MOTHER TERESA WOMEN'S UNIVERSITY,

KODAIKANAL - 624 102
Tamil Nadu.

Curriculum Framework and Syllabi for

M.Sc BOTANY

(For the candidates to be admitted from the academic year 2018-2019 onwards)

(UNDER CHOICE BASED CREDIT SYSTEM- CBCS)

MOTHER TERESA WOMEN'S UNIVERSITY, KODAIKANAL
M. Sc., Botany

Choice Based Credit System
Regulations and Syllabus
(Effective from the Academic year 2018-19 onwards)

AIMS

1. Aims at providing skills in critical thinking and evaluation of information.
2. To instill knowledge across wide areas of plant science.
3. Help to understand the evolution of land plants from simple ancestors.
4. Providing an opportunity to familiarize with life cycles and mode of Reproduction in different plant groups.
5. Identifying different flowering plants based on their characters.
6. The topics included in different units of different papers aim to enable the Students to develop technical skills and innovative approach in Botanical and Related branches.

SCOPE

1. This course considers the patterns of plant diversity and the processes that generate and maintain plant diversity. It is an interdisciplinary approach in which major groups of plants are overviewed in holistic manner.
2. This course also considers the Biology of plants. Different branches of Botany are given due importance as they deserve. Practical's are framed with an aim to improve skills in microscopy, observation, drawing, and laboratory exercise. During field trips the students are exposed to basic ecological principles and interactions.
3. Students who complete this course will have better understanding on the types and sources of plants by diversity and the role of human and non human factors in plant diversity.
4. Students who complete this course can pursue research. As topics from relevant course are included there is a scope for the student to have opportunity in employment in state and central governments. Also the student has a scope for self-employment.

PREAMBLE

Mother Teresa Women's University, whose foundation stone was laid by St. Mother Teresa herself, stands as an epitome of Women empowerment. The University stands as the first and the only Women's University in the State, and the third University in the Nation. With emphasis on research, supported by strong postgraduate programs in various disciplines, the University fosters high quality research activities in various disciplines at M.Phil. and Ph.D. levels.

Department of Biotechnology was started in 2002 with a vision to make an impact through research and technology based training. An herbal garden is maintained within the campus by the Department of Biotechnology which spreads on 0.25 acres of land where about 50 species of important traditional, medicinal and aromatic herbs are flowering. A state of art nanoscience lab is setup in the Department of Biotechnology funded by Consolidation of University Research for Innovation and Excellence in Women Universities (CURIE Programme), DST.

VISION

- To emerge into a top-notch International Women's University by creating empowered and socially responsible woman achievers through excellence in teaching, research and extension and enabling them to attain gender equity.

MISSION

- Striving for excellence in the tripartite goal f teaching, research and extension
- Promoting the educational standard of women at all levels
- Identifying and addressing the emerging trends and needs
- Providing community based learning experience
- Promoting community issues based research activities with global standards
- Developing intellectual professionals with ethics for the benefit of mankind and environment.
- Extending collaborative and innovative research work for National Development.
- Equipping the learners with employability skills and groom them as Capacity Builders.
- Promoting global entrepreneurs addressing the market challenges.

PROGRAMME OUTCOME (PEOS)	
The graduates of M.Sc., Botany program will be able to	
PEO1:	Address the socio-economic challenges related to plant sciences
PEO2:	Take up and shape a successful career in Botany
PEO3:	Have awareness on conservation and sustainable use of plants.
PEO4:	Develop skills to become entrepreneurs.
PEO5:	Inculcate thorough knowledge about various plants from primitive to highly evolved.

PROGRAMME OUTCOMES (POs)	
At the end of the programme the students will be able to	
PO1:	Know about different types of lower & higher plants, their evolution from algae to angiosperm & also their economic and ecological importance.
PO2:	Understand cell organelles & their functions through Cell biology & chemical properties of nucleic acid and their role in living systems through Molecular Biology.
PO3:	Learn laws of inheritance, various genetic interactions, chromosomal abrasions, multiple alleles and structural changes in chromosomes.
PO4:	Differentiate morphological & reproductive characters of plant and identify different plant families and classification.
PO5:	Apply the knowledge on economic importance of various plant products & artificial methods of plant propagation.
PO6:	Use modern Botanical techniques and advanced equipments.
PO7:	Inculcates scientific temperament and apply their knowledge outside the scientific community.
PO8:	Gain sound understanding on professional ethics, leadership and consensus building skills relevant to botany aspects of business enterprise.

PROGRAMME SPECIFIC OUTCOMES (PSOs)	
PSO1:	Students will acquire knowledge about various plant groups from primitive to highly evolved.
PSO2:	Students will imbibe deep understanding on basis plant life, reproduction and their survival in nature, role of living and fossil plants in our life.
PSO3:	Student will acquire skill as good laboratory practices and safety and field based studies
PSO4:	Student will apply knowledge on cultivation, conservation and sustainable utilization of biodiversity.
PSO5:	Student will know advance techniques in plant sciences like tissue culture, Phytoremediation, plant disease management, formulation of new herbal drugs, mushroom cultivation, biofertilizer production, fruit preservation and horticultural practices.

ALLOCATION OF PAPERS AND CREDITS (SEMESTER-WISE) FOR M.SC.BOTANY PROGRAMMES AS PER THE TANSCHE RULES 2018-19 ONWARDS

M.Sc. Botany Course Structure under Choice Based Credit System (CBCS)

S. No	Paper Code	Title of the Paper	Hours	Credits	Internal	ESE	TOTAL
Semester I							
1	PBOT11	Core I (Theory) Bio diversity– I	5	5	25	75	100
2	PBOT12	Core II (Theory) Bio diversity– II	5	5	25	75	100
3	PBOT13	Core III (Theory) Plant Taxonomy and Systematics	5	5	25	75	100
4	PBOP11	Practical I- Bio diversity– I, II and Plant Taxonomy and Systematics	5	5	25	75	100
5	PBOE11	**ElectiveI** **Choice-1** Ethanobotany and Economic Botany **Choice-2** Gardening and lawn making and Horticulture	5	5	25	75	100
		Total	**25**	**25**			**500**
Semester II							
6	PBOT24	Core IV (Theory) Plant pathology and Microbial Technology	5	5	25	75	100
7	PBOT25	Core V (Theory) Anatomy of angiosperm, Plant micro technique and Embryology	5	5	25	75	100
8	PBOT26	Core VI (Theory) Cell Biology and Biophysics	5	5	25	75	100
9	PBOP22	Practicals II– Plant pathology and Microbial Technology & Anatomy of angiosperm, Plant microtechnique and Embryology	5	5	25	75	100
10	PBOE22	Elective II-Other Department Elective **Choice-1** Food Preservation and Processing **Choice-2** Wood technology	5	5	25	75	100
		Total	**25**	**25**			**500**
Semester III							
11	PBOT37	Core VII (Theory) Plant physiology and Biochemistry	5	5	25	75	100
12	PBOT38	Core VIII (Theory) Genetics and Plant breeding	5	5	25	75	100

13	PBOT39	Core IX (Theory) Plant Biotechnology	5	5	25	75	100
14	PBOP33	Practical III- Plant physiology and Biochemistry	5	5	25	75	100
15	PBOE33	**Elective III** **Choice-1** Mycology **Choice-2** Bioprospecting of plants	5	5	25	75	100
		Total	**25**	**25**			**500**
Semester IV							
16	PBOT410	Core X (Theory) Bioinstrumentation, Biostatistics and Bioinformatics	5	5	25	75	100
17	PBOT411	Core XI (Theory) Algology	5	5	25	75	100
18	PBOP44	Project	5	5	25	75	100
		Total	**15**	**15**			100
		Grand Total		**90**			**1800**

REGULATIONS OF PG COURSE IN BOTANY

1. CONDITION FOR ADMISSION

A candidate who has passed B.Sc in Botany or equivalent, there to subject to such condition as may be prescribed therefore shall be permitted to appear examination and qualify for M. Sc. degree in Botany at this University after a course of study of two academic years.

2. DURATION OF THE COURSE

The course for the degree of Master of Science shall consist of two academic years divided in to four semesters. Each Semester consists of 90 working days. Practical examinations will be at the end of each semester.

3. PASSING MINIMUM

THEORY

ESE - 75 marks
Continuous Internal Assessment (CIA) - 25 marks

Classification of Internal Assessment Structure

Marks

Test - 10 Marks
Seminar - 5 Marks
Assignment - 5 Marks
Attendance - 5 Marks

Total Marks = 25 Marks

Passing minimum (CIA) 50% - 12 Marks
Passing minimum (ESE) 50% - 38 Marks

Total Passing minimum = 50 Marks

PRACTICAL

University Examination (ESE) - 75 Marks
Continuous Internal Assessment (CIA) - 25 Marks

SEMESTER I
CORE I-BIO DIVERSITY– I - PBOT11

Credits :5 **Hours :5**

LEARNING OBJECTIVE

- To understand the Classification of Algae, Comparative studies of range of structure, distribution, reproduction, life cycles, phylogeny and Economic Importance of Algae.
- To understand the Classification of Fungi, Range of structure, distribution, reproduction, Phylogeny and Economic Importance of Fungi
- To know the Classification of Lichens, Occurrence and interrelationship of phycobionts and mycobionts, structure and reproduction.
- To know the Classification of Bacteria, Plant and animal viruses and isolation and purification of bacteria and viruses.

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course students will be able to

- **CO1:** understand different classification system, thallus structure, reproduction, phylogeny and economic importance of algae. **K1**
- **CO2:** understand the classification, structure of mycelium, reproduction and evolutionary trends in fungi.**K2**
- **CO3:** acquire knowledge on classification, structure and reproduction of Lichens.**K2**
- **CO4:** classify the types, structure and reproduction in bacteria **K3**
- **CO5**: understand the classification, structure and reproduction of Viruses and Bacteriophages. **K2**

UNIT-I

Classification of Algae (Fritsch, 1945), Comparative studies of range of structure ,distribution, reproduction, life cycles, phylogeny and inter relationships of Cyanophyta,Chlorophyta, Phaeophyta and Rhodophyta, Economic Importance of Algae.Salient features of major classes:Chlorophyceae, Charophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae. Ecology of Algae: Freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae.

UNIT-II

Classification of Fungi (Alexopoulos and Mims, 1979), Range of structure, distribution,reproduction, Phylogeny and interrelationship of Myxomycetes, Oomycetes,Ascomycetes, Basidiomycetes and Deuteromycetes and economic importance of Fungi.

Reproduction, life cycle types, parasexual cycles. Fossil fungi.

Structure and life cycle of the following:

Myxomycotina : *Plasmodiophora.*

Mastigomycotina : *Phytophthora*.

Zygomycotina : *Rhizopus.*

Ascomycotina : *Taphrina.*

Basidiomycotina : *Polyporus.*

Deuteromycotina : *Cercospora.*

UNIT –III

Classification of Lichens (Hale, 1969). Occurrence and interrelationship of phycobionts and mycobionts, structure and reproduction in Ascolichens, Basiodiolichens and Deuterolichens. Lichens as indicators of Pollution, Economic importance of Lichens. Mycorhiza: Structure and types; use in agriculture.

UNIT-IV

Classification of Bacteria (Bergey, 1923), Morphology and ultra structure. Bacterial culture and cultural characteristics. Reproduction - Fission and sporulation. Genetic recombination- Transformation, Transduction and Conjugation. Isolation and maintenance of pure culture. Growth curve of Bacterial population, Determination of bacterial growth – Direct method: Haemocytometer, Viable plate count - Indirect method: Turbidity. Sterilization: Physical and chemical sterilizing agents.

Industrial uses of Bacterial-Lactic acid, Vinegar and Insulin. Reasons for inclusion of Cyanophyta under Bacteria.

UNIT-V

History of viruses, classification (Harrison et al., 1971), Structure of Virus, Multiplication. Viruses of Eukaryotes- Plant and animal viruses. Viroids and prions. Cultivation of plant and animal viruses.Control of viral infections.Double stranded DNA Viruses, Double stranded RNA Viruses, Cauliflower Mosaic virus, Wound tumor viruses, Bactriophages-Morphology, structure and replication, Isolation and purification of Plant viruses.

