SRI PADMAVATI MAHILA VISVAVIDYALAYAM
(WOMEN'S UNIVERSITY), TIRUPATI

Département of Biosciences and Sericulture

Accredited by NAAC with "A" Grade

SYLLABUS FOR

M.Sc. Botany

CHOICE BASED CREDIT SYSTEM

2020-2022

CURRICULUM - M. Sc. BOTANY- (4 SEMESTERS)- 2020–2022CBCS Pattern

SEMESTER	SUBJECT CODE	TITLE OF THE PAPER	COURSE TYPE
I SEMESTER			
Theory	BOT 101	**Cell Biology and Plant Development**	**CC**
	BOT 102	**Algae, Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany**	**CC**
	BOT 103	**Viruses, Bacteria, Fungi and Plant pathology**	**CC**
	BOT 104	**Taxonomy of Angiosperms**	**CC**
Practicals	BOT 101P	**Cell Biology and Plant Development**	**CC**
	BOT 102P	**Algae, Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany**	**CC**
	BOT 103P	**Viruses, Bacteria, Fungi and Plant pathology**	**CC**
	BOT 104P	**Taxonomy of Angiosperms**	**CC**
	Foundation course-01	**Communicative English**	**FC**
II SEMESTER			
Theory	BOT 201	**Plant Biochemistry and Plant Physiology**	**CC**
	BOT 202	**Molecular Biology of Plants and Bioinformatics**	**CC**
	BOT 203	**Plant Reproduction and Plant Breeding**	**CC**
	BOT 204	**Genetics and Biostatistics**	**CC**
Practicals	BOT 201P	**Plant Biochemistry and Plant Physiology**	**CC**
	BOT 202P	**Molecular Biology of Plants and Bioinformatics**	**CC**
	BOT 203P	**Plant Reproduction and Plant Breeding**	**CC**
	BOT 204P	**Genetics and Biostatistics**	**CC**
	Foundation course-02	**Foundation Course of Computer Application**	**FC**
III SEMESTER			
Theory	BOT 301 IE 1	**Internal electives (IE- I)** **MOOC's (Courses available on Swayam Platform) a), b) & c)**	**Elective**
	BOT 302	**Research methodology**	
	BOT 303	**Ethnobotany and Herbal Medicine**	
	BOT 304	**Plant Tissue Culture and Genetic Engineering**	
	BOT EE	**External Elective (EE)** **Phytomedicine**	**Elective**
	Foundation course-03	**Gender studies for Self Defence**	**FC**
Practicals	BOT 303 P	**Ethnobotany and Herbal Medicine**	
	BOT 304 P	**Plant Tissue Culture and Genetic Engineering**	
IV SEMESTER			
Theory	BOT 401- IE- II	**Internal Electives (IE- II)** **a) Plant Resource Utilization** **b) Applied Botany** **c) Post Harvest Technology of Horticulture crops**	**Elective**
	BOT 402	**Environmental Biology and Plant Biodiversity**	
Practicals	BOT 401 P IE- II	**Internal Electives (IE- II)** **a) Plant Resource Utilization** **b) Applied Botany** **c) Post Harvest Technologyof Horticulture crops**	**SBC**
	BOT 402 P	**Environmental Biology and Plant Biodiversity**	**CC**
Research Project and Industrial Training	BOT403 RP	**Research Project and Submission of Dissertation** **Project presentation and Viva –voce**	**SBC**
	BOT 404 IT	**Industrial Training and Submission of Report** **Presentation and Viva –voce**	**SBC**

CC-Core Course; SBC- Skill Based Course; FC- Foundation Course

CURRICULUM - M. Sc. BOTANY- (4 SEMESTERS)- 2020 – 2022
SCHEME OF EXAMINATION UNDER SEMESTER PATTERN (CBCS)

Subject Code	PAPER TITLE	EXAM. MAXIMUMMARKS			Total marks for each Semester
		Internal	External	Total	
I SEMESTER					
THEORY					
BOT 101	Cell Biology and Plant development	20	80	100	600
BOT 102	Algae, Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany	20	80	100	
BOT103	Viruses, Bacteria, Fungi and Plant Pathology	20	80	100	
BOT 104	Taxonomy of Angiosperms	20	80	100	
PRACTICALS					
BOT P1 (BOT 101 P & BOT 102 P)	Cell Biology and Plant development & Algae, Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany		100	100	
BOT P2 (BOT 103 P & BOT 104 P)	Viruses, Bacteria, Fungi and Plant Pathology & Taxonomy of Angiosperms		100	100	
II SEMESTER					
THEORY					
BOT 201	Plant Biochemistry and Plant physiology	20	80	100	600
BOT 202	Molecular Biology of Plants and Bioinformatics	20	80	100	
BOT 203	Plant Reproduction and Plant breeding	20	80	100	
BOT 204	Genetics and Biostatistics	20	80	100	
PRACTICALS					
BOT P1 (BOT 201 P & BOT 202 P)	Plant Biochemistry and Plant physiology & Molecular Biology of Plants and Bioinformatics		100	100	
BOT P2 (BOT 203 P & BOT 204 P)	Plant Reproduction and Plant Breeding & Genetics and Biostatistics		100	100	
III SEMESTER					
THEORY					
BOT 301	**Internal Elective's (IE-I)– MOOCs Course (Courses available on Swayam Platform)** a)	**30**	**70**	**100**	**600**

IE-1	b) c)				
BOT 302	Research Methodology	20	80	100	
BOT 303	Ethnobotany and herbal medicine	20	80	100	
BOT 304	Plant Tissue Culture and genetic Engineering	20	80	100	
BOT EE	**External Elective** Phytomedicine	20	80	100	
PRACTICALS					
BOT P (BOT 303P & 304 P)	Ethnobotany and herbal medicine & Plant Tissue Culture and genetic Engineering		100	100	
IV SEMESTER					
THEORY					
*BOT 401 IE - II	**Internal Electives (IE – II)** a). Plant Resource Utilization Applied Botany c) Post harvest Technology of Horticulture crops	20	80	100	
BOT 402	Environmental Biology and Plant Biodiversity	20	80	100	
PRACTICALS					
BOT P (401 P IE-II & BOT402 P)	**Internal Electives (IE – II)** a). Plant Resource Utilization Applied Botany c) Post harvest Technology of horticulture crops & Environmental Biology and Plant Biodiversity		100	100	600
Research Project and Industrial Training					
BOT 403 RP	Research Project and Submission of Dissertation		100	150	
	Project presentation and Viva –voce		50		
BOT 404 IT	Industrial Training and Submission of report		100	150	
	Presentation and Viva –voce		50		
				2400	**2400**

Note:

*** BOT 301 IE-Ia), 301 IE-I b) and 301 IE-I c) are Internal elective papers ofMOOC's Course for the Students of M.Sc. Botany and BOT EE is External Elective paper for the students of other PG Courses of the University.**

*** BOT 401 IE-IIa), 401 IE-II b) and 401 IE-II c)are Internal elective papers for the Students of M.Sc. Botany.**

CURRICULUM - M. Sc. BOTANY- (4 SEMESTERS)- 2020 - 2022

DETAILS OF CREDITS FOR THE COURSE

PAPERS			NO. OF THEORY HRS.	NO. OF PRACTICAL HRS.	NO. OF CREDITS (THEORY)	NO. OF CREDIT (PRACTICALS)	TOTAL CREDITS
I	BOT 101	Cell biology and Plant Development	4	4	4	2	24
	BOT 102	Algae, Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany	4	4	4	2	
	BOT 103	Viruses, Bacteria, Fungi and plant pathology	4	4	4	2	
	BOT 104	Taxonomy of Angiosperms	4	4	4	2	
II	BOT 201	Plant Biochemistry and Plant Physiology	4	4	4	2	24
	BOT 202	Molecular Biology of Plants and Bioinformatics	4	4	4	2	
	BOT 203	Plant Reproduction and Plant breeding	4	4	4	2	
	BOT 204	Genetics and Biostatistics	4	4	4	2	
III	BOT301* IE- I	**Internal electives (IE-I) MOOC's (Courses available on Swayam Platform) a), b) & c)**	4	-	4	-	24
	BOT 302	Research methodology	4	-	4	-	
	BOT 303	Ethnobotany and HerbalMedicine	4	4	4	2	
	BOT 304	Plant tissue culture and Genetic engineering	4	4	4	2	
	BOT EE	**External Elective** Phytomedicine	4	--	4	--	24
IV	*BOT 401 IE-II	**Internal Electives(IE-II)** a) Plant Resource Utilization b) Applied Botany c) Post Harvest Technology of Horticulture crops	4	4	4	2	
	BOT 402	Environmental Biology and Plant Biodiversity	4	4	4	2	
	BOT 403 RP	Research Project and Submission of Dissertation	4				
		Project presentation and Viva –voce	2				
	BOT 404 IT	Industrial Training and Submission of report	4				
		Presentation and Viva –voce	2				
						Total Credits	**96**

Note:

*** BOT 301 IE-I a), 301 IE-I b) and 301 IE-I c) are Internal elective papers ofMOOC's Course for the Students of M.Sc. Botany and BOT EE is External Elective paper for the students of other PG Courses of the University.**

*** BOT 401 IE-IIa), 401 IE-II b) and 401 IE-II c)are Internal elective papers for the Students of M.Sc. Botany.**

SRI PADMAVATI MAHILA VISVAVIDYALAYAM, TIRUPATI

(WOMEN'S UNIVERSITY)

Department of Biosciences and Sericulture

Master of Science in Botany - Programme Details:

PROGRAM EDUCATIONAL OBJECTIVES (PEOs)

- **The M.Sc. Botany Program is a two-year post-graduate program that focuses on fundamental and advanced plant research.**
- **It is one of the interdisciplinary areas that serves as the foundation for most current multidisciplinary courses dealing with plant life, such as Biochemistry, Physiology, Biostatistics, Bioinformatics and Molecular Biology.**
- **Along with core topics, it also makes it easier to study fast developing/expanding fields like Genetic Engineering, Tissue Culture, Phytomedicine, Biochemistry, and Horticulture.**
- **The program envisagesfoster understanding and expertise in areas such as Agriculture, Horticulture, Floriculture, Biotechnology, Genomics, Forest management, and the Environmental Biologyto enhance the professional skills, competitiveness and employability of the women students.**
- **Through subject relevant research projects, efficient technical skills, plant based formulations and bio-processes are developed according to the growing needs of society and also to mitigate industrial and environmental issues by utmost commitment and social responsibility.**

PROGRAM OUTCOMES (POs)- M.Sc BOTANY

PO 1. Disciplinary knowledge of botanical science: Acquainted with sound theoretical core subject knowledge and practical skills of the Morphology, Anatomy, Systematics, Genetics, Physiology and Ecology of different ecosystems and advanced knowledge skills in interdisciplinary courses of Botany.

PO 2. Scientific reasoning: Maintain a high level of scientific rigor, with a special focus on the function of plants and phyto products in botanical research.

PO 3. Critical thinking: Able to apply botanical perspective and scientific approach for conservation of biodiversity and environmental integrity with particular emphasis on surrounding flora of the ecosystem in which they live.

PO 4. **Problem solving:** Apply problem solving and analytical skills in the field of theoretical and applied sciences. Consider how current interdisciplinary courses may be applied rationally alongside core courses. Extrapolate learned skills to real life situations.

PO 5.Communication skills: Learn to use oral and writing communication skills to discuss and evaluate complex situations.Competent enough in various analytical and technical skills related to plant sciences. Able to express/ present acquired information in a clear and concise way.

PO 6. Analytical reasoning: Learn to make observations evaluate and synthesize different floral data and phylogeny from variety of sources including ICTand modern tools, draw valid conclusions within appropriate scientific derivation.

PO 7. Research related skills: Demonstrate a curiosity for learning and the ability to ask relevant/appropriate questions; the ability to recognize cause-and-effect relationships, define problems, formulate hypotheses, analyze, interpret, and draw valid conclusions from the data collected from various sources; and the ability to plan, execute, and report the results of an experiment or investigation.

PO 8.Collaboration/Cooperation/Team work: Ability to work efficiently with various teams as well as individually to find relevant resources for project management in multidisciplinary environments.

PO 9.Reflective thinking: Critical sensibility to live experiences, with self awareness and reflexivity of both self and societal safety and environmental considerations.

PO 10. Leadership readiness: Understand industrial processes gain expertise and suggest modifications. Formulate an inspiring vision, build a team who can help achieve thevision, motivate and inspire team members to engage with that vision, and usemanagement skills to guide the team to the right destination. Discover various careeropportunities and expertise through internship.

PO11. **Moral and Ethical awareness:** Adapt the holistic approach, ethical values and sustainable life style in protecting natural resourcesand ethnic knowledge for sustainable development.

PO 12.Self- directedlearning and Lifelong Learning: Create research hypotheses and a research proposal acquire the project and see it through to completion. Demonstrate knowledge and transferable skills in the fields of Plant Biodiversity, Genetics, Ethnobotany, Plant Molecular Biology, Plant Pathology, Tissue Culture, and otherdeveloping fields such as Biomedical Engineering, Pharmacognosy etc., that are relevant in job trades and employment opportunities like Faculty/Scientists/Bio Engineer in academia and industrial jobs such as Pharmaceuticals and Agro-based industries through self-paced and self-directed learning aimed at personal development and to meet the changing trades and demands of workplace.

