SRI VENKATESWARA UNIVERSITY

TIRUPATI – 517 502 (A.P.)

M.Sc. BOTANY DEGREE COURSE

Choise Based Credit System (CBCS)

SYLLABUS

(w.e.f. 2019-2020)

DEPARTMENT OF BOTANY

SRI VENKATESWARA UNIVERSITY

TIRUPATI

Vision

- To improve Internationally recognized status of the Department through excellence in higher education and application-oriented basic research in the field of plant science
- To perceive and disseminate the importance of plant diversity, its conservation and sustainable utilization
- To inspire intellectual pursuit and experimental skills through innovative teaching and research in basic processes of Plant life.

Mission

- Development of advanced infrastructural and technological facilities to strengthen quality education and research,
- To promote and foster collaborative research with scientific institutes and industry for enhanced scientific thinking and generating new ideas.
- To expand academic activity by offering new multidisciplinary courses and updating programs to suit to a wider spectrum of students and researchers.

Programme Specific Outcomes (PSOs)

- Students acquire enhanced knowledge of the fundamental concepts of Botany and diverse groups of plants that differentiate them from each other.
- Explain the general characters, classification, external and internal morphology, reproduction, life cycles, economic importance of different phylogenic plant groups including algal forms to Angiosperms.
- Understand the principles and practices of advanced plant taxonomy and gain expertise in the field of Plant Identification
- Understand in detail the physiological and metabolic processes of plants viz Plant development and growth, absorption and translocation of water and mineral elements, transpiration, photosynthesis, respiration.
- Understand the symptoms of abiotic and biotic stress and molecular basis of tolerance and resistance respectively, and apply the knowledge in plant protection.
- Understand the genetic basis of plant traits, gene expression and interaction, regulation in controlling plant development, reproduction, metabolic processes environmental interaction and Evolution.

- Students will be able to relate the physical and chemical components of the environment to the morphological and anatomical structures and adaptation of plant populations, communities, and ecosystems.
- Understand the Phytogeographical regions of India and Plant diversity, plant resources and their management and sustainable utilization.
- Understand the advanced aspects of plant tissue culture, genetic engineering and genomics and their use in plant improvement
- Acquire practical skills to learn about microscopic plant structures and perform experiments to demonstrate physiological, ecological processes and biochemical analysis of Macromolecules and Metabolites
- Demonstrate proficiency in the experimental techniques and methods of analysis appropriate for their area of specialization viz., Pathology, Physiology, Phyoto-medicine, Mushroom cultivation, Hydrophonics and Horticulture.
- Students are well aware of the latest research and innovations in basic and applied aspects of Plant sciences

Prepares students for further advanced studies, gain careers in academics, Research and Development, and Entrepreneurship in the plant field.

SRI VENKATESWARA UNIVERSITY::TIRUPATI

CHOICE BASED CREDIT SYSTEM

M.Sc. BOTANY DEGREE COURSE : 2019-2020

TITLE OF PAPERS

SEMESTER-I

Core Theory	BOT-101	Algae, Bryophytes, Pteridophytes & Gymnosperms
Core Theory	BOT-102	Taxonomy of Angiosperms
Foundation – I	BOT-103	Microbiology
Compulsory Foundation-I	BOT-104	Human Values& Professional Ethics – I
Practical-I	BOT-105 P I	Theory Papers : Bot-101 & 102
Practical - II	BOT-106 P II	Theory Paper : Bot-103 & Study tour/Herbarium/Field Work

SEMESTER-II

Core Theory	BOT-201	Plant Ecology
Core Theory	BOT-202	Plant Biochemistry & Plant Physiology
Foundation – I	BOT-203	Plant Development & Reproduction
Compulsory Foundation-I	BOT-204	Human Values & Professional Ethics – II
Practical-I	BOT-205 P I	Theory Papers : Bot-201 & 202
Practical – II	BOT-206 P II	Theory papers : Bot-203 & Instrumentation/Laboratory Techniques.

SEMESTER – III

Core Theory	BOT-301	Molecular Biology And Techniques
-do-	BOT-302	Biodiversity and Conservation
Generic Elective (Internal Elective)	BOT-303A	Biosystematics (IE)
-do-	BOT-303B	Molecular Plant Pathology **(IE)**
-do-	BOT-303C	Computer Applications and Bioinformatics (IE)
Open Elective (External Elective)	BOT-304A	Plants and Human Welfare (EE)
-do-	BOT-304B	Organic Farming and Mushroom Cultivation(EE)
-do-	BOT-304C	Gardening and Nursery Techniques (EE)
Practical-I	BOT-305 P I	Theory Papers : Bot-301 & 302
Practical - II	BOT-306 P II	Theory Papers : Bot-303A/303B/303C

SEMESTER – IV

Core Theory	BOT-401	Molecular Genetics, Genomics And Proteomics
-do-	BOT-402	Plant Biotechnology
Generic Elective (Internal Elective)	BOT-403A	Molecular Plant Physiology **(IE)**
-do-	BOT-403B	Horticulture and Agriculture Biology **(IE)**
-do-	BOT-403C	Ethnobotany and Phytomedicine **(IE)**
Open Elective (External Elective)	BOT-404A	Hydroponics (EE)
-do-	BOT-404B	Nano Biotechnology (EE)
Practical - I	BOT-405 P I	Theory Papers : Bot-401 & 402
Practical - II	BOT-406 P II	Theory Papers : Bot-403A/403B/403C

IE : Internal Elective ; EE : External Elective

SEMESTER – I

Course Code	Components of Study	Title of the course	No. of contact hours	No. of credits	IA Marks	Sem. End Exam marks	Total
Bot-101	Core Theory	Algae, Bryophytes, Pteridophytes & Gymnosperms	4	4	20	80	100
Bot-102	Core Theory	Taxonomy of Angiosperms	4	4	20	80	100
Bot-103	Foundation-I	Microbiology	4	4	20	80	100
Bot-104	Compulsory Foundation - I	Human Values and Professional Ethics - I	4	4	20	80	100
Bot-CP105	Core Practical – I	Bot-101: Algae, Bryophytes, Pteridophytes & Gymnosperms & Bot-102 : Taxonomy of Angiosperms	4	2	-	-	100
			4	2	-	-	
Bot-P- 106	Practical/ Project - I	Bot-103 Microbiology & Study tour/ Herbarium/ Field work	4	2	-	-	100
			4	2	--	--	
		Total :	**32**	**24**	**--**	**--**	**600**

SEMESTER – II

Course Code	Components of Study	Title of the course	No. of hours	No. of credits	IA Marks	Sem.End Exam marks	Total
Bot-201	Core Theory	Plant Ecology	4	4	20	80	100
Bot-202	Core Theory	Plant Biochemistry & Plant Physiology	4	4	20	80	100
Bot-203	Foundation-I	Plant Development & Reproduction	4	4	20	80	100
Bot-204	Compulsory Foundation-I	Human Values & Professional Ethics - II	4	4	20	80	100
Bot-CP-205	Core Practical– II	Bot-201 : Plant Ecology &	4	2	--	--	100
		Bot-202 : Plant Biochemistry & Plant Physiology	4	2			
Bot-P-206	Practical / Project - II	Bot-203: Plant Development & Reproduction & Instrumentation/Laboratory Techniques	4	2	--	--	100
			4	2			
		Total :	**32**	**24**	**--**	**--**	**600**

SEMESTER – III

Components of Study	Course Code	Title of the course	No. of hours	No. of credits	IA Marks	Sem.End Exam marks	Total
Core Theory	Bot-301	Molecular Biology and Techniques	4	4	20	80	100
Core Theory	Bot-302	Biodiversity and Conservation	4	4	20	80	100
Generic Electives (Internal Elective) Choose any one paper	Bot-303A	Bioinformatics (IE)	4	4	20	80	100
	BOT-303B	Molecular Plant Pathology (IE)	-	- -	-	-	-
	BOT-303C	Computer applications and Bioinformatics (IE)	-	-	-	-	-
External Elective (Open Elective) Choose any one paper	BOT-304A	Plants and Human Welfare (EE)	4	4	20	80	100
	BOT-304B	Organic Farming and Mushroom Cultivation (EE)	-	-	-	-	-
	BOT-304C	Gardening and Nursery Techniques (EE)	-	-	-	-	-
Practical-I	Bot-305PI	Theory Papers – Bot-301 & 302	4	2	--	--	100
			4	2			
Practical-II	BOT-306PII	Generic Elective Papers : Bot 303A/303B/303C	4	2	--	--	100
			4	2			
		Total :	**32**	**24**	**--**	**--**	**600**

IE – Internal Elective; EE – External Elective

SEMESTER – IV

Components of Study	Course Code	Title of the course	No. of hours	No. of credits	IA Marks	Sem.End Exam marks	Total
Core Theory	Bot-401	Molecular Genetics, Genomics And Proteomics	4	4	20	80	100
Core Theory	Bot-402	Plant Biotechnology	4	4	20	80	100
Generic Electives (Internal Elective) Choose any one paper	Bot-403A	Molecular Plant Physiology (IE)	4	4	20	80	100
	Bot-403B	Horticulture And Agriculture Biology (IE)	-	-	-	-	-
	Bot-403C	Ethnobotany And Phytomedicine (IE)	-	-	-	-	-
External Elective (Open Elective) Choose any one paper	BOT-404A	Hydroponics (EE)	4	4	20	80	100
	BOT-404B	Nano Biotechnology (EE)	-	-	-	-	-
Practical-I	BOT-405 PI	Theory Papers : Bot-401 & 402	4	2	--	--	100
			4	2			
Practical-II	BOT-406 PII	Generic Elective Papers :	4	2	--	--	100
		Bot - 403A/403B/404C	4	2			
		Total :	**32**	**24**	**--**	**--**	**600**

IE – Internal Elective; EE – External Elective

M.Sc. BOTANY DEGREE COURSE

CHOICE BASED CREDIT SYSTEM (CBCS)

(w.e.f. 2019-2020)

SEMESTER-I

BOT-101: ALGAE, BRYOPHYTES, PTERIDOPHYTES & GYMNOSPERMS

Course Objectives

1. To create awareness on classification and description of lower plants.
2. To create the knowledge about lower plants and their utilization in different methods.
3. Economic importance of lower plants.
4. To provide basic distribution pattern and structural organization of lower plants.

UNIT- I

Phycology: Classification of Algae; Cell ultra structure; general characters; Algae in diverse habitats (Terrestrial, Fresh water, Marine water and In Association); Thallus organization (Range of thallus structure and interactions in evolution of different groups: Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae & Rhodophyceae); Pigments and Reserve food; Reproduction (Vegetative, Asexual & Sexual); Economic importance of Algae (Algal blooms, Algal Biofertilizers, Algae as food, Feed and Medicines; Algae in Industry; Algae as Biodiesel source; Single cell proteins.

UNIT- II

Bryophytes: Origin, Distribution, Morphology, Structure, Reproduction and Evolution of Sporophyte; Life History, Classification. Fossil Bryophytes. General account of Marchantiales, Jungermaniales and Polytrichales; Economic and Ecological importance.

Lichens: Types of Lichens, Anatomy, Biology and Ecological importance.

UNIT- III

Pteridophytes: Origin, Morphology, Anatomy and Reproduction; Classification of Pteridophytes. Evolution of Stele. Heterospory and Origin of Seed habit; Apogamy and Apospory; Ecological importance, chemical factors controlling Gametophyte; Antheridia, Archegonia. Strobilus and Evolution of Sorus.

Fossil Pteridophytes: Brief account on Psilophytopsida, Psilopsida, Lycopsida, Sphenopsida and Pteropsida.

UNIT- IV

Gymnosperms: Introduction, Classification and Distribution of Gymnosperms. Structure and Reproduction in Cycadales, Ginkgoales, Coniferales, Ephedrales, Welwitschiales, and Gnetales. Evolution of Gymnosperms.

Fossil Gymnosperms: Brief account of families Pteridospermales (Lyginopteridaceae, Medulloaceae, Caytoniaceae and Glossopteridaceae) General account of Cycadeodiales and Cordaitales.

Course Outcomes :

1. Discuss the importance of morphological structure, classification, reproduction and economic importance of Algae ; Study and impart knowledge about the general Characteristics, structure, reproduction, life history and economic importance of fungi. Understand the features of Lichens.
2. Know the control measures of plant diseases.
3. Students are able to explain about structure, classification, reproduction, life cycle and economic importance of Bryophytes ; Students able to explain about structure, classification, reproduction, life cycle and economic importance of Gymnosperms.
4. Study and impart knowledge about the Structure, reproduction, life cycle, fossil, fossilization and geological time scale.

Suggested Books:

1. Kumar H. D. 1988. Introductory Phycology. Affiliated East-West Press Ltd., New Delhi.
2. Morries, I. 1986. An Introduction to the Algae. Cambridge University Press, U.K
3. Puri, P. 1980. Bryophytes. Atma Ram & Sons, Delhi.
4. Round, F.E.1986. The Biology of Algae, Cambridge University Press, Cambridge.
5. Sporne, K.R.1991. The Morphology of Pteridophytes, B.I. Publishing Pvt. Ltd., Bombay.
6. Stewart, W. N. and Rathwell, G. W. 1993. Paleobotany and the evolution of Plants. Cambridge University Press.
7. Bhatnagar, S.P. and Mitra, A. 1996. Gymnosperms, new Algae International Pvt. Ltd., New Delhi.

PAPER – I (BOT-101) : ALGAE, BRYOPHYTES, PTERIDOPHYTES AND GYMNOSPERMS

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1	PO_2	PO_3	PO_4	PO_5	PO_6	PO_7	PO_8	PO_9	PO_{10}

	Knowledge	Analysis	Design	Development	Modern Tools	Society	Environment	Ethics	Team work	Communicatio
CO_1	3	-	2	1	-	2	2	1	-	2
CO_2	3	-	2	1	-	1	1	1	2	1
CO_3	3	-	2	1	2	1	1	1	-	1
CO_4	3	-	2	1	-	1	1	1	-	1

BOT-102: TAXONOMY OF ANGIOSPERMS

Course Objectives

1. To create awareness in Classification of Plants and its arrangements.
2. To train the students to naming (create new names) the newly identified plants.
3. To improve the knowledge on classification of Angiosperms.
4. To inculcate interest in various classifications.

UNIT- I

Systems of Angiosperm classification: Historical development of Phenetic versus Phylogenetic systems of classification. Merits and demerits of Bentham and Hooker (Natural system), Engler and Prantle, Bessey, Hutchinson, Cronquist, Thorne, Dahlgren, and APG classification (Phylogenic) systems.

UNIT II

Taxonomic hierarchy, Identification and Speciation: Groups, Categories and Ranks; Species, Genus, Family and other categories; Principles used in assessing relationships; Delimitations of taxa and attribution of Rank. Plant identification and Taxonomic keys; Herbarium methodology, Important Herbaria, Botanical gardens and arboreta in India and World. Floras and Manuals; Monographs and revisions.

