimble, (2004). Academia to Biotechnology, Elsevier Academic Press.
5. Rajmohan Joshi (Ed.). (2006). Biosafety and Bioethics. Isha Books, Delhi.
6. Fleming, D.A., Hunt, D.L., (2000). Biotechnology and Safety Assessment (3rd Ed) Academic press.
7. Sibley (1994) Law and Strategy of biotechnological patents. Butterworth publication.
8. Ganguli (2001) Intellectual property rights- -Tat McGrawhill.
9. Thomas, J.A., Fuch, R.L. (2002). Biotechnology and safety Assessment (3rd Ed) Academic press

E- Materials:

Biological Safety: Principles and Practices –December-2001-ResearchGate

Course Out Comes :

1. To know what is biosafety and its importance.
2. To know about various organizations involved in biosafety and guidelines of biosafety.
3. To Intellectual property rights.
4. To understand the process of patenting.
5. To completely understand ethics involved biological research and its importance.

SKILL BASED SUBJECT PAPER - 3

ETHNO BOTANY AND HERBAL MEDICINES

Course Objectives:

- ❖ To study of traditional values in plant parts
- ❖ To know the different systems of phytomedicines.
- ❖ To identify the pharmacognostic studies of crude drugs.

- ❖ To be familiarize the pharmacological analysis and utilization.
- ❖ To knowledge the importance of herbal medicines.

UNIT - I

Ethnobotany-Introduction, history, scope and importance. Tribes of Tamil Nadu and their relevance in ethno medicine. Erosion of traditional cultures related to ethno medicine. Wild medicinal plants of Tamil Nadu a general account. Different types of crude drugs (based on origin, application and purpose / use). Potential medicinal plants of Tamil Nadu and their therapeutic values. Importance of Ethnomedicine in the establishment of alternative medicine.

UNIT - II

Phytomedicine and other systems of medicine - Different systems of indigenous medicine (Traditional Medicine, Ayurveda, Siddha, Unani) Homeopathy and Allopathy. Role of Phytomedicine in modern systems of medicine.

UNIT - III

Pharmacognostic studies of crude drugs - Introduction, history, scope and applications of Pharmacognosy. Phytopharmacy: constitution, identification of different constituents; Classification of drugs; analytical methods-drug adulteration, drug evaluation, anatomical and phytochemical analysis of crude drugs: preliminary screening, fractionation and separation of different groups of biodynamic compounds and biological evaluation

UNIT - IV

Pharmacological analysis and utilisation - Ethno pharmacology, phytopharmacology, dosimetry and administration of drugs; Phytopharmaceuticals: Drugs of alkaloids, volatile oils, tannins, resins and gums. Natural pesticides, antibiotics, allergens and poisonous plants. Potential drug yielding plants and their marketing avenues. Intellectual Property Rights and patenting of active principles.

UNIT - V

Herbal Medicine - Scope and Importance of Medicinal Plants. Indigenous Medicinal Sciences. Ethnomedicinal plant Gardens. Important medicinal plants and their uses. Folk medicines of ethnobotany, ethnomedicine, ethnoecology, ethnic communities of India. Application of natural products to certain diseases- Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases.

Text Books:

Unit - I: Cotton, CM. 1996. *Ethnobotany: principles and applications*.

Unit - II: Dey, A.C.1988. *Indian Medicinal Plants and Ayurvedic preparations*, Bishen Singh, M. Singh.

Unit - III: Kokate, CK., AP. Purohit & SB. Gokhale. 2000. *Pharmacognosy*. NiraliPrakashan Publ.

Unit - IV: Trease, GE and WC Evans. 2002. *Pharmacognosy*. Saunders. New York.

Unit - V: Peter B. Kaufman *et al.*, 1999. *Natural Products from Plants*

Reference Items: books, Journal:

1. Gibbs, R.D. 1974. *Chemotaxonomy of flowering plants*. Montreal & London.
2. Kokate,CK, Khandelwal, SB Gokhale 1996. *Practical Pharmacognosy*. NiraliPrakashan, Pune.
3. Manitto, P. 1981. *The biosynthesis of natural products*. Ellis Horwood, Chichester.
4. Martin, G.J. 1996. *Ethnobotany. A methods manual*. Chapman&Hall. London
5. Ramachandran, S.P. 1991. *Recent Advances in Medicinal, aromatic and spice crops*.

E- Materials:

https://www.edouniversity.edu.ng/oer/lecturenotes/economic_botany_and_ethnobotany

Course Out Comes :

1. To study of traditional values in plant parts
2. To know the different systems of phytomedicines.
3. To identify the pharmacognostic studies of crude drugs.
4. To be familiarize the pharmacological analysis and utilization.
5. To knowledge the importance of herbal medicines.

**SEMESTER VI
CORE PAPER - 8**

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

Course Objectives :

- ❖ To learn the mechanism involved in plants.

- ❖ To know the energy production and its utilization in plants.
- ❖ To understand the respiration , growth hormones, germination types and dormancy and fruit ripening in plants.
- ❖ To effort the knowledge on functions of various biomolecules and their metabolism.
- ❖ To provide knowledge of the bio energetic and biological reaction.

UNIT - I

Water uptake, Osmosis, Translocation of water, ascent of sap, transpiration, stomatal physiology, water stress and its significance. Mineral nutrition - micro and macronutrients and their deficiency symptoms. Growth measurement -growth curve. Plant growth regulators: auxins, gibberellins, cytokinins and ethylene, their regulation and application in agriculture. Photoperiodism, vernalization, phytochrome.

UNIT - II

Photosynthesis - Radiant energy, Absorption spectrum, Action spectrum - structure of Photosynthetic pigments, - Red Drop Phenomena, Enhancement effect. Cyclic and Non - cyclic photophosphorylation, C3 and C4 pathways, photorespiration.

UNIT - III

Classification, structure and Properties of Carbohydrates, Lipids and Proteins.

Enzymes - Properties, Nomenclature and classification as per ECIUB (Enzyme commission of the international Union Biochemistry) - Cofactor - Co - enzymes and factors affecting enzyme action.

UNIT - IV

Respiration - Aerobic, Anaerobic: Glycolysis - Kreb's cycle - Oxidation - Reduction potential - ATP synthesis, bioenergetics - factors affecting respiration. Respiration as an amphibolic process.

UNIT - V

Nitrogen metabolism: sources of nitrogen, role of Nitrogen, Conversion of nitrate to ammonia - assimilation of ammonia. urea cycle, mechanism of biological nitrogen fixation. Protein synthesis and Genetic code.

Text Books:

Unit - I: Gupta, N.K and Gupta, S. 2005. Plant Physiology. Oxford & IBH Publishing Co. Ltd., New Delhi.