PROGRAM SPECIFIC OUTCOMES (PSOs)

1. Trained in a variety of plant science analytical methodologies, assess the utilization of plants as industrial resources or as a human livelihood support system. Able to identify various life forms of plants, design and execute experiments related to fundamental as well as advanced studies. Recognize plants with therapeutic characteristics that are utilized in traditional medicine, as well as learn about phytohormones and their significance in the phytopharma industry. Enhance entrepreneurial abilities.

2. Well-versed in the application of transgenic technology in fundamental and applied plant research. Transform theoretical concepts of genetics and plant biotechnology ideas into practical designs. Evaluate different plant breeding mechanisms to combine desirable traits to design the process of new variety production.

3. Familiarized with the use of bioinformatic tools and the concepts of biological databases able to interpret the usage of numerous public domains to retrieve DNA and protein sequences in order to evaluate the structure of proteins homology using various modelling approaches. Capable of describing fundamental principles of biostatistics and applying them to diverse biological data.

4. Develop a scientific foundation for linking research to real-world applications. Capable of carrying out short-term research initiatives/ projects. Make observations and collect data in laboratory and in field studies, hone the analytical skills by utilising contemporary ICT tools and procedures, as well as other technological resources, to draw valid scientific conclusions and publish findings in order to address gaps in scientific information.

5. Develop a lifetime desire to acquire knowledge, as well as the ability to pursue higher education through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, and adapting to changing trades and demands of work place through knowledge/skill development/reskilling.

M Sc. BOTANY - I YEAR(SEMESTER - I

COURSE I
BOT101: CELL BIOLOGY AND PLANT DEVELOPMENT

COURSE OBJECTIVES

Enable the students

1. To gain knowledge about general organization of prokaryotic and Eukaryotic cells and to understand molecular complexity of cytoskeleton and its role in cell mobility.
2. To interpret about ultrastructure and functions of Plasma membrane,different cell organelles and nucleus.Illustrate cell fractionation by different centrifugation techniques
3. To learn about cell cycle and distinguish genetic significance of Mitosis and Meiosis.
4. To examine different tissue types and systems in the plant development.
5. To understand the growth and morphogenesis of leaf/ stem/root.

COURSE OUTCOMES (COs)

After the completion of this course, the students will be able to

CO 1.Examine various aspects of cell biologyand able to explain the cytoskeleton and its role in intracellular signalling networks;

CO 2.Describe and compare the ultrastructures and functions of basic components of cell, organization, Complexity and variability of cellular membrane facilitating cell/tissue specific functions

CO 3.Interpret different stages of cell divisions and distinguish the principle mechanisms of genome replication, maintenance, function and regulation of expression and molecular basis for the transmission of hereditary traits for genome targeting strategies to generate mutants or transgenic organisms.

CO 4. Analyze the principles and applications of different research techniques used in cell biology like microscopy, centrifugation, molecular and biochemical approaches and its modern applications in biomedical fields.

CO 5. Acquire knowledge on examination of various meristems, tissues and tissue systems and demonstrate in-depth anomalies related to anatomy of stem ,leaves and roots.

CO 6. Demonstrate practical knowledge on studying various internal organizations of plant parts at cellular level through laboratory practical skills such as sectioning and staining.Able to apply gained knowledge in different fields like histotaxonomy and pharmacognosyfor accurate Identification of the species.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H			M	L								M	L		M	
CO2	H	M	H		L											M	M
CO3	H						M							H		M	
CO4	H			M		L	M									H	
CO5	H												M			H	
CO6	H			M								H	H	M		H	H

SYLLABUS

UNIT-I

Structural Organization of Plant Cells: General organization of prokaryotic cell and Eukaryotic cell; Ultra structure of plant cell, Cell wall and functions; Molecular organization and functions of Plasma membrane.

Ultrastructure of cytoplasm: Cytoskeleton – Microtubules, Microtubular organelles; Microfilaments and Intermediate filaments; Cytoskeleton role in cell mobility.

UNIT-II

Structure and Functions of Cell organelles and separation techniques - Ultra structure and functions of Endoplasmic reticulum, Golgi apparatus, Lysosomes and peroxisomes; Structural organization of Chloroplast, Mitochondria and ribosomes.Cell fractionation by differential and gradientcentrifugation.

UNIT - III

Cell Cycle: Molecular events of cell cycle and its regulation, Mitotic and Meiotic cell cycles. Types of Spindle fibers, Molecular events of Spindle formation and Structure, Chromosomal movement, Synaptonemal complex, Molecular basis of Chromosome pairing, Genetic significance of Mitosis and Meiosis.

UNIT- IV

Growth, differentiation and morphogenesis: Tissue types (Simple, Complex and Meristematic) and Tissue systems (Dermal, Ground, Vascular and Secretary) in plants.

Root growth and development: Root Apical Meristems; Structure and theories of Root Apical Meristem formation. Vascular tissue differentiation, Root hair formation, Lateral root formation.

UNIT–V

Stem growth and development: Organization of the shoot apex, Structure and theories of Shoot Apical Meristem formation, Tissue differentiation in the Shoot, Vascular tissue differentiation in the

Shoot apex. Wood development in relation to environmental conditions

Leaf growth and differentiation: Leaf development, Initiation of Leaf Primordia, Histology and differentiation.

PRACTICALS

CELL BIOLOGY

1. Micro techniques: Preparation and use of fixatives, preservatives andstains.
2. Microscopic study ofcell.
3. Squash technique- Study of Mitosis from Onion root tip / *Cestrum nocturnum*shoottip /shoot tip). Meiosis – Critical stages of Prophase-I (Onion flower buds)
4. Separation of Cell organelles through centrifugation technique.

PLANT DEVELOPMENT

1. Examination of Meristems.
2. Study of tissues and tissue systems.
3. Study of internal organization of roots.
4. Study of internal organization of different types of stems
5. Microscopic examination of vertical sections of leaves.

TEXT BOOKS

1. Gupta, P.K. 2007. *Genetics*. Rastogi Publications,Meerut.
2. Powar, C. B. 1981. Cell biology – Himalaya Publishing House
3. Steeves, T.A and Sussex, I.M. 1989. Patterns in Plant Development (2^{nd}edition). CambridgeUnit.Press.Cambridge.
4. Pullaiah, T., Naidu, K. C., Lakshminarayana, K. and Hanumantha Rao, B. 2007. Plant Development. Regency Publications, NewDelhi.

REFERENCE BOOKS

1. De Robertes E. D.P and De Robertes E.M.F. Jr. 2001. Essentials of cell and molecular biology. Holt Lea and Febiger, NewYork.
2. Gupta, P.K. 2004. Cell and Molecular biology, III Edition, Rastogi Publications, Meerut,India.
3. Swanson, C.P. Merz, T and Young, W.J. 1990. Cytogenetics, Prentice Hall of India Pvt.Ltd.
4. Verma, P.S. and Agarwal, V.K. 2005. *Cell Biology, Genetics, Molecular Biology,Evolution*
5. Burgess, J.1985. An Introduction to Plant Cell development. CambridgeUnit. Press,Cambridge.
6. Pandey, B. P. 2001. Plant anatomy. S. Chand and Company Private Limited, New Delhi.
7. Waisel, Y., Esnel, A. and Kafkaki, U. (eds) 1996. Plant Roots. The HiddenHall (2^{nd}edition), Marcel Dekken, NewYork.

WEB REFERENCES

1. https://www.nature.com/ncb/
2. https://onlinelibrary.wiley.com/doi/book/10.1002/047146158X
3. https://cms.botany.org/media/collection/id.24.html
4. https://link.springer.com/chapter/10.1007/978-3-319-77315-5_6

COURSE II

BOT 102: ALGAE, BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS AND PALAEOBOTANY

COURSE OBJECTIVES

Enable the students to

1. Understand the diversity in habits, habitats and organization of various lower life forms such as Algae, Bryophytes, Pteridophytes and Gymnosperms.
2. Understand evolutionary trends in plants through Palaeobotanical studies.
3. Identify the anatomical variations in lower groups of plants through laboratory practices and field visits

COURSE OUTCOMES

After the successful completion of the course , the learner will be able to:

CO 1. Identify the anatomical variations in lower groups of plants. Able to recognize the ecological and economic importance of lower plants for human being directly or indirectly and also their use in environmental issues.

CO 2. Demonstrate the evolutionary trends by comparing fossil and existing organisms andrelate evolutionary trends amongst Algae, Bryophytes, Pteridophytes and Gymnosperms.

CO 3. Analyzes how heterospory leads to seed habit in the higher plants**.**

CO 4. Develop practical skills to recognize different biological forms in the natural field and identify different tissue structures of primitive non vascular and vascular plants in the practical sessions.

CO 5. Able to prepare suitable micropreparations.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	H								H	H	H				
CO2			M	H		H			L		M	H	H			M	
CO3				M		M	M				L					M	
CO4	H			H			M				H		H				H
CO5	H						M				L		M				H

SYLLABUS

UNIT–I

Algae: Classification and General Characteristics of algae, Diversity in habit, habitat and pigmentation, Salient features and evolutionary relationships of Chlorophyceae, Xanthophyceae, Phaeophyceae, and Rhodophyceae, Economic importance of Algae.
SCP in detail.

UNIT –II

Bryophytes: Classification and General Characters, and ecology of Bryophytes; Marchantiales, Anthocerotales, Jungermanniales, Polytrichales; Evolution of sporophyte, Economic importance, Fossil Bryophytes

UNIT-III

Pteridophytes: Origin and Phylogeny, Classification and General characters of Pteriodophytes, Diagnostic features and classification of Psilophytopsida, Psilotopsida, Lycopsida, Sphenopsida and Pteropsida, Telome theory, Stelar evolution, Heterospory and seed habit.

UNIT-IV

Gymnosperms: General characteristics and Classification of gymnosperms, Structure and Reproduction in Cycadales, Coniferales, Welwitschiales and Gnetales. Economic importance of Gymnosperms.

UNIT-V

Palaeobotany: Scope and objectives, Process of Fossilization, Types of Fossils, Geological time scale**,** Pteridospermales (Lyginopteridaceae, Medullosaceae) and Bennetitales (Cycadeoideaceae, Williamsoniaceae and Wielandiellaceae). Birbal Sahani Institute of Palaeobotany and its contributions.

PRACTICALS

1. Micropreparations, Culture identification, Section cuttings of the members of Cyanophyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae andRhodophyceae.
2. External and internal morphology and identification of the members in Marchantiales, Jungermaniales, Anthocerotales, Sphagnales, Funariales andPolytrichales.
3. External and Internal morphology, reproductive organs, anatomy of stem, root of Lycopsida, Sphenopsida andPteropsida.
4. External and internal morphology, reproductive organs, anatomy of stem, leaf of Cycadaceae, Pinaceae, Taxodiaceae,Araucariaceae
5. Observation of representatives of all groups in natural habitat.
6. Examination offossils.

TEXT BOOKS

1. Kumar, H. D. 1988. Introductory Phycology. Affiliated East- West Press Ltd., NewDelhi.
2. Puri, P. 1980. Bryophytes. Atma Ram & Sons,Delhi.
3. Parihar, N. S.1996. Biology & Morphology of Pteriodophytes. Central Book Depot. Allahabad
4. Sambamurty,A.V.S.S.2005.Bryophytes, Pteridophytes, Gymnosperms and Palaeobotany. I.K. International Pvt. Ltd., NewDelhi.

REFERENCE BOOKS

1. Round, F.E. 1986. The Biology of Algae. Cambridge University Press,Cambridge.
2. Vashishta B.R.2001. Bryophytes. S.Chand& Co Ltd; 5th edition.
3. Sporne, K. R. 1991. The Morphology of Pteridophytes. B.I. Publishing Pvt. Ltd.,Bombay.
4. Sporne. K. R. 1991. The Morphology of Gymnosperms. B.I. Publications Private Limited, Mumbai
5. Andrews, H. N. 1961, Studies in Palaeobotany Wiley,N.Y.
6. Stewart, W. N. and Rathwell, G.W. 1993. Palaeobotany and the Evolution ofplants. Cambridge UniversityPress.

WEB REFERENCES

1. https://www.biologydiscussion.com/algae/algae-characters-and-economic-importanceplant-kingdom/52154
2. https://www.biologydiscussion.com/bryophyta/bryophyta-features-classification-andeconomic-importance/5654
3. https://www.biologydiscussion.com/plants/plant-kingdom/pteridophytes-characters-andeconomic-importance-plant-kingdom/52192
4. https://www.biologydiscussion.com/gymnosperm/cycas-distribution-morphology-andreproduction-cycadales/22280

COURSE III

BOT 103: VIRUSES, BACTERIA, FUNGI AND PLANT PATHOLOGY

COURSE OBJECTIVES

Enable the students to

1. Understand and have a comprehensive idea on the major groups of microbes such as bacteria, viruses and Fungi, their classification, occurrence, reproduction and transmission/ distribution
2. Illustrate hands on studies on fungal culture and isolation methods.
3. Interpret the economic and pathological importance of microorganisms.
4. Summarize principles of plant pathology and some important plant diseases incited by Fungi, Bacteria, Virus and Phytoplasma to identify the common plant diseases according to geographical locations and their control measures.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1.Discuss the cellular makeup, function, and physiology of bacteria, viruses, viroids, prions, and phytoplasmas, as well as the ecological and economic significance of Cyanobacteria and Lichens.