REFERENCES:

1. Bold. H.C. and H.J. Wyne (1978) Introduction to the Algal structure and reproduction,Prentice Hall, Englewood Cliffs, New Jersey.
2. Chapman. V.J and P.J. Chapman (1973). The algae. The English language book society and Macmillen.
3. Fritsch, F.E. (1935-1945). Structure and reproduction of the Algae. Vol. II III & I.
4. Smith, G.M. (1971). Cryptogamic Botany Vol. Algae and Fungi.
5. Lee, R.E. (1987), Phycology, Cambridge University, London.
6. Round, F.E, (1973), The Biology of Algae.
7. Kumar, H.D, (1988), Introductory Phycology.
8. Alexopoulos, C.J. and C.W. Mims (1985). Introductory Mycology.
9. Anisworth, S.C., Sparrow, F.E. and A.D. Sussman. The fungi and advanced treatise.Vol. I, II, III, IV A & IV B.
10. Bessey, E.A. (1950), Morphology and Taxonomy of Fungi.
11. Webster, J. (1985), Introduction to Fungi.
12. Smith, K.M. (1974), Viruses, Cambridge University Press.
13. Power, C.B. and H.F. Daginawala. (1982), General Microbiology.
14. Michael, J. Pelczar, Jr. E.C.S. chan and N.R. Krief. (1995). Microbiology. Tata McGraw-Hill (Ed), New Delhi.
15. Singh, R.S.-Introduction to the Principles of plant pathology.
16. Mehrotra, R.S. (1985). Plant Pathology.
17. Rangaswamy, G. and Mahadevan, A. (1999). Diseases of crop plant in India 4th Edition.
18. Das Cupta M.K. (1958). Principles of Plant Pathology.
19. Hale, M.E. (1961). A Hand Book of Lichens.
20. Hale, M.E. (1970). The Biology of Lichens.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	M	S	S	S	S	S	S	S	S	S	2,9
CO2	S	S	S	M	S	S	S	S	S	S	S	S	M	2,8
CO3	S	S	S	M	S	S	S	S	S	S	S	S	S	2,9
CO4	S	S	S	M	S	S	S	S	S	S	S	S	S	2,9
CO5	S	S	S	M	S	S	S	S	S	S	S	S	M	2,8
													Mean score	2.86

The Mean Score is 2.86, which is moderately correlated

Strongly Correlating(S) - 3 marks
Moderately Correlating (M) - 2 marks
Weakly Correlating (W) - 1 mark
No Correlation (N) - 0 mark

CORE II-BIO DIVERSITY– II - PBOT12

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To know the classification of Bryophytes, Distribution, structure, reproduction and life cycle
- To know the Classification of Pteridophytes, Morphology, anatomy and reproduction
- To understand the Classification of Gymnosperms,distribution, morphology, anatomy, reproduction and phylogeny
- To attain knowledge on concepts of paleobotany - geological time scale, fossilization, types of fossil, carbon dating, role of fossil in oil exploration, fossil bryophytes, fossil pteridophytes

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply
K4: Analyze

COURSE OUTCOMES

Upon completion of this course, students will be able to

- **CO1:** understand the characters, distribution, classification and regeneration of Bryophytes **K2**
- **CO2:** learn different classification system of Pteridophytes. Also learn morphological and anatomical characters of different genus under Pteridophytes **K1**
- **CO3:** critically differentiate fossil and living fossil. Students will also understand the evolutionary tendencies and comparative morphology of Cycadales, Cycadeodales and Pteridospermales. **K2**
- **CO4:** compare the characters of different orders **K3**
- **CO5:** critically differentiate the characters of Gymnosperm orders such as Ginkogales, Coniferales, and Taxales **K4**

UNIT-I

Classification of Bryophytes (Reimers-1954), Distribution, structure, reproduction and life cycle of Marchantiales, Jungermanniales, Anthocerotales and Bryopsida. Evolution of gametophytes and sporophytes. Fossil bryophytes, economic importance.

UNIT-II

Classification of Pteridophytes (Reimers1965), Morphology, anatomy and reproduction of Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida and Pteropsida .Phylogenetic trends-Evolution of stele, sorus evolution, heterospory and seed habit, Affinities of various classes of Pteridophytes. Economic importance of Pteridophytes.

UNIT-III

Classification of Gymnosperms (Pilger and Melchoir) General account on the distribution, morphology, anatomy, reproduction and phylogeny of Pteridospermales, Cycadales, Coniferales, Bennettitales, Pentoxylales and Ginkgoales. Economic importance of Gymnosperms.

UNIT-IV

General account of Cordaitales, Taxales, Gnetales, Phylogenetic trends and affinities of various classes. Evolution of angiosperms.

UNIT-V

Geological time scale, fossilization, types of fossil, carbon dating, role of fossil in oil exploration, fossil bryophytes, fossil pteridophytes-*Rhynia, Sphenophyllum, Lepidocarbon, Cladoxylon, Pentoxylon, Botryopteris,* Fossil gymnosperms-*Lyginopteris, Lagenostoma, Cordaites.* Systematic and Nomenclature of fossil plants. Palaeoclimates and fossil plants. Role of fossil in oil exploration and coal excavation; Palaeopalynology.

REFERENCES

BRYOPHYTES

1. Rashid, A. (1998). An introduction to bryophyte. Vikas Publishing Co. New Delhi.
2. Vashishta, Sinha A.K, Adarsh Kumar. (2011). Bryophytes, S.Chand & Company ltd., New Delhi.
3. Cavers, F. (1971). The interrelationship of Bryophyta, Dawsons of Pall Mall, London.
4. Chopra ,R. N. (1998). Topics in Bryology, Allied Published Ltd, Mumbai.

5. Chopra, R.N and Kumar P.K. (1988). Biology of Bryophytes, John Wiley, New York.
6. Garham, L.E. (1993). Origin of land Plants. John Wiley, New York.
7. Prem Puri, P. (1990). Bryophytes: Morphology, Growth and Differentiation. Atmaram and Sons.
8. Smith, A.J.E. (1982). Bryophyte Ecology. Chapman and Hall. London.
9. Watson E.V. (1968). British Mosses and Liverworts, Hutchinson and Co., London.
10. Watson, E.V. (1970). Structure and life of Bryophytes. Hutchinson and Co, London.

PTERIDOPHYTES

1. Vashishta , P.C , Sinha and Anilkumar (2010). Pteridophytes, S.Chand & company Ltd, New Delhi.
2. Sharma, O.P. (1990). Textbook of Pteridophyta, MacMillan India Ltd., New Delhi.
3. Smith,G.M (1955). Cryptogamic Botany Vol. II, Tata Mcgraw Hill Publishing Co.,Ltd., New Delhi.
4. Rasheed, A. (1999). An Introduction to Pteridophyta, Vikas Publishing Co., New Delhi.
5. Vashishta.P.C .(1990). Pteridophyta , S.Chand & Co. Ltd, New Delhi.
6. Johri, R.M. Sneh Lata and Sandhya Sharma, (2004). A Textbook of Pteridophyta. Vedams Books (P) Ltd., New Delhi.
7. Eames, A.J.(1936). Morphology of Vascular Plants - Lower groups, Tata Mcgraw Hill Publishing company Ltd., New Delhi.
8. Sporne, K.R. (1972). The Morphology of Pteridophytes, B.I. Publications, Madras.
9. Sporne, K.R. (1970). The morphology of Pteridophytes (The structure of Ferns and Allied Plants) Hutchinson University, London.
10. Bower. F. O (1939) . The Ferns (Vol. I,II,III), Today & tomorrow's Printers, New Delhi.

GYMNOSPERMS

1. Sharma, O.P. (1997). Gymnosperms, Pragati Prakashan, Meerut, India.
2. Bhatnagar and Moitra, (1996). Gymnosperms. New age International Publishers, New Delhi.
3. Johri , RM, Lata S , Tyagi K (2005), A text book of Gymnosperms , Dominate pub and Distributer, New Delhi.
4. Biswas, C. and Johri, B.M. (2004). The Gymnosperms. Narosa Publishing House, New Delhi.
5. Vashista P.C. (1990) . Gymnosperms, S. Chand & Co. Ltd., New Delhi.

6. Bierhost, D.W. (1971). Morphology of Vascular plants. McMillan Company, New York.
7. Chamberlain, C.J. (1934). Gymnosperms: Structure and Evolution. Chicago Reprinted 1950) New York.
8. Delveloryas, T. (1962). Morphology and evolution of fossil plants.
9. Doyle, W.T. (1970). Non Vascular Plants: Form and function. Belmont, California.
10. Foster and Gifford, Jr., (1962). Comparative Morphology of Vascular Plants. Allied Pacific Pvt. Ltd., Bombay.

PALEOBOTANY

1. Atchlay W.R & Woodnuff D.S. (1981). Evolution and speciation, Cambridge University Press, Cambridge.
2. Kimura, M. (1983). The natural theory of molecular evolution, Cambridge University Press, Cambridge.
3. Arora M.P. (1990). Evolutionary biology, Himalaya Publication House, Delhi.
4. Arnold C.I.A() – An Introduction to Paleobotany
5. Kirkaldy, J.E. (1963). The study of Fossils. Hutchinson Educational, London

Mapping of COs with POs &PSOs:

CO	PO								PSO					SCORE
	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	M	S	S	S	S	S	S	2.9
CO2	S	S	S	S	S	S	M	S	S	S	S	S	S	2.9
CO3	S	S	S	S	S	S	M	S	S	S	S	S	S	2,9
CO4	S	S	S	S	S	S	M	S	S	S	S	S	S	2,9
CO5	S	S	S	S	S	S	M	S	S	S	S	S	S	2.9
													Mean score	2.9

The Mean Score is 2.9, which is moderately correlated

CORE III- PLANT TAXONOMY AND SYSTEMATICS - PBOT13

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To understand the classification of angiosperms, Computer applications in systematics- Role of herbarium, monographs and Flora.
- To understand the concepts and principles of Botanical gardens.
- To know the Source of taxonomic information, Anatomy, Embroyology, Palynology, Cytology
- To understand the principles and methods of Plant Biosystematics.

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course, students will be able to

- **CO-1:** understand different classification systems & **K1**
- **CO-2:** acquire knowledge on nomenclature of different plant taxa **K2**
- **CO-3:** understand the vegetative and floral characters of various plant families **K2**
- **CO-4:** know the role of herbarium, monographs and flora in plant systematics **K3**
- **CO-5:** analyse Plant Biosystematics. **K3**

UNIT-I

A brief historical account of the classification of angiosperms up to the present day.Systems of classification: Detailed study of Bentham and Hooker, Engler and Prantl,Bessy, Hutchinson, Takhtajan, Cronquist – Merits and demerits. International code of Botanical Nomenclature, Typification, Principles of priority and their limitations, Effective and valid publication, citation, retention, choice and rejection of names. Chemotaxonomy – Numerical taxonomy – Molecular taxonomy – Serotaxonomy. Computer applications in systematics- Role of herbarium,monographs and Flora.

UNIT-II

Menispermaceae. Polygalaceae, Caryophyllaceae. Portulacaceae, Oxalidaceae, Tiliaceae.Combretaceae. Onagraceae, Lythraceae, Aizoaceae. Myrtaceae, Nyctaginaceae, Cucurbitaceae

UNIT-III

Oleaceae, Gentianaceae, Apocynaceae, Boraginaceae, Bignoniaceae, Pedaliaceae, Nyctaginaceae, Chenopodiaceae, Loranthaceae, Commelinaceae, Aroideae, Cyperaceae, Scrophulariaceae, Asclepiadaceae, Convolvulaceae Apiaceae, Acanthaceae, Casuarinaceae,Economic importance of families mentioned.

UNIT-IV

Flora, Monograph, Keys, Botanical gardens. Source of taxonomic information, Anatomy, Embroyology, Palynology, Cytology and Ultra structure and phytochemistry.

UNIT-V

Biosystematic- its aim and scope. Biosystematic categories, Phenotypic lasticity.Turrreson's work. Population concept. Species and genus concepts, Genecology,ecological differentiation, Numerical taxonomy.