UNIT III

Origin and Phylogeny of Angiosperms: Origin and Evolution of Angiosperms; Angiosperms Phylogeny; Age and Place of origin, Biphyletic origin, Theories of origin; Origin of Monocots and Evolutionary lines of Angiosperms.

International Code of Nomenclature for Plants: Salient features of Binomial Nomenclature, Brief history of botanical codes; Principles, Rules and Recommendation of ICBN Ranks of taxa; generic names; species epithet; Typification, Nyms, Rule of Priority, Effective and Valid publication; Author citation; Retention, choice and Rejection of names. Nomen-nudum and Nomen-novo. Hortus malabaricus; General taxonomic Indices.

UNIT IV

Systematic study: Attribution of different systems of classification; orders: Magnoliales, Centospermae, Tubiflorae, Amentiferae, Helobiales and Glumiflorae.

Salient features, diversity, phylogeny of the following groups (based on APG classification): Magnoliids (Magnoliales); Monocots (Asparagales); Commelinids (Poales); Fabids (Malphigiales); Malvids (Caryophyllales); Lamiids (Gentianales); Campanulids (Asterales).

Learning Outcomes:

1. Classify the plants based on the Morphological variation for experimental work.
2. Every student able to create new name to the innovative plant species as per the rules formulated by ICN.

3. Student can help to other Scientists for identification of plants for their research fields.
4. He can learn the preparation of Herbaria for identification purpose.

Suggested Books:

1. Battacharya, B and Johri, B. M.1998. Flowering Plant taxonomy and Phylogeny. Narosa Publishing House, New Delhi.
2. Cronquist, A. 1981. An integrated system of classification of Flowering Plants. Columbia University Press, New York.
3. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy, Oliver and Boyed.
4. Gifford, E.M. and Foster, A.S. 1998. Morphology and Evolution of Vascular Plants. W.H.freemen & Co., New York.
5. Singh, Gurucharan. 2012. *Plant Systematics*: *Theory and Pactise*. Oxford & IBH. New Delhi.
6. Heywood, V.H. and Moore, D.M. (Eds.).1984. Current Concepts in Plant taxonomy. Acad. Press, London.
7. Hutchinson, J. 1973. Families of Flowering Plants (3rd Ed.) oxoford Univ. Press, New York.
8. Jeffrey, E. 1982. An introduction to plant Taxonomy. Cambridge.
9. Jones, S.B. Jr. and Luchsinger, A.E. 1986. Plant systematics (2nd Ed.). Mc Graw Hill. Book Co., New York.
10. Mayr, E. 1942. Systematic and Origin of Species. Columbia Univ. Press, New York.
11. Pullaiah, T. 1997. Taxonomy of Angiosperms. Regency Publications, New Delhi.
12. Radford, A.E. 1986. Fundamentals of Plant Taxonomy. W. H. Freemen and Company, San Francisco.
13. Stebbins, G. L. 1974. Flowering plants Evolution above the Species level. Academic Press London.
14. APG III (2009) An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG III. *Bot. J. Linnaean Soc.* 161: 105-121.
15. Gamble & Fischer 1915-1935. *Flora of Presidency of Madras*. 3 vols. BSMS, Dehradun.
16. Heywood, V.H., RK Brummitt, A. Culham, O. Seberg 2007. *Flowering Plant Families of the World.* Firefly books Ltd. New York.
17. Judd, W.S, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, and Michael J. Donoghue. 2016. *Plant Systematics: A Phylogenetic Approach*, 4rd ed. Sinauer.

PAPER – II (BOT-102) : TAXONOMY OF ANGIOSPERMS

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	1	2	1	-	2	2	2	2	2
CO_2	3	1	2	1	-	1	1	2	2	2
CO_3	3	1	2	1	-	1	1	2	2	2
CO_4	3	1	2	1	-	1	1	2	2	2

BOT-103: MICROBIOLOGY

Course Objectives

1. To impart the knowledge on basic principles and techniques of microbiology.
2. To provide understanding on antigen-antibody interactions and scope of vaccines.
3. To give an insight on Fungal/Bacterial and Viral diseases to plants.
4. To describe the structure and isolation of different Viruses.

UNIT-I

Viruses: General account of Viruses: Definition, occurrence, discovery, prokaryotic & eukaryotic viruses, chemistry, symmetry, ultra structure of bacteriophage, plant and animal viruses, purification of viruses, replication-lytic and lysogenic cascades, transmission and economic importance of viruses.

Principles of immunology: Immunity**,** types, antigens, general characteristics, antibody, types, antigen & antibody interactions.

UNIT-II

Bacteria: General characters and classification of Archaea and Eubacteria, Ultra structure, Nutrition ~~and~~ reproduction, and economic importance of Eubacteria. Salient features, biological importance, Thallus diversity, reproduction and Economic importance of Cyanobacteria.

UNIT-III

Classification of Fungi: Recent trends in Classification, Phylogeny of Fungi; General account of Myxomycota; Eumycota: general account of Mastigomycotina, Zygomycotina, Ascomycotina, Basidiomycotina, and Deutoromycotina.

Mycology: General characters of Fungi, Cell structure, Unicellular and Multicellular organization. Cell wall composition, Nutrition (Saprobic, Biotropic and Symbiotic):

Reproduction, (Vegetative, Asexual, and Sexual); Heterothalism: Heterocaryosis and Para sexuality. Economic importance of Fungi (Food-, Industry and Medicine); fungal diseases in plants and humans, Fungi as biocontrol agents. Mycorrihizae and Mushroom cultivation.

UNIT- IV

General principles of plant pathology: infection, disease development, Symptomology and Epidemiology of plant diseases incited by Fungi, Bacteria, Viruses, Viroids and Phytoplasmas. Principles of plant disease control. Physical, chemical and biological control of plant diseases- a general account

Course Outcomes

1. Develop the skill of isolation and identification of Pathogenic and Non-Pathogenic micro-organisms.
2. To prepare different media for cultivation of industrially important microorganisms.

3. Equip with the methods to control Plant Pathogens.
4. Understands the Ag-Ab mechanism.

Suggested Books

1. Alexopoulos, C.J., Mims, C.W. and Blackwel, M. 1996. Introductory mycology. John Wiley & Sons Inc.
2. Mandahar, C.L. 1978. Introduction to Plant viruses. Chand & Co., Ltd., Delhi.
3. Mehrotra, R.S. and Aneja, K.R. 1998. An introduction to mycology. New Age Internation al Press.
4. Mehrotra, R.S. 1980. Plant Pathology. Tata Mcgraw hill, India.
5. Sharma, P.D. 2000. Plant Pathology. Narosa Publishing House, India.

PAPER – III (BOT-103) : MICROBIOLOGY

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	2	2	2	2	2	2	-	-
CO_2	3	2	1	-	2	2	2	2	-	2
CO_3	3	2	-	-	2	2	2	-	2	2
CO_4	3	2	2	-	2	2	2	-	2	2

BOT-104: HUMAN VALUES & PROFESSIONAL ETHICS – I

Course Objectives

1. To understand the moral values that ought to guide the profession, Resolve the moral issues in the profession ; To justify the moral judgment concerning the profession.
2. Intended to develop a set of beliefs, attitudes and habits should display concerning morality ; To create an awareness on Ethics and Human Values.
3. To inspire Moral and Social Values and Loyalty.
4. To appreciate the rights of others.

UNIT- I

Definition and Nature of Ethics- Its relation to Religion, Politics, Business, Law, Medicine and Environment. Need and Importance of Professional Ethics- Goals – Ethical Values in various Professions.

UNIT- II

Nature of Values- Good and Bad, Ends and Means, Actual and potential Values, Objective and Subjective Values, Analysis of basic moral concepts- right, ought, duty, obligation,

justice, responsibility and freedom, Good behavior and respect for elders, Character and Conduct.

UNIT- III

Individual and society:

Ahimsa (Non-Violence), Satya (Truth), Brahmacharya (Celibacy), Asteya (Non possession) and Aparigraha (Non-stealing). Purusharthas (Cardinal virtues) - Dharma (Righteousness), Artha (Wealth), Kama (Fulfillment Bodily Desires), Moksha (Liberation).

UNIT- IV

Bhagavad Gita – (a) Niskama karma. (b) Buddhism – The Four Noble Truths – Arya astanga marga, (c) Jainism – mahavratas and anuvratas. Values Embedded in Various Religions, Religious Tolerance, Gandhian Ethics.

UNIT- V

Crime and Theories of punishment – (a) Reformative, Retributive and Deterrent. (b) Views on Manu and Yajnavalkya.

Course Outcomes

1. Discuss moral concept ; Define historical periods of the term moral ; Explain interaction between evolution of moral and social instruction.
2. List the moral theories ; Explain concept of ethics ; Explain development process of ethics. Identify differences between moral and ethics.
3. Debate interaction of ethics on profession.
4. Talk about the unethical issues in work life ; Talk about the ethic principles in different occupations.

Suggested Books

1. John S Mackenjie: A manual of ethics.
2. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3. "Management Ethics – integrity at work" by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. "Ethics in Management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian System of Duties: Religious and Civil (ed.) G.C. Haughton.
10. Susruta Samhita: Tr. Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit series, Vol. I, II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.
11. Caraka Samhita: Tr. Dr. Ram Karan Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I,II,III Vol I PP 183-191.

12. Ethics, Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed.) John H. Piet and Ayodhya Prasad, Cosmo Publications.
15. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.

PAPER – IV (BOT-104) : HUMAN VALUES AND PROFESSIONAL ETHICS - I

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	1	3	3	2	-	-	1	1	2
CO_2	3	-	1	1	1	-	-	1	2	1
CO_3	2	1	2	1	-	3	-	-	-	-
CO_4	3	-	1	2	-	2	-	-	-	-

PRACTICAL PAPER: BOT-CPI-105-(BOT101 & BOT102) Algae, Bryophytes, Pteridophytes & Gymnosperms & Taxonomy of Angiosperms)

1. Micro preparations, culture identification, section cuttings of the members of Cyanophycaae, Cholorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae and Rhodophyceae. Raising and maintenance of algal cultures.
2. External and internal morphology and identification of the members in Marchantiales, Jungermaniales, Anthocrotales, Sphagnales, Funariales and Polytrichales.
3. External and internal morphology, reproductive organs, anatomy of stem, root and fructifications of Lycopsida, Sphenopsida and Pteropsida.
4. Examination of Fossils.
5. Comparative study of the anatomy of vegetative and reproductive organs of *Cycas, Thuja, Cedrus, Cupressus, Araucaria, Cryptomaria, Taxodium, Podocarpus* and *Gnetum*.
6. Study of important fossil Gymnosperms from prepared sides and specimens.

Suggested Books for Laboratory Experiments

1. Sporne, R. K. 1997v (2^{nd} Ed). The Morphology of Gymnosperms. Hutchinson University Library.
2. Bernard Goffinet & A. Jonathan Shaw. 2008. *Bryophyte Biology*. 2nd ed. Cambridge.

3. Van den Hoek, Christian, D.Mann & H.M.Jahns *et al*. 1995. *Algae, An introduction to phycology*. Cambridge University Press.
4. Sporne K.R. 1965. *Morphology of Gymnosperms*. HUP, London.
5. Sporne K.R. 1976. *Morphology of Pteridophytes*. HUP, London.

BOT--102(Taxonomy of Angiosperms)

1. Preparation of floral diagrams, floral formulae and determination of taxonomic positions of 30 local plants up to family level.
2. Identification of genus and species following dichotomous keys (Flora of Madras Presidency by Gamble and Fischer)
3. Construction of keys for Families, Genera and Species based on morphological characters.
4. Nomenclature Exercises: Synonyms, Tautonyms, Basionyms.
5. Numerical Taxonomic Methods.
6. Botanical Study Tours, Preparation of Herbaria, Field Note Books & Tour Reports.

Suggested Books for Laboratory Experiments

1. Bailey, L.H. 1949. Manual of Cultivated Plants Macmilan, New York.
2. Bentham, G. & Hooker, J.D. Genera Plantarum, London, 3 Volumes.
3. Gamble, J.S. & Fischer. 1957. Flora of presidency of Madras. BSI, Calcutta.
4. Lawrence, G.H.M. 1951, taxonomy of vascular plants, Macmillan, New York.
5. Matew, K.M. 1983. The Flora of Tamilnadu Carnatic. Vol.1 Part 1 & 2. Tiruchirapalli.
6. Pullaiah, T. & Suryaprakash Babu, P. 1998. Flora of Andhra Pradesh. Vol. 1- 4, Scientific Publishers, New Delhi.
7. Willies, J. C. 1973. Dictionary of Flowering Plants and Ferns. 8th Ed. Cambridge Univ. Press, U. K.

PRACTICAL PAPER: BOT-PII-106 (BOT 103, Microbiology & Study tour/ Herbarium, Field work)

1. Symptomology of some Diseased specimens: White rust, Downy mildew, powdery mildew, Rusts, Smuts, Ergot, Ground nut leaf spot, Red rot of Sugarcane, Wilts, Paddy Blast, Citrus canker, Bacterial blight of paddy, Angular leaf spot of Cotton, Tobacco mosaic, little leaf of Brinjal, Sesame Phyllody, Mango malformation, Canker.
2. Section cutting of infected materials of *Albugo, Peranospora, Plasmospora, Scerospora, Taphrina, Phyllochora, Claviceps, Xylaria, Peziza, Puccinia, Uromyces, Ravanelia,Ustilago, Tolyposporium, Macrophoma, Colletotrichum, Fusarium, Rhizoctonia.*

3. Sterilization methods, Preparation of media and stains, Isolation and Maintenance of cultures. Gram staining of Bacteria.

Suggested Books for Laboratory Experiments

1. Susila, S.B. and Shantharam, S. 2000. General Microbiology. Oxford & IBH Publ., New Delhi.
2. Webster, J 1985. Introduction to Fungi. Cambridge Univ. Press.
3. Willey, J. L. Sherwood, C.J. Woolverton. 2016. Prescott's Microbiology. TataMcGraw Hill.
4. Rangaswamy, G. and Madhaven, A. 1999. Diseases of Crop Plants in India (4^{th} Ed.) Prentice hall of India Pvt. Ltd., New Delhi.

SEMESTER - II

BOT-201: PLANT ECOLOGY

Course Objectives

1. To understand the geographical distribution of organisms.
2. To know the inter-relationship between population and communities.
3. To learn the management of natural resource and pollution.
4. To develop the concept of Pollution and its Control.

UNIT I

Soil, Climate and Vegetation patterns: Soil profile, Types, Texture, Physical and Chemical properties, Organic matter and Micro flora- microbe interactions-Mutualism, Commensalism and parasitism.

Biomes: Concept, types, distribution of Tropical, Temperate, Alpine, Grass land, Aquatic and Desert Biomes.