CO 2. Demonstrate the basic fungal biology, taxonomy of the fungi and major fungal lineages. Gain skills necessary to isolate and handle fungi from nature, and to discern important microscopic characteristics of fungi.

CO 3. Asses the possible use of applications of fungi in industry to recover the valuable products. Evaluate the applications of microorganisms in various fields like agriculture, medicine, industry and health.

CO 4. Apply the knowledge of techniques for isolation and cultivation

CO 5. Examine advantages and disadvantages of current disease control practices based on chemical ecology, genetics of plant resistance.

CO 6. Develop concise overview of basic concepts and principles in the biology of plant pathogens and pests including disease epidemiology and disease management. Combine theoretical and practical knowledge of plant disease and pest management Suggest the strategies to control the spread of disease in a field.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H	L	M									H	M		H	H
CO2	H			M		H							H	M			H
CO3		H				H							H			H	
CO4	H					H							H				
CO5						H	H						M				
CO6		H					H						M			H	

SYLLABUS

UNIT I

Viruses: General characters, Classification**,** Replication, Transmission of viruses, General account on viroids, Prions. Structural and chemical composition of TMV and T_2 phages and their life cycles.
Phytoplasmas: General characteristics and role in causing plant diseases.

UNIT-II

Bacteria: General account, classification, Archaea, Eubacteria, Ultra structure, Nutrition, and reproduction. Medicinal and Industrial importance.
Cyanobacteria: General characters, classification and ecological significance and Economic importance.
Lichens: Biology and Ecological Importance.

UNIT-III

Mycology: General characters of fungi, Cell ultra structure, Cell wall composition, nutrition, reproduction, Heterothallism, and Para sexuality. Recent trends in classification - Ainsworth system of classification, Phylogeny of fungi. General account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina and Deuteromycotina.
Economic importance of Fungi: Beneficial – food, medicine, soil fertility andhuman welfare; Harmful - Plant diseases and humandiseases.

UNIT-IV

Principles of plant pathology: Infection, Disease development, Symptomology and Epidemiology. Important plant diseases incited by
Fungi- Phytophthora root rot, Puccinia rust, Ustilago smut, Magnaporthe Blast.
Bacteria- Bacterial blight and Bacterial canker.
Viruses and Viroids- Tobacco, Cucumber and Wheat mosaic.
Phytoplasmas: Little leaf disease, Witches' broom

UNIT- V

Disease management: Cultural, Physical methods: Heat treatment, Drying, Refrigeration, Radiation; **Chemical methods**: Direct protection, Reduction of inoculums, Chemicals used in Disease control, Mechanism of action of plant protection chemicals. **Biological methods**: Principles, Biopesticides - Microbial, Fungal, Bacterial, Viral and Botanicals. **Integrated Pest Management**; Integrated control of Annual and Perennial crop diseases.

PRACTICALS

1. Symptomology of some disease specimens: White rust, Downy mildew, Powdery mildew, Rusts, Smuts, Ergot, Groundnut leaf spots, Red rot of Sugarcane, Wilts, Rice blast, Citrus Canker, Bacterial blight of Rice, Angular leaf spot of Cotton, Tobacco mosaic, Little leaf of Brinjal, Sesame philology, Mango malformation. Section cuttings of infected tissues of some diseases- Rust, Powdery mildew, Downy mildew, Whiterust.
2. Gram staining of bacteria, sporestaining
3. Bacterial growthcurve
4. Sterilization methods, preparation of media andstains.
5. Identification of fungal cultures: *Rhizopus, Mucor, Aspergillus, Penicillium, Alternaria, Curvulaia, Fusarium,Macrophomina.*

TEXT BOOKS

1. Sharma, P. D. 2000. Plant Pathology. Narosa Publishing House,India.
2. Mandahar, C.L. 1978. Introduction to Plant Viruses. Chand & Co Ltd.,Delhi.
3. Alexopoulos, C.J., Mims, C. W. and Blackwell, M. 1996. Introductory Mycology. John Wiley & SonsInc.

REFERENCE BOOKS

1. Aneja, K. R. 2004. Experiments in Microbiology, Plant pathology and Tissue Culture, WishwaPrakashan, NewDelhi.
2. Clifton, A. 1958. Introduction to the Bacteria. Mac Graw- Hill Book Co., NewYork
3. Dimmock. N. J., Easton. A. J., Leppard, K.N. 2001. Introduction to Modern Virology. Blackwell Science.,Tokyo.
4. Mehrotra, R.S. and Aneja, K. R. 1998. An Introduction to Mycology. New Age Intermediate Press.
5. Pelczar, M. J. (Jr) Chan, E. C. S. and Krieg, N. R. 1988. Microbiology (5^{th}Ed.)Tata McGraw Hill Book Company,Singapore.
6. Rangaswamy, G. and Mahadevan, A. 1999. Diseases of Crop Plants in India(4^{th}Ed.)Prentice Hall of India Pvt. Ltd., New Delhi.
7. Singleton Paul.1995. Bacteria in Biology, Biotechnology and Medicine. John Wiley and Sons. NewYork
8. Sullia, S. B. and Shantharam, S. 2000. General Microbiology. Oxford & IBH Publ., New Delhi.

WEB REFERENCES

1. https://www.rvskvv.net/images/I-Year-II-Sem_Principles_Plant-Pathology_ANGRAU_20.04.2020.pdf
2. https://drive.google.com/file/d/1wjMME_p2MlcXcNTSfsd5GbDFrfbvCdEp/view
3. http://www.jnkvv.org/PDF/11042020102651plant_pathology.pdf
4. https://drive.google.com/file/d/1VOr3_kdKrvplwlY1liCCQtf6eBeWsKMj/view

COURSE IV

BOT 104: TAXONOMY OF ANGIOSPERMS

COURSE OBJECTIVES

Enable the students

1. Able to understand the history and theories underlying different approaches of plant taxonomy and classification, to become familiar with major taxa and their characteristics, and to build up profound knowledge of the current taxonomy of most important plant families through field studies.
2. To widen the knowledge and fluency with scientific names and the rules governing their application and to make use of diverse taxonomic resources, reference materials, herbarium collections and publications to identify different flora.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Compare the concepts of Plant Taxonomy and Systematics, taxonomic hierarchy, species and speciation. Distinguish the importance of different classification systems. Recognize common and major families of native plants with improved observational skills and field experience using Bentham and Hoockerssystem of classification.Employ the morphological peculiarities to classify the plants to respective families.

CO2. Prepare cladograms and phylogenetic trees to interpret phylogeny and diversification of Angiosperms.

CO 3. Summarize the concepts and the terminology used in plant systematics including modern molecular systematics and identify the local flora using the Flora of the Presidency of Madras (J. S. Gamble Volumes).Prioritize to the herbarium preparation.Estimate the floral diversity of A.P and appraise conservation priorities along with its application.

CO 4. Applies knowledge to work out nomenclatural problems regarding priority and author citations.

CO 5. Distinguish tools of angiosperm taxonomy. Analyze the salient features and phylogeny of most common families of angiosperms from their locality. Correlate the systematic principles to study the evolution of the taxa.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H		H	M	L	H	M		L		H		H			H	
CO2				H	H							H	H			H	
CO3	H		M			H	H						H			H	
CO4								M	M		M					H	H
CO5	H		M	M		H						L		H			M

SYLLABUS

UNITI:

Angiosperm Classifications: Plant taxonomy-scope and significance. History of plant classifications- a general account. Natural and phylogenetic Systems: A critical account of the systems of Classifications of a) Bentham and Hookers b) Angiosperm PhylogenyGroup.

UNITII:

Angiosperm Phylogeny, Origin and Diversification: Principles of phylogeny- plesiomorphy, apomorphy; monophylly and polyphylly. Cladograms and Phylogenetic trees.A comprehensive account on origin, phylogeny and diversification of angiosperms.

UNIT III:

Plant Identification: Process of identification-conventional and modern approaches; preparation of taxonomic keys.Taxonomic literature-floras, journals and databases.Herbarium methodology-methods of collection, processing and preservation of plant specimens.Significant herbaria of the world and India; Botanical Survey of India- organization and activities.Floral diversity of Andhra Pradesh-endemics and raretaxa.

UNITIV:

Nomenclature And Hierarchical Classification: International Code of Botanical Nomenclature (ICBN) - Principles, Rules and Recommendations; Nomenclature of taxa according to their Rank, typification, concept of names and author citation, effective and valid publication, rule of priority. Describing a newspecies.

Hierarchical Classification: Taxonomic hierarchy- species, genera and families.

UNITV:

Study of the Salient features, Systematics and Phylogeny of the following Angiosperm families: Annonaceae, Rutaceae, Fabaceae (Leguminosae), Myrtaceae, Rubiaceae, Apocynaceae (Includes Asclepidaceae), Acanthaceae, Lamiaceae, Amaranthaceae, Orchidaceae, Cyperaceae, Poaceae.

PRATICALS

1. Preparation of Floral Diagrams, Floral Formulae and Determination of Taxonomic Position of 30 local Plants up to Familylevel.
2. Identification of Genus and Species following Dichotomous Keys ("Flora of Madras Presidency" By Gamble &Fischer).
3. Construction of Keys for Families, Genera and Species based on MorphologicalCharacters.
4. Nomenclature Exercises: Synonyms, Tautonyms,Basionyms.
5. Botanical Study Tours, Preparation of Herbaria, Field Note Books & TourReports.

TEXT BOOKS

1. APG III (2009) An update of the Angiosperm Phylogeny Groupclassificationfor theorders and families of flowering plants: APG III. *Bot. J. Linnaean Soc.* 161:105-121.

2. Gamble & Fischer 1915-1935. *Flora of Presidency of Madras*.3 vols. BSMS,Dehradun.
3. Pullaiah, T. 2018. *Taxonomy of Angiosperms* (Fourth revised Edition). Regency publications, NewDelhi.
4. Bhattacharya, B and Johri, B. M. 1998. Flowering Plants Taxonomy and Phylogeny. Narosa Publishing House, New Delhi.

REFERECNE BOOKS

1. Angiosperm Phylogeny Group website. 2015. Consultwww.apgweb.
2. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, NewYork.
3. Davis, P.H. and Heywood, V. H. 1963. Principles of Angiosperm Taxonomy, Oliver andBoyed.
4. Harrison, H. J. 1971. New Concepts in Flowering plant Taxonomy. HeimanEducational.
5. Heywood, V.H., RK Brummitt, A. Culham, O. Seberg 2007. *Flowering Plant Families of the World.*Firefly books Ltd. NewYork.
6. Hutchinson, J. 19973. Families of Flowering Plants (3rd Ed.) Oxford Univ. Press, NewYork.
7. Sambamurty,A.V. S. S. 2005. Taxonomy of Angiosperms. I.K. International Pvt. Ltd., New Delhi.
8. Singh, Gurucharan. 2012. *Plant Systematics*: *Theory and Practice*. Oxford & IBH. NewDelhi.
9. Sokal, R. R. and Sneath, P. H. A. 1963. Principles of Numerical Taxonomy. W. H. Freeman and Company, SanFrancisco.
10. Takhtajan, A.L. 1997. Diversity and Classification of Flowering plants. Columbia University Press, NewYork.

WEB REFERENCES

1. https://books.google.mw/books?id=5AgOKyG6BnkC&printsec=copyright#v=onepage&q&f=false
2. http://assets.vmou.ac.in/MBO06.pdf
3. http://www.mobot.org/MOBOT/research/APweb/
4. https://www.digitalatlasofancientlife.org/learn/embryophytes/angiosperms/angiosperm-phylogeny/
5. http://www.filestube.to/s2/A-Textbook-of-Botany-Angiosperms---Taxonomy-Anatomy-Embryology-and-Economic-Botany

SEMESTER II

COURSE I

BOT 201 - PLANT BIOCHEMISTRY AND PLANT PHYSIOLOGY

COURSE OBJECTIVES

Enable the students to

1. Introduce the learner from fundamentals of biochemical process and plant physiological process and also the recent development take place in the subject area. Understand the role, structure and importance of the bio molecules associated with plant life.
2. Understand the basic principles related to various physiological functions in plant life. Familiarize with the basic skills and biochemical techniques related to plant physiology and Plant Biochemistry..
3. Familiarize with applied aspects of plant physiology in other fields like agriculture

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Demonstrate practical skills in performing experiments of different advanced areas of Biochemistry utilizing modern instruments

CO 2. Understand the various aspects of physic-chemical environment and critically examine its relation to plant life process.Identify the role, structure and importance of themajor biomolecules associated with plant life.

CO 3. Describe the biosynthesis and functions of secondary metabolites and the mechanism of action of enzymes, learn the kinetics of enzyme catalyzed reactions and understand various enzyme inhibitions and regulatory processes

CO 4. Demonstrate the basic skills in experiments related to metabolic pathways like photosynthesis, respiration and also the biochemical process take place in plants.

CO 5 Compare various phytohormones and their role in physiology of growth and development. Utilize physiological advances in sensory photobiology. Prioritize local and global issues that need intervention by a Biochemist and develop intelligent strategies and biochemical approaches in problem solving methods and generate useful products through biochemical engineering.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H		M		M	M						H	H			H	M
CO2	H			H								M	H				M
CO3	H	H											H			M	
CO4	H		H		H							H	H				M
CO5	H	H		H					L			H				H	

SYLLABUS

UNIT-I

Biochemical Techniques: Light and Electron Microscopy- Principles, Architecture and Applications.