Unit - II: Mukherji, S. and Ghosh, A.K. 2005. Plant physiology. New Central Book Agency Ltd. Kolkata

Unit - III: Rastogi, S.C (2003). Outlines of Biochemistry, CBS Publishers & Distributors New Delhi

Unit - IV: Jain J.L. *et al.*, (2008). Fundamentals of Biochemistry, Chand, New Delhi

Unit - V: Satyanaryana U, Chakrapani U, (2006). Biochemistry, Books and Allied (P)Ltd.

Reference Items: books, Journal:

1. Verma, S. K. 1995. A Textbook of Plant Physiology, Biochemistry & Biotechnology. S. Chand & Co.
2. Pandey, S.N and Sinha, B.K. 1989. Plant Physiology, Vikas Pub. House. New Delhi.
3. Jain, V.K. 1988. Fundamentals of Plant Physiology, S.Chand and Co. Ltd., New Delhi.
4. Apps *et al.*, (1992). Biochemistry, ELBS.
5. Caret *et al.*, (1993). Inorganic, Organic and Biological Chemistry, WMC Brown Pub. USA.
6. Nelson D.L, Cox M.M.(2005). Lehninger Principle of Biochemistry, W.H. freeman and Company, New York
7. Rawn, D. (1989). Biochemistry, Neil Patterson.
8. Zuley G.L., (1998). Biochemistry, Wm. C. Brown Publishers USA

E- Materials:

<http://www.uky.edu/~dhild/1/lect.html>

https://www.brainkart.com/subject/Plant-Biochemistry_257/

<https://employees.csbsju.edu/ssaupe/biol327/lecture-home.htm>

<https://www.bialigy.com/10-plant-physiology.html>

Course Out Comes :

1. Understand the various steps involved in the water uptake, minerals nutrition and growth measurement in plants.
2. Gain knowledge in the various process involved in the photosynthesis,
3. Impact knowledge in nitrogen metabolism and respiration.
4. Acquire knowledge on catabolic pathway of metabolites and properties of carbohydrates, protein and lipids.
5. Illustrate the mechanism of enzymes action and enzymatic kinetics.

CORE PAPER - 9

ECOLOGY, PHYTOGEOGRAPHY AND TOXICOLOGY

Course Objectives :

- ❖ To know the biotic and abiotic factors and their vegetation.
- ❖ Learn to concept, components and types of ecosystem.
- ❖ Study the plant communities and stages of plant succession.
- ❖ Know the causes, effects and control measures of pollution and describe the heavy metal toxicity and bioaccumulation.
- ❖ Study the different types of vegetation and forest.

UNIT - I

Biotic and abiotic factors and their influence on vegetation – a brief account of microbes, plants, animals, soil, wind, light, temperature, rainfall and fire. Biogeochemical cycles (Nitrogen, Carbon). Ecosystem – concept, processes and components. Food chain, food web, energy flow, pyramids. Types of ecosystems - fresh water, marine and grassland.

UNIT - II

Autecology and Synecology – Vegetation – Formation, Association, Consociation, Society – development of vegetation. Migration – ecesis, colonization, Methods of study of vegetation (Quadrat and transect). Plant succession – Hydrosere and Xerosere. Morphological and anatomical features of hydrophytes, mesophytes and Xerophytes.

UNIT - III

Pollution -air, water, soil, noise, thermal, radiation and its control. Agricultural pollution, insecticides, pesticides, fungicides, herbicides. Waste water treatment.

UNIT - IV

Phytogeography – principles – vegetation types in India. Tropical rain forest, Sholas and Deciduous Forest – Sand dunes and Mangrove vegetation and Scrubjungle, phytogeographical regions of India.

UNIT - V

Environmental toxicants-classification-occurrence-source-effects on plants. Heavy metal toxicity-lead and chromium-bioaccumulation. Atmospheric toxicants-carbon monoxides, sulphur oxides.

Text Books:

Unit - I: Sharma, P.D (2009). Ecology and Environment, Rastogi Publications.

Unit - II: Shukla, R.S. &P.S. Chandel (1991) :Plant Ecology & Soil Science S.Chand &Co.New Delhi

Unit - III: Vasishta, P.C, 1979 Plant Ecology, Vishal Publication

Unit - IV: Verma, V,A 1981 Text Book of plant Ecology, Emkay Publication.

Unit - V: Sharma, P.D. 1993, Environmental biology and toxicology. Rastogi and co, Meerut.

Reference Items: books, Journal:

1. Cain, S.A . (1944). Foundations of Plant Geography Harper & Brothers, N.Y.
2. Mani, M.S (1974) : Ecology & Biogeography of India Dr. W. Junk Publishers, he Haque
3. Good, R. (1997) : The Geography of flowering Plants (2nd Edn.,) Longmans, Green & Co., Inc., London & Allied Science Publishers, New Delhi- 495ppE- Materials
4. Ambasht R.S., 1978 The Book of Plant Ecology, Students friends Co.
5. Willings W.D. 1964 Plants and Ecosystem, Wasworti Publishing Co.
6. Daubenmire R.F, 1973 Plant and Environment. John Willey.

E- Materials:

<https://www.ohio.edu/plantbio/staff/mccarthy/dendro/ecology.htm>
<https://www.lcps.org/cms/lib4/VA01000195/Centricity/Domain/14721/Ecology%20Notes.pdf>
<http://ib.berkeley.edu/courses/ib168/LectureHandouts/Lecture26.pdf>
<https://www.coursehero.com/file/8469123/PHYTOGEOGRAPHY-Lecture-34/>

Course Out Comes:

1. To understand the aspects of biotic and abiotic factors.
2. To acquire knowledge on ecosystem.
3. To be familiarize with plant communities and ecological adaptations of plant.
4. To know about the hazards of pollution and the importance of environmental toxicants.
5. To gain an insight into the vegetation types and their importance.

CORE PRACTICAL - III

ANATOMY, EMBRYOLOGY, MORPHOLOGY, TAXONOMY, ECONOMIC BOTANY, GENETICS, PLANT BREEDING AND EVOLUTION

Course Objectives :

- ❖ To gain practical knowledge of tissues and internal structures of stem, root and leaves.
- ❖ To familiarize the fertilization, male and female gametophyte developments
- ❖ To know characters of different family plants and its importance.
- ❖ To know gene inheritance and its practical solutions.
- ❖ To knowledge of plant breeding techniques.

ANATOMY

1. Study of simple & Complex tissues (primary and secondary).
2. Study of internal structure of Young and old stem of dicotyledons. Young and Old root of dicotyledons. Normal stem and root of Monocotyledons. Anomolous stem of dicotyledons - *Bignonia*, *Nyctanthes* and Monocotyledons - *Dracaena*.
3. Study of internal structure of Dicot and Monocot leaves.
4. Study of Stomatal types.
5. Nodal Anatomy: uni, tri, and multi lacunar node.