UNIT II

a) Concept of Ecosystem: Earth Atmosphere system; ecosystem components; Physical and chemical sub system; Ecosystem dynamics, Energy flow, cycling nutrients, food webs, community dynamics substaturm.

b) Community Development: Succession process, quality establishment, dominance, dynamic equilibrium, climax successtion, types of succession, hydrarch, xerorch, secondary succession convergence, modification, species diversity, selection process, bioenergetics in ecological successtion.

c) Community organization and Stratification: Fresh water, horixantal, terrestrial, mountains, marine stratification, trophic structure, food chains, ecological pyramids, niche segregation, third level of organization, niche overlap, characters of niche, microclimate, niche phenology.

d) Association and interaction among organisms: Intra and inter specific association, Association, competition, predation, mutualism, insect-pant interactions, figs-fig wasps. Impact of Biota on the environment, microclimate, temperature, light intensity, and quality, moisture wind flow, gases and nutrient substratum.

UNIT III

a) Ecosystem Dynamics: Biogeochemical cycles; Water, Carbon, Nitrogen, Phosphorous and Oxygen cycles. Elements and distribution, cycling process, interaction of biotic and abiotic components. Role of decomposers; Man's interferences on the BGC Cycles.

b) Evaporation-Precipitation and Water Cycle: Parameters controlling water cycle,

Hydrological cascade system; local ctcling, global evaporation, precipitation and water budget, Impact of water cycle on environment, biota, impact of man on hydrological cycle.

c) Ecosystem energetic: Productivity in ecosystem; Primary productivity, secondary productivity, factors affecting primary and secondary production.

d)Energy flow and ecosystem budgets: Light energy laws of thermodynamics, energy fixation and production, flow through food chain, energy flow-models, energetic relations of ecosystem detritus food chain, trophic interaction with microbial food web, loss of energy of different trophic levels, community food web, scale and structure of natural food webs, energetic and decomposition.

UNIT IV

Environmental Hazards and Management: Pollutants: kinds- Air, Water, Soil, Sound, Radiation, Heavy Metals and Atomic Pollution, Effects on Plants and Ecosystems, strategies for pollution waste water treatment.

Climatic Changes: Green House Gases and Global Warming; Ozone hole, Impact on Plant and Ecosystem, Restoration.

Waste management and bio-energy: Conventional, Non conventional energy resources, Environmental impacts, biogas digester, design and methanogenesis.

Course Outcome:

1. Students will know about the factors leading to environmental degradation and their impact.
2. Develop concern about the environment protection and conservation.
3. Evolve the relation between biotic and abiotic factors in an ecosystem.
4. Understand the concepts of biome and its importance.

Suggested Books:

1. Brady, N.C. 1990. The Nature and Properties of Soils. MacMillan.
2. Chapman, J.L. and Reiss, M.J. 1988. Ecology Principles and Application. Cambridge University Press. Cambridge, U.K.
3. Hill, M.K. 1997. Understanding environmental Pollution. Cambridge University press.
4. Kormondy, E.J. 1996. Concepts of Ec1ology, Prentice-Hall of India Pvt. Ltd., New Delhi
5. Kumar, H. D. 1998. Modern Concepts of Ecology, Vikas Publishing, New Delhi.
6. Ludwig. J. and Reynolds, J. F. 1988. Statistical Ecology. A Primer on Methods and Computing. John Wiley & sons.
7. Mason, C.F. 1991. Biology of Freshwater Pollution Longman.
8. Moldan, B. and Billharz, S. 1997. Sustainability Indications, John Wiley & Sons New York.
9. Mukherjee, B. 1997.Environmental Biology, Mc. Graw Hill, New Delhi.
10. Muller-dombois, D. and Ellenberg, H. 1974. Aims and Methods of Vegetation Ecology, Wiley,

New York.
11. Odum, E.P. 1971 Fundamentals of Ecology, Saunders, Philadelphia.
12. Smith R.L. 1996 Ecology and Filed Biology. Harper Collins, New York.
13. Treshow, M. 1985. Air Pollution and Plant Life. Wiley lnterscience.
14. *Alan beebay & Anne-Maria Brennan. 2008.* First Ecology. 3rd ed. Oxford University Press.
15. *Begon M., Colin, T. & John L. Harper.* 2005. Ecology, From Individuals to Ecosystems. *4th ed. Black well.*
16. Dash, M.C.2009. *Fundamentals of Ecology*. Tata Mc GrawHill Pub.New Delhi.
17. Manuel C. Molles Jr. 2013. *Ecology-concepts and applications*. 6th ed. Mc GrawHill.
18. Ricklefs, R,E. &Gary L. Miller. 2000.*Ecology*. 4th ed. W.H. Freeman and Company. New York.
19. Sharma, P.D. 2015. *Ecology and Environment*. Rastogi Publications, Meerut.
20. Stiling, P. 2002. *Ecology*, *Theory and applications*. Prentice-Hall of India, New Delhi.
21. Tom Hennigan & Jean Lightner. 2013. *The Ecology Book*. Master Books.
22. Ernst-Detlef Schulze, Erwin Beck, Klaus Müller-Hohenstein. 2010. *Plant Ecology*. Springer, Berlin.

PAPER – I (BOT-201) : PLANT ECOLOGY

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	-	2	3	-	3	3	-	3
CO_2	3	2	2	-	1	-	2	-	3	2
CO_3	3	-	2	2	1	2	1	2	2	1
CO_4	3	-	2	-	2	2	1	2	2	2

BOT-202: PLANT BIOCHEMISTRY AND PHYSIOLOGY

Course Objectives

1. To study the method of photosynthesis in plants
2. To study the method of respiration in plants
3. To study HMP pathway in plants
4. To study importance of growth regulators and to study the fat metabolism in plants

UNIT I

Biochemistry of Carbohydrates and Proteins:

Carbohydrates: Classification, D and L designation, open chain and cyclic structures, epimers and anomers, maturation, reactions of carbohydrates (due to functional groups-hydroxyl, aldehyde and ketone), amino sugars, glycolysis, mono, di, tri and polysaccharides, glycosaminoglycons, glycolproteins.

Amino acids: Classification, structure stereochemistry, chemical reactions of amino acids (due to carbonyl and amino groups), pK value, peptide bond-nature and conformation.

Proteins: General properties, denaturation and renaturation, structural organization of proteins primary, secondary, tertiary and quaternary structures.

UNIT II

Respiration and Lipid Metabolism: Over view of plant respiration, Glycolysis, TCA cycle, Electron transport and ATP synthesis, Pentose Phosphate Pathway. Regulation and significance of Photo respiration. Structure and functions of Lipids, Glyoxylate cycle, Fatty acid biosynthesis; Synthesis of Membrane, Structural and storage lipids; Catabolism of lipids.

Nitrogen and Sulphur metabolism: Biological Nitrogen Fixation, Mechanism of Nitrate uptake and reduction, Ammonia assimilation; Sulphate uptake and assimilation.

UNIT – III

Thermodynamic Concepts: Free energy, Chemical potential, Redox potential.

Translocation of Water and Solutes: Plant cell water relations, Mechanism of water uptake and transport in plants; SPAC concept; Stomatal movements, Phloem transport of organic substances Phloem loading and unloading; Passive and active solute transport; Membrane transport proteins.

Fundamentals of Enzymology: General concepts, Allosteric mechanism, Mode of Enzyme action, Regulator and Active sites, Isozymes.

UNIT IV

Plant growth regulators and elicitors: Physiological effects and mechanism of action of Auxins, Gibberellins, cytokinins, Ethylene, Abscissic acid, Brassinosteroids, Polyamines, Jasmonic acid and Salicylic acid.

Couse Outcome

1. Explain what a Plant Physiologists does.
2. Describe how cell, tissue and whole-plant structures are related to their function.
3. Describe the physiological processes in plants, with an emphasis on water, energy, and mineral relations in higher plants.
4. Understand the fundamental processes of metabolism in plants and describe how a plant obtains and uses energy. Understanding of the functioning of plants as organisms.

Suggested Books:

1. Buchanan, B.B. Grussem, W. and Jones, RL. 2000. Biochemistry and Molecular Biology

of Plants. American Society of Plant Physiologists, Maryland, USA.

2. Dennis, D.T. Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (Eds.) 1997. Plant Metabolism (2nd Ed.) Longman, Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag. New York, USA.
4. Hooykaas, P.J.J., Hall, M.A. and Libbeng, K.R. (Eds.). 1999 Biochemsitry and Molecular biology of plant Hormones. Elsevier, Amsterdam, The Netherlands.
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, New York, USA.
6. Lodish, H., Berk, A., Zipursky, SL., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (4tt Ed.). W.H. Freeman and Company, New York, USA.
7. Moore, T.C. 1989. Biochemistry and Physiology of plant Hormones (2nd Ed.). Springer-Verlag, New York, USA.
8. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (2 Ed.). Academic Press, San diego, USA.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4thEd.). Wadswroth Publishing Co., California, USA.
10. Singhal, G.S., Renger, G., Sopory, S.K. lrrgang K.D. and Govindjee 1999. Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing Houses, New Delhi.
11. Taiz, L. and Zeigler, E. 1998.Plant Physiology (2nd Ed.). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
12. Thomas, B. and Vince-Prue, D. 1997. Photoperiodism in plants (2nd Ed.). Academic Press, San Diego, USA
13. Westhoff, P. Jeske, H. Jurgens, G. Kloppstech, K. Link, G. 1998. Molecular Plant Development: From Gene to Plant. Oxford University Press, Oxford, UK.

PAPER – II (BOT-202): PLANT BIOCHEMISTRY AND PLANT PHYSIOLOGY

CO-PO Mapping Matrix/ Programme Articulation Matrix: BOT-202

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	-	3	2	2	2	3	2	2	2
CO_2	3	2	2	2	2	2	2	-	1	1
CO_3	3	2	1	2	-	1	3	-	2	1
CO_4	3	2	1	2	-	-	2	2	-	1

CO_5										

BOT-203: PLANT DEVELOPMENT AND REPRODUCTION

Course Objectives

1. Making the students acquainted with the fundamentals and present understanding of development differentiation and internal structure of root and shoot, and vascular tissue differentiation.
2. Enable the students to know present understanding of leaf development and tissue differentiation, Transition to flowering, Floral Organ differentiation and development.
3. Making the students familiar with basic and present understanding of reproductive processes: Male and female gametophyte development, gametogenesis, pollination and fertilization.
4. Making the students familiar with basic and present understanding of Endosperm, Dicot and embryo development, fruit growth and Seed Development.

UNIT I

Tissue types and Tissue systems in Plants: Root growth and Development: Root apical meristem; Cell division, Cell expansion and elongation. Differentiation of root; vascular tissue, root hair and Lateral roots formation.

Stem growth and development: organization of the shoot apex; cytological and molecular analysis of shoot apical meristems. Tissue differentiation in the shoot; xylem regeneration and Phloem differentiation.

UNIT II

Leaf and flower development: Development of leaf, History, Specialized cells and tissue differentiation.

Development and Anatomy of flower, including transition to Flowering and reproductive shoot apex.

UNIT III

Reproduction and Flower: Vegetative options and reproduction; Genes controlling Floral Organ Differentiation.

Male gametophyte: Structure of anther; Microsporogenesis, Role of Tapetum; Pollen development, Pollen germination, Pollen tube growth and Guidance; Pollen storage.

Female Gametophyte: Ovule Structure and development; Megasporogenesis; Development and Organization of the mature Embryo sac; Structure of the Embryo sac cells; Embryo sac haustoria.

UNIT IV

Fertilization, Seed and Fruit Development: Pollination mechanisms and Vectors; Structure of the Pistil; Pollen- Stigma Interactions, Sporophytic and Gametophytic Self-Incompatibility; Double Fertilization.

Endosperm development during early maturation and Desiccation stages; Embryogenesis- Dicot types; Monocot embryo; Polyembryony; Apomixis; Parthenocarpy. Dynamics of Fruit growth and Seed Development.

Course Outcome

1. Describe the organization of shoot and root apices and development of shoot and root; Differentiation of vascular tissue and wood formation
2. Describe development and differentiation of leaf, transition to flowering and flower development
3. Describe the formation of male and female gametophytes, pollination, pollen tube germination and Double fertilization.
4. Describe development of endosperm, embryogenesis, seed and fruit development.

Suggested Books:

1. Atwell, B.J. Kriedermann, P. E. and Jumbull, C.G.N. (Ed.) 1999. Plants in Action. Adaptation in Nature, performance in cultivation. MacMilan Education, Sydney, Australia.
2. Burgess, J. 1985. An introduction to Plant Cell development. Cambridge Univ. Press, Cambridge.
3. Fahn, A. 1982. Plant Anatomy (^{3rd}Ed.), Pergamon Press, Oxford.
4. Fosket, D.E. 1994. Plant growth and Development. A molecular approach, Academic Press, San Diego, USA.
5. Howell, S.H. 1998. Molecular Genetics of Plant Development, Cambridge Univ. Press, Cambridge.
6. Jane, F.W. 1970. The structure of wood. Black, London.
7. Lyndon, R.F. 1990. Plant Development. The Cellular Basis, Unnin Hyman, London.
8. Murphy, T.M. and Thompson, W.F. 1988. Molecular Plant Development, Prentice Hall, New Jersey.
9. Pullaih, T., Naidu, K. C., Lakshminarayana, K. & Hanumantha Rao, B. 2007. Plant Development. Regency Publications, New Delhi.
10. Raghavan, V. 1999. Developmental Biology of Flowering Plants, Springer-Verlag, New York.
11. Steeves, T.A. and Sussex, TM. 1989. Patterns in Plant Development (2^{nd}Ed.). Cambridge
12. Univ Press, Cambridge.

13. Waisel, Y., Esnel, A, and Kafkaki U. (Eds.). 1996. Plant Roots. The Hiden Hall (2nd Ed.), New York, USA.
14. Bhojwani, S. S. and Bhatnagar, S.P. 2000. The embryology of Angiosperms (4th Revised and Enlarged Ed.). Vikas Publishing House, New Delhi.
15. The plant cell. Special issue on Reproductive Biology of Plants, Vol. 5. 1993. The American Society of plant physiologist, Rockville, Maryland, USA.
16. Howell, S. H. 1998. Molecular genetics of Plant Development. Cambridge Univ. Press, Cambridge.
17. Murphy, T .M. and Thompson, W. F. 1988. Molecular plant development, prentice Hall, New Jersey.
18. Pullaiah, T .Lakshiminarayana, K. & Hanumantha rao, B. 2008.plant reproduction. Scientific publishers, Jodhpur.
19. Raghavan, V. 1997. Molecular embryology of Flowering plants, Cambridge Univ. Press, Cambridge.
20. Raghavan, V. 1999. Developmental Bilogy of Floewring plants. Springer- Verlag, New York.
21. Sedgely, M.. and Griifin, A. R. 1989. Sexual reproduction of Tree crops. Academic Press, London.
22. Shivanna, K.R. and Sawhney, V.K. (Eds). 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge Univ. Press, Cambridge.
23. Shivanna, K.R. and Johri, B.M. 1985. The Angiosperm pollen: the Structure and function. Wiley Eastern Ltd., New York.