REFERENCES:

1. A classification of flowering plants Vol. I & II Rendle A.R. Cambridge University press.
2. Taxonomy of vascular plants. Lawerance.H.M. Mac Millan & Co.
3. Principles of Numerical Taxonomy. Sokal, S.R and Sneath P.H, N.H Fremen & co.
4. New concepts in flowering plants taxonomy. Heslop. J. Herrison.
5. Plant Taxonomy – Hey wood, V.H. English hand book society
6. Principles and methods of Plant Biosystematics-solbrig. The Mac Millian company.
7. An introduction to plant Nomenclature. S.S.R. Bennet international Book distribution India.
8. An aid to the International code of Botanical. Hentry A.N. Today & Tomorrow Pvt. Ltd.
9. Principles of angiosperm Taxonomy. Devis & Hey wood Krieger publication Co.
10. Introduction to Principles of Plant Taxonomy Sivarajan Oxford & IBH Pvt. Company.

E-book links

1) https://www.pdfdrive.com/plant-systematics-e184843919.html

Mapping of COs with POs &PSOs:

CO	PO								PSO					SCORE
	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

PRACTICAL I- BIO DIVERSITY– I, II AND PLANT TAXONOMY AND SYSTEMATICS - PBOP11

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To classify flowering plants, gymnosperms, and ferns. Emphasis on collection in the field, identification, and preparation of herbarium specimens.
- To perform isolation and identification of bacteria and growth measurements of pure culture
- To differentiate the morphological and anatomical study of representative members of the genera of Pteridophytes, Gymnosperms and Bryophytes
- To develop skill to identify and document the plant specimens

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply
K4: Analyze

COURSE OUTCOMES

Upon completion of this course, students will be able to

- **CO1:** classify and identify the algal and fungal specimen **K3**
- **CO2:** identify different types of bacteria , culture and to measure the bacterial growth **K2**
- **CO3:** make micropreparation and anatomical analysis of Pteridophyta and bryophytes. **K3**
- **CO4:** understand different aspects of Paleobotany and its application. **K1**
- **CO5:** collect and identify plants morphologically. **K4**

Algae

A) Cyanobacteria-*Spirulina, Nostoc*
B) Chlorophyceae-*Pandorina, Spirogyra*
C) Bacillriophyceae-*Cyclotella, Navicula* (Diatoms)
D) Phaeophyta-*Padina, Turbinaria*
E) Rhodophyceae-*Batrchospermum, Gracilaria*

Fungi

A) Myxomycetes: *Plasmodiophora*
B) Oomycetes: *Saprolegenia*
C) Zscomycetes: *Neurospora*
D) Basdiomycetes: *Lycoperdon*
E) Duteromycetes: *Cercospora*

Lichens

Parmelia

Bacteria

A. Nutrient media preparation and inoculation of *E.Coli*
B. Growth measurement-Turbidity method, colony counting
C. Colony morphology of bacteria

Viruses

Photographs of TMV and HIV viruses

Bryophytes

Morphological and anatomical study of representative members of the following genera:

Marchantia, Lunularia, Targionia, Reboulia, Porella and *Polytrichum*

Pteridophytes

Study of the morphology and anatomy of the vegetative and reproductive parts of the following genera:

Isoetes, Lygodium, Angiopteris, Osmunda, Gleichenia, Pteris, Nephrolepis and *Azolla*

Gymnosperms

Study of the morphology and anatomy of vegetative and reproductive parts of the following genera:*Araucaria, Podocarpus, Ginkgo* and *Ephedra*

Paleobotany

Lepidodendron, Stigmaria, Calamostachys, Lyginopteris, Lagenostoma and *Cordaites*

Taxonomy of angiosperms

Study of the characters of the families given below

Menispermaceae. Polygalaceae, Caryophyllaceae. Portulacaceae, Oxalidaceae, Tiliaceae.Combretaceae. Onagraceae, Lythraceae, Aizoaceae, Oleaceae, Gentianaceae,Apocynaceae, Boraginaceae, Bignoniaceae, Pedaliaceae,Nyctaginaceae, Chenopodiaceae, Loranthaceae, Commelinaceae, Aroideae, Cyperaceae. Myrtaceae, Casuarinaceae.

And submission of herbarium sheets – 25.

The students should undertake as part of their course a tour and field study of Vegetation under the guidance of the staff for three to five days within the state and neighbouring states.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0

													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

ELECTIVE – I-CHOICE-1 ETHANOBOTANY AND ECONOMIC BOTANY - PBOE11

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To understand the origin and cultivation of crops
- To know the cultivation and processing of Tea and Rubber
- To characterize the timber yielding plants and classify tribal medicinal plants
- To attain knowledge on Ethnobotany and its significance.

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course , students will be able to

- **CO-1:** understand the origin and cultivation of various crops **K1**
- **CO-2:** know about the history, cultivation and processing of rubber and tea. **K1**
- **CO-3:** understand the characteristics and uses of timber yielding plants **K2**
- **CO-4:** understand the basics of Ethnobotany and its significance **K2**
- **CO-5:** attain the knowledge about the plants used by major tribes of South India **K3**

UNIT- I

i. Cereals
ii. Pulses
iii. Fibres
iv. fats and
v. oils
vi. spices and condiments,
vii. beverages

UNIT –II

Origin and cultivation of

i. Rice
ii. Jute
iii. Sugarcane
iv. Mustard
v. Potato.

UNIT- III

History, cultivation and processing of

i. Tea and
ii. Rubber

UNIT- IV

Characteristics and uses of timber yielding plants

i. Teak
ii. Sal
iii. Bamboo

UNIT-V

Ethnobotany and its significance,

Study and Classification of some plants used by major tribes of South India as

i. food,
ii. clothing
iii. shelter, and
iv. medicines.

REFERENCES

1. Rashtra Vardhana. Economic Botany. *Sarup Book Publishers Pvt. Ltd., New Delhi*, First Edn. 2009.
2. Hill, A.F. Econmic Botany; A Textbook of Useful Plants and Plant Products. *McGraw- Hill Book co., Inc., New York*, Second Edn. 1952.
3. Thompson, H.C. Vegetable Crops. *McGraw- Hill Book co., Inc., New York*, Fourth Edn. 1949.
4. Wallis, T.E. Text book of Pharmacognosy. *J. &A. Churchill Ltd., London*, 1946.
5. Pandey, B.P. Economic Botany, *S. Chand & Company Ltd. New Delhi*. Fourth Edn. 1990.
6. Verma, V.A. Textbook of Economic Botany, *Emkay Publications*, New Delhi, Third Edn. 1980.

Mapping of COs with POs &PSOs:

CO	PO								PSO					SCORE
	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

CHOICE-2 GARDENING AND LAWN MAKING AND HORTICULTURE - PBOE11

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To know the scope of gardening, Gardens and types of gardens in India
- To know the Principles of gardening, garden components, adornment and lawn making,
- To understand Basic concepts of horticulture Scope and importance
- To attain knowledge in Nursery techniques and cropping systems

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply
K4: Analyze

COURSE OUTCOMES

Upon completion of this course the students will be able to

- **CO-1**.understand economic importance of plant and plant product. **K2**
- **CO-2.** know the different methods of plant propagation. **K1**
- **CO-3**.understand the principles of gardening, garden components, adornment and lawn making, **K3**
- **CO-4**.understand the scope & importance of Horticulture.**K2**
- **CO-5**.understand the methods of nursery techniques and cropping systems **K4**

Unit I

History, scope of gardening, aesthetic values. Gardens in India, types of gardens. Landscaping, historical background, definition. Floriculture industry: importance, area and production, industrial importance in India. Landscaping, basic principles and basic components. Principles of gardening, garden components, adornments, lawn making, methods of designing rockery, water garden, etc. Special types of gardens, their walk-paths, bridges, constructed features.

Unit II

Greenhouse. Special types of gardens, trees, their design, values in landscaping, propagation, planting shrubs and herbaceous perennials. Importance, design values, propagation, plating,climbers and creepers, palms, ferns, grasses and cacti succulents. Flower arrangement: importance, production details and cultural operations, constraints, post-harvest practices. Vertical gardens, roof gardens. Parks and public gardens.

Unit III

Importance and scope – turf grasses – species and types – selection of site –media and field preparation – types of lawn making – turf establishment for golf ground, cricket pitch and football field – turf management - renovation of lawns – astroturf and management.

Unit IV

Basic concepts of horticulture Scope and importance – Global scenario of horticultural crops- Divisions of horticulture - area and production – export and import - classification of horticultural crops – Nutritive value of horticultural crops – horticultural therapy – Horticulture Zones of India and Tamil Nadu – Horticultural developmental agencies.

Unit V

Nursery techniques and cropping systems .Nursery techniques – vegetable garden – Nutrition garden, kitchen garden and other types of gardens - planting systems – planning, layout and management of an orchard- wind breaks - after-cultural practices – clonal orchards- use of growth regulators – water management – drip and fertigation - weed management - nutrient management - soil fertility management - cropping systems - intercropping - multi-tier cropping.

References

Adams, C.R. and M. P. Early. 2004. Principles of horticulture. Butterworth – Heinemam, Oxford University Press.

2. Bansil. P.C. 2008. Horticulture in India. CBS Publishers and Distributors, New Delhi.

3. Kumar, N.1997. Introduction to Horticulture, Rajalakshmi Publication, Nagercoil.

4. Bhattacharjee.S.K. 2006. Amenity Horticulture, Biotechnology and Post harvest technology. Pointer publishers. Jaipur

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

SEMESTER -II

CORE IV– . PLANT PATHOLOGY AND MICROBIAL TECHNOLOGY – PBOT24

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To classify Plant diseases, symptoms and modes of infection
- To perform staining procedures, establishment of pure culture and maintainance of microbes
- To understand the organization of Bacterial genome, Genomics and Proteomics.
- To attain knowledge on basic and current research on Agricultural and Environmental microbiology
- To comprehend the microbial growth, food spoilage and food borne diseases

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course the students will be able to

- **CO-1.**understand the scope and importance of plant pathology and know disease cycle and disease development **K2**
- **CO-2.**know the common plant diseases of India **K1**
- **CO-3**: comprehend the basics of genomics and proteomics **K2**
- **CO-4:** analyse the concepts of bioremediation and biofertlizers **K3**
- **CO-5:** identify the food microorganisms and controlling food spoilage pathogen **K2**

Unit - I Plant pathology

Introduction to plant pathology – disease – concept , component and causes, classification of disease, brief account on general symptoms of Plant disease – modes

of Infection and dissemination – defense mechanisms in plants – phytoalexin – pathogen related protein, Systemic Acquired Resistance (SAR)- Plant diseases forecasting – Plant disease management – plant quarantine, chemical, cultural and biological control – bioformulation – Organisms and causal factor responsible for plant diseases: symptomology, Etiology, Epidemic disease, Control measures - Host parasite interactions - Mycotoxins - Aflatoxins, Defense mechanisms in plant - integrated disease management. Pathogenesis, Host parasite interaction, recognition concept and infection, symptomatology, disease development- role of enzymes, toxins, growth regulators; defence strategies- oxidative burst; Phenolics, Phytoalexins, PR proteins, Elicitors.

Unit-II: Plant Pathology

Common plant diseases of India (Tobacco Mosaic, Cucumber mosaic, Little leaf disease of Brinjal, Citrus canker, Rice blight, Tikka disease of groundnut, Anthracnose of mango, Wilt of Cotton, Downy mildew of grapes, White rust of Mustard, Damping off disease of seedlings, Rust of wheat, Root knot of tomato.

Unit II General microbiology

History, Scope and branches of microbiology - Staining procedure and confirmatory test, Growth Curve, Sterilization and inoculation procedures– Establishment of pure culture, Culture media – Synchronous, Batch and continuous culture, chemostate and turbidostate – preservation of microbes .

Unit III Microbial genetics

Organization of Bacterial genome, Plasmids and extra chromosomal material– Conjugation- the F–factor, Hfr strains, F’ strain– transformation; competence, mechanisms of transformation, Transduction–generalized transduction, Specialized transduction. Recombination and mechanisms - Transposable elements – classes, evolutionary significance of transposable elements. Genomics and Proteomics.