EMBRYOLOGY:

1. T.S. anther at various stages of development (permanent slide)
2. Types of ovule (permanent slide)
3. Male gametophyte, Female Gametophyte.
4. Embryo sac (permanent slide)
5. Stages in the development of dicot and monocot embryos (slide)
6. Mounting of Dicot embryos (Globular, Heart shaped stage)
7. Types of Endosperms (Permanent slide)

REFERENCE BOOKS:

EMBRYOLOGY

1. Bhojwani. S.S. and Bhatnagar. S.P. 1978. The embryology of Angiosperms. Vikes Publishing Pvt. Ltd., Delhi.
2. Maheswari P.1971. An introduction to embryology of Angiosperms Tata Mc Graw Hill, Delhi.
3. Swamy B.G.L. and Krishnamurthy K.V. 1950. From flower to fruit. Tata Mc Graw Hill, New Delhi.

**PRACTICAL:
MORPHOLOGY:**

Morphology study of root, stem, leaf and inflorescence. Fruit types with suitable examples.

TAXONOMY

1. A detailed study of the range of vegetative and floral characters of plants belonging to the families mentioned in the theory part.
2. Submission of 15 herbarium sheet with proper field note book for practical examination.
3. Field trips to places of plant diversity within or outside Tamilnadu with a minimum duration of seven days compulsory for plant collection and also to study the plants in their natural habitats.
4. A brief report of the trip has to be submitted.
5. Economic botany: Cereals, Pulses, Spices, Oils, Dyes, Fibres, Resins & Gum

REFERENCE BOOKS:

MORPHOLOGY:

1. Annie Ragland, 1999. Fundamentals of botany Vol.3. Saras publication.

TAXONOMY:

1. Singh, V. and Jain, D.K - Taxonomy of Angiosperms - Rastogi Publications, Meerut.
2. Pandey, B.P. 2007 Botany for Degree Students. S. Chand & Co. New Delhi.
3. Vasishta, P.C. 1974 Taxonomy of Angiosperms. S. Chand & Co., Chennai.

ECONOMIC BOTANY:

1. Hill AW. 1951 Economic Botany - Mc Graw Hill, New Delhi.
2. Pandey, B.P., Economic Botany, S.Chand & Co., NewDelhi.

GENETICS: PRACTICAL

1. Simple problems on Monohybrid and Dihybrid ratio and interaction of factors.
2. Construction of chromosome maps using three - point test cross data.

PLANT BREEDING

1. Hybridization techniques - Emasculation, Bagging (For demonstration only)

REFERENCES:

1. Gupta, P.K. 2000. Genetics. Rastogi publications. Meerut.
2. Sinnott, E.W; L.C. Dunn and T. Dobzhansky 1958. Principle of genetics. McGraw Hill, Newyork.
3. Verma, P.S and Agarwal. V.K. 2007. Genetics. S. Chand & Co. Chennai.

CORE PRACTICAL - IV

PLANT PHYSIOLOGY AND PLANT BIOCHEMISTRY

Course Objectives :

- ❖ To gain practical knowledge of physiological functions of plant.
- ❖ To know the photosynthesis under different CO₂ concentrations
- ❖ To know fermentation techniques
- ❖ To knowledge of enzymes activity
- ❖ To knowledge of ecological vegetations and phytogeographical regions.

LLIST OF PHYSIOLOGY EXPERIMENTS:

1. Determination of solute potential by plasmolytic method.
2. Colorimetric determination of effect of solvents and temperature on membrane permeability.
3. Separation of plant pigments by paper chromatography.
4. Study the rate of photosynthesis under different light intensities.
5. Study the rate of photosynthesis under different CO₂ concentrations.

6. Determination of respiration rate under different substrates using respiroscope method.

II. LIST OF BIOCHEMISTRY EXPERIMENTS:

1. Preparation of standard graph for KMnO_4 by using colorimetric method.
2. Qualitative test for amino acid and protein.
3. Qualitative test for sugars (Glucose, sucrose & starch)

III. DEMONSTRATION EXPERIMENTS IN PLANT PHYSIOLOGY AND BIOCHEMISTRY:

1. Fermentation experiment.
2. Study of relative rates of transpiration of different plants.
3. Assay of protease or amylase.
4. Test for alkaloid.
5. Induction of roots by auxins.
6. Effect of temperature, pH on enzyme activity.

IV. TOXICOLOGY

1. lead, copper, zinc and chromium

V. ECOLOGY & PHYTOGEOGRAPHY

1. Study of morphological and internal structural adaptations of locally available hydrophytes, xerophytes, mesophytes and epiphytes. Eg. Hydrophyte: Nymphaea, Hydrilla. Xerophytes: Nerium, Casuarina. Mesophytes: Tridax, Vernonia. Epiphytes: Vanda
2. Construction of meter quadrat – to study the percentage of frequency & abundance.
3. Map of phytogeographical regions of India

REFERENCE BOOKS:

1. Bidwell .R.G.S. 1974. Plant Physiology. Macmillan. Publication Co. Newyork.
2. Ting. I.P. 1982 Plant Physiology. Addison Wesley Publication Co. Philippines.
3. Conn. E.E.; P.K. Stumps; G. Brueming and Doi. R.G. 1987. Outlines of Biochemistry. John wiley & Co. Newyork.

INTERNAL ELECTIVE PAPER -2 (to choose one out of 3)

A. PLANT BIOTECHNOLOGY

Course Objectives :

- ❖ To train the students in advanced level of biotechnological principles and genome organization.
- ❖ To study the cloning strategies, gene transfer methods and genetic manipulation in genetic engineering.
- ❖ To understand the methods of transgenic plants and molecular farming.
- ❖ To provide information pertaining to bio sector, metabolites and algal and fungal biomass production.
- ❖ To trace and discuss about the intellectual property rights.

UNIT - I

Introduction to plant Biotechnology, scope; Plant genome organization - chloroplast genome; nucleosome; C-value paradox; TATA box.

UNIT - II

Genetic engineering - Basic principles, Restriction endonucleases; Cloning vectors – plasmids, phages and cosmids, Transposons; Methods of gene transfer –electroporation, viral vectors, particle gun method and microinjection; Ti plasmid mediated transfer –*Agrobacterium tumifaciens*. Genetic manipulation of eukaryotic cells.

UNIT - III

Methodology to develop transgenic plant - herbicides resistance, drought resistance, pests and insects resistance and pathogens resistance. Biocontrol of plant diseases and pest. Molecular farming - edible vaccines; Flavr savr tomato.