Chromatography: Principles, Types- Paper, Thin layer and HPLC.

Electrophoresis: Principles, Types- Gel electrophoresis – Agarose, Non SDS-PAGE, SDS-PAGE and Applications
Spectroscopy: Beer's Law, Absorbance and Transmittance, Extinction Co-efficient, **Centrifugation**: Principles, Types – Differential, Density Gradient and Applications.

UNIT-II
Carbohydrates: Classification, Structure of Mono, Di, Oligo and Polysaccharides.
Amino acids: Structure, Properties and Biosynthesis.
Proteins: Synthesis, Structure, composition and functional diversity.
Enzyme kinetics: Nomenclature and classification, Structure, Mode of action, Regulation of enzyme activity.

UNIT-III
Bioenergetics: Energy transformation in living systems, Laws of thermodynamics, actual free energy and standard free energy changes and Redox potentials, Phosphate group transfers and ATP, ATP as energy source, Biological oxidation-reduction reactions.
Lipid: Classification, composition; α-Oxidation and β-Oxidation of fatty acids, Glyoxylate cycle and Gluconeogenesis; Biosynthesis of saturated and unsaturated fatty acids.

UNIT- I V
Plant growth and development: Pattern of plant growth and development, growth kinetics, morphogenesis- principles of differentiation
Growth regulators: Natural and Synthetic growth regulators- Auxins, Gibberelins, Cytokinins, Abscisic acid, Ethylene, Brassinosteroids, Polyamines, Jasmonic acid and Salicylic acid.

UNIT –V
Photosynthesis: **S**tructure and function of Chloroplast, Photosynthetic pigments and their characteristics; Photosynthetic carbon assimilation in C_3, C_4 and CAM Plants; Photorespiration- Mechanism and regulation.
Respiration: Glycolysis, TCA cycle; Electron transport, Pentose phosphate pathway- Mechanism and Significance

PRACTICALS

PLANT BIOCHEMISTRY

1. Estimation of proteins in plant samples by Biuret / Lowry's method & Bradford's method.

2. Estimation of reducing sugars in plant samples by Nelson's / Benedict's method.
3. Determination of amylase activity.
4. Determination of protease activity.
5. Chromatographic techniques-Paper, TLC

PLANT PHYSIOLOGY

1. Separation and estimation of chloroplast pigments (chl-a, chl-b and carotenoids) by solvent extraction method.
2. Separation of chlorophyll pigments by chromatography methods
3. Separation of chlorophyll pigments into two groups.
4. Determination of the absorption spectra of chlorophyll pigments by colorimetric method.
5. Studies on the Leaf anatomy of C3 and C4 plants.

TEXT BOOKS

1. Moore, T. C. 1979.Biochemistry and Physiology of plant hormones. Springer-Verlag. New York, Heidelberg. Berlin.
2. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & sons, Inc., New York,USA.
3. Salisbury, F.B and Ross, C.W.1992 Plant Physiology (4^{th} edition).Wadsworth Publishing Co., California, USA
4. Lehninger, A .L. 1978. Biochemistry. KalyanPubl, Ludhiana

REFERENCE BOOKS

1. Dey and Horborne.1996 Plant Biochemistry. Academic PressKeldt, H. W. 1997. Plant Biochemistry and Biology. OUP.
2. Lea, P.J. and Leegood, R.C. 1999. Plant Biochemistry & Molecular Biology. John Wiley and Sons. New York.
3. Wilkins, M.B. (Ed). 1987. Advanced Plant Physiology. ELBS and Longman. Essex, England.
4. Buchanan, B.B., Grussem, W. and Jones, R. 2000. Biochemistry and Molecular Biology of plants. American Society of Plant Physiologists, Maryland, USA.
5. Hooykaas, P. J. J., Hall, M.A and Libbenga, K.R. (eds) 1999. Biochemistry and Molecular Biology of Plant Hormones. Elsevier, Amsterdam, The Netherlands.
6. Mc Elroy, W. D. 1995. Cell physiology and Biochemistry, Prantice Hall of India.

WEB REFERENCES

1. https://photosynthesiseducation.com/photosynthesis-and-cellularrespiration
2. https://byjus.com/biology/plant-growth-regulators
3. https://byjus.com/biology/photoperiodism-vernalisation
4. http://www.agrimoon.com/wp-content/uploads/Fundamentals-of-Biochemistry.pdf

5. http://aulanni.lecture.ub.ac.id/files/2012/01/15616949-Lehninger-Principles-of-Biochemistry-1-copy.pdf

COURSE III

BOT 202: MOLECULAR BIOLOGY OF PLANTS AND BIOINFORMATICS

COURSE OBJECTIVES

Enable the students to

1. To understand basic organization of genetic material in plant cell and the realms of events associated with replication, DNA damage, DNA repair, Protein synthesis and gene expression.
2. To understand the concept of biological databases and use of different public domains for DNA and protein sequence retrieval
3. To explain the structure of proteins homology by different modeling approaches.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Distinguish between structure and function of nucleic acids DNA and RNA and able to analyze their applications. Able to correlate between mode of gene expression and functioning of an organism.Understand repair of DNA damage by the living systems and the mechanisms of this process to gain knowledge in the gene regulation, Genomics and Transcriptomics

CO 2. Able to interpret nucleochloroplastic interactions, differentiate the prokaryotic and eukaryotic gene structure. Explain about transcription mechanism.

CO 3. Compare and distinguish the processes and mechanisms involved in transcription anddiverse translation strategies, prioritize the applications of molecular biology to societal needs with reference to medicine, industry and agriculture.

CO 4. Explain mechanism of RNA synthesis, initiation, capping, elongation, template specificity and various factors affecting its regulation. Distinguish the link between metabolic pathways and gene regulation. Utilize the practical skills in molecular biology techniques to enhance the entrepreneurial activities among rDNA technology.

CO 5. Gain an understanding of the concept of biological databases and use of different public domain for DNA and proteins sequence retrieval. Able to utilize computers to handle biological database.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	M	M								H	H				H
CO2	H	L		M			M					M	H				H
CO3	H			H				M		M		M	H				H
CO4	H			H			M	M				H	H	H		H	H
CO5	H					H	M					H	H		H		

SYLLABUS

UNIT–I

Structure and Biochemistry of Nucleic acids: Structure and Properties of DNA- Watson and Crick model of DNA, Types of DNA- A, B & Z forms, C-value paradox, cot curve and its significance; *In situ*-hybridization- concept and technique. DNA replication in Prokaryotes and Eukaryotes, DNA Damage and repair: Types of DNA damage - deamination, Oxidative damage, Alkylation and Pyramidine dimmers, Repair pathways- Excision, Mismatch and Recombination repair. Restriction mapping: Concept, Techniques andApplications.

UNIT – II

Chloroplast genome: Organization and Gene expression; RNA editing, Nucleochloroplastic interactions.

Gene- Structure: Fine structure of Prokaryotic and Eukaryotic genes; Types (Structural, Regulatory, Split and House Keeping genes), Cis-trans test.

Transcription:Enzymes and molecular mechanisms involved in Transcription and Transcriptionalfactors.

UNIT-III

Proteins: Genetic code (Elucidation of genetic code, mechanism); Mechanism of translation-Polypeptide chain initiation, elongation and termination in Prokaryotes and Eukaryotes, Post translational modifications. Features of promoters.

UNIT –IV

Types of RNA, RNA Processing, Regulation of Gene expression in prokaryotes and eukaryotes, An overview of levels of regulations, Operon concept, Positive and Negative regulation in E.coli, Lac and Ara operon. Structure and role of rRNA and tRNA in initiation, elongation and termination.

Unit-V:**Bioinformatics**

Introductionon Biological databases

1. Primarydatabases

A. Nucleotide databases: NCBI, EMBL,DDBJ.

B. Protein databases: SWISS PROT, PIR, MIPS,Tr-EMBL

2. Secondary databases: PROSITE, PRINTS, BLOCKS,PATTERNS
3. Protein structural Classification Databases: SCOP, CATH
4. Protein structure database:PDB

PRACTICALS

MOLECULAR BIOLOGY

1. Isolation of plant DNA and its quantification by spectrophotometricmethod.
2. Isolation of RNA from dry Yeast and its quantification byspectrophotometric method.
3. Restriction digestion of plant DNA, its separation by Agarose gel electrophoresisand visualization by Ethidium bromidestaining.
4. Separation of plant RNA by Agarose gel electrophoresis and visualizationby Ethidium bromidestaining.

5. Southern blot analysis using a gene specificprobe.

BIOINFORMATICS

1. Retrieval of Nucleotide sequences from NCBI,DDBJ,EMBL.
2. Protein sequence retrieval from Swissport.
3. Protein sequence classification using SCOP andCATH.
4. Secondary databases information retrieving from PROSITE, PRINTS andBLOCKS.
5. Local alignment of sequence usingBLAST.
6. Global alignment of sequence usingFASTA.

TEXT BOOKS

1. Brown,T.A. 2000. Essential of Molecular Biology, Vol-I and 2 Ed. Oxford UniversityPress
2. Bal Harshawardhan,P. 2006. Bioinformatics- Principles and Applications.TataM.C.Graw- Hill Publishing Company, NewDelhi.
3. Verma P.S and Agarwal VK. 2009. Genetics. S. ChandPublication.
4. Kuppuswamy.C. 2007. Bioinformatics Alogorithms. DominananjPublishersand Distributers, New Delhi.

REFERENCE BOOKS

1. Alberts, B. Bray, D., Lewis, J., Raff, M., Roberts, K., and Watson, J.D.1999. Molecular biology of the cell. Garland Publishing Inc., NewYork.
2. Ausubel,F. M., Brent, R., Kingston, R.E., Moore, D.D., Seidman, J.G.,Smith, J.A. and Struhl,K. 2005. Current Protocols in Molecular Biology. (CurrentEdition).
3. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000.Biochemistry and molecularBiology of plants. American Society of plants Physiologists, Maryland,USA.
4. Krishnamurthy, K.V.2000. Methods in cell wall Cytochemistry. CRC Press, Boca Raton Florida.
5. Yadav Neelam. 2004. A hand book of Bioinformatics. AnmolPublicationsPvt.Ltd., New Delhi.
6. Rastogi,S.C, MendirattaNamita, Rastogi Parag. 2006. Bioinformatics-concepts, Skills and Applications. CBS Publishers and Distributors, NewDelhi.
7. Campbell.A. Malcolm; HeyerLaurie.J. 2002. Discovering Genomics Proteomicsand Bioinformatics. Benjamin Cummings, New York.

WEB REFERENCES

1. https://molbiomadeeasy.files.wordpress.com/2013/09/fundamental_molecular_biology
2. https://www.easybiologyclass.com/molecular-biology-online-tutorials-lecture-notes-study-materials/
3. https://www.brainkart.com/subject/Genetics-and-Molecular-Biology_240/
4. https://www.uou.ac.in/sites/default/files/slm/BSCBO-301.pdf

COURSE II

BOT 203: PLANT REPRODUCTION AND PLANT BREEDING

COURSE OBJECTIVES

Enable the students

1. To impart knowledge on methods of reproduction, development of gametes,fertilization mechanism and post fertilization changes.
2. To study the principles and approaches in various plant breeding techniques

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Interpret the developmental stages in the life-cycle of Angiosperms. Have practical skills to do basic developmental biology experiments.Apply the knowledge of Palynology in the oil & honey industry and also in Forensic science.

CO 2.Differentiate reproductive organs at Morphological, Anatomical, Physiological and Biochemical level.Distinguishthe knowledge of traditional and modern practices in Horticulture for plant propagation and developing different propagation practices

CO 3. Develop conceptual understanding of different methods in plant breeding. Demonstrate various aspects of plant breeding to critically evaluate the research prospects in the subject area.

CO 4. Design the strategy for breeding of commercially important plant to induce the ploidy in plants to develop the elite phenotype. Collaborate with research institutes for development of plant variety.

CO 5. Apply genetic principles and solve problems apply the modern as well as conventional methods of crop improvement and will have experiences in conductiong hybridization and plant propagation methods.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	H		M		M							M			M	
CO2	H	H		H									H			H	M
CO3					M		H				M	H	M				H
CO4						H	H			H			H			H	
CO5			H	H						H			H				H

SYLLABUS

UNIT I

Types of reproduction- Asexual and Sexual -Structure of flower

Microsporogenesis: - Male reproductive unit- Pollen grain formation- Structure of anther, Microsporogenesis-Pollen grain –Development of male gametophyte, Pollen structure, Malegamete

UNIT–II

Megasporogenesis: Female reproductive unit- Ovule – Structure and development; Megasporogenesis; Development of embryo sac- Structure of Embryo Sac – Female gamete- Pollination, Significance and types- Pollen - Pistil interaction, Fertilization, Double fertilization

UNIT–III

Post fertilization- Endosperm development - Embryogenesis – Dicot and Monocot embryo types; Seed and Fruit Development, Polyembryony; Apomixis; Parthenogenesis, Apogamy, Polyembryony, Parthenocarpy.

UNIT- IV

Plant introduction and acclimatization: Scope, objectives and limitations, plant quarantine Plant introduction agencies (National and International).

Selection: Mass selection, pure line selection, clonal selection- Definition, methods and procedures followed.