PAPER – III (BOT-203) : PLANT DEVELOPMENT AND REPRODUCTION

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	1	3	3	2	-	-	1	1	2
CO_2	3	-	1	1	1	-	-	1	2	1
CO_3	2	1	2	1	-	3	-	-	-	-
CO_4	3	-	1	2	-	2	-	-	-	-

BOT- 204: HUMAN VALUES AND PROFESSIONAL ETHICS – II

COMMON SYLLABUS FOR ALL P.G. COURSES (CBCS & NON-CBCS)(With effect from 2016-17)

Course Objective

1. To understand the moral values that ought to guide the profession, Resolve the moral issues in the profession ; To justify the moral judgment concerning the profession.
2. Intended to develop a set of beliefs, attitudes and habits should display concerning morality ; To create an awareness on Ethics and Human Values.
3. To inspire Moral and Social Values and Loyalty.
4. To appreciate the rights of others.

UNIT-I

Value Education- Definition – relevance to present day - Concept of Human Values – Self introspection – Self esteem. Family values - Components, structure and responsibilities of family Neutralization of anger – Adjustability – Threats of family life – Status of women in family and society – Caring for needy and elderly – Time allotment for sharing ideas and concerns.

UNIT-II

Medical ethics- Views of Charaka, Sushruta and Hippocratus on moral responsibility of medical practitioners. Code of ethics for medical and healthcare professionals. Euthanasia, Ethical obligation to animals, Ethical issues in relation to health care professionals and patients. Social justice in health care, human cloning, problems of abortion. Ethical issues in genetic engineering and Ethical issues raised by new biological technology or knowledge.

UNIT-III

Business ethics- Ethical standards of business-Immoral and illegal practices and their solutions. Characteristics of ethical problems in management, ethical theories, causes of unethical behavior, ethical abuses and work ethics.

UNIT-IV

Environmental ethics- Ethical theory, man and nature – Ecological crisis, Pest control, Pollution and waste, Climate change, Energy and population, Justice and environmental health.

UNIT-IV

Social ethics- Organ trade, Human trafficking, Human rights violation and social disparities Feminist ethics, surrogacy/pregnancy. Ethics of media- Impact of Newspapers, Television Movies and Internet.

Course Outcomes:

1. Discuss moral concept ; Define historical periods of the term moral ; Explain interaction between evolution of moral and social instruction.
2. List the moral theories ; Explain concept of ethics ; Explain development process of ethics. Identify differences between moral and ethics.
3. Debate interaction of ethics on profession.
4. Talk about the unethical issues in work life ; Talk about the ethic principles in different occupations.

Suggested Books:

1. John S Mackenjie: A manual of ethics.
2. "The Ethics of Management" by Larue Tone Hosmer, Richard D. Irwin Inc.
3. "Management Ethics – integrity at work' by Joseph A. Petrick and John F. Quinn, Response Books: New Delhi.
4. "Ethics in management" by S.A. Sherlekar, Himalaya Publishing House.
5. Harold H. Titus: Ethics for Today
6. Maitra, S.K: Hindu Ethics
7. William Lilly: Introduction to Ethics
8. Sinha: A Manual of Ethics
9. Manu: Manu Dharma Sastra or the Institute of Manu: Comprising the Indian system of Duties: Religious and Civil(ed.) G.C. Haughton.
10. Susruta Samhita: Tr. Kaviraj Kunjanlal, Kunjalal Brishagratha, Chowkamba Sanskrit series, Vol. I, II and III, Varnasi, Vol I OO, 16-20, 21-32 and 74-77 only.
11. Caraka Samhita: Tr. Dr. Ram Kraran Sarma and Vaidya Bhagavan Dash, Chowkambha Sanskrit Series office, Varanasi I,II,III Vol I PP 183-191.
12. Ethics, Theory and Contemporary Issues, Barbara Mackinnon, Wadsworth/Thomson Learning, 2001.
13. Analyzing Moral Issues, Judith A. Boss, Mayfield Publishing Company, 1999.
14. An Introduction to Applied Ethics (Ed.) John H. Piet and Ayodhya Prasad, Cosmo Publications.
15. Text book for Intermediate logic, Ethics and Human Values, board of Intermediate Education & Telugu Academic Hyderabad.
16. I.C. Sharma Ethical Philosophy of India. Nagin & co Julundhar.

PAPER – IV (BOT-204) : HUMAN VALUES AND PROFESSIONAL ETHICS - II

CO-PO Mapping Matrix/ Programme Articulation Matrix: BOT-204

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio

CO_1	3	2	3	2	-	-	3	-	2	3
CO_2	3	1	1	-	3	-	2	-	1	2
CO_3	3	2	2	-	2	1	-	2	-	1
CO_4	3	-	1	3	-	-	1	-	-	1

PRACTICAL PAPER: BOT-205 CPII- BOT 201& BOT202) (Plant Ecology & Plant Biochemistry and Physiology)

Suggested Laboratory Exercises

1. To determine Minimum size and Number of Quadrants required for Reliable estimate of Biomass in Grasslands.
2. Vegetation Analysis: Frequency, Density, Abundance, IVI, Grasslands and Forests.
3. To determine Soil Moisture content, Porosity and Bulk density of Soils collected from varying depths at different locations.
4. To determine the Water Holding Capacity of Soils collected from different locations.
5. To determine Per cent Organic Carbon and Organic Matter in the Soils of Crop lands, Grassland and Forests.
6. To estimate the Dissolved Oxygen content in Eutrophic and Oligotrophic water samples by Azide modification of Winklers method.
7. To estimate chlorophyll content in SO_2 fumigated and Un-fumigated plant leaves.
8. To Estimate Rate of Carbon dioxide evolution from different soils using soda lime or alkali absorption method.

Suggested Books

1. Trivedy R.K.Goel, P.K.91987), Practical Methods in Ecology and Environmental Science, Environmental Publications, India.

BOT- 202 (Plant Biochemistry and Physiology)

Suggested Laboratory Exercises

1. Effect of Enzyme concentration on the rate of Enzyme reaction.
2. Effect of Substrate concentration on the Activity of an Enzyme and Determination of its K_m value.
3. Effect of Solutes and Temperature on Membrane Permeability.
4. Determination of Osmotic Potential of Plant Cell Sap.
5. Determination of Plant Tissue water Potential.
6. Determination of the Rate of Relative Transpiration.
7. Estimation of Chloride Content and its Accumulation Ratio in an Aquatic plant.
8. Effect of Promoters and Inhibitors on Stomatal Opening.
9. Determination of the activity of Succinate Dehydrogenase and its sensitivity to inhibitors.
10. Extraction, Separation and Determination of Absorption Spectra of Chloroplast

Pigments.

11. Assay of Chloroplast activity -Hill reaction.
12. Estimation of Titrable acidity of plant material.

Suggested Books for Laboratory Experiments

1. Buchanan, B.B. Grussem, W. and Jones, RL. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
2. Lodish, H., Berk, A., Zipursky, SL., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (4tt Ed.). W.H. Freeman and Company, New York, USA.
3. Taiz, L. and Zeigler, E. 1998.Plant Physiology (2^{nd} Ed.). Sinauer Associates, Inc., Publishers, Massachusetts, USA.
4. Singhal, G.S., Renger, G., Sopory, S.K. lrrgang K.D. and Govindjee 1999. Concepts in Photobiology: Photosynthesis and Photomorphogenesis. Narosa Publishing Houses, New Delhi.
5. Moore, T.C. 1989. Biochemistry and Physiology of plant Hormones (2^{nd} Ed.). Springer-Verlag, New York, USA.

PRACTICAL PAPER: BOT-206-PII (Plant development and reproduction& Instrumentation/Laboratory Techniques)

Suggested Laboratory Exercises

Plant Development

1. Representative types of roots - Diarch, Triarch, polyarch types — transverse sections with double staining, ex. *Vicia*, *Ficus*, *Tinospora* (aerial root), vanda (velamen root).
2. Types of Stems: for transverse sections with double staining methods — showing Primary and Abnormal Secondary Growth. Ex. *Aristolochia*, *Citrullus*, *Cucurbita*, *Polyanthus*, *Sorghum*, *Strychnos*, *Cocculus*, *Bignonia*, *Amaranthus*, *Achyranthus*, *Piper*, *Peperomia*, *Bouganvilla*, *Boerhaavia*, *Dracaena*.
3. Maceration of wood: For observation of Individual Xylem elements with single staining.
4. Leaf types: Dorsiventral leaf, lsobilateral leaf, Xeromorphic leaves-*Muehlenbeckia*, *Nerium*, *Casuarina*, *Peperomia*, and *Ficus* leaves, *Nymphaea*, *Typha* leaves. *Sorghum* and *Saccharum* leaves for C4 anatomy.
5. Nodal anatomy — types.

Plant Reproduction

1. Study of Microsporogenesis in sections of Anthers.
2. Examination of Modes of Anther Dehiscence and collection of Pollen grains for

microscopic examination (Maize, Grasses, *Cannabis sativa*, *Crotalaria*, *Tradescantia*, *Brassica*, *Petunia*, *Solanum melongena* etc.

3. Tests for Pollen Viability using stains and in vitro Germination. Pollen Germination using Hanging drop and Sitting drop cultures, Suspension culture and Surface culture.
4. Estimation of Percentage and Average Pollen tube Growth *in vitro*.
5. Study of ovules in cleared preparations; Study of Monosporic, Bisporic and Tetrasporic types of Embryo Sac development through examination of permanent stained serial sections.
6. Field study of several types of flowers with different pollination mechanisms (Wind Pollination, Thrips pollination, Bee / Butterfly Pollination, Bird Pollination).
7. Study of Nuclear and Cellular endosperm through dissections and staining.
8. Isolation of Zygotic Globular, Heart-shaped, Torpedo stage and mature embryos from suitable seeds.
9. Polyembryony in Citrus, Jamun (*Syzygium cumin*) etc. by Dissections.

Suggested Books for laboratory exercises

1. Chopra, V.L. 2001. Plant breeding: Theory and Practice. Oxford IBH Pvt. Ltd. New Delhi.
2. Chopra, V.L. 2001. Plant breeding: Field Crops, Oxford IBH Pvt. Ltd., New Delhi.
3. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A laboratory Manual. Springer verlag, Berlin Heidelberg.
4. Shivanna, K.R. and Sawhney, V.K. (Eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge.

SEMESTER-III

BOT-301: MOLECULAR BIOLOGY AND TECHNIQUES

Course Objectives

1. To make the students to understand the DNA structure, properties, replication, damage repair and organization of genetic material in chromosomes.
2. To make the students to understand organization, mechanism of gene expression and processing of gene products in Prokaryotes and Eukaryotes.
3. To make the students to understand mechanisms of gene expression regulation in Prokaryotes and Eukaryotes
4. To make the students to understand basic principles of microscopy and techniques for separation and analysis of nucleic acids and proteins.

UNIT – 1

Structure and Replication of DNA:

Nature of genetic material, and structure of DNA and polymorphism (A, B, and Z DNA). Biochemical and physical properties of DNA and RNA; DNA replication in prokaryotes and eukaryotes. Unit of replication, enzymes involved, replication origin and replication fork, fidelity of replication, DNA damage and repair mechanisms, Nucleosome structure and levels of Chromatin organization in Chromosomes; Cell cycle and its regulation.

UNIT – II

Gene expression:

Structure of prokaryotic and eukaryotic genes; RNA synthesis and processing: Transcription factors and machinery, formation of initiation complex, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing, and polyadenylation, RNA transport.

Protein synthesis and processing: Elucidation and features of genetic code, aminoacylation of tRNA, tRNA-identity, aminoacyl tRNA synthetase, Ribosome, formation of initiation complex, initiation factors and their regulation, elongation and elongation factors, termination, translational proof-reading, Post- translational modification of proteins. Secondary structure, domains, motif and folds.

UNIT – III

Regulation of gene Expression

Regulation of phage and viral gene expression Prokaryotes - Organization of Lac and Tryptophan operons; Negative and Positive Control and Attenuation mechanisms.

Eukaryotes: *Cis*-acting elements and Trans-acting factors in gene regulation

Role of Chromatin remodeling and histone code in gene expression.

DNA methylation in gene regulation and gene imprinting. RNAs in gene silencing

UNIT – IV

Techniques for analysis of Molecules:

Microscopic techniques: Resolving powers, microscopy of living cells, Scanning and Transmission Electron microscopes & specimen preparation, Image processing methods.

Molecular separation techniques; Centrifugation: Sedimentation - RCF, Differential & Density Gradient centrifugation, Chromatography- Basic Principles, Types of Chromatography.

Electrophoresis: Principles and Types of electrophoretic techniques. Spectroscopy: UV/visible and Mass spectrometry; Labeled tracers.

Course Outcomes

1. Describe DNA structure and properties . Explain the role of machinery and mechanism of DNA replication and DNA damage repair pathways in Prokaryotes and Eukaryotes
2. Describe the levels of Chromatin organization leading to metaphase Chromosomes structure and mechanism of Cell Cycle regulation
3. Describe gene organization, role of machinery and mechanism of Transcription and Translation, and processing of gene products in Prokaryotes and Eukaryotes. Explain the role of Cis- acting elements and Trans – acting factors , and strategies used by Prokaryotes and Eukaryotes in regulation of gene expression
4. Describe how chromatin alteration, Methylation and RNAs regulate gene expression in Eukaryotes. Explain the basic principles of Microscopy, Nucleic acid and protein separation and identification Techniques and methods

Suggested Readings: BOT – 301

1. Adams, R. L. P., Knowler, J. T. and Leader, D. P. 1994.The Biochemistry of the Nucleic acids. Chapman & Hall.
2. Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., and Watson, J. D. 1999. Molecular Biology of the Cell. Garland Publishing Inc., New York.
3. Brown, T. A. 1999. Genomes 3. John Wiley & Sons, New York, USA.
4. *Watson JD, Baker TA, Bell SP, Gann A, Levine M, Losick R. 2004 Molecular biology of the Gene* (5^{th} Ed.) Benjamin Cummings.
5. Robert F. Weaver.2008. Molecular Biology. Mc Graw Hill Higher Education.
6. Buchanan, B. B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. Am. Society of Plant Physiologists, Maryland, USA.
7. Lewin, B. 2006. Genes VIII. Oxford University Press, New York.
8. Upadyaya, A., Upadyaya, K., and Nath, N. Biophysical Chemistry-Principle and Techniques, Himalya Publishing House, New Delhi
9. Lodish, H., Berk, A., Zipursky, S.L., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (4^{th} Ed.), W.H. Freeman and Co., New York, USA
10. Keith Wilson and John Walker (Editors) 2005.Principles and Techniques of Biochemistry and Molecular Biology (6th Ed.) Cambridge University Press, New York.