UNIT - IV

Plant as a bioreactor, Production of primary and secondary metabolites by plant tissue culture. Algal biotechnology - Algal biomass production and maintenance. Fungal biotechnology - single cell protein production.

UNIT - V

Intellectual property rights – Private public sector issues – Physical property and intellectual property – Farmers rights – Plant breeders' right – trade secrets. Patents – Patenting of biological Materials – patents for higher plants and microbes – Patenting transgenic organisms.

Text Books:

Unit - I: Dubey, RC (2004) A text book of Biotechnology”3rd Edition , S.Chand & Company Ltd, New Delhi.

Unit - II: Gupta, PK.(2004).Elements of Biotechnology”, I st edition Rastogi publications – Meerut

Unit - III: Razdan, MK (2008) Introduction to plant tissue culture” ,2nd edition Oxford & IBH publishing Co. Pvt. Ltd., New Delhi.

Unit - IV: Kumaresan, V(2009) .Biotechnology”, Saras Publications, Nagercoil,

Unit - V: Brown TA (2006) gene cloning and DNA analysis ; Blackwell scientific publishers

Reference Items: books, Journal:

1. Prime rose SB, Twyman RM & old RW (2001) .principle of gene manipulation; an Introduction to genetic engineering. 6th Ed Blackwell oxford
2. Wilson K & walker J (2008) principle and techniques of Biochemistry an dmolecular Biology . Cambridge university Press.
3. Smith JE(2005) Biotechnology , Cambridge university press, UK.

E- Materials:

<https://www.agrimoon.com/principles-of-plant-biotechnology-icar-ecourse-pdf/>

<https://cnx.org/resources/f523305248cf1c5a5e6a320b70d907ff2c73cb4b/PlantBioI-INTRODUCTION.pdf>

http://www.unice.fr/EB/USTH%202013/BP04_introduction_biotechnology_part_1.pdf

Course Out Comes :

1. To learn about genomic organization
2. To know the tools and techniques of genetic engineering
3. To asses the transgenic plant and molecular farming.
4. To gain knowledge about the bioreactor, metabolites by plant tissue culture and describe the microbial biotechnology.
5. To know the intellectual property rights and patenting.

INTERNAL ELECTIVE PAPER -2

B. BIOFERTILIZERS

Course Objectives :

- ❖ To incubate the basics of biofertilizers and their mass cultivation
- ❖ To study the isolation and maintenance of *azospirillum* and *azotobacter*.
- ❖ To understand cyanobacteria association and their factor affecting growth.
- ❖ To study the VAM mycorrhizal association and its influence on growth and yield of crop plants.
- ❖ To improve knowledge of organic farming and their methods.

UNIT - I

General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass cultivation, carrier based inoculants, symbiosis.

UNIT - II

Azospirillum, isolation and mass cultivation – carrier based inoculant, associative effect of different microorganisms. *Azotobacter* – classification, characteristics – crop response to *Azotobacter* inoculum, maintenance and mass cultivation.

UNIT - III

Cyanobacteria (blue green algae), *Azolla* and *Anabaena azolla* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

UNIT - IV

VA-Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

UNIT - V

Organic farming – Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermi composting – field Application.

Text Books:

Unit - I: Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.

Unit - II: Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi.

Unit - III: John Jothi Prakash, E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.

Unit - IV: Sathe, T.V. 2004 Vermiculture and Organic Farming. Daya publishers.

Unit - V: Kumaresan, V. 2005, Biotechnology, Saras Publications, New Delhi.

Reference Items: books, Journal:

1. Vayas,S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming Akta Prakashan, Nadiad.
2. Dubey, R.C., 2005 A Text book of Biotechnology S.Chand & Co, New Delhi.

E- Materials:

<http://eagri.org/eagri50/SSAC222/lec17.pdf>

<http://www.hillagric.ac.in/edu/coa/agronomy/lect/agron-3610/Lecture-12-BINM-Biofertilizers.pdf>

Course Out Comes :

1. To realizes about the microbes used as biofertilizer.
2. To understand the msaa cultivation of *Azospirillum* and *Azotobacter*
3. To gain knowledge on *Azolla* and anabaena association.
4. To knowledge about the VAM-Mycorrhizal types, growth and yield of crop plants.
5. To know about the organic farming and fertilizers.

INTERNAL ELECTIVE PAPER -2

C. POSTHARVEST TECHNOLOGY

Course Objectives :

- ❖ To learn how to maintain quality of fruits and vegetables.
- ❖ To know protect food safety for us
- ❖ To knowledge of reduce losses between harvest and consumption
- ❖ To learn various techniques of postharvest in crop plants.
- ❖ To knowledge of storage techniques in different crops

UNIT - I

Introduction to post harvest technology of agricultural produce; Status of Production, Losses, Need, Scope and Importance. Introduction to various post harvest operations such as Primary Processing Operation Vs. Secondary Operation, Operations like Harvesting, Handling cleaning, grading, sorting, drying, storage, milling, size reduction, expelling, extraction, blending, heat treatment, separation, material handling (transportation, conveying, elevating), washing; their functions and use in the post harvest processing.

UNIT - II

Introduction, importance of drying, principles of drying and factors affecting drying, types of drying methods i.e. sun drying & artificial drying by mechanical means – Psychometric Chart, Moisture content representation, equilibrium moisture content, determination of moisture content by direct and indirect methods.

UNIT - III

Introduction to various grain drying systems - solar drying system, batch drying system, continuous flow drying system. Precautions during drying. Principles and operation of different types of Dryers viz. Deep Bed Dryers, Flat Bed Dryers, Continuous Flow Dryers, L.S.V. Dryers, Spray Dryer, Fluidized Bed Dryers, Rotary Dryer, Spouted Beds, Freeze Dryer, Tray And Tunnel Dryers

UNIT - IV

Introduction, need and importance, general principles of storage. Temperature and moisture changes during storage i.e. influence of moisture content, relative humidity, temperature, fungi etc. on stored product. Fungi, insect and other organism / Infections associated with stored grains. Familiarization with the various types of storage structures. Deep and shallow bins. Traditional and modern storage structures. Management of storage structures. Losses during storage and their control, space requirement of bag storage structure. Types of material conveying Systems. Belt Conveyor, Bucket Elevator, Screw Conveyor, Pneumatic Conveyor.

UNIT - V

Methods of Harvesting and Post harvest losses in fruits and vegetables, Handling of Fruits and Vegetables. Introduction to the storage of fruits and vegetables. Need and importance of storage. Principle of storage of fruits and vegetables. Recommended storage operation conditions for some important fruits and vegetables and their storage life. Post harvest treatment to increase shelf life i.e. freezing, chilling, dehydration, canning, thermal processing. Introduction to Packaging of fruits and vegetables and types of packaging. Concept of modified atmosphere packaging.