Hybridization : Hybridization strategies in breeding (single cross, double cross, back cross, three-way cross, reciprocal cross)-Interspecific and Intergeneric crosses. Advantages and constraints – Bulk and pedigree methods. Heterosis and crop improvement.

UNIT-V

Polyploidy: Definition, Types & Induction– Polyploidy in plants, Crossing of polyploidy species, characters associated with polyploidy- significance of polyploidy.

Mutation breeding: Definition, types-artificial induction of mutations-mutagens-methods of increasing the frequency of mutation - role of physical and chemical mutants in inducing beneficial mutations. Impact of mutation of breeding – practical applications.

Multilocational tests: applications in screening the evolved genotypes. Methods adopted in releasing new genotypes.

PRACTICALS

1. Study of Microsporogenesis and Gametogenesis in sections ofAnthers.
2. Examination of modes of Anther dehiscence and collection of pollen grains for microscopic study (Maize, Grasses, *Cannabis sativa, Crotolaria,Tradescantia, Brassica, Petunia, Solanum melongena*etc.).
3. Study of Ovules in cleared preparations; Monosporic, Bisporic and Tetrasporic types of Embryo sac development through examination of Permanent stains serialsections.

4. Estimation of Percentage and Average Pollen tube growth*invitro*.
5. Acetolysis of Pollen grains fromHoney.
6. Studies on the plant introduction and selection methods (Demonstration with appropriate models)
7. Hybridization studies (floral biology, pollen viability, pollen collection and preservation. Stigma receptivity, artificial pollination, bagging, handling the crossed fruits (demonstration with appropriate models).
8. Studies on the induction of polyploidy
9. Studies on the induction of mutations through irradiation and EMS treatment.
10. Evaluation of genotypes (agro-botanical and yield contributing parameters).

TEXT BOOKS

1. Bhojwani, S.S. and Batnagar, S.P.2000. The Embryology of Angiosperms (4^{th}revised and enlarged edition). Vikas Publishing House, NewDelhi.
2. Pullaiah,T.,Lakshminarayana,K.andHanumanthaRao,B.2008.Plant Reproduction. Scientific Publishers,Jodhpur.
3. Raghavan, V.1999. Developmental Biology of Flowering Plants. Springer- Verlag, NewYork.
4. Esau. 2006. Anatomy of seed plants 2^{nd} edition. John Wiley&sons.Singh, B. D. 2000.
5. Plant Breeding Principles and Methods. Kalyani Publishers,

REFERENCE BOOKS

1. Shanna, K.R and Rangaswamy, N.S.1992. Pollen Biology. A Laboratory Manual. Springer-Verlag,Berlin.Shanna, K.R. and Johri, B.M.1985.
2. TheAngiosperm Pollen. Structure and Function. Wiley Eastern Ltd., NewYork.
3. Allard. R. W. 1976. Principles of plant breeding, John Willey and sons Inc, New York,.
4. Chaudhary, R. C. 1997. Introduction to Plant Breeding. Oxford and IBH, New Delhi.
5. Chopra, V.L. 2000. Plant Breeding – Theory and Practice. Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.
6. Gardener, E.J. and D.P.Snustad. 1996. Principles of genetics, John Wiley and Sons, New York.
7. Singh, B.D. 1990. Plant breeding, Kalyani Publ. New Delhi.

WEB REFERENCES

1. https://organismalbio.biosci.gatech.edu/growth-and-reproduction/plant-reproduction/
2. https://www.britannica.com/science/plant-reproductive-system
3. https://www.britannica.com/science/plant-breeding
4. https://pubs.acs.org/doi/10.1021/jf305531j

COURSE IV

BOT 204: GENETICS AND BIOSTATISTICS

Course Objectives

Enable the students

1. To study Mendel principles of Genetics, its deviations,Sex- linked inheritanceandself incompatibility in plants.
2. To understand the genetics of prokaryotes. Explainchromosome as a Linkage unit, and understand Chromosomal mapping, Chromosomal aberrations and Genetic Recombination.
3. To analyze the new emerging concepts in geneticsand heredity, gene mutations and mechanism of transposition.
4. To differentiate Autopolyploids and Allopolyploids. and significance of Trisomics and Monosomics
5. To impart knowledge about basic principles of Biostatistics and know its application in various biological methods.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Explain the principles of genetics and different types of heritable traits andable to relate mechanism of extra chromosomal and epigeneticinheritance. Identify the genetic importance of plasmids in recombination.

CO 2. Able to interpretdifferent types of gene interactions based on genotypic and phenotypic ratios. Able to predict the phenotypic and genotypic ratios when two interacting genes are influencing the expression of a character.Able to apply the knowledge to understand various traits in individuals and populations of microbes andplants.

CO 3. Demonstrate the structure and various aspects of transmission genetics. Equipped to apply genetic principles and solve problems. Able to execute repetitive elements and types of transposons and their significance in transgenics.

CO 4. Able to apply the principles of polyploidy breeding in crop improvement

CO 5. Describe the basics of probability and statistics relevant to biological research and. able to perform inferential statistics for the data analysis of biological data.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H		M			M	M					H		M		H	H
CO2	H		M			M						H		M		H	H
CO3	H					M						H		H			H
CO4	H			H		M								H			M
CO5	H					M	H									H	H

SYLLABUS

UNIT–I

Laws of Mendel; Monohybrid, Dihybrid and Trihybrid ratios, Incomplete dominance and Co-dominance. Deviations of Mendel's laws, Interaction of genes, Cytoplasmic gene interaction, Multiple alleles, Self incompatibility alleles in plants. Sex linked inheritance, sex determination.

UNIT-II

Genetics of Prokaryotes: Bacterial Conjugation, Mapping Bacterial genome, Transformation, and Transduction in bacteria, Phage phenotypes, Genetic recombination in phage. Episomes and Plasmids in recombination.

Chromosome Mapping: Linkage: Complete and incomplete linkage and Linkage groups, Genetic markers, Construction of molecular maps, Correlation of genetic and physical maps.

Genetic recombination and genetic mapping: Mechanism ofcrossing over and recombination, TetradAnalysis.

UNIT-III

Mutations: Occurrence, Types of mutations, Physical and Chemical mutagens, Molecular basis of gene mutations, Applications and Significance of Mutations. Transposable elements in Prokaryotes and Eukaryotes, Mechanism of Transposition.

UNIT-IV

Structural and numerical alterations in chromosomes: Origin, Meiotic behavior of Duplication, Deficiency, Inversion and Translocation; Origin, Production and Meiotic behavior of Haploids, Autopolyploids and Allopolyploids. Evolution of major crop plants, Production, Meiosis and significance of Trisomics and Monosomics

UNIT- V

Statistical methods in Biology: Basic statistics: (Methods of sampling, Measures of dispersion, Coefficient of variation and Standard error).Types of distributions (Normal, Binomial and Poisson).Tests of Significance- t-test and f-test, Correlation and Regression, chi square test, ANOVA.

PRACTICALS

1. Study of problems with specific examples ingenetics.
2. Study of geneticvariability
3. Induction ofMutations
4. Study of Genetic maps (Phase,Maize)
5. Geneticspotters.

TEXT BOOKS

1. Griffiths, A. J. F., Miller, J. H., Suzuki, D. T., Lewontin, R. C., and Galbert, W. M. 2000. An Introduction to Genetic Analysis. W. H. Freeman Publishers, NewYork.
2. Singh, B. D. 2000. Plant Breeding Principles and Methods. Kalyani Publishers, Ludhiana.
3. Verma P.S and Agarwal VK. 2009. Genetics. S. ChandPublication.

REFERENCE BOOKS

1. Ahluwalia. K. 1985. Genetics. Wiley Eastern Ltd., NewDelhi.
2. Farnsworth. M.D. 1978. Genetics. Harper &Row.,New York.
3. Hard, D. L. and Jones, F.W. 1998. Genetics: Principles and Analysis (4^{th}Ed.) Jones and Barlett Publ. Massachusetts,USA.
4. Lewis, B. 2000. Gene VII. Oxford Univ. Press, New York.USA.
5. Snustad, D. P. and Simmons, M. J. 2000. Principles of Genetics (2^{nd} Ed.) John Wiley &Sons Inc.,USA.
6. Sybenga, J. 1972. General Cytogenetics, Elsevier Publishing Co.,USA.
7. Tamarin, R. H. 1999. Principles of Genetics. McGraw Hill, NewDelhi.

WEB REFERENCES

1. https://www.technologynetworks.com/genomics/lists/11-milestones-in-plant-genetics-296248
2. https://www.nal.usda.gov/legacy/topics/agricultural-biotechnology-plant-genetics-and-plant-breeding
3. https://sphweb.bumc.bu.edu/otlt/mph-modules/bs/bs704_biostatisticsbasics/bs704_biostatisticsbasics_print.html

SEMESTER III

COURSE I

INTERNAL ELECTIVES (IE-I) - OPTIONAL COURSE
BOT 301 IE-Ia, b & c MOOCs (COURSESAVAILABLE ON SWAYAM PLATFORM)

COURSE OBJECTIVES

Enable the students

1. To encouragestudents to take one or two online MOOC courses in place of discipline elective course to facilitate large-scale interactive participation and open access via the web platforms,
2. To provide interactive user forums that help build a networking community for students to achieve self directed learning.
3. To provide free and open registration and distance education learning and to access online resources.
4. To provide opportunities for students to manage their own time in order to develop their intrinsic motivation and commitment to the course
5. To provide alternatives for students to accredit MOOCs to increase the retention.
6. To provide opportunities for students to contribute in discussion forums and blogs in order to sustain their motivation to participate and complete the course.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Acquire knowledge to access the free online courses and integrate social networking for personal enrichment and lifelong learning opportunities.

CO2. Choose to self-organize to participate according to learning goals, prior knowledge and skills, and common interests

CO3. Integrate self-directed learning environments to expand autonomy, computer and language skills.

CO4. Justify learner-centered communities by participating in group projects or collaborative study groups to develop self learning skills.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1						H										H
CO2												H				H
CO3						H										H

CO4								H				H				H

COURSE II

BOT 302 - Research methodology

COURSE OBJECTIVES

Enable the students

1. Tounderstand the significance of research methodology, develop ability to use appropriate data gathering methods and enhance the ability to interpret and present data in research report.
2. Gain knowledge on the role of statistics in research and apply statistical techniques in interpreting data meaningfully, and know the issues in research, intellectual property rights and patents.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Identify research methodologies and significance of scientific research procedures qualities of researcher.

CO2. Execute research planning, hypothesis formation and sketch different types of hypothesis.

CO3. Compare the experimental designs and sampling methods.

CO4. Summarize research report in a better way and choose better options for publication and presentation

CO5. Compile research results and follow ethics in scientific writing to get intellectual property rights and able to produce patents.

Mapping COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4
CO1		H				H			H	H		M		H		M
CO2		H				H			H	H		M		H		M
CO3		H				H			H	H		M		H		M
CO4		H				H			H	H		M		H		M
CO5		H				H			H	H		M		H		M

SYLLABUS

UNIT-I

Research: Meaning, Objectives, Motivation, Utility of Research, Research Significance – Types: Fundamental, Applied and methods, Qualities of researcher – Steps in Scientific research.

UNIT – II

Planning a Research: Selection of a problem – Formulation of research problem – Need for literature review – Sources of literature – Hypothesis formation – Types of hypothesis.

UNIT – III

Research Design: Basic principles – Features of a good design – Experimental designs.

Sampling methods: Characteristics of a good sample design – Probability and non-probability sampling methods.

UNIT – IV

Report Writing: Components – Types of reports, Layout of research report, Principles of writing, References, Appendices – Format of publication in research Journals – Paper Presentations: Planning, Preparation, Visual aids – Preparation of research proposal.

UNIT –V

Application of research results and ethics: Ethical issues –copy right, plagiarism, royalty-ethical committees, Intellectual property rights and Patents- Types of patents, Patent filling procedure.

TEXT BOOKS

1. Kothri. C.R. 2004. Research Methodology: Methods and Techniques. New Delhi: New age International Publishers.
2. Kumar, R. 2009. Research Methodology: A Step by Step Guide for Research. New Delhi: Pearson Education.
3. William, C.G. 1981. Concepts of Statistical Influence 2nd Edition. New York: Mc. Graw Hill International.

REFERENCES BOOKS

1. Anthony, M. Graziano, A.M. and Raulin, M.L. 2009. Research Methods: A Process of Inquiry. Allyn Bacon.
2. Burno, R.B.. 2000. Introduction to Research Methods. New Delhi: Sage Publications.
3. Coley, S.M. and Scheinberg, C.A. 1990. Proposal Writing. New Delhi: Sage Publications.
4. Aay, R.A. 1992. How to Write and Publish a Scientific Paper. Cambridge University Press.
5. Fink, A. 2009. Conducting Research Literature Reviews: From the Internet to Paper. New Delhi: Sage Publications.
6. Leedy, P.D. and Ormrod, J.E. 2004 Practical Research: Planning and Design. New York: Prentice Hall.