Practical BOT-CP-301 (Molecular Biology and Techniques)

Suggested Laboratory Exercises related to 301

1. Study of Chromosomal Behavior during Mitosis in root tips of Onion.
2. Isolation of plant DNA

3. Determination of λ max of DNA.
4. Estimation of DNA quantity by Diphenylamine method
5. Isolation of RNA
6. Determination of λ max of RNA
7. Estimation of RNA quantity by Orcenol method
8. Effect of pH and temperature on DNA and RNA
9. Determination of λ max of Proteins.
10. Estimation of Protein quantity

1. Assignments on DNA structure, Replication and Gene expression.

1. **Suggested Books for Laboratory exercises**

2. A.K. Sharma and A. Sharma, Chromosome techniques, Butterworth's Publications
3. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology Biotechnology. CRC Press, Boca Raton, Florida.
4. Sadasivam, S. & Manikam, A. 1992. Biochemical methods. Wiley Eastern Ltd.
5. Sawhney, S. K. and Ranbir Singh (Eds).2000.Introductory Practical Biochemistry, Narosa Publishers, New Delhi.
6. Shaw, C.H. (Ed.). 1988. Plant Molecular Biology: A Practical Approach, IRL Press, Oxford.
7. An Introduction to practical biochemistry by D.T. Plummer (Mc Graw Hill).
8. Lab Manual in Biochemistry by J. Jayaraman (Wiley Eastern Limited).Gelvin, S. V. and Schilperoort, R. A. (Eds.) 1994. Plant Molecular Biology Manual, (2nd Ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands
9. Biochemistry by Lubert Stryer (5th Ed.) (Freeman-Toppan)
10. 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, New York.
11. Frank, H. Stephenson. 2008: Calculations in Molecular Biology and Biotechnology-A Guide to Mathematics in the Laboratory, Academic Press

PAPER – I (BOT-301) : MOLECULAR BIOLOGY AND TECHNIQUES.

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	1	3	2	-	2	3	2	1
CO_2	3	2	1	2	1	2	2	2	2	1
CO_3	3	1	-	1	1	-	1	3	-	2

CO_4	3	1	2	1	2	1	1	2	-	1

BOT-302: BIODIVERSITY AND CONSERVATION

Course Objectives

1. To create awareness in the biodiversity on globe.
2. To create interest in identifying the available resources in the world.
3. To inculcate interest to conserve the natural resources on the Earth.
4. To identify the endangered species in Hotspots.

UNIT I

Concept and Importance of Biodiversity: Status in India, World Centers of Primary Diversity, Types of Biodiversity, Causes for Rarity, loss of Species, *Extinction*, Red data book, Exploration, Intensions, Introduction of species, Status species-based on IUCN; and Genetic Diversity in crops, Sustainable Agriculture in Biodiversity; *Arborata, Palmata*; Global Warming and its effect on Bio diversity.

Nature of biodiversity-genetic, species and ecosystem diversity. Values of biodiversity-anthropocentric and ecocentric. Magnitude and global distribution of biodiversity. Global biodiversity hotspots. Megadiverse countries-India as a mega diversity center; floristic richness of India. Agrodiversity-centers of origin.

UNIT II

Remote Sensing Applications in biodiversity conservation Status and Analysis of Species Diversity: Remote sensing-Concept, Principles, Applications and Role in study and Identification of Phyto Diversity and Natural Resources. GIS, Application of Microwaves and Radiation.

UNIT III

Principles of Diversity Phytogeography: Concepts of Phytogeography, generic cycles, theories of Phytogeography, Phyto geographical areas in India and Plant Diversity. Continental drift, plate tectonics of World and India, Endemism, Hotspots, Species rarity and Extinction.

UNIT – IV

Strategies for Conservation of Diversity: *In situ* Conservation – Sanctuaries, National Parks, Biosphere Reserves, MPCA, MPDA, Mangroves, Coral Reefs, Sacred Groves, *Ex-situ* Conservation.

Botanical Gardens. Arborata and Palmata; Herbaria, Gene Banks, Seed Banks, Traditional Role of National and International Organizations – WWF, IPGN, IUCN, NBPGR, BSI, ICAR, CSIR, DBT, DST, NGOs and Role of Indigenous people in Biodiversity conservation.

Course Outcome

1. Students achieve knowledge on variations in living organisms.
2. They can also know the availability of natural resources on Earth.
3. Once they know the degradation of biodiversity, they will contribute to the protection of nature (Plants/Animals/Minerals/Air/Water).
4. They got awareness in endemic, threatened species and par;ticipate in protection of the Taxa.

Suggested Books:

1. 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 Genetic Resources, New Delhi.
2. Chaudhuri, A. B. & Sarkar, D. D. 2002. Biodiversity Endangered. Scientific Publishers, New Delhi.
3. Clive Hambler, 2004. Conservation. Cambridge University Press, Cambridge, UK.
4. Chuvieco, E. and Uete, A.H. 2010. Fundamentals of Satellite Remote sensing.
5. Frankel, O.H., Brown, A.HD. & Burdon, J.J. 1995. The Conservation of Plant Diversity. Cambridge University Press, Cambridge, U.K.
6. Gabriel Melchias. 2001. Biodiversity and Conservation. Oxford IBH Publishers, New Delhi.
7. Christopher, D., Cook, K. 1996. Aquatic and Wet Land Plants of India Oxford University Press, New Delhi, India.
8. Mehra, K. L., Arora, R. K. 1982. Plant Genetic Resources of India -Their Diversity & Conservation, Vol III, Chapman Hall ,U. K.
9. Manilal, K. S. 1988. Flora of Silent Valley, Mathrubhumi Press, Calicut.
10. Nayar, M. P. 1996. Hot Spots of Endemic Medicinal Plants of India, Nepal & Bhutan, Tropical Botanical Garden & Research institute, Palode, Tiruvananthapuram, Kerala.
11. Negi, S. S. 2005. Biodiversity & Its Conservation in India. Indus Publishing Company. New Delhi.
12. Prasad, B. N. 2000. Biotechnology & biodiversity in Agriculture / Forestry. Oxford University Press.
13. Pullaiah, T. 2002. Biodiversity in India. Vol. I -IV. Regency Publications, New Delhi.
14. Rajiv K. Sinha. 1996. Global Biodiversity, INA, Shree Publications, Jaipur, India.
15. Santapau, H. 1970. Endangered Plant Species and their Habitat Status. IUCN Publications, Switzerland.
16. Sinha, R. K. Biodiversity -Global Concerns.1996. Commonwealth Publishers, New Delhi.
17. Supriva Chakraborthy. 2004. Biodiversity Pointer Publishers, Jaipur.
18. Walter, K.S. and Gillett, H.J. 1998. 1997 IUCN Red List of Threatened Plants. IUCN, the World conservation Union. IUCN, Gland, Switzerland, and Cambridge, U.K.

19. *Kevin J. Gaston & John I. Spicer. 2004. Biodiversity, an introduction. Blackwell* Christian Leveque, Jean-claude Mounolou and Vivien Reuter. 2004. *Biodiversity*. John Wiley
20. Given, D.R. 1995. *Principles and practice of plant conservation*. Timber Press, Oregon.
21. *Jensen*, John R. 2007. *Remote Sensing of the Environment: An Earth Resource Perspective.*PHI.
22. Krishnamurthy, K.V. 2004. Advanced Textbook On Biodiversity: Principles And Practice. Oxford Lillesand. T.M. & R.W.Kiefer. 2015.
23. Remote Sensing and Image Interpretation*.* 7th ed*.* Wiley. Ravi Prasad Rao, B. 2005.
24. Pullaiah, T. (ed.) Taxonomy of Angiosperms*.* Regency Pub.
25. Sharma, P.D. 2015. Ecology and Environment. 12th ed. Ratogi Publications, Meerut.

PRACTICAL BOT-302 (BIODIVERSITY AND CONSERVATION)

Suggested Laboratory Exercises related to BOT- 302

1. Study of the Species Diversity in Fields and Forests.
2. Study of Bio-diversity of identical areas.
3. Study of Mangroves and Sacred groves.
4. Study of Endemic, Rare, Extinct species of Seshachalam hill range.
5. Genetic Diversity of species / varieties of *Vinca*, *Oscimum*, *Gomphrena*, *Portulaca*, *Plumbago*, *Amaranthus* etc.
6. Screening of Plant species for Secondary metabolites.
7. Extraction of Plant Dyes from various parts.
8. Saponification and Iodine Number of Different Plant oils.
9. Study and Distribution of Genera and Species of Indigenous (Endemic) and World.
10. Endemic plant diversity and Distribution in India.
11. Study on Forest types of India. 12. Identification of Hotspots, National parks and Sanctuaries of India and World. 13. Study of FCC and TCC related to remote sensing.

Suggested Books for Laboratory Exercises

1. Bajracharya, D. 1999. Experiments in Plant Physiology: A laboratory manual. Narosa Publishing House, New Delhi.
2. Cooper, T.G. 1977, Tools in Biochemistry. John Wiley, New York, USA.
3. Copeland, R,A. 1996. Enzymes: A practical introduction to Structure, Mechanism, and Data analysis. VCH Publishers, New York.
4. Dennison, C. 1999. A guide to protein isolation. Kluwer Academic Publsihers, Dordrecht, The Netherlands.
5. Devi, P. 2000. Principles and methods of plant molecular biology, Biochemistry and Genetics, Agrobios, Jodhpur. India.

6. Dryer, R.L. and Lata, G.G. 1989. Experimental Biochemistry, Oxford University Press, New York.
7. Hames, B.D. (Ed). 1998. Gel Electrophoresis of proteins: A Practical approach. (3rd Ed.). RA,S Oxford University Press. Oxford UK
8. Harborne, J. B. 1981. Phytochemical methods: A guide to modern techniques of plant analysis. Chapman & Hall, London.
9. Meidner, H. 1984. Class experiments in Plant physiology, George Allen & Unwin Publishers, Boston, USA.
10. Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory manual. Springer Verlag, Berlin.
11. Ninfa A.J. and Ballou, D.P. 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, Fitzgerald Science Press, Inc., Maryland, USA.
12. Plummer, D.T. 1988. An Introduction to Practical Biochemistry. Tata McGraw Hill Publisf, iriCo. Ltd., New'Delhi.
13. Scott R.P.W. 1995. Techniques and Practice of Chromatography. Marcel Dekker, Inc., New York.
14. Wilson, K. and Goulding, K.H. (Eds.). 1986. A Biologists guide to principles and ltechniques of practical biochemistry. Edward Arnold, London, UK.
15. Wilson, K. and Walker, J. 1994. Practical Biochemistry: Principles and Techniques, (4th Ed.). Cambridge University Press, Cambridge, UK.

PAPER – II (BOT-302) : BIODIVERSITY AND CONSERVATION.

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	3	3	-	3	-	-	-	2	3
CO_2	3	2	2	-	1	-	-	-	1	1
CO_3	3	1	1	-	2	-	-	-	1	1
CO_4	3	3	1	1	-	-	-	-	1	2

BOT-303A : BIOSYSTEMATICS (IE)

Course Objectives

1. To create awareness to students related to the significance of the evolution process.
2. To inculcate interest in the methods of breeding systems.
3. To know the biochemical and molecular systematic including chemical constituents and metabolites.
4. To develop the concept on various systems of classification.

UNIT I

Biosystematic Categories: Introduction, history, scope, importance and objectives; Ecotype: nature, origin and their significance, different types of ecotypes, ecospecies, coenospecies, comparium; phenotype, genotype, biotype; deme concept. Variation and speciation; Types of variation, isolating mechanisms, gradual or Phyletic and additive speciation. Infra specific and Inter specific variations. Genecotypes and phenecotypes. Plasticity of phenotypes; factors affecting phenotype variations and their significance, role of biosystematics in evolution.

UNIT II

Concept of Character and Breeding Systems: Character- definition, different types of characters - analytic Vs synthetic, qualitative Vs quantitave, homology Vs analogy, consistent Vs variable, etc; Heterobathmy, Character weighting, Character state transitions, Correlation of characters, role of selection pressures on character. Methods of sampling and processing of data. Breeding systems and their role in sexual and asexual populations; Ideal species.

UNIT III

Source of Characters and Evaluation (Omega Taxonomy): External morphology, Comparative Anatomy, Embryology, Palynology-pollen apertural morphoforms, exine stratification and ornamentation. Cytology: Chromosome morphology and behavior, banding patterns. Biochemical and molecular systematics: Secondary metabolites, chemical markers, Chemotypes, Semantides, Isozymes, Allozymes and Immuno systematics.

UNIT IV

Taximetrics and Concept of Species: Adansonian principles. Phenetics and Phyletics. Apomorphies and Plesiomorphies, summerizing the data and analysis of relationship and distance among the taxa, Merits and demerits of numerical taxonomy. Cladistics: Phenograms, Cladograms and Dendrograms, construction of taxonomic groups. Concept of species; Classification of species (taxonomic, biological, semispecies, successional species, cryptic and semi-cryptic). Mechanism of speciation-allopatry, sympatry and parapatry.

Course Outcomes

1. After completing the course the students able to understand the significance of Biosystematics.
2. They got awareness the different methods of breeding to develop hybrids by carrying research in crops.
3. Students develop the concept of phytochemicals which will be useful in

Pharmaceuticals.

4. They will get knowledge on grouping of taxa and correlation and relationship among the groups

Suggested Books:

1. Crawford, DJ. 1990. Plant molecular systematics: Macromolecular approach, John Wiley, New York
2. Davis, PH. & VM.Heywood.1963. Principles of Angiosperm Taxonomy Oliver & Boyd. Edinburgh.
3. Gibbs, RD. 1974. Chemotaxonomy of flowering plants. Montreal. & London.
4. Gurucharan Singh, 2000, Plant Systematics. Theory and Practice. Oxford & IBH Publishing Co.PVT.LTD., New Delhi.
5. Heywood, VH. (ed) 1968. Modern methods in Plant Taxonomy. Academic press. London.
6. Hollis, DM. 1996. Molecular Systematics (2^{nd} Ed). Freeman & Co.
7. Judd, W.S, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, and Michael J. Donoghue. 2007. Plant Systematics: A Phylogenetic Approach, 3rd ed. Sinauer.
8. Lawrence, GHM. 1951. Taxonomy of vascular plants. McMillan, New York.
9. Naik, VN. 1992. Taxonomy of Angiosperms. (2^{nd} Ed). Tata Mc. Graw Hill
10. Pullaih.T.2013 Text Book of Biosystemaitcs. Theory and Practicals, Regency Publications, New Delhi.
11. Pullaiah, T.1998. Taxonomy of Angiosperms. Regency Publications, New Delhi.
12. Radford. AE.et al., 1974. Vascular Plant systematics. Harper & Row. New York.
13. Radha krishnaiah, M. 1996. Essentials of Plant Taxonomy. Hyderabad.

PRACTICAL BOT- 303 IE: BIOSYSTEMATICS

Laboratory Exercises related to BOT- 303IE

1. All the students taken admission into this course are to go on local field trips minimum 1-2 days each at least thrice in a semester covering local forests, plains and wastelands for collection of the selected group of plants for taxonomic assessment.
2. Description of a minimum of five species of any genus with the help of different characters.
3. Construction of keys (Bracketed and Indented) for the selected groups.
4. Study of different ecotypic variations in selected group of plants.
5. Study of not less than 75 characters using external morphology, leaf architecture, epidermal and trichome complex, Palynology, Phytochemistry, Cytology etc., in the selected taxa.