Text Books:

Unit - I: K. P. Sudeer and V. Indra. 2007. Post harvest technology of horticultural crops. New India Publishing Agency, New Delhi.

Unit - II: Amalendu Chakraverti, Arun S. Mujumdar, G.S. Vijayaraghavan and Hosahalli S. Ramaswamy. 2003. Handbook of Post Harvest Technology. Mercel-Dekker Inc. USA.

Unit - III: K.K. Balachandran. 2001. Post Harvest Technology of Fish and Fish Products. Daya Publishing House, New Delhi.

Unit - IV: A. Chakraverty. 2019. Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH Publishing Company

Unit - V: P. Jacob John. 2008. A Handbook on Post Harvest Management of Fruits and Vegetables. Daya Publishing House, New Delhi.

Reference Items: books, Journal:

A. Chakraverty. 2019. Post Harvest Technology of Cereals, Pulses and Oilseeds. Oxford & IBH

Publishing Company

E- Materials:

<http://www.fao.org/3/y4358e/y4358e05.htm>

https://casfs.ucsc.edu/documents/Teaching%20Direct%20Marketing/4.7_Harvest_Post-Harvest.pdf

Course Outcomes:

1. To learn how to maintain quality of fruits and vegetables.
2. To know protect food safety for us
3. To knowledge of reduce losses between harvest and consumption
4. To learn various techniques of postharvest in crop plants.
5. To knowledge of storage techniques in different crops

INTERNAL ELECTIVE

PAPER -3

(to choose one out of 3)

A. FERMENTATION TECHNOLOGY

Course Objectives :

- ❖ To impact knowledge of enzymes production.

- ❖ To know the production of distilled beverages liquors
- ❖ To familiarize alcohol production and fermentation methods
- ❖ To study antibiotics-strain improvement for secondary metabolite production
- ❖ To knowledge of principles and practices in fermentation

UNIT - I

Theory and principles of industrial fermentation, Batch, fed-batch and continuous cultures, Microbial growth and product formation kinetics, media formulation and sterilization, isolation, preservation and improvement of industrially important micro-organisms, inoculums development for industrial fermentations, fermenter design, various types of fermenters used in industrial fermentation. Surface, submerged and solid-state fermentation processes. Basic principal of microbial fuel cells and its application.

UNIT - II

Alcohol production: Preparation of medium, Fermentation process and recovery; Production of Malt beverages: Production of Beer-malting process, mashing process and finishing; other malt products. Production of Wine: Microbial process, wine from grapes, Fermentation and recovery, types of wine-white and red wine.

UNIT - III

Production of distilled beverages or liquors-rum, whiskey and brandy; Microbial production of organic acids-vinegar production (substrate, Microbial processing and product recovery); Citric Acid-fermentation, recovery and uses; Lactic acid-fermentation, medium and manufacturing process, recovery and uses.

UNIT - IV

Production of antibiotics-strain improvement for secondary metabolite production; Penicillin-Fermentation and recovery; Tetracycline and Chloramphenicol production; Streptomycin-structure, media composition, production and recovery, Production of Amino acids: L-Lysine production and strain improvement for lysine production; L-glutamic acid production-strain improvement for glutamic acid production and recovery process; Tryptophan production and recovery.

UNIT - V

Production of enzymes: Pectolytic enzymes- Pectinases production, harvest, recovery and uses; Invertase and Lipase production; Cellulase production and recovery; Production of vitamins: VitaminB12 (Cyanocobalamine) production; Riboflavin (vitamin B2) production; Biotransformation of steroids. Algal biomass cultivation, harvesting and extraction of value added compounds. Production of lipids and carbohydrate for production of biodiesel and bioethanol from algal biomass.

Text Books:

Unit - I: A.N. Shukla, Industrial Bioprocess Technology, ISBN: 9789350560303, 9789350560303

Unit - II: Modi H.A. Bioprocess Technology, Pointer Publishers) ISBN: 9788171325924, 9788171325924.

Unit - III: P T Kalaiselvan and I. Arul Pandi. Bioprocess Technology: Volume 1. MJP PUBLISHERS. 9788180940323.

Unit - IV: A.N. Shukla, Advanced Bioprocess Technology. ISBN Number: 978 935056 0273

Unit - V: Stanbury, P.E. and Whitaker A., Principles of Fermentation Technology (1984) Pergamon Press.

Reference Items: books, Journal:

1. Pirt, S.J. Principles of Microbial and Cell Cultivation. Blackwell Scientific Publication, London.

E- Materials:

<http://www.himpub.com/documents/Chapter941.pdf>

Course Out Comes :

1. To knowledge of principles and practices in fermentation
2. To familiarize alcohol production and fermentation methods
3. To know the production of distilled beverages liquors
4. To study antibiotics-strain improvement for secondary metabolite production
5. To impact knowledge of enzymes production.

**INTERNAL ELECTIVE
PAPER -3**

B. COMPUTER APPLICATIONS IN BOTANY

Course Objectives :

- ❖ To learn the basic application of computer and internet.
- ❖ To gain a working knowledge on computer operations and search strategies.

- ❖ To recognize the database and operating skills.
- ❖ To assess the biological database and search engines.
- ❖ To educate the importance and applications of bioinformatics.

UNIT - I

Types of computers, accessories and its functions, input&output devices, concepts of different operation systems, details of Networks, internet & email. Databases types and its uses, fundamentals of digital imaging.

UNIT - II

Introduction to MS - WINDOWS and LINUX, application of MS WORD - word Processing, editing tools (cut, copy, paste), formatting tools. MS EXCEL - creating worksheet, data entry, sorting data. Statistical tools (SUM, MEAN, MEDIAN and MODE). Preparation of graphs and diagrams (Bar diagram, pie chart, line chart, histogram). MS-POWERPOINT - presentation based on a biological topic; inserting tables, charts, pictures. Open source and free alternatives, to MS Office: Libre Office, Open Office (brief study).

UNIT - III

Computer Network (LAN,WAN), DATA-Representation- Number systems- Binary, arithmetic, Organizing information- the database – definition-Data entry indexing – storage – retrieval – Operating systems – WINDOWS 2000, Word Processing software MS-Office. Introduction to DESKTOP PRINTING (DTP).

UNIT - IV

Biological Sequence searching and comparison Softwares (Blast), Search engines: Google.com; GIS Softwares (Google Earth), Meta search engine – Dogpile.com; academic search - Google scholar. Educational sites related to Biological Science – Scitable.