WEB REFERENCES

1. https://sciencing.com/five-characteristics-scientific-method-10010518.html
2. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5019873/
3. https://explorable.com/research-methodology

COURSE III

BOT 303: ETHNOBOTANY AND HERBAL MEDICINES

COUSE OBJECTIVES

Enable the students

1. Students will be able to study the scope and importance of Ethnobotany, various systems of medicine there importance in treating various diseases.
2. Students will be able to acquire knowledge on propagation, cultivation of medicinal plants and production of secondary metabolites.
3. To demonstrate preparation of herbal formulations, dosage forms of plant medicines and to aware of different kinds of adulterations.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Appraise the importance of Ethnobotany.Able to predict ethnic knowledge of important medicinal plantsand use of traditional knowledge in India. .

CO 2. Identify and understand ethnobotanical values of plant species. Identify the potential use of plants as medicine. Identify theadulteration of herbal medicines.

CO 3. Demonstrate macro and micro propagation and cultivation of medicinal plants. Develop skills and methods used to collect, classify and preserve plant materials for quality production of crude plant materials according to the market trend and to facilitate profitable trade ethically.

CO 4. Evaluate the ethnobotanical survey techniques. and analyze the data for research and drug discovery. Correlate the competence to initiate start-ups or job opportunity in phytochemical and pharmaceutical industries.

CO 5. Understand and apply therapeutic uses of different medicinal plants to contribute in the field of research in Ayurveda.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	M	H		M	M	H	H			H	H	M	H	M		H	H
CO2		M		M		M	M			H	H		H			H	H
CO3							H	M	H	H	H	H	H			H	
CO4						H	H		M		H		H			H	H
CO5		H		H			H			H	H		H			H	H

SYLLABUS

Unit - I

Ethnobotany: Scope and importance; Inter disciplinary approaches in Ethnobotany; study of Medicinal, Edible and Miscellaneous plants used by the Tribes of Andhra Pradesh; Applications of Ethnobotany.

Unit - II

Phytomedicine: Systems of Medicine (brief); Brief history, Origin and Scope of Plant Medicines; Identification of locally available Medicinal plants.Vitamins, Various secondary metabolites and Biosynthesis; Adulteration and Alternations of the Drugs.

Unit - III

Propagation and Cultivation of Medicinal Plants: Macro and Micro Propagation and cultivation of medicinal plants; Multiplication of Medicinal Plants and Production of Specific Biologically Active Molecules through Tissue culture;Methods of Collection, Processing and Storage of Plant Medicines; Plant Medicines, and their Trade and Marketing.

Unit – IV

Adulteration, Identification and Substitutions: Macroscopy and microscopy of medicinally useful plant parts such as Leaves (Senna, Neem, Tulasi), Stems (Datura, Cinnamon, Cinchona), Underground parts (Turmeric, Ginger, Asparagus), Flowers (Clove), Fruits (Fennel, Nux-vomica, Emblica, Terminalia) and Root (Ipecacuanha). Plant Medicines - Adulteration, Identification and Substitutions.

Unit - V

Formulations and Dosage forms of Plant Medicines:Formulations and dosage forms of plant medicines; Study of the important Diagnostic features of Active constituents; Quality, Purity and Uses of Plant Medicines; Herbal Cosmetics and Dietetics; Biologically Active Principles of established Herbal Medicines.

PRACTICALS

1. Identification of important medicinal plants and study of important morphological features of the Medicinal plant parts.
2. Field trip to study and identify locally occurring Medicinal plants.
3. Practical Methods of Cultivation, propagation, conservation and protection of important Medicinal plants to develop familiarity.
4. Practical demonstration of collection, processing and storage of Plant Medicines.

5. Demonstration of Drug Adulteration.
6. Demonstration of drug Formulation and Herbal cosmetics.
7. Organoleptic examination of Physical and Chemical properties of important Plant Medicines.
8. Visit to nearest Pharmaceutical Industry.

TEXT BOOKS

1. Harborne, J. B. 1948. Phytochemical Methods (Ed.) Chapman and Hall, London
2. Kokate, C. K. Purohit, A.P. Gauchely, S.B. 1990. Pharmacognosy, Narial Prakashan, India.
3. Trivedi, P.C. 2002. Ethnobotany, Avishkar Publishers, Jaipur, India.
4. Sharma, R. 2003. Medicinal plants of India – An Encyclopedia

REFERENCE BOOKS

1. Khare, C. P. 2000. Indian Herbal Therapies. Delhi Book Co., M-Connaught, Circus, New Delhi.
2. Trease, G. E. and Evans, W.C. 1983. Pharmacognosy.(12th Ed.), Bailine, Londong.Wallis, T. E. 1999. Text Book of Pharmacognosy, (5th Ed.) CBS Publishers & Distributions, New Delhi.
3. Arber, A. 2008. Herbal Plants & Drugs. Agro Science Book Centre, New Delhi.
4. Cutler. S.J. & Cutler. H.G. 1999. Biologically Active Natural Products – PharmaceuticalsAgro Science Book Centre, New Delhi.
5. Khare, C.P. 2000. Indian herbal therapies. Delhi Book Co., Connaught, Circle, New Delhi.
6. Nadkarni, K. M.2004. Indian plants & Drugs with their Medicinal Properties. Agro Sci. Publ. Centre, New Delhi.
7. Panda, H. 2003.Medicinal Herbs & Their Uses with Formulations. DayaPubli. House, New Delhi.

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WEB REFERENCES

1. https://www.researchgate.net/publication/259423567_Ethnobiologvethnobotanistethnomedicine_and_traditional_knowledge_with_special_reference_to_India
2. https://en.wikipedia.org/wiki/Ethnobotany
3. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC1071505/

COURSE- IV

BOT 304: PLANT TISSUE CULTURE AND GENETIC ENGINEERING

COURSE OBJECTIVES

Enable the students

1. To train the students in the aspects of innovative applications and techniques in plant tissue culture which are essential for conservation programs.
2. To Study about various vectors and DNA modifying enzymes used in rDNA technology
3. To understand the molecular techniques essential for genetic diversity analysis and gene transfer programs.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Describe the core concepts and fundamentals of plant tissue culture and genetic engineering. Familiarized with equipment required in Tissue culture Lab, Media preparation and Sterilization techniques for different plants

CO 2. Demonstrate good practical knowledge to perform plant tissue culture. Able to useEmbryo rescue technique, Somaclonal variation, In vitro mutation and isolation of plant protoplastsfor multiplication of important plants at the verge of extinction.

CO 3. Evaluate Protoplast fusion techniques, gene cloning and analyze different methods of gene transfer.Evaluate the principles of rDNA technology and how it can be used in plants to generate better traits.

CO 4. Design Tissue culture of important Horticultural, medicinal plants to take up micro propagation business with small investment for entrepreneurshipin a setting of Medical Biotechnology, Industrial Biotechnology, and Agricultural Biotechnology..

CO 5. Develop conceptual understanding of the application of basic molecular biology in manipulating and modifying genetic material, cells and organisms. Able to design the techniques and applications of genetic engineering from academic and industrial perspectives. Choose biosafety in legal and ethical issues of plantgenetic engineering

Mapping with COs with POs andPSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H	M	M	M	M		M					H	H			H	
CO2	H					H	H				H	H		H			H
CO3	M		M			H	H					H		H		H	
CO4			M	M	M		H			H			H			H	
CO5						H			H	H	H	H	H			H	

SYLLABUS

UNIT- I

Introduction to Plant Tissue culture : History, Scope and concepts of basic techniques in plant tissue culture, Terms and definitions, Laboratory requirements and organization, Sterilization – methods, Laboratory contaminants – its control measures

Culture Media preparation: Role of Macro and Micro nutrients, Carbon source, vitamins, organic supplements, gelling agents, phytohormones, composition of commonly used culture media. Various media preparation – pH, temperature, maintenance of cultures, Environmental conditions, Explant characteristics

UNIT-II

Basic concept of regeneration: Concept of cellular totipotency and differentiation. Factors affecting morphogenesis and proliferation rate.

Culture Techniques: Selection of explants, sterilization and inoculation.

Initiation of cultures: Induction and growth parameters; Callus initiation, Callus and Cell suspension culture.

Micropropagation: Organogenesis-formation of shoots and roots, Acclimatization, Micropropagation through various explants (Leaf, Stem, Axillary bud), Somaclonal variation, Synthetic seeds, technical problems inmicropropagation.

UNIT-III

Applications of Plant Tissue Culture: Production of haploids and its significance in crop improvement. Production of virus free plants (meristem and shoot-tip).

Somatic hybridization: Protoplast isolation, fusion and culture, achievements and limitations of protoplast research; Methods of hybrid selection and characterization of hybrids.

Cryopreservation – methods and *in vitro* conservation of germplasm

UNIT-IV

Principles of Gene cloning and Enzymology of r DNA technology: Cloning vectors- plasmids, Phages, Cosmids, Phagemids and strategies of cloning, expression vectors. Bacterial transformation and transfection. Genomic and c DNA libraries construction, Selection and analysis of cloned genes and its products.

UNIT-V

Genetic Engineering of Plants: Plant Gene Isolation; Gene transfer Methods - Ti and Ri Plasmid, Biological method of t-DNA transfer; Physical methods of gene transfer - Electroporation,

Macroinjection, Microinjection, Biolistic and Chemical methods of gene transfer - PEG mediated gene transfer. Chloroplast transformation; Regulations of release and concerns of genetically modified crops; Intellectual Property Rights; Applications of transgenic plants.

PRACTICALS

1. Sterilization Techniques - Autoclave and Hot AirOven,
2. Preparation of nutrientmedia.
3. Establishment of callusculture.
4. Organogenesis in calluscultures
5. Micropropagation through various explants
6. Production of Asepticseedlings
7. Preparation of Synthetic seeds using Sodiumalginate

TEXT BOOKS

1. Bhojwani, S.S and Razdan, M.K. 1996. Plant Tissue culture Theory and Practical (a revised edition). Elsevier Science Publishers, New York,USA.
2. Smith, R. H. 2000. Plant Tissue Culture: Techniques and Experiments. Academic Press, NewYork.
3. Smith, R. H. 2000. Plant Tissue Culture: Techniques and Experiments. Academic Press, NewYork.

REFERENCE BOOKS

1. Collins,H.A and Edward, S. 1998 Plant Cell Culture. Bio-Scientific Publishers Oxford, UK.
2. Jain, S.M., Sopory, S.K. and Veilleux, R.E. 1996. *In vitro* Haploid Production in Higher plants. Vols 1-5, Fundamental Aspects and Methods, Kluwer Academic Publishers, Dordrecht, TheNetherland.
3. Kartha,K.K 1985. Cryopreservation of Plant Cells and Organs. CRC Press, Boak Raton, Florida,USA. Bhojwani, S.S 1990. Plant Tissue-Culture Applications and Limitations.ElsevierScience Publishers, New York,USA.
4. Bhojwani, S.S 1990. Plant Tissue-Culture Applications andLimitations.ElsevierScience Publishers, New York,USA
5. Razdan, M.K. 2004. Introduction to Plant tissue culture.2nd Edn. Oxford andIBHPublishing Co. Pvt. Ltd, New Delhi.
6. Vasil, I.K and Thorpe, T.A 1994. Plant Cell and Tissue-culture Kluwer Academic Publishers, The Netherland.

WEB REFERENCE

1. https://nptel.ac.in/courses/102/103/102103016/
2. http://assets.vmou.ac.in/MBO08.pdf

3. https://www.biologydiscussion.com/plants/plant-tissue-culture/plant-tissue-culture-benefit-structure-types-and-techniques/10632
4. https://www.aminotes.com/2019/05/plant-biotechnology-notes_4.html

COURSE -V
EXTERNAL ELECTIVE

BOT EE - PHYTOMEDICINE

COURSE OBJECTIVES

Enable the students

1. To recognise the importance of plant constituents and its classification.
2. To describe history of herbalism and traditional system of medicine.
3. To know about the Cultivation, collection, processing, adulteration, identification and substitutions of medicinal plant drugs.
4. To explain formulations, diagnostic features and biological activities of plant medicines and their trade. Distinguish the importance of IPR

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Acquire knowledge on the importance of plants in promotive and curative aspects for the benefit of human beings.

CO 2. Explore by examining various plant drugs microscopically and macroscopically to aware of the adulteration.

CO 3. Prioritize on the extraction, isolation, purification and characterization of bioactive compounds of commercial importance.

CO4. Correlate use of medicinal herbs in different diseases. Produce herbal pharmaceutical products as a part of a small-scale industry. Contribute in the field of Research in Ayurveda.Analyze the concept of IPR, various legal issues related to IPR. Able to practice IPR.

CO 5. Study and analyze the marketing strategies of Indian herbal drugs at national and International level to assess the trade.

Mapping with COs with POs and PSOs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H		H										M				
CO2		H	M	M									H	M			

CO3					**M**	**H**	**H**									**H**	
CO4							**H**	**M**	**H**	**H**						**H**	**M**
CO5						**H**	**M**				**H**	**H**				**H**	**H**

SYLLABUS

Unit – I

Origin, Scope and Source of Plant Medicines: Brief History, origin and scope of Plant Medicines. Ayurveda, Unani, Siddha and Homeopathy. Study of Medicinal plants from the following groups: Gymnosperms, Angiosperms (Asteraceae, Rubiaceae, Leguminosae, Apocynaceae, Asclepiadaceae, Lamiaceae, Liliaceae and Zingiberaceae.)

Unit – II

Cultivation, Multiplication, Collection, Processing and Marketing: Macro and Micro Propagation and cultivation of medicinal plants; Multiplication of Medicinal Plants and Production of Specific Biologically Active Molecules through Tissue culture; Methods of collection, Processing, Storage.