Molecular basis of gene-for-gene hypothesis; R-gene expression and transcription profiling, mapping and cloning of resistance genes and marker-aided selection, pyramiding of R genes

Unit IV Agricultural and Environmental microbiology

Waste as a resource; organic compost – factor affecting composting – Biogas production – Sewage treatment –microbial leaching – Biodegradation: Biodegradation of petroleum, Xenobiotics. Biosorption of heavy metal – biofiltration – bio

deterioration of leather, paper, metal, plastics, safe practices. Agriculture microbiology- Biofertilizer - mass cultivation of cyanobacteria, *Rhizobium, Azotobacter* production of mycorrhizal bio fertilizer- phosphate solublizing bacteria – biopesticides –*Pseudomonas putida , Bacillus thuringiensis* , Virus insectides, Fungi – *Trichoderma sp., Gliocladium virens* – Mushroom cultivation.

Unit V Food and Industrial microbiology

Microorganisms growth in food – Controlling food spoilage pathogen- food borne disease – detection of food born pathogen – Aflatoxins, structure, function. Fermentation techniques – basis of fermentation process – surface culture process, submerged culture process – screening, detection and assay of fermentation products, stock culture and production media development. Microbiology of fermented foods– cheese production – Alcoholic beverages, Antibiotic, Vitamins, citric acid, organic acid, amino acid, single cell protein– factor affecting fermentation process– Food preservation methods – physical, chemical, biological.

REFERENCES

Plant Pathology

1. Bilgrami, K. S. and Dube, H. C. (1990). A Textbook of Modern Plant Pathology. Vikas Publishing House Pvt. Ltd., New Delhi.
2. Butler, E. J. and Jones, S. G. (1949). Plant Pathology. Macmillan & Co., London.
3. Cooper, J. I. (1995). Viruses and the Environment. 2nd ed. Chapman & Hall, London.
4. Mehrota, R. S. (1994). Plant Pathology. Tata McGraw Hill Publishing Co. Ltd., New
   Delhi.
5. Pandey, B. P. (1982). A Textbook of Plant Pathology, Pathogen and Plant Diseases. S.Chand and Co. Ltd., New Delhi.
6. Rangaswamy, G. (1972). Diseases of Crop Plants in India. Prentice Hall of India Pvt.Ltd.
7. Rangaswamy, G. and Soumini Rajagopalan. (1973). Bacterial Plant Pathology. Tamil
   Nadu Agricultural University, Coimbatore.
8. Singh, R. S. (1990). Plant Diseases. 6th ed., Oxford & IBH, New Delhi.
9. Smith, K. M. (1957). A Textbook of Plant Virus Diseases. Little Borwn & Co., Boston.
10. Southey, J. F. (1965). Plant Nematology. Tech. Bull. No.7, Ministry of Agricultural, Fisheries and Food, Her Majesty’s Stationery Office, London.

11. Walker, J. C. (1952). Diseases of Vegetable Crops. McGraw Hill Book Co. Inc., New York.

Microbiology

1. Dubey RC, Maheswari DK (2007). A text book of Microbiology, S.chand & company, New Delhi.
2. Powar, C.B. and Dagniwala, H.F. (1986). General Microbiology. Himalaya Publishing House, Bombay.
3. Bilgrami, K.S. & H.C.Dube (1990) A text book of Modern Plant Pathology – Vikas Publishing House (P) Ltd., New Delhi.
4. Freifelder, D. (1987). Microbial genetics. Narosa Publishing House, New Delhi.
5. Sharma, P.D. (1992). Microbiology – Rastogi & Co,Meerut.
6. Prescott, Harley and Klein' S. (2008). Microbiology 7th edition, McGraw hill International Edition, New York.
7. Alexander, (1978). Introduction to soil Microbiology, Wiley Eastern Private Ltd., New Delhi.
8. Carpenter, P.L. (1977). Microbiology, W.B. Saunders Co., London.
9. Darglos, J. (1975). Bacteriophages. Chapman & Hall Ltd., London.
10. Ketchum, Paul, A. (1988). Microbiology: Concepts and application, John Wiley and Sons, New York.
11. Mandahar, C.L. (1978). An Introduction to Plant Viruses. S. Chand & Co., New Delhi.
12. Mehrotra R.S. and Ashoka Agarwal.(2003). Plant Pathology. TATA McGraw-Hill
    Publishing Co., Ltd., New Delhi.
13. Pelezar Jr. M.J., Chan, E.C.S. and Krieg, N.R. (1986). Microbiology (5th edn.).TATA McGraw- ill publishing Co., Ltd., New Delhi.
14. Rangasami, G. (1972). Diseases of Crop Plants in India. Prentice Hall India (Pvt.) Ltd., New Delhi.
15. Singh, R.S. (1980). Plant Diseases. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
16. Subba Rao, N.S. (1977). Soil Microorganisms and Plant growth. Oxford & IBH
    Publishing Co. Pvt. Ltd., New Delhi.
17. Gardner E.J, Simmons M.J, Snustad D.P.(2010) Principle of Genetcis (VIII Edition),
    WSE India Pvt. Ltd , New Delhi
18. Gunasekaran,P.(1995).laboratory manual in Microbiology , New age (P)Ltd Publisher
19. Agrawal , A.K, parihar ,P. (2006). Industrial microbiology , Student Edition , Jodhpur.

20. Prescott, L.M., Harley, J.P. and Klien, D.A. 1996. Microbiology [3rd Ed.], W. C Brown Publishers, Boston, U.S.A., pp.935.
21. Tortora, G.J., Funke, B.R. and Case, C.L. 1995. Microbiology-An Introduction [5th Ed.,
22. The Benjamin/Cummings Publishing Company Inc., Redwood city, California, U.S.A., pp.801
23. Wistreich, G.A. and Lechtman, M.D. 1988. Microbiology [5th Ed.] Macmillan Publishing Company, 886, Third Avenue, New York, U.S.A., pp.916
24. Stainer, R.Y., Ingraham, J.1., Wheelis, M.L. and Painter, P.R. 1986. General
25. Microbiology [5th Ed.], Macmillan Press Ltd., London, pp. 689
26. 20. Pelezar, M.J., Reid, R.D. and Chan, E.C.S. 1983. Microbiology, Tata McGraw Hill Publishing Co., New Delhi.
27. Sinha, U. and Srinivasa, S. 1983. An Introduction to Bacteria, Vikas Publishing House Pvt. Ltd. New Delhi.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	M	2.9
CO2	S	S	S	S	S	S	S	S	S	S	S	S	M	2.9
CO3	S	S	S	S	S	S	S	S	S	S	S	S	M	2.9
CO4	S	S	S	S	S	S	S	S	S	S	S	S	M	2.9
CO5	S	S	S	S	S	S	S	S	S	S	S	S	M	2.9
													Mean score	2.9

The Mean Score is 2.9, which is moderately correlated

CORE – V - ANATOMY OF ANGIOSPERMS, PLANT MICROTECHNIQUES AND EMBRYOLOGY – PBOT25

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To understand the role and types of meristems and Vascular system and its etiology.
- To learn the nodal, wood and Seed Anatomy.
- To understand the principles and applications of types of microscopy
- To know the development of anther, physiology and etiology of anther and development of ovule, Pollen– pollen morphology and concept of Fertilization

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply
K4: Analyze
K5: Evaluate
K6: Create

COURSE OUTCOMES

Upon completion of this course the students will be able to

- **CO-1**.understand the terms: Meristems, Vascular cambium, secondary xylem and secondary phloem **K1**
- **CO-2**. comprehend the systematic study of plant anatomy and seed anatomy **K1**
- **CO-3**. differentiate the principles and types of microscopic techniques and application **K2**
- **CO-4**: apply the principles of micrometry and their uses **K4**
- **CO-5:**know the development of anther, pollen, endosperm, polyembroyogeny, seed germination and seedling growth **K2**

UNIT -I

Meristems – general account . Vascular cambium – origin, types, structure and etiology.Secondary xylem – ontogeny , structure and function – wood – diffuse and porous – Sap and heart wood – compression and tension wood- Arrangement vessels in secondary xylem, Secondary phloem – structure and function and ontogeny.

UNIT -II

Anomalous secondary thickening (*Aristolochia, Bignonia, Achyranthes,Nyctanthes* and *Dracaena.* Periderm formation –Lenticels. Secondary

structure and vascular differentiation of root , Shoot and root transition – Ontogeny of Dorsiventral and Isobilateral leaf. Nodal anatomy. Wood Anatomy - Ecological Anatomy – Systematic Plant Anatomy and Seed Anatomy.

UNIT -III

Light microscopy –optical principle, resolution, magnification, aberration. Phase contrast microscopy – Dark field illumination. Electron microscope (TEM &SEM) – Principle and preparation techniques. Special techniques– Maceration, Squashes, Smears, Whole mount and clearing techniques.

UNIT- IV

Micro technique steps –Fixation and fixatives, dehydration, clearing, infiltration, embedding, block making and sectioning. Microtome's – types – Principles and operating mechanisms, Stains and staining techniques, Camera Lucida – types, Principles and their uses. Micrometry.

UNIT -V

Development of anther, physiology and etiology of anther, tapetum and development of ovule , Pollen– pollen morphology – pistil interaction, concept of Fertilization, Sexual incompatibility– genetics basis, barrier to fertilization, physiology and Biochemistry of Incompatibility. Structure and development of different types of Endosperm. Embryo development and nutrition of embryo. Polyembryogeny - causes –classification – practical value. Embryogenesis Apomixis: agamospermy and apospory , parthenocarpy - types.

Seed germination and Seedling growth – Embryology relation to taxonomy and applications of Embryology

REFERNCES

Plant Anatomy

1. Pandey, B.P. (1978). Plant Anatomy, S. Chand & Co., New Delhi.
2. Singh, V. Pande, P.C. & Jain D.K. (1987) – Anatomy of seed plants – Rastogi Publications, Meerut.
3. Pijushroy,(2010).plant Anatomy, New central Book Agency ,Pvt Lit, New delhi
4. Cutter, E.G. (1970). Plant Anatomy: Experimental and interpretation. Edward,Arnold Pub. Ltd., London.
5. Cutter, E.G. (1971). Plant Anatomy, Edward Arnold Pub. Ltd., London.
6. Cutter, E.G. (1978). Plant Anatomy, Experimental and Interpretation. Edward Arnold Pub.Ltd., London
7. Esau, K.(1960). Plant Anatomy, Wiley Eastern Private Ltd., New Delhi.
8. Esau, K.(1977). Anatomy of seed plants. Wiley Eastern Publication, New Delhi.
9. Fahn, A.(1989). Plant Anatomy. Macmillan Publication (P) Ltd, Singapore.

Embryology

1. Bhojwani, S.S. and Bhatnagar, S.P. (1981). The Embryology of Angiosperms. Vikas,Publishing House Pvt. Ltd., New Delhi.
2. Maheswari, P. (1976). An introduction to the Embryology of Angiosperms. TATA McGraw-Hill Publishing Co., Ltd., New Delhi.
3. Johri, B.M. (1984). Experimental Embryology of Vascular plants
4. Davis, G.L. (1966). Systematic Embryology of the Angiosperms.
5. Dwivedi, J.N. (1988). Embryology of Angiosperms. Rastogi & Co., Meerut.
4. Rahavan, V. (1976). Experimental Embryogenesis in Vascular plants, Academic Press,London
6. Sporne, K.R. (1972). The Evolution of pollen types in Dicotyledons. New Phytol. 71: 181-185

Micro techniques

1. Patki L.R, Bhalchandra B.L, Jeevaji I.H.(1987). An introduction to Microtechnique,S.Chand.
2. Johansen, D.A. (1940). Plant Microtechnique, TATA McGraw Hill Book Co., Ins., New delhi.
3. Peter Gray, (1964). Hand book of Basic Microtechnique. McGraw hill publication ,new york
4. Steven Ruzin, (2005).Plant Microtechnique and Microscopy. oxford university press,London

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

CORE VI- CELL BIOLOGY AND BIOPHYSICS – PBOT26

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To understand the basic structure and functions of biomolecule
- To understand the concepts enzymes and coenzymes
- To know the important functions of the cell, structure and the structure and function of the different cell organelles, membranes, Damage and Repair of DNA
- To know the principles of catalysis, enzymes and enzyme kinetics, enzyme regulation

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course the students will be able to

- **CO-1.** understand the scope of cell biology and its composition **K1**
- **CO-2.** study the principles of enzymes and enzyme kinetics **K2**
- **CO-3**. understand the structure and functions of different membrane models and their transport mechanism **K2**
- **CO-4.** analyse the structural organization and the functions of intracellular organelles **K3**
- **CO-5.** comprehend the organisations of genes and chromosomes **K3**

UNIT-I

Composition, structure and function of biomolecules (carbohydrates, lipids, proteins, nucleic acid and vitamins)- Stabilizing interactions (Van der Waals, electrostatic, hydrogen bonding, hydrophobic interaction etc.) Stability of proteins and nucleic acids – Metabolism of Carbohydrates, lipids, amino acids nucleotides and vitamins.