UNIT - V

Introduction to Bioinformatics and its applications, EMBL and GenBank Data libraries, PIR Database, Fundamentals of Geographic Information Systems (GIS) and Remote Sensing and its uses in biology, Information systems – BTIS, ENVIS.

Text Books:

Unit - I: Pradeep K. Sinha and Priti Sinha, 2004. Computer Fundamentals, 6th Edition, PBP Publications, New Delhi- 110002.

Unit - II: Naidu, B. E. V. L., Kavuri Sridhar, Kumar, V. S. N. 2018. Computer Fundamentals and Photoshop, 3rd Edition, Publisher : Pragati Prakashan

Unit - III: Alexis Leon and Mathews Leon, 2008. Introduction to Computers, Vikas Publishing House, New Delhi.

Unit - IV: Rajaraman, V. 2003. Fundamentals of Computers, 4th Edition, Prentice Hall of India

Unit - V: Anita Goel, 2010. Computer Fundamentals. Dorling Kindersley (India) Pvt. Ltd

E- Materials:

<https://faculty.franklin.uga.edu/dhall/sites/faculty.franklin.uga.edu.dhall/files/lec1.pdf>

<http://ocw.jhsph.edu/index.cfm/go/viewCourse/course/MethodsInBiostatisticsI/coursePage/lectureNotes/>

Course Out Comes :

1. Acquisition of working knowledge on computer and surfing the internet.
2. Import knowledge on computer applications
3. Train knowledge on database and operating systems.
4. Employ knowledge on biological sequence search.
5. Study about the biological gene and information systems.

**INTERNAL ELECTIVE
PAPER -3
C. FORESTRY**

Course Objectives :

- ❖ To know increasing forest area and restoring ecological balance
- ❖ To knowledge of controlling of pollution
- ❖ To learn soil erosion
- ❖ To conserve natural water spring
- ❖ To knowledge conserve the wildlife.

UNIT - I

Introduction to Forestry: - Forests; definitions, role, benefits-direct and indirect. History of Forestry-definitions - divisions and interrelationships. Classification of forests- Forest types- Agricultural lands and forests- Agroforestry systems; differences in nutrient cycling, diversity etc.

UNIT - II

Social forestry, joint forest management; programmes and objectives. Important acts and policies related to Indian forests. Global warming; forestry options for mitigation and adaptation- carbon sequestration. Introduction to world forests- Geographical distribution of forests and their classification- Factors influencing world distribution of forests- productivity potential and increment of world forests.

UNIT - III

Forest resources and forestry practices in different regions of the world; Western Europe, North America, Central America, Central Africa, Australia, Russia, Japan, and China. General problems of forest development and economy at national and Tamil Nadu State level.

UNIT - IV

Forest based Industries in developed and developing countries with special reference to India in general and Tamil Nadu in particular. Trade patterns of forest based raw materials. Recent trends in

forestry development in the world. National and international organizations in forestry. Important events/dates related to forests and environment-themes and philosophy.

UNIT - V

Study of families, as survey of trees or woody plant resources: Magnoliaceae, Rhizophoraceae, Ebenaceae, Sapotaceae, Caesalpiniaceae, Santalaceae, Mimosaceae, Elaeagnaceae, Fabaceae, Meliaceae, Lauraceae, Apocynaceae, Moraceae, Tiliaceae, Euphorbiaceae, Pinaceae, Dipterocarpaceae, Guttiferae (Clusiaceae), Myrtaceae, Rubiaceae, Sterculiaceae, Bignoniaceae, Lamiaceae, Cycadaceae and Combretaceae.

Text Books:

Unit - I: Beazley, M. 1981. *The International Book of Forest*. London

Unit - II: Champion and Seth. 1968. *Forest types of India*.

Unit - III: K. C. Sahni. (2000). *the Book of Indian Trees*. Bombay Natural History Society. Mumbai.

Unit - IV: Westoby, J. 1991. *Introduction to World Forestry*. Wiley, 240p

Unit - V: Gurucharan Singh. (2000). *Plant Systematics*. Oxford and IBH Publishing Co. Pvt. Ltd. New

Delhi.

Reference Items: books, Journal:

1. Mather, A.S. 1990. *Global forest resources*. Belhaven, London
2. Persson, R. 1992. *World forest resources*. Periodical experts, New Delhi.
3. Khanna, L.S. 1989. *Principles and Practice of Silviculture*. Khanna Bandhu, New Delhi.
4. M. S. Randhawa. (1957). *Flowering Trees in India*. SreeSaraswati Press Ltd. Kolkatta.
5. N. L. Bor (1990). *Manual of Indian Forest Botany*. Periodical Expert Book Agency. New Delhi.
6. PradipKrishnen (2013). *Jungle Trees of Central India*. Published by Penguin Books India Pvt. Ltd. New Delhi.

E- Materials:

<https://unaab.edu.ng/2009/12/forestry-a-wildlife-management-lecture-notes/>
<http://www.fao.org/3/t3500e/t3500e02.htm>

Course Out Comes :

1. To know increasing forest area and restoring ecological balance
2. To knowledge of controlling of pollution
3. To learn soil erosion
4. To conserve natural water spring
5. To knowledge conserve the wildlife.

SKILL BASED SUBJECT

PAPER - 4

PLANT AND WATER CONSERVATION AND MANAGEMENT

Course Objectives

- ❖ Recognize the natural and human-caused factors that cause plant species to be rare or imperilled, and describe the genetic and ecological implications of rarity in plant species.
- ❖ Evaluate and generate a conservation strategy for a rare or imperilled plant species.
- ❖ Apply ecological and population genetics principles to evaluate the long-term viability of such a plant species.

UNIT - I

Plant diversity- Definition, Importance of plants and importance of plant diversity, biodiversity at global, national (India) and regional levels. Hotspots and mega diversity countries, Biological diversity – Genetic and ecological species concept, classical and modern, inter and intra specific species diversity. Allopatric and sympatric speciation-endemism, relics and paleoendemism. Natural forests and their importance in biodiversity

UNIT - II

Threats to biodiversity - Red Data Book, Endangered and Endemic and extinct species of India, study of plant decline and its causes, invasive species, over collection, overexploitation, inappropriate fire regimes, clearing of vegetation, Inappropriate grazing regimes, fragmentation, habitat loss, natural calamities, effect of degeneration of biodiversity on future of evolution, effects of loss of species on ecosystems

UNIT - III

Plant Conservation - Concept and practices, ex situ conservation, in situ conservation, management of problem species, captive breeding, plant propagation, reestablishment and relocation, habitat conservation, botanical gardens, *wild plant conservation*, *Invasive species control*, reintroductions/habitat restoration, advance technology in service of endangered species,

conservation of plant diversity in seed banks, gene banks or germplasm reserves, Global Strategy for Plant Conservation.