Unit – III

Adulteration, Identification and Substitutions: Macroscopy and microscopy of medicinally useful plant parts such as Leaves (Senna, Neem, Tulasi), Stems (Datura, Cinnamon, Cinchona), Underground parts (Turmeric, Ginger, Asparagus), Flowers (Clove), Fruits (Fennel, Nux-vomica, Emblica, Terminalia) and Root (Ipecacuanha). Plant Medicines - Adulteration, Identification and Substitutions.

Unit – IV

Formulations, Diagnostic features and Biological activity of Plant Medicines: Formulations and dosage forms of plant medicines; Pharmacology and Pharmacognosy; Study of the important Diagnostic Features of Active Constituents, Quality, Purity; and Pharmaceutical uses of important Plant Medicines. Herbal Cosmetics and Dietetics

UNIT-V

Plant medicine and their trade: Adoption of GATT, Patent rights and Market potential and Trade of plant medicine, IPR, TRIPS, BMC (Biodiversity Management committees).

TEXT BOOKS

1. Harborne, J. B. 1948. Phytochemical Methods (Ed.) Chapman and Hall, London.
2. Kokate, C. K., Purohit, A.P. and Gauchely, S. B. 1990. Pharmacognosy, Narial Prakashan, India.
3. Sharma, R. 2003. Medicinal Plants of India – An Encyclopaedia.
4. Khare, C. P. 2000. Indian Herbal Therapies. Delhi Book Co., M-Connaught, Cirucus, New Delhi.

REFERENCE BOOKS

1. Arber, A. 2008. Herbal Plants & Drugs. Agro Science Book Centre, New Delhi.
2. Cutler, S. J. and Cutler, H. G. 1999. Biologically active Natural Products- Pharmaceuticals, Agro Science Book Center, New Delhi.
3. Irfan A. Khan and Atiya Khanum. 1998. Role of Biotechnology in Medicinal and Aromatic plants.Vol.1.Ukaaz Publications, Hyderabad..
4. Nadkarni, K. M. 2004. Indian Plants and Drugs with their Medicinal Properties. Agro. Sci. Publ. Centre, New Delhi.
5. Panda, H. 2003. Medicinal Herbs & Their Uses with Formulations. DayaPubli. House. New Delhi.
6. Trease, G. E. and Evans, W. C. 1983. Pharmacognosy. (12th Ed.), Bailine, London.
7. Wagner et al (1988) Economic and Medicinal Plant Research. Academic Press, Harcourt Brace Jovanovich Publishers, London.

WEB REFERENCES

1. https://www.ncbi.nlm.nih.gov/books/NBK92773/
2. https://apps.who.int/iris/bitstream/handle/10665/43034/9241592214_eng.pdf
3. https://medlineplus.gov/herbalmedicine.html

SEMESTER IV

COURSE I – INTERNAL ELECTIVES (IE-II)

BOT 401 IE- a): PLANT RESOURCE UTILIZATION

COURSE OBJECTIVES

Enable the students

1. To understand the importance of grain, vegetable, oil, fats, beverages, dyes, timber, and fiber yielding plants.
2. To develop a basic knowledge of paper industry raw material and important medicinal plants.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Describe the basic technique in the preparation of herbarium. Recognize the plants having immense economic importance.

CO 2. Appraiseimportant medicinal plants and plant products encountered in everyday life.

CO 3. Recognizethe diversity of plants, predict the valuable economic products present in plants and the plant products in human use. Explore the potential of various phytochemical techniques, industrial processes, pharmacognostic procedures,¬ authentication of specimens, Preservation of plants and plants products

CO 4. Describe the industrial production of certain valuable products. Discover the alternative source of major nutrients.

CO 5. Integrate the cultivation process of the plant with downstream processing to acquire finished products.

Mapping with COs with POs

CLO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H													H		M		
CO2		H												H		M		
CO3			H				H										H	
CO4				M					H	M			M				H	H
CO5				M								H						M

SYLLABUS

UNIT –I

History, morphology and chemical composition of the following:
a.Cereals and Millets: Wheat, Maize, Sorghum, Rice, Finger millet (Ragi), Pearl Millet and Pseudo cereals.
b.Pulses: Black gram, Chickpea, Cluster bean, Common bean, Horse gram, Cow pea, Lentil Peas, Green gram,Pigeon pea (Red gram)
c.Oils and Fats: Groundnut, Safflower, Coconut, Sesame, Mustard, Castor and Oil palm, Sunflower, Linseed, Soybean, Olive.

UNIT –II

Beverages: Coffee, Tea, Cocoa.
Sugar and Starch: Sugarcane, Beet root, Tapioca, Arrow root, Yam taro and Potato
Non Wood Forest Products: Rubber, Latex, Gums, Resins, Dyes, Tannins, Apiculture,BioVitaminsandAromatic plants.

UNIT –III

Spices and condiments: Cardamom, Pepper, Ginger, Clove, Turmeric, Coriander, Cumin, Nutmeg, Cinnamon, Fenu-greek, Capsicum, All spices
Commercial crops: Spices and Condiments, Flavoring Products, Fumigatories and Mastigatories,Narcotics, Orchids, Ornamentals and Cut flowers

UNIT –IV

Fiber yielding plants: Timber yielding plants; Conventional and Non Conventional EnergyResource Development. Bamboos, Ratans, Generation of Paper Industry Raw material.

UNIT –V

A study of the following medicinal plants with reference to the chemicals and pharmacognosticproperties;
Azadirachtaindica ,Curcuma longa, *Adhatodavasica*, *Rauwolfiaserpentina*, *Catharanthus roseus,Bacopamonera*, *Strychnosnux-vomica*, *Acoruscalamus*, *Saracaindica*, *Aeglemarmelos*, *Terminalia chebula*.

PRACTICALS

1. Food crops: Morphology, anatomy and chemical tests of parts of Wheat, Rice, Maize,Chick pea, Potato,Tapioca, Sweet potato, Sugarcane.
2. Forage/ fodder crops: Study of any five important crops of the locality (for eg: fodder Sorghum, Bajra, Clover gram bean andFicus sp.
3. Plant fibre

a. Textile fibres: Cotton, Jute, Linen, Sun hemp, Cannabis

b. Cordage fibres: Coir.

c. Fibres for stuffing: Silk cotton or Kapok. Morphology, anatomy microscopic study of whole fibresusing appropriate staining procedures.

4. Medicinal and aromatic plants: Screening for secondary metabolites Study of live or herbarium specimens or other visual materials to become familiar with these resources
5. Vegetable oils: Mustard, Ground nut, Soyabean, Coconut, Sunflower, Castor. Morphology, microscopic structure of oil yielding tissues, tests for oil and iodine number.
6. Gums, resins, tannins, dyes: perform simple tests for gums and resins.Prepare a water extract of vegetable tannins (*Acacia, Terminalia, Thea, Cassia*spp,) and dyes (*Turmeric, Bixaorellana, Indigo, Buteamonospermum, Lawsoniainermis*) and perform tests to understand the chemical nature.

TEXT BOOKS

1. Council of Scientific and IndustrialResearch 1986.The Useful Plants of India.Publications and Information Directorate,CSIR,New Delhi.
2. Chandel, K.P.S., Shukla, G and Sharma, N.1996. Biodiversity in Medicinal and Aromatic Plants in India: Conservation and Utilization. National Bureau of Plant
3. Singh,M.P.Soma Dey.2004.Natural resources and renewable energy.DayaPublications,New Delhi.

REFERENCE BOOKS

4. Chrispeels, M.J. and Sadava, D.1977. Plants, Food and People. W.H. Freeman and Co., San Francisco.
5. Cristi, B.R. (eds) 1999. CRC Handbook of Plant Sciences and Agriculture. Vol. I. *In-situ*conservation.CRC Press, Boca Raton, Florida, USA.
6. Conway, G.1999.The Doubly Green Revolution: Food for All in the 21st Century. Penguin Books.
7. Conway, G. and Barbier, E.1994. Plant, Genes and Agriculture. Jones and Bartlett Publishers, Boston.
8. Falk, D.A., Olwell, M. and Millan, C.1996. Restoring Diversity. Island Press,Columbia,USA.
9. Thomas,P.2000.Trees: Their national history,Cambridge University Press,Cambridge.

WEB REFERENCES

1. https://www.researchgate.net/publication/337826434_Plant_Resources_Utilization_-_Class_notes
2. https://onlinecourses.swayam2.ac.in/cec19_bt10/preview
3. http://assets.vmou.ac.in/MBO07.pdf

COURSE I - INTERNAL ELECTIVEIE-II

BOT 401 IE b) : APPLIED BOTANY

COURSE OBJECTIVES

Enable the students

1. To understand the importance of vegetables and flowering crops to mankind.
2. To understand the principles and to practice the plant propagation methods, polyhouse management and protected cultivation of vegetables and flowers and crop protection strategies.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Describe the scope and importance of Applied Botany. Develop their competency in different types of propagation methods of plants.

CO 2. Analyse and compare the organic and inorganic farming. understand the organic farming which does not totally exclude the elements of modern agriculture. prepare suitable soil media for potting up, seedling and cutting, impart the skills like germinating seed and transplant seedlings and cutting into pots.

CO 3. Select and operate nursery raising business with small investment for entrepreneurship. Gain knowledge in cultivation of vegetables and flowers in green house and Develop entrepreneurial skills in the field of horticulture.

CO 4. Equipped with farming skills, the agro-processing, and entrepreneurship. Starting from kitchen garden, able to scale up farming to commercial level.

Mapping with COs with POs

CLO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	H													H			
CO 2						H		M		H						H	
CO 3		H								H						H	
CO 4		H								H							

SYLLABUS

UNIT-I

Introduction to Applied Botany and Production Technology of vegetable crops
a. Cultivation practices of Tomato, Brinjal,Capsicum
b. Cultivation practices of leafy vegetables, Fenugreek,Palak and Amaranthus
c. Cultivation practices of onion, potato and carrot

UNIT-II

Principles and Practices of Plant Propagation:
a. Seedlings; Collection of seeds and Growing seedlings in nurseries;
b. Cuttings: Anatomical and Physiological basis of Propagation by Cuttings;
c. Grafting: Selection of Stock and Scion materials; Stem, Root and Bud grafting techniques;
d. Layering: Ground, Air and Trench layering methods.

UNIT-III

Protected cultivation of flowering plants:
a.Green House Operation and management,
b. Cultivation of Chrysanthemums, Carnations and Roses.
c.Biotechnology of Flower longevity and vase life.

UNIT –IV
Protected cultivation of Vegetable crops
a.Protected cultivation of Tomato
b. Protected cultivation of capsicum
c. Quality vegetable seedling production under shade net

UNIT –V
Crop protectionStrategies:
a. Physical and Mechanical crop protection methods
b. Chemical method of crop protection
c. Biological control – Bio-organisms for Pest Management, Bt based Pesticides, Baculovirus Pesticides

PRACTICALS

1. Methods of Plantpropagation:-

a. Seedlingpropagation
b. Preparation ofgrafts
c. Cuttingpreparation
d. Layering

2. Vegetablecultivation
3. Study of Agricultural tools and implements.
4. Visit to localnurseries
5. Green housemanagement
   a. Roses
   b. Chrysanthemum

TEXT BOOKS

1. Bose T.K and Yadav L.P 1992.Commercial flowers. Nayaprakashan,Calcutta.
2. Krishnamurthy.H.M. 1981.Plant Growth substancesincluding applicationin Agriculture.
3. Rangaswamy, G. and Mahadevan, A. 2002. Diseases of crop plants in India, PrenticeHall of India Pvt.Ltd. NewDelhi.
4. Sadhu, M.K. 1989. Plant propagation Wiley eastern Ltd. New Delhi.

REFERENCE BOOKS

1. Abbott, A.J. and Atkin, R.K. 9eds.) 1987 Improving vegetatively propagated crops. Academic press, NewYork.
2. Bose T.K and Mitra S.K 1990.Fruits – Tropical and Subtropical. Nayaprakashan, Calcutta.
3. Bose, T.K., Sadhu, M.K., & Das, P. 1986. Propagation of Tropical and Subtropical Horticultural crops, NowyaPrakash,Calcutta.
4. Gerald E Wickens. 2001. Economic Botany. Principles and Practices. KluwerAcademic Publishers.
5. Hartmann, H.T., Dester E.D., Davis, F.T., and Geneve, R.L. 1997. Plant propagation. Principles and practices. Prentice Hall of India Private Limited, NewDelhi.
6. Mac Donald, B. 1987. Practical woody plant propagation for nursery growers. Portland, OR: Timberpress.
7. Mehrotra R S –1983-Plant Pathology Tata Mc. Graw Hill Pub. Co. Ltd.,New prentice Hall of India publishing Ltd.Bombay.
8. Randhawa, G.S. and Mukhopadhyay. 1994.Floriculture in India: Allied publishers, New Delhi.

WEB REFERENCES

1. https://en.wikipedia.org/wiki/Branches_of_botany
2. https://www.jstor.org/stable/1627945?seq=2#metadata_info_tab_contents

COURSE I - INTERNAL ELECTIVE IE-II

BOT 401IE-II c): POST HARVEST TECHNOLOGY OF HORTICULTURE CROPS

COURSE OBJECTIVES

Enable the students

1. To learn the importance and scope of Post-Harvest technology of horticultural crops.
2. To Acquaint knowledge on preservation, packaging techniques.
3. To understand Pre and post harvest treatments for extending shelf life period of harvested products of various horticultural crops

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1. Acquire good knowledge on pre harvesting, harvesting and handling techniques for preserving the post-harvest products.