6. Construction of similarity matrix and cladistic analysis to indicate the taxonomic relationship among the members of study.

Suggested Books for Laboratory Experiments

1. Pullaih.T.2013 Text Book of Biosystemaitcs. Theory and Practicals, Regency Publications, New
2. Delhi.
3. Judd, W.S, Christopher S. Campbell, Elizabeth A. Kellogg, Peter F. Stevens, and Michael J. Donoghue. 2007. Plant Systematics: A Phylogenetic Approach, 3rd ed. Sinauer.
4. Gurucharan Singh, 2000, Plant Systematics. Theory and Practice. Oxford & IBH Publishing Co.PVT.LTD., New Delhi.

Internal Elective

PAPER – III (BOT-303 IE) : BIOSYSTEMATICS

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	-	3	2	3	3	2	2	2
CO_2	3	-	-	-	3	3	3	1	1	-
CO_3	3	1	3	2	-	1	2	1	2	2
CO_4	3	-	3	1	1	2	-	2	-	-

BOT-303B: MOLECULAR PLANT PATHOLOGY (IE)

Course Objectives

1. To study biotic (living), mesobiotic and abiotic (non-living and environmental) causes of diseases or disorders
2. To study the mechanisms of disease development by pathogens
3. To study the plant (host)-pathogen interaction in relation to environment
4. To develop methods of management of plant diseases Plant disease.

UNIT - I

Symptoms and Diagnosis of Plant Diseases

Disease development: Concept of plant diseases, Casual agents-Fungi, Eumycota, Protozoa, Bacteria, Phytoplasma and Spiroplasma, Viruses. Historically important diseases. Stages in Disease cycle – Inoculum, Inoculum Potential, Penetration, Infection, Invasion, Reproduction, Spread and Survival of the Pathogens. Susceptibility, Specificity, Toxins, Enzymes and Growth Regulators.

Plant Disease Epidemiology: Stages in diseases cycle, Molecular biology in plant pathology, use of model organisms, transformation techniques, forward and reverse genetics, defense mechanisms, plant disease epidemiology.

UNIT - II

Physiology of the infected plant: Changes in Respiration, Photosynthesis, Carbohydrate metabolism, Nitrogen metabolism, Nucleic acid metabolism and growth characteristics of plants.

UNIT – III

Plant Disease Management: Physical, Chemical and Cultural. Plant fungal and Bacterial Diseases-Control. Bio-Control: Principles**.** (a) Biopesticides- Microbial, Fungal, Bacterial, Viral and Botanicals. (b) Integrated Pest Management-

Transgenics: Insect (pest) Resistant Plants (Bt-cotton), Disease Resistant Plants (Virus Resistance).

UNIT IV

Specific plant disease: Symptoms, Etiology, Disease cycle and control of the Following diseases. Club-rot diseases of crucifers, Damping-off Vegetables, Late blight of potato, Green ear disease of Bajra, White rusts of Brassica, Powdery mildew of Cucurbits, Ergot of Bajra, Leaf spot of Turmeric, Groundnut rust, Whip smut of Sugarcane, Leaf spot of Groundnut, Brown spot of Rice, Blast of Rice and Blight of Rice.

Course Outcomes

1. An ability to know what is disease and how it is caused and ability to know about different causal agents.
2. An ability to know how to develop disease and mode of action.
3. An ability to know how the metabolic activities altered during host pathogen interaction.
4. An ability to control diseases by using Ecofriendly management and IPM instead of Chemical methods.

Suggested Books:

1. Agrios, G.N. 1997. Plant Pathology, (4th Ed.), Academic Press, London.
2. Bilgrami, K. S. and Dube, H. C. 2000. A text book of Modern Plant Pathology, Vikas Pub. New Delhi.
3. Mukerji, KG. and Garg, K. L. 1993. Bio-control of plant diseases, Vol. I & II CBS Publishers & Distributors Delhi.
4. Rangaswami, G., 1988(3rd Ed.) Diseases of Crop plants in India. Prentice-Hall of India.

5. Wood, R.K.S. 1980. Specificity in Plant diseases.

Practical-BOT-303B : MOLECULAR PLANT PATHOLOGY (IE)

Suggested laboratory exercises

1. Isolation of Pathogenic Fungi and Bacteria.
2. Demonstration of Koch's postulates Citrus canker.
3. Estimation of Rhizosphere, Phyllosphere, Spermosphere microorganisms by Serial dilution methods.
4. Screening method of Antagonists against Pathogenic Micro Organisms.
5. Isolation of Hyperparasites form Plant Fungal disease by Serial Dilution Methods.
6. Screening of Antibiotics against Pathogens by Paper Disc Method.
7. Screening of Botanical Pesticides (plant extracts) against Fungal Pathogens by incorporating in the medium.
8. Submission of Plant Pathology Herbarium.

Suggested Books for Laboratory Exercises

1. Schaad, N.W. 1990. Laboratory Guide for identification of plant pathogenic bacteria (2nd Ed.), APS. (USA)
2. Sharma, PD. 201. Plant pathology
3. Staples, R.C. and G.H. Toenniessen .1981. Plant disease control resistance and susceptibility John Wiley & sons, New York 339 pp.

PAPER – IV (BOT-304 IE) : MOLECUAR PLANT PATHOLOGY

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	2	-	-	2	3	-	3	3
CO_2	3	3	1	-	-	1	2	-	1	1
CO_3	3	1	-	1	2	2	1	1	1	1
CO_4	3	1	-	-	1	-	-	-	-	-

BOT-303C : COMPUTER APPLICATIONS AND BIOINFORMATICS (IE)

Course Objectives

1. To demonstrate understanding of the basic operations of a computer system..

Demonstrate a knowledge and understanding of using computers to solve problems related to practical applications.
2. Operate a variety of advanced spreadsheet, operating system and word processing functions.
3. To prepare students who wish to go on to further studies in computer science and related fields.
4. To provide opportunity for the study of modern methods of information processing like bioinformatics databases and its applications.

UNIT I

Computer Operating systems. Types of Operating Systems, MS Office

UNIT II

Bioinformatics –definition, introduction, scope and applications. Databases – CBI GenBank, PDB, OMIM, EMBL. Literature Databanks – Pub Med, Med line. Plant Biology Specific search Engines.

UNIT III

Sequence Alignment based on Matrices (BLOSUM and PAM), Algorithm (Needleman Wunsch & Smith Waterman). Tools for sequence alignment – BLAST, FASTA. Pair wise and Multiple sequence alignment and phylogenetic analysis.

UNIT IV

The biological databases & Types; Types of biological databases; Sequence databases; Structural databases; Prediction of genes and gene function. Translation of gene into protein; Protein secondary structure prediction; Prediction of domains, motifs and profiles of proteins.

Course Outcomes

1. MS-Office operating skills
2. Exploring various types of Databases like NCBI, Gen Bank, PDB, OMIM, EMBL.
3. Exploring Literature Data Banks like PubMed, Med line.
4. Exploring Literature sequence alignment tools like BLAST and FASTA.

Suggested Books:

1. Bioinformatics. A practical guide to analysis of genes and proteins. 1998. Baxevanis and Quellette.
2. Bioinformatics: A biologist's guide to biocomputing and the internet. 2000. Stuart M. Brown.
3. Bioinformatics: Sequence and genome analysis. 2001. David W. Mount.

PRACTICAL BOT- 303C : COMPUTER APPLICACATIONS AND BIO INFORMATICS

Suggested Laboratory Exercise related 305IE

1. Document files creation using MS word. Creating document style.
2. Internet – E-mail and mail attachment Downloading webpage; Saving a web page; Printing the web page; Document Search engine; Image
3. Visit to genebank database; NCBI; EMBL
4. Visit to protein database; Swiss- Prot ;PDB
5. Use of literature database Virtual library; Agricola; PubMed
6. Use of similarity search tools: NBLAST; PBLAST

Suggested Books for Laboratory Exercises

1. Bioinformatics. David H Mount. 2005. Second Edn. CBS Publishers, New Delhi.
2. Bioinformatics- Methods and applications. S.C.Rastogi, N.Mendiratta and P.Rsatogi. Third edition. PHI Learning Pvt. Ltd, New Delhi.

PAPER – IV (BOT-306 IE) : COMPUTER APPLICATIONS AND BIOINFORMATICS

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	3	3	3	1	-	-	2	2	-
CO_2	3	2	2	3	2	-	-	-	1	-
CO_3	3	1	1	2	1	1	2	-	1	1
CO_4	3	1	1	1	1	-	-	1	-	1

BOT-304A : PLANTS AND HUMAN WELFARE (EE)

Course Objectives

1. To understand the preparation and development of herbal formulation.
2. Describe about herbs or natural origin drugs as raw materials for preparation of cosmetics, excipients, conventional herbal formulation and novel dosage forms like phytosomes.
3. Explain method for identification and authentication of herbal drugs.
4. To be familiar with the modern extraction techniques, characterization and identification of the herbal drugs and phytoconstituents.

UNIT-I

Diversity of plants: Food Yielding Plants (Major & Minor crops- Cereals, Pulses, Oil seeds, Vegetables and Fibers); Wood and Timber Yielding plants and their utilization in day to day human life.

UNIT-II

Plants in Medicine: Medicinal and Aromatic Plants (Ethno medicinal or Traditional Medicinal plants); Poisonous plants; Medicinal plants used to cure human diseases, Insect bites/ Snake bites; Veterinary diseases (Live stock); plants used in Ayurvedic; Homeopathy, Allopathy, Sidha and Unani Medicines.

UNIT-III

Non wood forest products: Spices and condiments ; beverages, Sweetening's, Starch, Honey, Bio vitamins; Bamboos, Rattans, Gums, Waxes, Resins, Tannins, Dyes, Fruits, Nuts, Cork, Paper, Pulp, Rubber, Volatile oils; Petroleum substitutes.

UNIT-IV

Preparation and application of plants as Bio fertilizers (N_2 fixers; Zeevamrutham, Vermi compost); Bio pesticides (For Fungal, Bacterial and viral diseases); Bio insecticides (mosquitoes repellents; Book worms; Beatles, mushroom cultivation, plants as preservatives.

Course Outcome

1. Carryout isolation and identification of phytoconstituents.
2. The pharmaceutical legislations and their implications in the development and marketing.
3. Acquire an understanding of the importance of plants in tribal lives.

4. Describe rules and regulation for assessment of herbal drugs, patenting of natural products and manufacture of herbal formulations based on traditional medicinal system.

Suggested Books:

1. Economic Botany, S.N Panday, Ajanta Chadha, Vikas Publishing House pvt Ltd.1996.
2. Economic Botany, B.P. Panday. S.Chand & Company Ltd.1984.
3. A Phyto chemical approach to Economic Botany S.D. Sabis, M.Daniel, Kalyani Publishing. 1990.
4. A Text Book of Ecomonic Botany, A.V.S.S. Sambamurty, N.S Subrahmanyam Eiley Eastern Ltd. 1989.
5. Econic Botany- A Text Book of useful Plants and plant products by Algert F. Hill.
6. The Medicinal and Poisonous Plants of India by J.F.Caius Scientific Publishers journal dept. 5th Revised edition- 2003.
7. Poisonous Plans of India by R.N. Chopra. New Delhi, Indian council of Agricultural Research- 1965.
8. Plants used as Veterinary Medicine in Chittoor District of Andhra Pradesh, India. Pharmaceutical biology, January-1987
9. Veterinary Medicinal Plants by Ramesh Handan-2015.
10. Veterinary Herbal medicine by Susan G. Wynn, Barbanafongene . 2016.

PAPER – IV (BOT-307 EE) : PLANTS AND HUMAN WELFARE

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	-	-	-	-	-	-	1	-	3
CO_2	2	3	2	-	-	-	2	3	-	-
CO_3	-	-	1	-	2	2	-	-	-	-
CO_4	-	1	2	1	1	1	1	1	1	2

BOT-304B : ORGANIC FARMING AND MUSHROOM CULTIVATION (EE)

Course Objectives

1. To study methods of growing edible mushrooms and isolation of Mushroom culture and Culture maintenance;
2. To study the basic mushroom substrate preparation, composting, spawn generation techniques, inoculation methods;
3. To study method of harvesting of Mushrooms and Pest Management of Mushrooms.
4. To provide awareness of Organic Farming and its Scope in India.

UNIT-I

Concept of organic farming: Principles, types and benefits of organic farming. Conventional farming versus Organic farming. Types of compost, Green manure, Farmyard manure, Vermicompost, Methods of compost preparation. Processing, packing and storage of vermicompost. Nutritive value of compost. Panchagavya; collection, processing, advantages and disadvantages

UNIT-II

Biofertilizers: Production, processing and storage of biofertilizers and organic preparations. Cost of production system. Benefit cost ratio. Marketing: export and import. Maintenance of records, farm management system and role of NGOs.

UNIT-III

Mushrooms: Introduction to mushrooms, morphology, classification, edible mushrooms and poisonous mushrooms. Life cycle of *Valvarellia sp*, *Pleauritus sp*, *Agaricus sp.*, *Calocybe sp.,* and *Leutinus sp.*

UNIT-IV

Mushroom cultivation: Conditions for mushroom cultivation, isolation, spawn production, growth media, spawn running, harvesting and storage of mushrooms. Medical and nutritional value of mushrooms. Mushrooms diseases and management.

Course Outcomes

1. An ability to know types of edible and poisonous mushrooms.
2. An ability to know method of cultivation of mushrooms.
3. An ability to have self employment.
4. Able to prepare Organic fertilizers and apply it to field level.

Suggested Books:

1. Handbook of organic farming and Biofertilizers by M.K. Gupta.

2. The Organic Farmer's Business Handbook by Richard Wiswal.
3. Practical Handbook of Agricultural Science by Hanson.
4. Year Round Vegetables, Fruits and Flowers by Bob Randall.
5. Organic Management for the Professional by Howard Garrett.
6. Handbook of organic farming and Biofertilizers by M.K. Gupta.
7. Biofertilizer Technology by R. Shankara Reddy, Biofertilizer Technology by Kannaiyan. S

PAPER – IV (BOT-308 EE) : ORGANIC FARMING AND MUSHROOM CULTIVATION

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	3	3	2	-	2	2	-	-
CO_2	3	3	1	2	1	3	-	2	3	-
CO_3	3	2	1	-	-	1	3	2	1	-
CO_4	3	2	-	-	-	-	-	-	-	-
CO_5										

8.

BOT-304C : GARDENING AND NURSERY TECHNIQUES (EE)

Course Objectives

1. Analyze the green houses based on shape, utility, construction, covering materials and cost.
2. Study of Plant Propagation and Nursery Management.
3. Study about tissue culture methods and applications are extensively studied with application point of view
4. Knowledge Production technology of medicinal and plantation crops; Awareness of basics of fruit, ornamental and medicinal plants nurseries.