UNIT- II

Principles of catalysis, enzymes and enzyme kinetics, enzyme regulation, mechanism of enzyme catalysis. Methylation of DNA. Damage and Repair of DNA. Genetic code- Translation-ribosome assembly, formation of initiation complex, initiation factors, elongation and termination, Wobble hypothesis, translational proof-reading, translational inhibitors, post- translational modification of proteins

UNIT-III

Membrane structure and function- Structure of model membrane, lipid bilayer and membrane protein diffusion, osmosis, ion channels, active transport, membrane pumps, mechanism of sorting and regulation of intracellular transport, electrical properties of membranes.

UNIT-IV

Structural organization and function of intracellular organelles- Cell wall, nucleus, mitochondria, golgi bodies, lysomes, endoplasmic reticulum, peroxisomes, plastids, vacuoles, chloroplast, structure and function of cytoskeleton and its role in motility. Structure and functions of nucleus, nuclear envelope and nucleolus.

UNIT- V

Organization of genes and chromosomes- Operon, unique and repetitive DNA, interrupted genes, gene families, structure of chromatin and chromosomes, heterochromatin, euchromatin, transposons, Cell division and Cell cycle – Mitosis and Meiosis, their regulation, steps in cell cycle, regulation and control of cell cycle.

REFERENCES:

Biophysics

1. Casey, E. J. (1962). Biophysics: Concepts and Mechanics. Van Nostrand Reinhold Co. and East-West Press, New Delhi.
2. Lehninger, A. L. (1971). Bioenergetics: The Molecular Basis of Biological Energy.
3. Transformation. Addison Wiley.
4. Salil Bose, S. (1982). Elementary Biophysics. Vijaya Printers, Madurai.
5. Hartl D.A and Jones E.W. 2000. Genetics: Analysis of genes and genomes, Jones & Bartlett Publishers, Sudbury, Massachusetts.
6. Alberts B, Johnson A, Lewis J, Raff M, Roberts K, Walter P. 1994. Molecular Biology of the Cell, Fourth Edition, Academic Press. New York.
7. Lodish, Berk, Baltimore et al . 2000. Molecular Cell Biology, 6th Eds, W.H. Freeman & Co.
8. Cooper G. 2000. The Cell: A molecular approach. 2nd Eds, Sinauer Associates Inc.
9. Kleinsmith L. J. and Kish V.M. 1995. Principles of Cell and Molecular Biology. 2nd edn., McLaughlin, S., Trost, K., Mac Elree, E. (eds.)., Harper Collins Publishers, New York.

10. De Robertis and De Robertis. 2005. 8th Eds. Cell and Molecular Biology. Lippincott Williams & Wilkins.
11. Brown T.A, 2002. Genomes. 2nd Edition. Wiley-Liss, New York.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

PARCTICAL – II -PLANT PATHOLOGY AND MICROBIAL TECHNOLOGY AND ANATOMY OF ANGIOSPERMS,PLANT MICROTECHNIQUES AND EMBRYOLOGY– PBOP22

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To know the disease symptoms, causatives, transmission and control measures of the plant diseases.
- To handle the Microbial technology, isolate and identify bacteria and fungi from spoiled food
- To perform Microtechniques
- To know the germination, isolation of plant embryos and embryonic tissues techniques

COGNITIVE LEVEL

K2: Understand
K4: Analyze
K5: Evaluate

COURSE OUTCOMES

Upon completion of this course the students will be able to

- **CO-1:** identify plant diseases, causative agents and control measure for plant diseases **K2**
- **CO-2**: acquire knowledge on fungicide and other bio-controls. **K2**
- **CO-3**: identify bacteria and fungi through microbial techniques **K4**
- **CO-4:** comprehend the plant development **K5**
- **CO-5:** examine vascular cambium and identification of wood **K5**

1. Plant Pathology

Study of the disease symptoms, causal organism, and transmission and control measures of the following plant diseases.

1. Damping off of *Pythium.*
2. Little leaf of Brinjal (Mycoplasma).
3. Bacterial Blight of Paddy.
4. Bunchy top of Banana (Virus).
5. Rust of wheat, Wilt of cotton, White rust of mustard, Anthracnose of mango – citrus canker, rice blight - Tobacco mosaic, Cucumber mosaic - Little leaf of brinjal

2. Microbial technology

1. Grams staining of bacteria found in Milk, curd , root nodule
2. Isolation and identification of bacteria and fungi from spoiled food
3. Testing quality of Milk by methylene blue reductase and phosphatase Test

3. Anatomy and Micro techniques

Preparation of hand sections, maceration and clearing

1. Temporary and permanent mounting of whole specimens and Sections using different types of mountants.
2. Calibration of microscope and micrometry
3. Microtomy and microtome sectioning
4. Examination of different cell and tissue types with help of techniques
5. Structure of (primary and or secondary) leaf , root , stem and floral parts (including fruits)
6. Examination of vascular cambium and study of its activity
7. Examination of Structural and identification of Wood of some common Indian Timbers such as *Prunus , Mangifera indica , Terminalia , Tectona grandis, Swietenia Mahagoni , Azadirachta indica Lagerstroemia* and *Pterocarpus*

EMBRYOLOGY

1. Organization of anthers and pollens, pollen wall patterns, pollen germination andPollen tube growth.
2. Study on ovary, ovules and their modification.
3. Isolation of plant embryos and embryonic tissues

Plant Anatomy

1. Pandey, B.P. (1978). Plant Anatomy, S. Chand & Co., New Delhi.
2. Singh, V. Pande, P.C. & Jain D.K. (1987) – Anatomy of seed plants – Rastogi Publications, Meerut.
3. Pijushroy,(2010).plant Anatomy, New central Book Agency ,Pvt Lit, New delhi
4. Bhojwani, S.S. and Bhatnagar, S.P. (1981). The Embryology of Angiosperms. Vikas,Publishing House Pvt. Ltd., New Delhi.
5. Maheswari, P. (1976). An introduction to the Embryology of Angiosperms. TATA McGraw-Hill Publishing Co., Ltd., New Delhi.
6. Patki L.R, Bhalchandra B.L, Jeevaji I.H.(1987). An introduction to Microtechnique,S.Chand.
7. Johansen, D.A. (1940). Plant Microtechnique, TATA McGraw Hill Book Co., Ins., New delhi.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0

CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

ELECTIVE -II –CHOICE 1:FOOD PRESERVATION AND PROCESSING– PBOE22

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To understand the general principles of preservation, classification of methods of preservation, need and importance of preservation at domestic and large scale.
- To know the principles of food freezing
- To understand the processing of food and its importance
- To know the current methods of food handling and storage and Large-scale food processing technology

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course the students will be able to

- **CO-1:** understand the nutritive aspects of food constituents. **K2**
- **CO-2:** know about the principles of food preservatives and its classification **K1**
- **CO-3**: understand the processing of food and its importance **K2**
- **CO-4:** acquire knowledge the methods of Large-scale food processing **K2**
- **CO-5:** know about the different methods of food handling and storage **K3**

UNIT I

Food and its preservation : General principles of preservation, classification of methods used for preservation, need and importance of preservation at domestic and large scale, Causes of food spoilage; Nature of harvested crop, plant and animal – moisture, pH and water activity of foods.

UNIT II

Principles of food freezing: Freezing of raw and processed foods, freeze concentration, freeze drying. Chemical preservatives, preservation by ionizing radiations, ultrasonics, high pressure, fermentation, curing, pickling, smoking. Food Packaging: Basic packaging materials, types of packaging, packaging design, packaging for different types of foods, retort pouch packing, costs of packaging and recycling of materials.

UNIT III

Processing of food and its importance : Source of food - food of plant, animal and microbial origin; different foods and groups of foods as raw materials for processing – cereals, pulses, grains, vegetables and fruits, milk and animal foods, sea weeds, algae, oil seeds & fats, sugars, tea, coffee, cocoa, spices and condiments, additives; need and significance of processing these foods.

UNIT IV

Methods of food handling and storage: Nature of harvested crop, plant and animal; storage of raw materials and products using low temperature, refrigerated gas storage of foods, gas packed refrigerated foods, sub atmospheric storage, Gas atmospheric storage of meat, grains, seeds and flour, roots and tubers; freezing of raw and processed foods.

UNIT V

Large-scale food processing: Milling of grains and pulses; edible oil extraction; Pasteurisation of milk and yoghurt; canning and bottling of foods; drying – Traditional and modern methods of drying, Dehydration of fruits, vegetables, milk, animal products etc.; preservation by use of acid, sugar and salt; Pickling and curing with microorganisms, use of salt, and microbial fermentation; frying, baking, extrusion cooking, snack foods.

References

1. Subbulakshmi, G., and Shobha A. Udipi “Food Processing and Preservation”.New Age Publications, 2006.

2. HUi, Y.H. “Handbook of Vegetable Preservation and Processing”. Marcel Dekker, 2003.

3.Karnal, Marcus and D.B. Lund “Physical Principles of Food Preservation”. Rutledge,2003.

4. Gould, G.W. “New Methods in Food Preservation”. Springer,1995.

5.VanGarde, S.J. and Woodburn. M “Food Preservation and Safety Principles and Practice”. Surbhi Publications, 2001.

6. Sivasankar, B. “Food Processing & Preservation”, Prentice Hall of India, 2002.

7. Khetarpaul, Neelam, “Food Processing and Preservation”, Daya Publications, 2005.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

ELECTIVE II-CHOICE 2: WOOD TECHNOLOGY–PBOE22

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To understand the basic concepts and principles of wood technology
- To know microscopic structure and chemical composition of wood.
- To elucidate the mechanical properties and natural durability of wood.
- To analyze the types and uses of wood

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO-1: understand the microscopic structure of wood.**K1**
CO-2: know about the physical and chemical properties of wood **K1**
CO-3: compare the monocot and dicot wood **K2**
CO-4: understand the various wood preservation methods **K2**
CO-5: know about the chemically modified wood **K3**

Unit-I Microscopic structure of wood: Vessels, Tyloses, Tracheids, Fibres, Wood parenchyma - Wood rays, Grain and Texture. Organisation of the cell wall - Microfibrils - Orientation, cell wall pit – structure. Detailed anatomical structure of a few Indian hard woods, bamboos and canes.

Unit-II Chemical composition of wood, structure and properties of Cellulose - Hemicellulose - Wood polysaccharides and Lignin. Distribution of chemical constituents in wood. Physical properties of wood - Colour - Lustre - Fluorescence - Odour and Weight.

Unit-III Mechanical properties of wood - Bending properties - Composition - Hardness - Shear. Properties of Dicot and Monocot wood. Growth rings in wood - Annual rings, early wood and late wood, soft wood and hard wood, pycnoxylic and manoxylic wood. Dendro - Chronology.

Unit-IV Natural durability of wood - Wood preservation - Non-pressure processes - Pressure process - Chemical processing of wood - Commercial wood species and

identification, Synthetic woods, Marine plywood, Fuel wood, pulp and paper making woods, matchstick wood. Economic importance of pulp and wood.

Unit-V Improved wood – compressed wood, Improved wood-Compressed wood, Impregnated wood, Compregnated wood, Heat stabilized wood, Chemically modified wood, densified wood. Uses and scope.