UNIT - IV

Water Conservation Introduction -Definition and aim of water conservation. History of water conservation in India & abroad. Water conservation and management policies, strategies and activities. Water resources in India, their distribution and quality parameters, Sources of water, Hydrology- surface water hydrology, groundwater hydrology (hydrogeology), and marine hydrology. Hydrological cycle- types and importance in water management.

UNIT - V

Methods of Water Conservation - Protection of Water from Pollution, Redistribution of Water, Use of Modern Irrigation Methods – drip, sprinkler and mist irrigation, Elementary knowledge of gully control structures ,drop spillway, drop inlet spillway, chute spillway, check dams and diversion bunds. Grass waterways. Change in Crop Pattern, Role of grasses in water conservation. Role of forestry in water conservation. Watershed Management, Water harvesting and its techniques.

Text Books:

Unit: I, II and III

1. King, A. Cleveland H. and Streatfeild G. 1980. Bio resources for development: The renewable way of life. Pergamon Press, Headington Hill Hall.
2. Ananthkrishnan, T.N. 1989. Bio resources Ecology. Oxford and IBH Publishers, Delhi.
3. Krishnamurthy, K.V. 2009. An Advanced Textbook on Biodiversity Principles and Practice. Oxford and IBH Publishers, Delhi.
4. Rajamannar, 2004 Environmental studies EVR College Pub. Trichy.
5. Kalavathy, S (E.D) 2004, environmental studies, Bishop Heber College Pub., Trichy.

Unit: IV and V

1. Chatterjee S.N. (2008), Water Resources, Conservation and Management Atlantic Publishers, New Delhi.

Reference Books:

1. Chaudhuri A.B. and Sarkar, D. D., 2004 .Mega diversity Conservation: Flora, Fauna and Medicinal Plants of India's Hot Spots. Daya Publishing House, New Delhi.
2. Singh, M.P and S. Dey. 2004. Bio resources and Gene pool Conservation. Daya Publishing House, New Delhi.
3. Shiva, M.P. 1998.Inventory of Forest Resources for Sustainable Management and Biodiversity Conservation. Indus Publications New Delhi.
4. Heathcote, I.W. 1988. Integrated Watershed Management: Principles and Practices. John Wiley and Sons.
5. Ragnath, H.M. 2007. Hydrology: Principles, Analysis and Design, 3rd edition. New Age International Publishers, Chennai.
6. Ghanshyam Das, Hydrology: Soil Conservation and Watershed Management. PHI. Pvt. Ltd, Delhi.
7. Suresh, R. 2009. Soil and Water Conservation Engineering, 2nd revised edition .Standard Publishers, New Delhi.
8. Heywood, V.H. & Iriondo, J.M. 2003. Plant conservation: old problems, new perspectives. *Biological Conservation* 113 (3):321-335.

9. Krupnick, G.A. & Kress. 2005. *Plant conservation: a natural history approach*. Chicago: University of Chicago Press.
10. Soulé, M. 1985. What is Conservation Biology? *Bioscience* 35:727-734.

E- Materials:

1. 2000 IUCN Red List of Threatened Species By Craig Hilton-Taylor, Russell A. Mittermeier, International Union for Conservation of Nature and Natural Resources Species Survival Commission.
2. Soil and Water Conservation News, Volumes 9-10.

Course Out Comes :

1. To know about the importance and types of plant diversity.
2. To know about the causes and effects of loss of biodiversity.
3. To find out the ways of biodiversity conservation.
4. To know about the basics of water conservation.
5. To understand the ways of water conservation and management.

CORE PRACTICAL - I

(COVERING PAPERS - I & II)

(Phycology, Mycology, Microbiology, Lichenology, Bryology and Plant Pathology)

Time: 3 hrs

Marks : 75

1. Cut transverse sections of **A, B** and **C** Stain and mount in glycerin. Identify giving reasons. Draw diagrams. Leave the slides for valuation-----**18**
2. Identify the two algal specimens in **D**. Draw diagrams and write short notes. -- **8**
3. Identify, draw diagrams and write notes of interest on **E, F,** and **G** ----- **12**
4. Name the genus, group and morphology of the given part of **H, I, J** and **K** (Diagrams not necessary) -----**12**
5. Write the name of the disease, causal organism, symptoms of the pathological specimen, **L** and draw diagrams. ----- **9**
6. Identify and write notes on economic importance of **M** and **N**----- **6**

	65
Record	10
Total	75

CORE PRACTICAL - I
(COVERING PAPERS - I & II)

KEY

Time: 3 hrs

Marks : 75

1. **A-** Algae (Identification- 1, Diagram-1, Reasons-2, Slides-2) ----- **6**
B- Fungi (Identification -1, Diagram-1, Reasons-2, Slides -2) ----- **6**
C- Bryophytes (Identification- 1, Diagram-1, Reasons-2, Slides-2) -- ----- **6**
2. **D-** Algal mixtures
 1. (Identification -1, Diagram-1, Notes-2)-----**4**
 2. (Identification- 1, Diagram-1, Notes-2) -----**4**
3. **E-** Algae (Identification -1, Diagram-1, Notes-2) ----- **4**
F- Fungi (Identification -1, Diagram-1, Notes-2) ----- **4**
G- Bryophytes (Identification -1, Diagram-1, Notes-2)----- **4**
4. **H-** Algae (Genus-1, Group-1, Morphology - 1) -----**3**
I- Fungi (Genus-1, Group-1, Morphology-1) ----- **3**
J- Bryophytes (Genus-1, Group-1, Morphology-1)----- **3**
K- Lichens (Genus-1, Genus-1, Morphology-1)----- **3**
5. **L-** Plant Pathology / Fungi /Microbiology
 (Name of the disease -1, Name of the Causal Organism -1, Diagram-3, Symptoms -
 4) ----- **9**
 Economic importance:
6. **M-** Algae / Fungi (Identification-1, Notes -2) ----- **3**
N- Microbiology / Lichenology (Identification – 1, Notes -2) ----- **3**

	65
Record	10
Total	75

CORE PRACTICAL - II
(COVERING PAPERS- III & IV)
(Pteridology, Gymnosperms, Paleobotany and Cell Biology)