Unit-I

GARDENING AND NURSERY: Importance of Nursery, Role of Nurseries in Horticulture Development, Components of Nursery-, Layout, Physical Resources Inputs, Management, Propagation Structures, Planning and Scheduling of Nursery Activities.Garden designing with annuals, biennials and Perennials

Unit-II

PLANT PROPAGATION METHODS: Sexual Propagation - Seed Production and Seed Propagation, Methods of Breaking Dormancy; Asexual Propagation- Division and Separation, Cuttings,

Grafting, Budding, Layering and Tissue Culture; Advantages and disadvantage of Sexual and asexual propagations.

Unit-III

PLANT NUTRITION AND MANAGEMENT IN NURSERY: Plant Nutrition, Macro and Micronutrients and their role, Nutrient Deficiency Symptoms in Plants; Manures and Fertilizers; Types of Growth Media and Media Preparation; Water Quality and Irrigation methods; Pest and Weed Management and Control.

Unit-IV

TYPES OF GARDENS AND NURSERIES- Types of gardens: Formal, Informal, Egyptian, Roman, Chinese, Hindu- Buddhist Mughal and Japanese. Types of Nurseries: Fruit Plant Nurseries, Vegetable Nurseries, Ornamental Plant Nurseries, Medicinal and Aromatic Plant Nurseries, Forest Plant Nursery, Hi-Tech Nurseries.

Course Outcomes

1. Provide basic knowledge about tools, equipment and growing structures used in nurseries for plant production ; Management practices of nursery practices record keeping, nursery standards
2. Plant nutrition and its management in nursery; Propagation by cuttings, layering, grafting, budding, specialized structures, and micropropagation.
3. Acquire knowledge regarding the theory and practice of cultural and production techniques and methods.
4. To learn management practices for nutrition, water management, pest management, pruning and training, storage and handling, shipping.

1. **Suggested Readings:**

2. Fundamentals of Horticulture, Edmond, J.B., Sen., T.L., Andrews, F.S and Halfacre R.G, 1963. Tata McGraw Hill Publishing Co., New Delhi.
3. Introduction to Horticulture, Kumar, N. 1990. Rajyalakshmi Publications, Nagarcoil, Tamilnadu.
4. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
5. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
6. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. institution)
7. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.
8. Christopher Brickell, 1992, The Royal Horticultural Society Encyclopedia of Gardening.Dorling Kinderlsey, London.

9. Plant Propagation. Principles and Practices, Hartman, HT and Kester, D.E.1976, Prentice Hall of India Pvt. Ltd. Bombay.
10. Plant Propagation. Sadhu, M.K. 1996. New Age International Publishers,New Delhi.

PAPER – IV (BOT-309EE) : GARDENING AND NURSERY TECHNIQUES

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	-	3	3	-	3	3	-	3	-
CO_2	3	2	3	1	3	-	2	-	3	3
CO_3	3	-	2	2	1	1	1	2	3	3
CO_4	2	-	2	1	3	2	2	1	2	2

SEMESTER IV

BOT-401: MOLECULAR GENETICS, GENOMICS AND PROTEOMICS

Course Objectives

1. To enable students to understand the basic principles of construction of genetic maps in Prokaryotes and Eukaryotes..
2. To enable students to understand Plant genome organization, Whole genome sequencing strategies, and structural and functional annotation.
3. To enable the students to understand principles and methods of Transcriptome and Proteome analysis.
4. To enable the students to understand mechanisms of genome evolution and construction of Phylogenetic trees; to enable the students to understand key features of Arbidopsis and rice genomes and applications of genome projects.

UNIT – I

Molecular genetics: Mendelian principles, complementation test, gene interactions.
Linkage and Recombination: Mechanism of Homologous and non-homologous recombination
Gene mapping methods: Genetic and Molecular Markers. Generation of mapping population in plants, Three point Linkage maps, Molecular genetic maps. Marker assisted selection. QTLs
Microbial genetics: Fine structure analysis of gene (rII locus), Mapping genes by interrupted mating, Transformation and Transduction. Tetrad analysis, Inheritance of Mitochondrial and chloroplast genes

UNIT – II

Sequencing genomes:

The structure of plant genomes Isolation, purification of plant DNA. Fractionation of genomes, Generation of BAC and YAC libraries. Construction of Physical maps – Restriction maps, FISH and STS maps. Maxim & Gilbert, Sanger and Next generation DNA sequencing methods. Whole genome sequence alignment strategies; clone by clone and shot gum sequencing. finished sequences. DNA sequence data bases. Genome annotation, in silico methods for gene identification.

UNIT III

Functional Genomics: Experimental techniques for functional identification of genes: Insertional mutagenesis, Targeted induced local lesions (TILLING), RNA interference (RNAi) and gene knockout.

Transcript profiling – DNA Micro array, Serial analysis of gene expression (SAGE) and Massively parallel signature sequencing (MPSS)

Proteomics: Protein sample preparation and separation techniques – 2D-analysis, Multidimensional liquid chromatography. Identification of proteins by Mass spectrometry, protein sequencing, protein micro arrays. Analysis of protein interactions and protein complexes.

UNIT IV

Comparative and evolutionary genomics and Application of genomics:

Nature and Molecular mechanisms of gene mutations-Transposons; Gene sequence homologies – analogy, orthology and paralogy. Gene duplication and divergence. Evolution of novel genes and proteins, DNA quantities and non-coding sequences in plant genome evolution.

Molecular clocks, Molecular phylogenetics and construction of phylogenetic trees.

Salient features of Arabidopsis and rice genome projects, and genomes, Applications of plant genomics in agriculture and industry.

Course Outcomes

1. Explain basic principles of gene transmission and methods for construction of genetic maps in Prokaryotes and Plant systems; explain the principles of DNA marker systems and methods for the construction of Molecular genetic and Physical maps, and their applications
2. Describe the organization of plant genomes and explain principles of DNA sequencing methods and whole genome sequence assembly strategies; describe the organization of DNA Databases, and structural and functional annotation of finished genomes
3. Explain the principles and describe methods for Transcriptome and proteome analysis; explain the mechanisms of spontaneous, induced and transposon mutagenesis.
4. Explain the mechanisms which underlie evolution of genomes/genes/proteins at the molecular level and Construct a Phylogenetic tree; describe key features of Arabidopsis and rice genomes, and applications of plant genome projects result

Suggested Books: BOT 401

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, New York.
2. Douglas J. Futuyma, 1998. Evolutionary Biology (3rd. Ed). Sinauer Associates, Inc. Publishers
3. Russel, P.J.1998. Genetics (5th Ed), the Benjamin/ Cummings Publishing Co., Inc.,
4. Singh, B.D., 2000. Plant breeding Principles and Methods. Kalyani Publishers, Ludhiana.
5. Tamarin, R.H. 1999. Principle of Genetics. Mc Graw Hill, New Delhi.
6. Brown, T. A. 1999. Genomes 3. John Wiley & Sons, New York, USA.
7. Primrose, S.B. & Twyman, R. M. 2003.Principles of Genomic Analysis and Genomics. (7th Ed.). Blackwell Science

8. Brown, T.A.2001.Gene cloning and DNA Analysis- An introduction (5th Ed.), Blackwell Scientific Publications, Oxford, U.K.
9. Christopher A. Cullis. 2004. Plant Genomics and Proteomics. John Wiley & Sons, New Jersey.
10. Gustafson, J. P. 2000. Genomes, Kluwer Academic plenum publishers, New York, USA.
11. Jolls, O. and Jornvall, H. (eds.) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
12. Biochemistry by Lubert Stryer (5th Ed.) (Freeman-Toppan) .
13. Arthur M. Lesk. 2002. Introduction to Bioinformatics. Oxford University Press, USA
14. Henry, R. J. 1997. Practical application of Plant Molecular Biology. Chapman & Hall, London. U.K.
15. Mount, D., 2004. Bioinformatics: Sequence and Genome Analysis. (2nd Ed.) Cold Spring Harbor Laboratory Press.
16. Chawla, H.S. 2002. Introduction to Plant Biotechnology. (2nd Ed.) Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi.

Practical-BOT-CP-401 (MOLECULAR GENETICS, GENOMICS AND PROTEOMICS)

Suggested Laboratory Exercises:

1. Study of chromosomal behavior during meiosis using flower buds of Onion
2. Isolation of Plant genomic DNA.
3. Isolation of plasmid DNA
4. Determination of quality and quantity of DNA by spectrophotometry.
5. Isolation of RNA from plant tissue.
6. Determination of quality and quantity of RNA by spectrophotometry
7. Restriction Digestion of the plant genomic DNA.
8. Agarose Gel Electrophoresis of DNA fragments and Size determination.
9. PCR Amplification of DNA. RAPD profiling.
10. Isolation of proteins from plant tissue.
11. Estimation of Protein concentration.
12. Determination of Isoelectric point of Proteins.
13. Separation of Proteins by SDS- PAGE and size determination.
14. Problems related to Genomics and Proteomics.
15. Practical exercises on concepts of Genetics

Suggested Books for Laboratory Exercises

1. Gelvin, S. V. and Schilperoort, R. A. (Eds.) 1994. Plant Molecular Biology Manual, (2nd Ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands.
2. Brown, T. A. 1999. Genomes 3. John Wiley & Sons, New York, USA.
3. Mickloss, D. A. and Freyer, G. A. 1990. DNA Science a first course in recombinant technology. Cold Spring Harbour Laboratory Press, New York, USA.
4. Sambrook, J., Fritsch, EF & Maniatis, T. 1989. Molecular Cloning, A laboratory manual, (2nd Ed.). Cold Spring Harbour Laboratory Press, New York, USA.
5. A.K. Sharma and A. Sharma, Chromosome techniques, Butterworth's Publications
6. Frank, H. Stephenson. 2008: Calculations in Molecular Biology and Biotechnology-A Guide to Mathematics in the Laboratory, Academic Press.
7. Elrod, S. and Stansfield, W. 2002. Genetics, Schaum's Outlines. Tata Mc Graw Hill, New Delhi.
8. Griffiths, A. J. F., Miller, J.H., Suzuki, D. T., Lewontin, R. C., and Galbert, 'N. 2000. An Introduction to Genetic Analysis. W. H. Freeman Publishers, New York.
9. Henry, R. J. 1997. Practical application of Plant Molecular Biology. Chapman & Hall, London. U.K.
10. Sawhney, S. K. and Ranbir Singh (Eds).2000.Introductory Practical Biochemistry, Narosa Publishers, New Delhi.
11. Shaw, C.H. (Ed.). 1988. Plant Molecular Biology: A Practical Approach, IRL Press, Oxford.

PAPER – I (BOT-401) : MOLECULAR GENETICS, GENOMICS AND PROTEOMICS

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	3	3	3	-	-	-	3	-
CO_2	3	3	2	2	2	-	-	3	-	-
CO_3	3	-	-	2	2	-	-	2	-	1
CO_4	3	-	1	1	3	-	-	-	1	-

BOT-402: PLANT BIOTECHNOLOGY

Course Objectives

1. The course would provide the students with understanding of Principles and Techniques of Plant Tissue Culture.
2. Know the concept and importance of genetically modified crops.
3. Understand the molecular mechanism of r-DNA technology.
4. To develop the skill on Cell Culture Technique.

UNIT I

Basic concept of regeneration: Concept of Cellular Totipotency and Differentiation. Fundamental aspects of Morphogenesis. Organogenesis-direct & indirect. Role of plant growth regulators and factors governing *in vitro* behavior of cultures.

Propagation and variation

Modes, stages and Application of Micropropagation. Production of Pathogen free plants and their application.. Somatic embryogenesis, role of physical and chemical factors in the induction; synthetic seeds-production and uses. Origin, Molecular basis and application of Somaclonal variation.

UNIT II

Applications of Plant Tissue culture: Production of Haploids and its significance in Crop improvement. Secondary metabolite production through Cell and Organ cultures-Hairy roots. Shikonin production. Cryo preservation, methods and *in vitro* conservation of Germplasm.

Somatic hybridization: Protoplast isolation, Fusion and culture, Hybrid selection and characterization of hybrids. Symmetric, Asymmetric hybrids and Cybrids, significant achievements and limitations of Protoplast research, production of test tube plants.

UNIT III

Principles of Gene Cloning and Analysis: Enzymology of rDNA 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 IV

Genetic engineering of plants: Plant Gene Isolation-Transposons and T-DNA tagging and map based cloning. Ti and Ri plasmids-mechanism of T- DNA transfer; Viral and other vectors. Physical methods of gene transfer; PEG mediated gene transfer, Electroporation, Biolistics, Micro injection and other techniques. Chloroplast transformation, Production and application of transgenic plants (Drought tolerance, Golden rice, Edible Vaccines). Regulations of release and concerns of genetically modified crops; intellectual property rights.

Course Outcomes

1. Develop skill to produce tissue culture plants of economic importance.
2. Acquire knowledge on production of transgenic plants.
3. Learn the molecular technique for Crop improvement.
4. Able to establish Cell Culture systems for production of Secondary Metabolites.

Suggested Books: BOT-401

1. Bhojvani, S.S. and Razdan, M.K. 1996. Plant tissue Culture: theory and Practice. Elsevier, New York, USA.
2. Bhojvani, S.S. 1990. Plant Tissue Culture: Applications and Limitations. Elsevier, New York, USA.
3. George, E.F., Vol-I (1986) and Vol II (1993) Plant propagation by Tissue culture.
4. Kartha, K.K. 1985. Cryopreservation of plant cells and organs. CRC Press, Boac Raton, Florida, USA.
5. Razdan, M.K. 1993. An Introduction to Plant Tissue culture. (2^{nd} Ed.). oxford IBH, New Delhi.
6. Reinert, J. Bajaj, YPS (Eds.). 1977. Applied and fundamental aspects of plant cell, tissue, and organ culture. Springer-Verlag, New York.
7. Vasil, I.K. and Thorpe, T.A. 1994. Plant cell and Tissue culture, Kluner Academic Publishers, The Netherlands.
8. Altman, A. 2001. Gene cloning and DNA Analysis- An introduction. (5^{th} Ed.). Blackwell Scientific Publication, Oxford, U.K.
9. Brown, T.A. 1999. Genomes. John Wiley & Sons (Asia) Pvt. Ltd., Singapore.
10. Chrispeels, M.J. and Sadava, D.E. 1994. Plants, Genes and Agriculture. Jones and Bartlett Publishers, Boston, USA.
11. Copping, L.G. and Rodgers, P. (Eds.). 1989. Biotechnology and its application to Agriculture. British Crop Protection Council.
12. Glazer, A.N. and Nikaido, H. 1995. Microbial Biotechnology, W.H. Freeman & Company, New York, USA.
13. Glick, B.R. & Pasternak, J.F. 1994. Molecular Biotechnology. Principles and applications of Recombinant DNA. Panima Publishing Corporation, New Delhi.
14. Old, R.W. and Primose, S.B.1989. Principle of Gene Manipulation Blackwell Scientific Publications, Oxford, UK.
15. Primrose,S.B. & Twyman, R.M. 2003.Principles of Genomic analysis and Genomics. (7^{th}Ed.) Blackewll Science.
16. Sandhya Mitra. 1996. Genetic Engineering: principles and Practice. Macmillan India Ltd.
17. Santharam, S. and Montgomery, J.F. 1999. Biotechnology, Biosafety, and Bio0diversity,

oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
18. Slater, A. Scott, N. W. and Fowler, M.R. 2003. Plant Biotechnology. The Genetic Manipulation of Plants. Oxford University Press.
19. Winnacker, E.L. 2003. From Genes to Clones- Introduction to Gene Technology. Panima Publishing Corporation, New Delhi.