REFERENCES:

• Brown et al. (1981). Textbook of Wood Technology. Tata McGraw-Hill, New Delhi.

• Brown, H. P. (1985). Manual of Indian Wood Technology. International Books and Periodicals Supply Service, New Delhi.

• Chowdhury, K. A. and Ghose, S. S. (1958). Indian Woods. Publication Division, Government of India, New Delhi

. • Franz, F. P., Kollmann and Wilfred A. Cote, Jr. (1968). Principles of Wood Science and Technology. Vol. I: Solid Wood. Springer-Verlag, New York.

• Franz, F. P. Kollmann (1988). Wood Science and Technology. Vol. I and II. SpringerVerlag, New York.

• Pearson and Brown (1984). Commercial Timbers of India. Government of India Publication, New Delhi.

• Tieuran, H. D. (1951). Wood Technology. Pituran Publishing Co., New York.

• Vaux, H. J. (1952). Textbook of Wood Technology. Vol. II. McGraw Hill, New York.

• Wadoo MS. (1992). Utilization of Forest Resources. IDRIS Publ.

• Wilson, K and White, D.J.B.1986. The Anatomy of Wood: Its Diversity and Variability. Stobart and son Ltd.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

SEMESTER III
CORE- VII- PLANT PHYSIOLOGY AND BIOCHEMISTRY – PBOT37

Credits : 5 **Hours :5**

LEARNING OBJECTIVES

- To understand the concepts of water relations of plants.
- To know about seed dormancy, physiology of seed germination and mechanism of fruiting ripening
- To acquire knowledge on the stress physiology in plants
- To know the chemistry of biological molecules, biosynthesis and functions of Secondary metabolites

COGNITIVE LEVEL

K1: Recall
K2: Understand

COURSE OUTCOMES

Upon completion of this course the students will be able to

- **CO-1:** know the scope and importance of plant physiology and water relation. K1
- **CO-2**: understand the process of photosynthesis, C3, C4, CAM pathways. **K2**
- **CO-3:** understand the process of respiration, growth and developmental process in plant. **K2**
- **CO-4:** acquire knowledge on different biochemical reaction in plant cell **K2**
- **CO-5:** cognize the structure and function of carbohydrate, amino acids, proteins, and lipids **K2**

UNIT-I

Water relations of plants - Physicochemical properties of water, chemical potential and water potential in the plant, bulk movement of water, soil-plant atmosphere continuum, Transpiration- movement and loss of water in plants; transpiration and evapotranspiration - stomatal physiology and regulation. Modern concepts of mineral salt absorption and translocation.

UNIT- II

Photosynthesis: Photophysical and photochemical phase; Light reactions; sequence of photosynthetic pathway - Electron Transport Chain,

Photophosphorylation- Photo protective mechanisms,CO_2 fixation,C3, C4 and CAM pathways- Photorespiration and its significance. Biochemistry and molecular biology of RUBISCO- Pathways of CO2 fixation. Respiration: Photorespiration and dark respiration. Cycles of respiration, Oxidative Phosphorylation,Gluconeogenesis. Glycolysis, Citric acid cycle and plant mitochondrial electron transport couples ATP synthesis; alternate oxidase. Bio-energetics of respiration, Respiratory inhibitors – Cyanide resistant respiration. Amphibolic role of respiration

Unit-III

Mechanism of nitrogen fixation, Nitrogen uptake and assimilation. Plant growth regulators, their mode of action and effects. Phytochrome and hormones in movements and flowering. Physiology of Dormancy break. Senescence and aging. Effect of water and salt stress on crop production.

Growth and development, Growth kinetics - Biosynthesis and mode of action of phytohormones - auxins, gibberellins, cytokinins, ethylene, abscissic acid, Brassinosteroids. Phytochrome - properties and photochemical transformation. Movement - nastic and tropic movements. Seed dormancy - causes and methods to break seed dormancy - physiology of seed germination. Fruiting- mechanism of fruiting – hormonal control of fruiting – climacteric rise .

Abscission and Senescence.

Stress physiology – Classification of stress –biotic and abiotic stress factors- response of plants to salt, drought, freezing, and heat.

Unit-IV

Structure of atoms, molecules and chemical bonds. Chemistry of biological molecules.Carbohydrates: Classification, structure of mono, di, oligo and polysaccharides.Protein: Classification, structure and composition of amino acids. Enzymes classification mode of action, km value, coenzymes, isoenymes. Reverse turn and Ramachandran Plot.

Unit-V

Lipids: Classification, structure and properties of acyl lipids and phosphates. Biosynthesis of fatty acids.Nucleic acids: Structure, composition, secondary metabolites: A general account. Biosynthesis and function of lignins, suberins, terpenes, phenols, alkaloids, flavonoids

Secondary metabolites. Biosynthesis and functions of flavonoids, phenols, terpenoids, alkaloids, steroids. Anthocyanin, Lignin, nitrogenous compounds – Role of secondary metabolites in plant.

REFERENCES

1. Plant Physiology• Devlin, R. M. (1969). Plant Physiology. Van Nostrand, Reinhold Co., New York.
2. Fang, F. K. (1982). Light Reaction Path of Photosynthesis. Vol. 35. Molecular Biology,Biochemistry and Biophysics. Springer Verlag.
3. Jain, V. K. (2007). Fundamentals of Plant Physiology. S. Chand & Co., New Delhi.
4. Leopold, A. C. (1973). Plant Growth and Development. Tata McGraw Hill PublishingCo. Ltd., New Delhi.
5. Meyer, Anderson and Bonning (1965). Introduction to Plant Physiology. D. Van Nostrand.
6. Noggle, R. and Fritz, G. I. (1989). Introductory Plant Physiology. 2nd ed. Prentice Hall New Delhi.
7. Norton, G. (1978). Plant Proteins. Butterworth, London.Palmer, J. M. (ed.). (1984). The Physiology and Biochemistry of Plant Respiration.Cambridge University Press, UK.
8. Salisbury, F. B. and Ross, E. (1992). Plant Physiology. Wadsworth, Belmont, California, USA.
9. Verma, S. K. (1999). Plant Physiology. S. Chand & Co., New Delhi.Plant Biochemistry
10. Blonstein, A. B. and King, P. J. (1987). A Genetic Approach to Plant Biochemistry.Narosa, New Delhi.
11. Lehinger, A. L. *et al.* (1993). Principles of Biochemistry. CBS Publishers, New Delhi.
12. Stryer, L. (1995). Biochemistry. 4th ed. W. H. Freeman Co., New York.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	M	S	S	S	S	S	S	S	S	S	2,9
CO2	S	S	S	M	S	S	S	S	S	S	S	S	M	2,8
CO3	S	S	S	M	S	S	S	S	S	S	S	S	S	2,9
CO4	S	S	S	M	S	S	S	S	S	S	S	S	S	2,9
CO5	S	S	S	M	S	S	S	S	S	S	S	S	M	2,8

													Mean score	2.86

The Mean Score is 2.86, which is moderately correlated

CORE -VIII - GENETICS AND PLANT BREEDING – PBOT38

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To understand the Mendel's Law of inheritance
- To comprehend the molecular basis of mutation, mutagens and mode of action.
- To know the extra chromosomal inheritance, genome of mitochondria and plastids and their role in inheritance
- To know the regulation of gene expression. Genetic variability and its role in plant breeding. Patent and intellectual properties
- To become aware on rights of plant breeders and Biotechnologists.

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply
K4: Analyze

COURSE OUTCOMES

Upon completion of this course the students will be able to

- **CO-1**. understand the Mendelian inheritance and interaction of genes, multiple alleles and linkage and crossing over. **K1**
- **CO-2**. differentiate sex linked inheritance and chromosomal aberrations **K2**
- **CO-3.** understand the scope & importance of plant breeding.**K3**
- **CO-4.** know about Red Data Book, germplasm maintenance, patent and IPR **K4**
- **CO-5.** know the evolutionary sequence of various groups of plants and its breeding methods **K4**

UNIT-I

Mendel's Law of inheritance-interaction of genes, quantitative inheritance, sex determination in plants, theories of sex determination. Sex linked characters-primary, secondary and permanent, non-disjunction of sex chromosomes in Drosophila. Sexes influenced and sex limited characters. Chromosome theory of inheritance. Gene

mutation-Detection of mutation CLB Method, Muller 5 method, Biochemical mutants in Bacteria and Neurospora. Detection of mutation in Bacteriophages and higher plants. Molecular basis of mutation, physical and chemical mutagens and their mode of action.

UNIT-II

Multiple alleles and pseudoalleles. Modern concept of genes. Fine structure of the gene IS Element-transposons. Extrachromosomal inheritance, genome of mitochondria and plastids and their role in inheritance. Uniparental inheritance in Chlamydomonas and Paramoecium-Male sterility, Population genetics-gene frequencies, mutation selection, Detection of mutation CLB Method, Muller method, Biochemical mutants in Bacteria and *Neurospora*. Detection of mutation in Bacteriophages and higher plants. migration, genetic drift, genetics disorder of chromosomal and geneic origin. Regulation of gene expression in Eukaryotes and Prokaryotes. Extra chromosomal inheritance, genome of mitochondria and plastids and their role in inheritance.

UNIT-III

Methods of plant breeding self-fertilized, cross fertilized and vegetatively propagated plants. Breeding plants for improving yield and quality and resistant to diseases and pests. Plant breeding work in India with special reference to Rice, cotton and Sugar cane. Role of polyploidy and distant hybridization in plant improvement. Induced mutations in crop improvement. .

UNIT-IV

World diminishing plant resources threatened and endangered plants. Red Data Books. Plant germplasm resources-plantation, horticultural and field crops. Medicinal plantsgermplasm collection and conservation. Germplasm maintenance of Rice and Sugarcane. The role of IBPGR (Rome, Italy) and NBPGR (New Delhi), in germplasm conservation, patent and intellectual properties-Rights of Plant breeders and Biotechnologists.
Patent and intellectual properties (IPR)-Rights of Plant breeders and Biotechnologists.

UNIT-V

Genetic variability and its role in plant breeding - Breeding methods in self pollinated, cross pollinated, vegetatively propagated and apometic plants. Inbreeding depression - Role of heterosis and hybrid vigour in plant breeding. Plant breeding techniques. Somaclonal variation in crop improvement. RFLP in plant breeding.

REFERENCES

Genetics

1. Dayanasargar, V. R. (1990). Cytology and Genetics. Tata McGraw Hill Publishing Co.Ltd., New Delhi.

2. Gardner *et al*. (2004). Principles of Genetics. John Wiley and Sons Inc., Singapore. Gardner, E. J. (1972). Principles of Genetics. John Wiley & Sons Inc., New York.

3. Primrose, S. B. and Twyman, R. M. (2006). Principles of Gene Manipulation and Genomics. 7th ed. Blackwell Science, London.

4. Rothwell, N. V. (1983). Genetics. Oxford University Press, London.

5. Sharma, A. K. and Sharma, A. (1985). Advances in Chromosome and Cell Genetics.Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

6. Sinnot, E. W., Dunn, L. C. and Dobshansky, T. (1977). Principles of Genetics. 5th ed.Tata McGraw Hill, New Delhi.

7. Strickberger, M. W. (1976). Genetics. 2nd ed. Macmillan Publishing Co., New York.

8. Swanson, C. P. (1972). Cytology and Genetics. Macmillan Publishing Co., New York.

Plant Breeding

1.Allard, R. W. (1960). Principles of Plant Breeding. John Wiley & Sons Inc., New York.

2.Chopra, V. L. (1989). Plant Breeding. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.

3.Jensen, N. F. (1988). Plant Breeding Methodology. Wiley Inerscience Publications, New York.

4.Sinha, V. and Sinha, S. (1986). Cytogenetics, Plant Breeding and Evolution. Vikas Publishing House Pvt. Ltd., New Delhi.

5.Sundararaj, D. D. and Thulasidas, G. and Durairaj, M. S. (1997). Introduction to Cytogenetics and Plant Breeding. Popular Book Depot, Chennai.