Time : 3 Hrs

Marks : 75

1. Cut transverse sections of **A** and **B**. Stain and mount in glycerin. Identify giving reasons. Draw diagrams. Leave the slides for valuation ----- **16**
2. Make suitable micro preparation of **C**. Identify by giving reasons. Draw diagrams. Leave the slides for valuation ----- **8**
3. Make Acetocarmine preparation of **D**. Show any one dividing stage and draw diagrams. Leave the slides for valuation. Write explanatory notes.-----**8**
4. Identify the given Fossil slide/ Specimen **E**. Draw diagrams and write notes of interest----- **9**
5. Identify and draw diagrams with notes of interest on **F, G, H** and **I** ----- **16**
6. Give the names of Genus, Group and Morphology of the Given part of **J** and **K** (diagrams not necessary)-----**8**

	65
Record	10
Total	75

CORE PRACTICAL –II
PRACTICAL-II – (COVERS PAPERS- III & IV)
(Peridology, Gymnosperms, Paleobotany and Plant Cell Biology)
KEY

Time : 3 Hrs

Marks : 75

1. **A** - Pteridophytes (Identification-1, Diagram-1, Reason-3, Slide-3)-----**8**
B - Gymnosperm (Identification-1, Diagram-1, Reason-3, Slide-3) -----**8**
2. Reproductive Parts of Pteridophytes or Gymnosperms
C - (Identification-1, Diagram-1, Reason-3, Slide-3) -----**8**
3. **D** - Root tip Squash ((Diagram-2, Notes-3, Slide-3) -----**8**
E - Fossil Slides (Identification 2, Diagram-3, Notes-4)-----**9**
4. Slides / Spotters
F - Pteridophytes (Identification-1, Diagram-1, Notes-2)-----**4**
G - Gymnosperms (Identification-1, Diagram-1, Notes-2)-----**4**
H – Cell Biology (Identification-1, Diagram-1, Notes-2)-----**4**
I - Cell Biology (Identification-1, Diagram-1, Notes-2)-----**4**
5. **J** - Pteridophytes (Genus-2, Group-1, Morphology-1)-----**4**
K - Gymnosperms (Genus-2, Group-1, Morphology-1)-----**4**

	65
Record	10
Total	75

CORE PRACTICAL - III
(COVERING PAPERS - V, VI & VII)

**(Anatomy, Embryology of Angiosperms, Morphology, Taxonomy of Angiosperms,
Economic Botany, Genetics, Plant Breeding, Evolution and Biostatistics)**

Time : 3 Hrs

Marks: 75

1. Cut transverse sections of **A**. Stain and mount in glycerin. Draw diagrams (Ground plan and a section enlarged) Identify by giving reasons. Leave the slides for valuation -----8
2. Dissect the material **B** and mount any one of the stage of the developing Embryo. Draw diagrams Leave the preparation for valuation.-----8
3. Refer **C** to their respective family. Find out the characters on which identification is based at each level. Diagrams not necessary. -----5
4. Describe **D** in technical terms. Draw diagrams of the floral parts and Construct the floral diagrams and write down the floral formula.-----5
5. Construct the Gene Map of **E** using three point test cross-----8
6. Identify and write notes of interest on **F, G, H, I** and **J**. -----10
7. Write name of the Genus ,Species ,Family and Morphology of the useful part of **K** and **L**-----8
8. **M** and **N** – Identify and write about the modification of the given specimens.-----8

	60
Herbarium	05
Record	10
Total	75

CORE PRACTICAL –III

(COVERS PAPERS -V, VI, & VII)

(Anatomy, Embryology of Angiosperms, Morphology, Taxonomy of Angiosperms, Economic Botany, Genetics, Plant Breeding, Evolution and Biostatistics)

KEY

Time : 3 Hrs

Marks: 75

1. **A** - Anatomy- Root, Stem or Leaf (Dicot or Monocot)
(Identification-1 Diagram-2, Reason-2, Slide-3) -----8
2. Embryo mounting, Globular / Heart shaped
B - (Diagram-4, Slide -4)-----8
3. Respective Families
C - (Identification-1, Reason-4)-----5
4. Twig with flowers of any plant
D - (Technical description -2, Diagram-3)-----5
5. Genetics
E - Genetic Map Construction. -----8
6. Slides /Spotters
F – Anatomy (Identification-1, Diagram & Notes-1)-----2
G – Embryology (Identification-1, Diagram & Notes-1)-----2
H - Genetics (Identification-1, Diagram & Notes-1)-----2
I - Plant Breeding (Identification-1, Diagram & Notes-1) -----2
J - Evolution and Biostatistics (Identification-1, Diagram & Notes-1)-----2
7. Economic Botany,
K - (Genus-1, Species-1, Family-1, Morphology-1)-----4
L - (Genus-1, Species-1, Family-1, Morphology-1)-----4
8. Morphology
M - (Identification-1, Notes-3)-----4
N - (Identification-1, Notes-3)-----4

	60
Herbarium	05
Record	10
Total	75

CORE PRACTICAL –IV
(COVERS PAPERS- VIII, IX & X)

(Plant Physiology, Plant Biochemistry, Ecology, Phytogeography and Toxicology)

Time : 3 Hrs

Marks: 75

1. Outline the procedure, Apparatus and Materials required for investigating the Physiology problem **A** assigned. Setup the experiment. Tabulate the data observed and report the results. Leave the setup for valuation-----**20**

2. Based on the Morphological and Anatomical characters, assign **B** and **C** to their respective probable habitats. Draw suitable diagrams. Submit the slide for valuation.
----- **14**

3. Comment on the setup **D**.-----**7**

4. Identify and write critical notes on **E, F, G** and **H**-----**16**

5. Identify **I**, the Phytogeographical region of India and write notes.-----**4**

6. Identify **J**, the Heavy metal toxicity and write notes-----**4**

	65
Record	10
Total	75

CORE PRACTICAL –IV
PRACTICAL-IV – (COVERS PAPERS- VIII, IX & X)

(Plant Physiology, Plant Biochemistry, Ecology, Phytogeography and Toxicology.)

KEY

Time : 3 Hrs

Marks: 75

1. Physiological experiments - Individual
A - (Procedure-5, Apparatus and Materials- 4, Tabulated data-4,
 Results-4, Setup- 3) -----**20**

2. Ecological Adaptation:
B - (Habitat-1, Reasons-2, Diagram-2, Slide-2)----- **7**
C - (Habitat-1, Reasons-2, Diagram-2, Slide-2)----- **7**

3. Biochemistry - Any test **D** ----- **7**

4. **E** - Physiology setup (Identification-1 ,Notes-3) -----4
F - Any Pollution Related (Identification-1, Notes-3) -----4
G - Ecological quadrat (Identification-1, Notes-3) -----4
H - Hot Spots in India Map (Identification-1, Notes-3) -----4

5. **I** - Phytogeographical region of India. (Identification-1 ,Notes-3)-----4

6. **J** - Heavy metal toxicity (Identification-1, Notes-3)-----4

	65
Record	10
Total	75