CO2. Describe the factors effecting affecting the quality. losses and deterioration of horticulture produce.

CO3. Examine the technology used for preservation, packaging and factors affecting the Post harvest products.

CO4.Analyze various treatments for Pre and post harvestproduce for extending shelf life period.

CO5. Demonstrate practical knowledge on equipments, containers and packaging practices for better storage of horticulture products.

Mapping with COs with POs

CLO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1				H					H	H	M	H	H				
CO 2								H		H	M	L		H			
CO 3		M					H		H		M					H	
CO 4				H			H	H			H	H	M			H	
CO 5								H		H			H			M	H

UNIT-I

Importance, Status and Scope of Post-harvest technology in horticulture crops. Preharvest factors affecting the quality. Post-harvest losses and factors responsible for deterioration of horticulture produce. Physiological and biochemical changes during ripening process.

UNIT-II

Preservation Techniques: Maturity standards, Preharvesting, harvesting, handling. Curing, grading and precooling of horticulture produce. Preservation of Horticulture produce-drying and dehydration, Canning and bottling.

UNIT-III

Packaging, Transportation and Marketing: Packaging requirements of fruits, vegetables, flowers, spices and plantation crops for domestic and export to market. Types of containers, packaging, and cushioning materials, use of grape guard in packaging. Vacuum and shrink packaging. Transportation-modes of transport, types of transport vehicles. Marketing of fresh produce.

UNIT-IV

Pre and Post harvest treatments: Pre and post harvest treatments for extending shelf life period, storage life-skin coating with wax emulsion, green layering / biomaterials, botanicals, fungicides, chemicals and growth regulators.

UNIT-V

Storage techniques: Methods of storage-traditional methods, special storage structures for potato, onion. Cold storage-Refrigerator and freezing, equipment and construction of cold storage room. Evaporation cool chambers,Controlled/Modified atmosphere storage.

PRACTICALS

1. Physico-chemical analysis of fruits and vegetables- PLW, ascorbic acid, acidity, sugars and pigments.
2. Grading of horticulture produce.
3. Pre-post-harvest treatment of horticulture produce-physical and chemical methods.
4. Packaging of fruits, vegetables, cut flowers, spices and plantation crops, bulk and consumer packs. Storage behavior of fruits and vegetables in cold storage.
5. Equipments and containers used in food processing units. Preparation of dried and

dehydrated products- raisin, potato chips, banana chips etc. canning of fruits and vegetables. Preparation of juice, squash, syrup, jam, jelly, marmalade, candies, crystallized products, preserves, chutney, pickles, tomato products, (sauce, ketchup) etc.

6. Visit to commercial handling and packaging units, markets and cold storage units, CFTRI.

TEXT BOOKS

1. Adel A.Kader, (2002) Post harvest technology of horticultural crops 1,2,3&4 Volumes, University of California Agriculture and Natural Resources Publications 3311.
2. GopinathanPaliyanth, (2008) Postharvest Biology and Technology of Fruits, Vegetables and Flowers, Wiley Black Well Publishers.
3. Peter Golob (Editor), Graham Farrell (Editor), (2002) Crop Post-Harvest: Science and Technology: Principles and Practice Crop Post-Harvest: 1 (Crop Post Harvest Science and Technology, Vol.1) Wiley-Blackwell Publishers.

REFERENCE BOOKS

1. Verma, L.R., Joshi, V.K., (2006) Postharvest Technology of Fruits and Vegetables Handling, Processing, Fermentation and Waste Management, Indus Publishing Company.
2. Chavan, U. D., (2013) Postharvest Management and Processing Technology by Daya Publishing House.
3. Singh, L.S., (2009) Post-Harvest Handling and Processing of Fruits and Vegetables Westville Publishing House.
4. FAO &APO(Asian Productivity Organization) (2006) Post harvest technology of fruit and Vegetables in Asia Pacific Region.
5. Pandit,P.S., (2014) Post harvest technology and Processing of Horticulture crops.

WEB REFERENCES

1. www.Postharvest.ucdavis.edu
2. https://www.wnc.edu/files/departments/ce/sci/postharvesthandling.pdf
3. www.fao.org

COURSE II

BOT 402: ENVIRONMENTAL BIOLOGY AND PLANT BIODIVERSITY

COURSE OBJECTIVES

Enable the students

1. To understand the structure and function of ecosystem so that acquire knowledge on the components of environment, species interactions and population dynamics.
2. To know about natural resources, to get an idea about different types of pollutions and the lab techniques to analyse.
3. To acquire knowledge about Biodiversity and its essential values, levels of biological diversity found within a habitat or ecosystem.
4. To understand various *in-situ* and *ex-situ* conservation strategies of biodiversity.
5. To distinguish activities of National and International Conservation Organizations.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO 1. Recognize how the ecological life cycle, energy flow, biodiversity of ecosystems responds to climate change. Able to predict population dynamics. Comprehend interactions between species and the environment responsible for community composition and structure to apply ecological principles to current conservation issues

CO 2. Predict the level of pollution through field practicals and lab analysis techniques and apply the knowledge in control of pollution. Learn to behave responsibly in order to minimize impact on the environment.

CO 3.Predict the risk of environmental damage and Communicate the knowledge of environmental pollution and the advanced biotechnological approaches and suggest measures to society on pollution and natural disasters to mitigate pollution

CO 4.Gain complete knowledge and recognizethe importance and conservation of biodiversity at local, national and global levels for sustainable development Able to derive ways to better interact with nature

CO 5.Appreciatethe need of biodiversity conservation in the context of various developmental pathways and policy framework that the mankind has been undergoing ¬ Concepts of Hotspots, megadivsrsity regions of the world.. Identify the rare and endangered medicinal plants of India.. Report the legal action for biodiversity conservation.

Mapping with COs with POs and PSOs

CLO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO1	H		H	H	M		H		M		H	H				H	H
CO2	H	M				H	M				H	M				H	H

CO3			H	M	M				H		H	H				H	H
CO4			H	M				M	H		H	M				H	H
CO5					M		H		H	M	H	H				H	

SYLLABUS

UNIT-I

Ecosystem structure and function; Energy flow in ecosystems; Ecological life cycle; Autecology and Synecology – species interaction – types – Population Ecology – Density ,Mortality,Natality. Survival and r and k selection-Characteristics and study of plant communities-Density, Abundance, Frequency and IVI, Polygraph charting – Raunkiaer's Life forms.

Unit -II

Natural resources and their management; renewable and nonrenewable - Preservation, conservation, and restoration of resources. Environmental Pollution: causes, effects and control of air, water, soil, noise, marine, thermal and radioactive pollution. Biomagnification: Eutrophication, Solid Waste management. Bioremediation ; Global warming- Green house effect, impacts on environment and biodiversity; Ozone layer depletion and Acid rain;

UNIT -III

Nature, Values And Distribution of Biodiversity: Nature of biodiversity-genetic, species and ecosystem diversity. Values of biodiversity-economic and environmental. Plants for food, forage, fibre, medicine, yielding gums and resins, essential oils and timber. Concept of Non-Timber Forest Produce. Magnitude and global distribution of biodiversity. Global biodiversity hotspots and hotspots in India. Megadiverse countries-India as a mega diversity center. Agrodiversity- Centers ofOrigin.

UNIT-IV

Biodiversity Conservation and Assessment: Principlesof conservation; the process of extinction; threats to biodiversity-habitat destruction, invasive species and climate change. IUCN Threat categories and criteria. Threatened plants of India. *In situ* conservation of biodiversity: natural protected areas-biosphere reserves, sanctuaries, national parks and sacred groves with reference to India. *Ex situ* conservation- plant propagation methods; botanical gardens and genebanks.

UNIT -V

Conservation Organizations: Brief account on the conservation organization and their activities-International (CI, UNEP, IUCN) and national (BSI, DBT, NBPGR); International agreements on biodiversity conservation-CBD, CITES, RAMSAR.

Strategies for Conservation of Biodiversity: Intellectual Property Rights (IPR) and Patents;

NGO's role in Biodiversity Conservation; BMC (Biodiversity Management committees), Biodiversity Registers, Environmental Impact Assessment (EIA)

PRACTICALS

Environmental Biology

1. Estimation of organic matter in different soil samples.
2. Estimation of dissolved O_2 in different water samples
3. Estimation of water pH in different water samples.
4. Methods of studying vegetation 1. Quadrat method : List quadrat, count-quadrat,
5. Determination of minimum size of the quadrat for a given vegetation by species area-curve method
6. Determination of relative frequency, relative density , relative abundance and relative dominance.
7. Determination of species wise Important value index in a plant community and polygraph charting.

Plant Biodiversity

1. Study of Bio-diversity of identicalareas.
2. Study of Endemic, Rare, Extinct species of Seshachalam hillrange.
3. Genetic Diversity of Species / varieties of *Vinca, Ocimum, Gomphrena, Portulaca, Plumbago, Amaranthus etc.*
4. Screening of plant species for SecondaryMetabolites.
5. Study of Diversity in Flowering Plants – Mesophytes, Xerophytes, Parasites, Hydrophytes, Lianes, Insectivorous plants.

TEXT BOOKS

1. Heywood, V.H. and Watson, R.K.1995 Global Biodiversity Assessment. CambridgeUniversity Press.
2. Kormondy, E.J.1996. Concepts of Ecology, Prentice-Hall of IndiaPvt.Ltd.,New Delhi.
3. J S Singh, S P Singh, S R Gupta – Ecology Environmental Science and Conservation, S Chand Publ. 2014
4. Pullaiah, T. 2002-2005. Biodiversity in India. Vol. I- IV. Regency Publication, New Delhi.
5. Sharma, P.D. 2015. Ecology and Environment.12thed. Rastogi Publications,Meerut.

REFERENCE BOOKS:

1. Lakshmi Narasaiah, M. 2004. Bio diversity and Environment. Discovery publication House., New Delhi
2. Sahni, K. C 2000. The Book of Indian Trees, 2ndEdition. Oxford University Press, Mumbai.
3. Christian Leveque,Jean-claudeMounolouandVivien Reuter. 2004.*Biodiversity*. JohnWiley
4. Cunningham, W.P. &M.A. Cunningham 2007.Principles of EnvironmentalScience-Inquiry and Applications.Tata McGraw Hill Pub. NewDelhi.
5. Lillesand.T.M. &R.W.Kiefer. 2015. Remote Sensing and Image Interpretation.7thed. Wiley.

6. Campbell, J.B & R.H. Wynne. 2011. Introduction to Remote Sensing. 5th ed.The Guilford Press.

WEB REFERENCES

1. https://openoregon.pressbooks.pub/envirobiology/front-matter/introduction
2. https://openoregon.pressbooks.pub/envirobiology/chapter/1-3-environment-sustainability/
3. http://www.uilis.unsyiah.ac.id/oer/files/original/1c18821adec76287db06550e04d69314.pdf
4. https://en.wikipedia.org/wiki/Biodiversity

COURSE -I

BOT 403 RP - RESEARCH PROJECT ANDSUBMISSION OF DISSERTATION, PROJECT PRESENTATION AND VIVA –VOCE

COURSE OBJECTIVES

Enable students

1. To develop scientific inquiry skills to design and carry out scientific investigations.
2. To train students in basics of research, literature recession, analysis and expression of their understanding of the topic in their own words. To create research oriented thought process and basic training
3. To learn about data collection, analysis of data and preparation of project report and submission of report.

COURSE OUTCOMES:

After successful completion of the course the student will be able to

CO1-Students will generate a report based on the experiences and project will be carried out with the ability to apply knowledge of Botany.

CO2 -Design the experiments of his interest and execute it and able to handle the basic and advance instruments.

CO3 - Generate the data, compile and analyze and interpret the data. Develop Presentation skill is. Ready to work in any R&D setup

CO4 -Demonstrate competency in research through problem identification, formulation and solution. Effectively implement skills in communication, in writing and using multimedia tools.

Mapping with COs with POs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1		M		H	H	H							M				
CO2									H					M			
CO3						M	H								H	H	
CO4							H			H		H			H	H	H

COURSE -II

BOT 404 IT: INDUSTRIAL TRAINING AND SUBMISSION OF REPORT, PRESENTATIONAND VIVA –VOCE

COURSE OBJECTIVES

Enable Students

1. To expose the students to actual working environment and enhance their knowledge and professional skills from what they have learnt during their course. .
2. To instil the good qualities of integrity and self confidence and to cultivate student's leadership ability and responsibility to perform the given task.
3. Research abilities of the students will be tested by evaluating the dissertation and conducting a grand viva on the assigned research topic.

COURSE OUTCOMES

After successful completion of the course the student will be able to

CO1 - Extend the boundaries of knowledge through research and development.

CO2 - Explore the principles of experimental designs and differentiates between the different types of designs.

CO3 - Develop significant commitment towards their profession and develop greater clarity about academic and career goals.

CO4 - Develop competence to initiate start-ups or job opportunity

Mapping with COs with POs

CLO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4	PSO5
CO1						H							H				
CO2						H	H									H	
CO3							H									M	H
CO4										H						H	