6.Vasishta, P. C. and Gill, P. S. (1998). Genetics: Speciation and Plant Breeding. Pradeep Publications, Jalandhar.

7.Vijendra Das, L. D. (1998). Plant Breeding. New Age International Publishers, New Delhi.

E-book links

1. https://www.google.com/url?sa=t&source=web&rct=j&url=https://pdfs.semanticscholar.org/e1c1/512490f246c986d116fb7c29ea484ad4ac4f.pdf&ved=2ahUKEwjzs62m4MDqAhU_zDgGHTvYCks4ChAWMAl6BAgBEAE&usg=AOvVaw3EfkuuQpzXx9NzNMutzKxg

2. https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.ubkv.ac.in/wp-content/uploads/2014/03/PG-Syllabus_Genetics-Plant-Breeding.pdf&ved=2ahUKEwjzs62m4MDqAhU_zDgGHTvYCks4ChAWMAB6BAgDEAE&usg=AOvVaw2kPWbIO6kjzMPlnR3zq99U

3. https://www.google.com/url?sa=t&source=web&rct=j&url=http://gtu.ge/AgroLib/Principles%2520of%2520Plant%2520Genetics%2520and%2520Breeding.pdf&ved=2ahUKEwii1PyX2cDqAhXRX3wKHdILDz8QFjAAegQIARAB&usg=AOvVaw0BKLCdOl5cQQfpTMPd-Dg5

4. https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.millenniumassessment.org/documents/bridging/papers/kumar.pushpam.pdf&ved=2ahUKEwi52PDy18DqAhUl63MBHc0LA7UQFjAMegQICRAB&usg=AOvVaw3-rIVwgtP0rZpItLuO9_kz

5. https://www.google.com/url?sa=t&source=web&rct=j&url=https://icar.org.in/files/mGen.pdf&ved=2ahUKEwii1PyX2cDqAhXRX3wKHdILDz8QFjACegQIBBAB&usg=AOvVaw1oVDW0CsVvbMRVTubxM4Ar

Mapping of COs with POs &PSOs:

CO	PO								PSO					SCORE
	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3,0, which is strongly correlated

CORE- IX -PLANT BIOTECHNOLOGY – PBOT39

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To understand the genome organization in Plants- Nucleus, Chloroplast and Mitochondria
- To know the Molecular Marker-aided plant Breeding

- To perform Plant Genetic Transformation Techniques
- To become well-versed on modern researches on metabolic engineering and Plant Molecular Farming.

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply
K6: Create

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO-1. understand the fundamentals of genome organisation in plants **K1**
CO-2. expertise in tissue culture techniques. **K3**
CO-3. acquire knowledge on the Plant Genetic Transformation Techniques - Ti and Ri plasmids and its use as vectors **K6**
CO-4. understand the concept of Transgenic plants and techniques. **K2**
CO-5. understand the basics of metabolic engineering and Plant Molecular Farming **K2**

UNIT- I

Genome Organization in Plants: Nucleus, Chloroplast and Mitochondria, Molecular Marker-aided Breeding: RFLP maps, linkage analysis, Microsatellites, SCAR, SSCP, AFLP, QTL, map based cloning, molecular marker assisted selection, Allele mining for crop improvement.

UNIT-II

Plant Cell and Tissue Culture: Plant tissue culture techniques, in-vitro pollination and fertilization, embryo culture, anther culture, endosperm culture, embryogenesis, organogenesis and micropropagation. Protoplast isolation, culture and regeneration, methods of fusing protoplasts, somatic hybridization. Protoplast and tissue culture manipulation for genetic manipulation of plants.

UNIT-III

Plant Genetic Transformation Techniques: Features of Ti and Ri plasmids and its use as vectors, binary vectors, viral vectors, 35S and other promoters, use of reporter genes and marker genes, Gene transfer methods in plants: direct and indirect DNA transfer. Chloroplast transformation and its advantages.

UNIT-IV

Transgenic plants: Transgenic rice with Vitamin A, transgenic plants with stress tolerance for drought and salinity, crop improvement, herbicide resistance, insect resistance, virus resistance, plants as bioreactors. Genetically modified foods - application, future applications, ecological impact of transgenic plants. Organic food, types of organic food, identifying organic food, organic food & preservatives.

UNIT-V

Metabolic Engineering and Plant Molecular Farming: Plant secondary metabolites, control mechanisms and manipulation of phenylproponoid and shikimate pathway; alkaloids, industrial enzymes, biodegradable plastics, therapeutic proteins, lysosomal enzymes, antibodies, edible vaccines, purification strategies, oleosin partitioning technology.

REFERENCES:

1. An introduction to genetic engineering in plants, Mantel, Mathews and Mickee, 1985. Blackwell Scientific Publishers. London.
2. In Vitro culture of higher plants by Pierik, 1987. MartinusNijhoff Publisher, Dordrecht.
3. Plant cell culture. A practical approach. Second edition. Edited by R.A. Dixon and R.A. Gonzales.1994.Oxford University Press. Oxford.
4. Plants, genes and agriculture by Chrispeels and Sadava, 2000.The American Scientific Publishers, USA.
5. Plant Biotechnology by Hammond, Mc Garvey and Yusibov 2000, Springer Verlag, UK.
6. Plant Biotechnology and Transgenic Plants, Edited by Kirsi-MarjaOksman-Caldentey and Wolfgang Barz. 2002, Marcel Dekker, Inc. New York.
7. Plant Biotechnology: The genetic manipulation of plants by Slater, Scott and Fowler, 2008, Second edition, Oxford University press, UK.
8. Molecular Plant Biology: A practical approach (Vol. I and II), Edited by Gilmartin and Bowler, 2002, Oxford University press, UK.

E-book links

1) https://www.google.com/url?sa=t&source=web&rct=j&url=http://www.routeetvies.fr/medias/files/1-plant-biotechprinciples-techniques-and-applications1.pdf&ved=2ahUKEwjVhoyb4cDqAhVqyDgGHXd5AD0QFjAAegQIAhAB&usg=AOvVaw2tGR6jmMTzuTeXuTrEgFxZ
2) https://www.google.com/url?sa=t&source=web&rct=j&url=https://www.lonestar.edu/departments/biotech/Plant_Biot_chapterwlinks.pdf&ved=2ahUKEwjVhoyb4cDqAhVqyDgGHXd5AD0QFjALegQIAxAB&usg=AOvVaw1HmC2HaTlwrA26xdOYuyvf&cshid=1594318042931

Mapping of COs with POs &PSOs:

CO	PO								PSO					SCORE
	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0

CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

PRACTICAL - III – (PLANT PHYSIOLOGY, BIOCHEMISTRY, GENETICS AND PLANT BREEDING) PBOP33

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To determine the water potential in different tissues and estimation of chlorophyll-a, chlorophyll-b and total chlorophyll
- To get trained in the techniques of isolation of DNA from plants and electrophoretic separation
- To solve the problems involving Dihybrid cross and understand the chromosome mapping from test cross data.
- To perform plant breeding techniques.

COGNITIVE LEVEL

K2: Understand
K3: Apply
K5: Evaluate
K6: Create

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: extract chloroplast and pigments from leaves. **K3**
CO2: perform basic biochemical tests **K5**
CO3: isolate DNA from Plant materials **K3**
CO4: understand and solve the problems related to genetics **K2**
CO5: know the basic techniques in plant breeding **K6**

Plant Physiology

1. Determination of water potential in different tissues.
2. Determination of chlorophyll-a, chlorophyll-b and total chlorophyll by the Arnon's method.
3. Determination of carotenoids.

Biochemistry

a) Total free amino acids (Ninhydrin reagent method)
b) Total soluble carbohydrates (Anthrone reagent method)
c) Total phenolics
d) Protein extraction from plant material seeds-purification. Separation of proteins by Electrophoresis (PAGE).
c) Isolation of DNA from plants and electrophoratic separation.

Genetics

Solving problems involving

1. Dihybrid cross
2. Interactions of factors
3. Chromosome mapping from test cross data. Calculation of interference.
4. Multiple alleles and blood group inheritance
5. Calculation of gene frequencies

Plant Breeding

Emasculation, Crossing, Bagging.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

ELECTIVE- III CHOICE 1: -MYCOLOGY– PBOE33

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To know the nature, distribution, structural variation, development, modes of reproduction, patterns of life cycle of fungi
- To understand lichens - structure, nutrition, reproduction, classification and economic importance of lichens
- To understand the industrial uses of fungi in fermentation technology
- To know the plant diseases caused by fungi.

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course, students will be able to

CO1: characterize and classify fungi through different lifecycle. **K1**
CO2: know the basics of lichens and mycorrhizae **K2**
CO3: acquire knowledge on fermentation techniques and usage of fungi in industries **K2**
CO4: identify and differentiate fungal diseases in plants. **K3**
CO5: apply the knowledge on commercial production of fungal products **K2**

UNIT I

A general account of fungi, their nature, distribution, structural variation, development, modes of reproduction, patterns of life cycle. Classification of fungi as given by Ainsworth.

UNIT II

Occurrence, distribution, somatic structure, distribution and modes of reproduction with special reference to sexuality in Myxomycetes, plasmodiophoromycetes, Chytridiomycetes, oomycetes, Zygomycetes.

UNIT III

Lichen: A general account of lichens - Structure, nutrition; reproduction, classification and economic importance of lichens. Mycorrhizae – Ectomycorrhizae, AM fungi & its use in agriculture.

UNIT IV

Fungal Biotechnology: Industrial uses of fungi in fermentation technology, enzyme production, Citric acid production. Commercial exploitation of fungal metabolites.

UNIT V

A General account of plant diseases caused by fungi. Causes, symptoms and identification of plant diseases. Host – parasite interaction. Defence mechanism in plants.

REFERENCE:

1. AINSWORTH, G.C., F.K. SPARROW, AND A.S. SUSSMAN (Eds.). 1965 - 1975. The fungi and advanced treatise. Vol. I - IV. G.L. Academic press, New York and London.
2. ALEXOPOLOUS, C.J and C.W. MISRA. 1972. Introductory mycology. John Wiley and Sons, New York.
3. SUBRAMANIAN, C.V. 1971. Hyphomycetes. ICAR Publications, New Delhi.
4. COOKE, W.B. 1979. The ecology of fungi. C.R.C. Press. Inc., Florida.
5. MEHROTRA, R.S. 1980. Plant pathology. Tata McGraw Hill Publishing Company Ltd, New Delhi.
6. SINGH. R.S. 1980. Introduction to Principles of Plant Pathology. III - Edition. Oxford. IBM. Publishing Co. Pvt. Ltd, New Delhi.

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

ELECTIVE III CHOICE 2: -BIOPROSPECTING OF PLANTS - PBOE33

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To update current practices in bioprospecting for conservation of Biodiversity and Genetic resources
- To know the basics and concepts of Medicinal Plants Bioprospecting/ Pharmaceutical Bioprospecting
- To isolate and cultivate Marine bioresources for Bioactive compounds
- To perform isolation of Microbial metabolites and explore the usage.

COGNITIVE LEVEL

K1: Recall
K2: Understand

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO1: understand the basic concepts of bioprospecting **K2**
CO2: comprehend the basics of medicinal plant bioprospecting **K2**
CO3: know the basics of Marine bioprospecting and their applications **K2**
CO4: know about the basics of Microbial bioprospecting **K1**
CO5: comprehend the basics of forest products **K2**

Unit I:

Bioprospecting: Definition, Introduction, Current practices in Bioprospecting for conservation of Biodiversity and Genetic resources. Bioprospecting Act: Introduction, Phases of Bioprospecting, Exemption to Act. Fields of Bioprospecting.

Unit II:

Medicinal Plants Bioprospecting/ Pharmaceutical Bioprospecting: for new drugs, assays in Bioprospecting. Antioxidant assay – NO free radical scavenging assay, Antigenotoxicity assay – MTT assay, Antiviral activities of plants – SRB assay.

Unit III:

Marine Bioprospecting: Sources of marine planktons and their Bioprospecting, Isolation and cultivation of Marine bioresources, Isolation of Marine Yeast and its industrial applications, Bioactive chemicals from Seaweeds and their applications.

Unit IV:

Microbial Bioprospecting: Isolation of Microbial metabolites and their bio-activity. Endophytic microbial products as Antibiotics.

Unit V:

Origin, evolution, botany, cultivation and uses of Food, Fodder, Fibers, Oil yielding crops, wood and timber, Non-wood forest products(NWFPS): Bamboos, Gums, Dyes, Resins, Fruits etc.

REFERENCES

1. Arora, R.K. and Nayar, E.R. (1984), Wild relatives of crop plants in India, NBPGR Science MonographNo.7.
2. Baker, H.G. (1978), Plants and civilization. Ill Ed. (A. Wadsworth, Belmount).
3. Bole, P.V. and Vaghani, Y. (T986). Field guide to common Indian trees, Oxford University Press, Mumbai.
4. Thakur, R.S., Puri, H.S. and Husain, A. (1969). Major medicinal plants of India, Central Institute of medicinal and aromatic plants, Lucknow.
5. Swaminathan, M.S. and Kocchar, S.L. (Es.) (1989). Plants and Society, MacMillan Publication Ltd.,
6. Sharma, O.P. (1996). Hills Economic Botany, Tata McGraw Hill co., Ltd., New Delhi,
7. Kocchar, S.L. (1998). Economic Botany of the tropics, II Edn. MacMillan India Ltd.,
8. CSIR (1986), The useful plants of India Publication and Information directorate, CSIR^ New Delhi.
9. CSIR (1948 - 1976) The wealth of India, 53

Mapping of COs with POs &PSOs:

	PO								PSO					SCORE
CO	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

SEMESTER IV

Core –X-BIOINSTRUMENTATION, BIOSTATICS AND BIOINFORMATICS – PBOT410

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To know the fundamental principles and applications of basic instruments in biology
- To explore the use of statistical methodology in designing, analyzing, interpreting, and presenting biological experiments and observations.
- To introduce the most important and basic concepts, methods, and tools used in Bioinformatics

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply
K4: Analyze

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO-1. understand the various analytical techniques used for research purposes **K2**
CO-2. know the basic terms and test of hypothesis in biostatistics. **K1**
CO-3. apply research methodology and write their thesis **K3**
CO-4. acquire knowledge on the concepts of bioinformatics and various tools used. **K2**
CO-5. perform sampling methods and analysis of biostatical data **K4**

Unit I

Analytical techniques based on optical principles : Photomicrography: Camera as the remote sensing device – types – shutter speed – aperture – depth of field – photographic techniques – printing (photographic emulsion, enlarger, developer and fixer) - Spectroscopy: Principles, components and working mechanism – Colorimeter, UV visible and Infra Red (IR), nuclear magnetic resonance (NMR), electron paramagnetic resonance (EPR), atomic absorption spectroscopy (AAS).

Unit II

Quantitative procedures based on physical principles: Centrifugation: Principles, components, mechanism and application of clinical, refrigerated and ultra centrifuges – separation of organelles and macromolecules. Chromatography: Principles (absorption – partition – ion exchange – affinity), components, methodology and applications of the different types of chromatography – thin layer, GC, HPLC, qualitative and quantitative analysis of biomolecules. Radiometry: Isotopes, radioactivity, measurement of radioactivity- radioactive counters (scintillation counter), applications of radioisotopes, autoradiogram.

Unit III

Methods targeting the electrolytic behavior: pH metry- pH concept, electrodes, standardization and buffers – acetate-phosphate-Tris Glycine, titration curve, pKa value. Electrophoresis: Principles, equipment, methodology and applications - PAGE, AGE, SDS- PAGE, 2 D- electrophoresis, iso electrofocusing.

Unit IV

Research methodology: Choosing the problem for research –literature collection – Primary, secondary and tertiary sources – Bibliography – indexing and abstracting – Reporting the results of research in conferences – Oral and Poster presentation . Thesis writing – Research journals – National and International –monographs – reprints – proof correction – Full paper – Short Communication – Review paper.

Unit - V

Biostatistics and Bioinformatics: Biostatistics – Scope – Collection – classification, Tabulation and presentation of data – mean – median and mode. Standard deviation – Standard error – probability analysis – test of significance - 't' test – Chi-square test – permutation and combination – Skewness and kurtosis - correlation and Regression analysis- ANOVA. *In silico* methods: Computing in biology (statistical analysis, pictorial presentations and 3D simulation), online monitoring- introduction to bioinformatics - analysis of proteins and nucleic acids and data bases. Probability of distribution (binomial, poisson & normal). Tests of statistical significance-chi square test, theories of probabilities. Analysis of variance.

REFERENCES

1. Christian, G. D. (1979). Atomic Absorption Spectroscopy - John Fredric, J. Fieldman
   Wiley & Sons, New York.
2. Dwivedi, J. N. and Singh, R. B. (1985). Essential of Plant Technique. Scientific Publications, Jodhpur.
3. Jayaraman, J. Laboratory Manual in Biochemistry. Wiley Eastern Ltd., New Delhi.
4. Jensen, W. A. (1962). Botanical Histochemistry: Principles and Practice. W. H.

Freeman and Co., San Francisco, USA.
5. Johansen, D. A. (1940). Plant Microtechnique. McGraw Hill, New York.
6. Krishnamurthy, K. V. (1988). Methods in Plant Histochemistry. S. Viswanathan & Co., Madras.
7. Sass, J. E. (1967). Botanical Microtechnique. 3rd ed. Oxford & IBH Publishing Co.,New Delhi.
8. Skoog, A. and West, M. (1980). Principles of Instrumental Analysis - W. B. Saunders Co., Philadephia, USA.
9. Wilard, H. H., Meritt, L. L. Jr. and Dean, J. A. (1965). Instrumental Methods of Analysis. 4th ed. Van Nostrand Inc. Princeton, New Jersey.
10.Williams, B. L. and Wilson, K. (1983). A Biologist's Guide to Principles Techniques of Practical Biochemistry. Edward Arnold, London.

E-book links

1. https://www.google.com/url?sa=t&source=web&rct=j&url=http://www.evolbiol.ru/docs/docs/large_files/biostatistics.pdf&ved=2ahUKEwjKkbDp1MDqAhU54jgGHZ1mB9wQFjADegQIBRAB&usg=AOvVaw1vPsZ6wExYVPz1iF4s6wLO&cshid=1594314693482

2. https://www.google.com/url?sa=t&source=web&rct=j&url=http://ee.bonabu.ac.ir/uploads/31/CMS/user/file/103/Biomedical-Instrumentation/Bio-Instrument-1-Intro-5.pdf&ved=2ahUKEwjd45Xs1cDqAhWMyjgGHXD4B3YQFjAHegQIBBAB&usg=AOvVaw0nFeNYrQZm7OnT7kdEuUAf&cshid=1594314915517

3. https://www.google.com/url?sa=t&source=web&rct=j&url=https://files.eric.ed.gov/fulltext/ED407284.pdf&ved=2ahUKEwjd45Xs1cDqAhWMyjgGHXD4B3YQFjABegQICBAB&usg=AOvVaw1jerYXGjT7eWi_-MfVZf7u&cshid=1594314915517

Mapping of COs with POs &PSOs:

CO	PO								PSO					SCORE
	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	M	S	S	S	S	S	S	2.9
CO2	S	S	S	S	S	S	M	S	S	S	S	S	S	2.9
CO3	S	S	S	S	S	S	M	S	S	S	S	S	S	2,9
CO4	S	S	S	S	S	S	M	S	S	S	S	S	S	2,9
CO5	S	S	S	S	S	S	M	S	S	S	S	S	S	2.9
													Mean score	2.9

The Mean Score is 2.9, which is moderately correlated

CORE XI - ALGOLOGY – PBOT411

Credits :5 **Hours :5**

LEARNING OBJECTIVES

- To classify algae and characteristic features of major classes of algae
- To understand industrial and pharmaceutical uses of marine algae.
- To acquire knowledge on composition and preparation of Bluegreen algal biofertilizers
- To know the importance and usage of algae as pollution indicators, treating industrial effluents for current research problems

COGNITIVE LEVEL

K1: Recall
K2: Understand
K3: Apply

COURSE OUTCOMES

Upon completion of this course the students will be able to

CO-1. Differentiate and identify the characteristic features of major classes of algae **K2**
CO-2. know about the thallus organization and reproduction of important families of algae **K1**
CO-3. understand the life-cycles in algae **K2**
CO-4. Get well-versed in the Industrial and Pharmaceutical usage of algae **K2**
CO-5. analyze various applications of algae **K3**

UNIT I

Introduction to algae; Classification of algae. Criteria in the classification of algae; Characteristic features of major classes of algae; Phylogeny and interrelationships among algae. Green algae as ancestors of higher plants.

UNIT II

Thallus organization and reproduction of the members of the Cyanophyceae, Chlorophyceae, Charophyceae, Phaeophyceae and Rhodophyceae. Structure, reproduction, ecological significance and economic importance of the members of the classes Dinophyceae and Bacillariophyceae.

UNIT III

Life-cycles in algae: Haplontic/zygotic life-cycle, Diplontic/gametic life-cycle; Diplohaplontic/Sporic life-cycle; Diplobiontic/sporic life-cycle and Somatic life-cycle.

UNIT IV

Immobilized algae; Industrial uses of marine algae. Biotechnological potential of algae: Health food and aqua feed; Recipes with algae. Algae as a source of fuels such as methane and Hydrogen; algae as a source of biodiesel. Pharmaceutical uses of algae**.**

UNIT V

Algae as biofertilizers. Composition and preparation of Bluegreen algal biofertilizers and the method of application. Liquid seaweed fertilizers: preparation and application. Bioactive compounds; Algae as pollution indicators. Use of algae in treating industrial effluents; Treatment of sewage using algae.

REFERENCES

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

2. BECKER, E. W. 1994 Microalgae-Biotechnology and microbiology. Cambridge University Press.

3. 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 Universilty, Madurai and Ahimsa Agri division, Chennai, 1 ih and 18th October, 2007.

4. IYENGAR, M.O.P. AND T.V. DESIKACHARY. 1981 Volvocales. ICAR, New Delhi. Lembi, Carole, A. and J. Robert Waaland 1988 Algae and human affairs. Cambridge University Press, Cambridge.

5. LOBBAN, C.S. AND M.J. WYNNE (Eds.) The Biology of Seaweeds. Blackwell Scientific Publications, Oxford.

6. TRIVEDI, P.C. (Ed.) 2001 Algal Biotechnology. Pointer Publishers, Jaipur, India.

7. VENKATARAMAN, L. V. AND E. W. BECKER. 1985 Bioiehnology and Utilization of Algae- The Indian Experience. Department of Science and Technology, New Delhi and Central Food Research Institute, Mysore, India.

E-book links

1) https://www.google.com/url?sa=t&source=web&rct=j&url=http://site.iugaza.edu.ps/elnabris/files/2015/03/Algae-Introduction.pdf&ved=2ahUKEwiw6bOT18DqAhUU4XMBHVMQDUYQFjACegQIBxAB&usg=AOvVaw2R_ExFhc7XcXsIHUCqHmHC
2) https://www.google.com/url?sa=t&source=web&rct=j&url=https://archive.org/details/introductiontoal00hoop&ved=2ahUKEwjfiKyxt8DqAhUxyzgGHSLjCiAQFjABegQIBBAB&usg=AOvVaw1QKeQmX5FvLx7ktGoRiN7_&cshid=1594306976995

Mapping of COs with POs &PSOs:

CO	PO								PSO					SCORE
	1	2	3	4	5	6	7	8	1	2	3	4	5	
CO1	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO2	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO3	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO4	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
CO5	S	S	S	S	S	S	S	S	S	S	S	S	S	3.0
													Mean score	3.0

The Mean Score is 3.0, which is strongly correlated

MAJOR PROJECT -PBOP44

All the candidates of M.Sc (Botany) are required to undergo a Major project and submit the following:

1. Dissertation/Thesis based on the work done by the student.
2. Soft copy of the project on CD/DVD

Project Evaluation Guidelines.
The project is evaluated on the basis of following heads:
Presentation - 25% of total marks.
Viva - 20% of total marks.
Thesis/ Dissertation - 30% of total marks.