PRACTICAL-BOT-CP-402 (PLANT BIOTECHNOLOGY)

Suggested Laboratory Exercises

1. Preparation of Stock solutions and Media.
2. Production of Aseptic seedlings.
3. Isolation and culture of embryos of Maize, Crotalaria, Cyamopsis etc.
4. Induction of callus and histological/cytological studies of callus.
5. Direct organogenesis and somatic embryogenesis from Tobacco explants.
6. Androgenesis and production of haploids from *Datura flower* buds.
7. Establishment of Cell cultures and determination of plating efficiency.
8. Enzymatic isolation and culture of protoplasts.
9. Fusion of protoplasts using PEG.
10. Preparation of synthetic seeds using sodium alginate. Estimation of IAA using Salkowski reagent.
11. Isolation of Genomic DNA.
12. Agarose Gel Electrophoresis of DNA and Southern Blotting.
13. Isolation of Yeast RNA and Quantification by Spectrophotometry.
14. Isolation of Plasmid DNA.
15. Restriction digestion of the plasmid DNA.
16. Ligation of DNA fragments.
17. Bacterial Transformation and Identification of Transformants.
18. Co-cultivation of the plant material (e.g. leaf discs) with *Agrobacterium* and study of GUS activity histochemically.
19. Problems related to R-DNA technology.

Suggested Books for Laboratory Exercises

1. Gamborg, O. L. & Philips, G.C. (Eds.) 1995. Plant cell, Tissue and Organ culture. Fundamental methods. Narosa publishing house, New Delhi.
2. Hall, R.D. (Ed.) 1999. Plant cell culture protocols, Humana press aInl., New Jersey, USA.
3. Reinert, J. and Yoeman, M.M. 1982. Plant cell and Tissue culture: A laboratory manual. Springer-Verlag.
4. Mascarenhas, A.F. 1991. Hand book of plant tissue culture, ICAR publications, New Delhi.

5. Smith, R.H.2000. Plant tissue culture: techniques and Experiments. Academic press, New York.
6. Gelvin, S.B. and Schilperoort, R.A. (Eds.). 1994. Plant molecular biology manual, (2nd Ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands.
7. Glover, D.M. and Hames, B.D. (Eds.) 1995. DNA cloning 1: A practical approach; Core techniques, (2nd Ed.), PAS IRL Press, oxford.
8. Mickloss, D.A. and Freyer, G.A. 1990. DNA science. A first course in Recombinant Technology. Cold spring harbor laboratory press, New York.
9. Frank, H. Stephenson. 2008: calculations in molecular biology and Biotechnology-A guide to mathematics in the laboratory, Academic press.

PAPER – II (BOT-402) : PLANT BIOTECHNOLOGY

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	1	2	2	3	--	-	-	-	1
CO_2	3	3	1	1	-	-	-	2	-	1
CO_3	3	-	3	3	-	2	2	2	-	-
CO_4	3	1	`1	1	1	-	-	1	1	-

BOT-403A : MOLECULAR PLANT PHYSIOLOGY (IE)

Course Objectives

1. To inculcate awareness among the students regarding Plant Production (Photosynthesis)
2. To create awareness regarding the response of plants for environmental changes.
3. To develop knowledge in identify the saline soils and environmental fluctuations.
4. To inculcate interest in Nanotechnology.

UNIT- I

Signal transduction: Overview, Receptors and G-Proteins, Phospholipid signaling, Role of cyclic nucleotides, Calcium-Calmodulin Cascade, Protein kinases, MPK and Phosphates. Specific signaling mechanisms- Two component ***sector*** regulatory system in plants, sucrose-senesing mechanism. Hormone receptors, signal transduction pathways and gene expression.

UNIT II

Photosynthesis: Photosynthetic pigments, Photosystems & Light harvesting complexes. Regulation of PS I and PS II activities; Photo-oxidation of Water, Oxygen evolving complex, Water oxidation clock, Mechanism of Photosynthetic electron and Proton transport; Energy spill over mechanisms; ATPase and Photophosphorylation; Rubisco activation and its mechanism of action; Light Activation of Photosynthetic enzymes; Chloroplast Protein Phosphorylation and Enzyme regulation of Photosynthetic carbon Assimilation; Mechanism of C_4 cycle and CAM Pathway.

UNIT-III

Nanotechnology: Nanotechnology in Biology, Chemical synthesis and Bio-synthesis of Nano particles, Diversity of Nano particles; Nano sensors, Nano probes, Nano shells, Nano tubes; Application in Agriculture, Medicine and Industry; Quantam dots (Properties, Synthesis, Solubilization & Bioconjugation, Diversity, Binding specificity and application)

UNIT -IV

Stress Physiology: Concept of Stress, Plant Molecular Responses and Tolerance Mechanism to Abiotic Stress such as Water, Salt, Heavy Metal, and Temperature and cold Stresses. Heat shock proteins, LEA Proteins, miRNA involved in stress response in plants.

Senescence: Physiological, molecular and genetic changes associated with leaf Senescence.

Molecular Physiology of Flowering: Photoperiodism, Photoinduction and Evocation; Endogenous Clocks and Regulation; Physiological Signals of Floral Induction; Genetic and Molecular analysis, Vernalization.

Course Outcomes

1. After completion of the course, the student can aware, how the plants can prepare human food and how different plants utilize efficiently the same natural sources like sunlight and Carbon dioxide and water and produce food in effective manner.
2. Students get knowledge regarding the response of the plants in stressed conditions i.e., in less or more availability of water, salts, sunlight, heat, cold and pathogens.
3. They are also aware how plants can respond to environmental changes like human beings. All this knowledge will be helpful to students for production of efficient plants (Crops) in Agriculture.
4. They identify the soil types, mineral deficiency in plants and suitability of Crops to concern environmental conditions.
5. Students can understand the role and functions of Nanotechnology in Medicine, Agriculture, Urban and Environmental applications. Apart from traditional methods using to reduce pollution, they can use nano devices noval applications in reudicng the pollution.

Suggested Books:

1. Buchanan, B.B. Grussem, W. and Jones, RL. 2000. Biochemistry and Molecular Biology of Plants. American Society of Plant Physiologists, Maryland, USA.
2. Dennis, D.T. Turpin, D.H., Lefebvre, D.D. and Layzell, D.B. (Eds.) 1997. Plant Metabolism (2^{nd} Ed.) Longman, Essex, England.
3. Galston, A.W. 1989. Life Processes in Plants. Scientific American Library, Springer-Verlag. New York, USA.
4. Hooykaas, P.J.J., Hall, M.A. and Libbeng, K.R. (Eds.). 1999 Biochemsitry and Molcular biology of plant Hormones. Elsevier, Amsterdam, The Netherlands.
5. Hopkins, W.G. 1995. Introduction to Plant Physiology. John Wiley & Sons, New York, USA.
6. Lodish, H., Berk, A., Zipursky, SL., Matsudaira, P., Baltimore, D. and Darnell, J. 2000. Molecular Cell Biology (4tt Ed.). W.H. Freeman and Company, New York, USA.
7. Moore, T.C. 1989. Biochemistry and Physiology of plant Hormones (2nd Ed.). Springer-Verlag, New York, USA.
8. Nobel, P.S. 1999. Physiochemical and Environmental Plant Physiology (2 Ed.). Academic Press, San diego, USA.
9. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology (4th Ed.). Wadswroth Publishing Co., California, USA.
10. Singhal, G.S., Renger, G., Sopory, S.K. lrrgng K.D. and Govindje 1999. Concepts in Photobiology: Photosynthesis and Photornorphogenesis. Narosa Publishing Houses, New Delhi.
11. Taiz, L. and Zeigler, E. 1998.Plant Physiology (2 Ed.). Sinauer Associate, Inc., Publishers, Massachusetts, USA.

12. Thomas, B. and Vince-Prue, D. 1997. Photoperiodism in plants (2 Ed.). Academic Press, San Diego, USA
13. Westhoff, P. 1998. Molecular Plant Development: From Gene to Plant. Oxford University Press, Oxford, UK.
14. Tuanvo, Dinh Eds. Nanotechnology in Biology and Medicine; CRC Press, USA.
15. Subbaiah balaji, 2010. Nanobiotechnology; MJP Publishers, Chennai.
16. Chandrabhanu, T. K. and Bhatnagar, V. 2009. Nano science and Technology. Published by Campus Books international, New Delhi.
17. Charles P. Poole, Jr. Frank, J. Owens. Introduction to Nanotechnology. John Wiley & Sons Publications.
18. ODED Shoscyov & I Lan Levy. Nano Biotechnology, Bioinspired devices and materials of the future. Humana press, Totowa, New Jersey.
19. Nanobiotechnology: inorganic nanoparticles Vs Organic Nanoparticles. Elsevier.
20. Gerhard wilde. Nano standard materials. Elsevier.
21. M.N.V. Prasad, Salt stress.
22. Paras N. Prasad. Introduction to Nanomedicine and Nano bioengineering. Wiley series in.
23. Harry F. Tiffals. Medical Nanotechnology and Nanomedicine. University of Texas south western medical centre, Dallar, USA, CRC Press.

PRACTICAL - BOT-403 IE: MOLECULAR PLANT PHYSIOLOGY

1. **Suggested laboratory exercises**
2. Extraction and Estimation of Chlorophyll pigments.
3. Substrate Inducebility of the enzyme Nitrate Reductase.
4. Preparation of Standard Curve of Proteins and Estimation of Protein content in the Extracts of Plant materials using Lowry's or Brodfords method.
5. Preparation of Standard Curve of Glucose and Estimation of Carbohydrate in the extracts of Plant materials using Anthrone reagent.
6. Studies on hormonal regulation of senescence.
7. Effect of Salt and Water stress on the Accumulation of Proline.
8. Seed viability test using Tetrazolium chloride and Seedling vigour.
9. Temperature, Seed germination and Acid Phosphatase activity.
10. De-repression of Dwarf Characters of plants by Gibberellins.
11. Separation of Isozymes of Peroxidase by native Polyacrylamide Gel Electrophoresis.
12. Extraction and separation of soluble plant proteins by SDS PAGE.

Suggested Books for Laboratory Exercises

1. Sambrook, J., Fritsch, EF & Maniatis, T. 1989. Molecular cloning, A laboratory Manual. (2nd Ed.), Cold spring harbor laboratory press, New York.
2. Schuler, M.A. & Zielinski, R.E. 1989. Methods in plant molecular biology. Academic press Inc., San Diego, CA, USA.
3. Dixon, R.A. (Ed). 1987. Plant cell culture: A practical approach. IRL. Press, oxford.
4. Becker, J.M. Caldwell, G.A., 1990. Biotechnology- A laboratory course. Academic press, New York, USA.

PAPER – III (BOT-403 IE) : MOLECULAR PLANT PHYSIOLOGY

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	-	1	3	3	1	2	3	2	3
CO_2	2	2	-	-	1	1	2	1	-	-
CO_3	3	-	3	-	1	-	-	-	-	2
CO_4	2	2	-	2	2	-	1	2	3	1

BOT-403B : HORTICULTURE AND AGRICULTURE BIOLOGY (IE)

Course Objectives

1. To impart basic knowledge and develop skills about propagating different types of plants by seed, cuttings, budding and grafting, separation, division, layering as well as micro-propagation.
2. Deals with soil science and fertility management for horticultural crops; Study of Plant Propagation.
3. Deals with seed production technology of horticultural crops.
4. Aware with the mechanism of Pest and Disease Management of Horticultural Crops;
5. Awareness created about general principles of fruits and vegetable preservation.

UNIT I:

Introduction and importance of Gardening, Soil types and preparation and treatment, Fertilizers, organic fertilizers and bio fertilizers Gardening, bonsai, Outdoor garden types and arrangements annuals, biennials. Perennials with common examples and culture: influence of environment, training (trimming), pruning and transplantation.

UNIT II:

Methods of plant propagation – layering, cutting, grafting, budding and their advantages. Pest and weed management – historical, theoretical, philosophical and biological insect pest suppression. Weed problem and ecological perspective, biological control of weeds, growth regulators, growth retarders, sex modification, flower induction, parthenocarpy, harvesting seed storage, preservation of fruits and vegetables.

UNIT III

Bio fertilizers: Importance of biofertilizers in agriculture (Rhizobium, Azatobacter, Mycorrhiza, Actinorhixa) advantages and current status. Vermiculture, Composting, current practices & production of biofertilizers. Nitrogen fixation-diazotrophic microorganisms, genetics of free living and symbiotic diazotrophs (N_2 fixation genes, transfer of nif genes to micro propagation). Blue green algae & Azolla-identification of elite species (strains) & mass products for practical application.

UNIT IV

Bio pesticides: Control of pests. Importance of Juvenile Hormone and JH analogues in insect pest control. Insect pheromones and their application. Biological control of pests & diseases of crop plants and weeds, biopesticide predators, parasites, insect virus, antagonistic fungi & bacteria, antifeedents and insecticidal activities of the compounds of botanicals.

Course Outcomes

1. Demonstrate a fundamental understanding of plant identification, selection, use and maintenance of plant material best suited for conventional and sustainable landscapes; Demonstrate a working knowledge and appreciation of the diversity of plants, their culture and utilization.
2. To impart basic knowledge and develop skills about propagating different types of plants by seed, cuttings, budding and grafting, separation, division, layering as well as micro-propagation ; Recognize and apply ethical professional practices to horticultural Crops ; Bonsai making and maintenance.
3. Apply horticultural principles to the successful growth and production of horticultural plants ; Demonstrate technical competence in their concentration by identifying the majority of globally important food, and/or ornamental plants and demonstrating applications of theoretical sciences to their production, maintenance and post-harvest handling ; Demonstrate an understanding of the composition, fertility and biology of soil and how they relate to good plant growth.
4. Identify and prescribe sustainable options in horticulture that benefit the environment while maintaining productivity and economic viability; Identify common biotic and abiotic plant pests and disorders and develop strategies to manage them in an environmentally safe and sustainable manner.

Suggested Books:

1. Al David – A complete guide to gardens.
2. Vishnu Swarup – Garden flowers
3. Readers digest – Complete library of gardens (3 volumes) Kissan world.
4. Reinert and Bajaj 1977 – Plant cell, tissue and organ culture, Narosa publication. New Delhi.
5. Agricultural microbiology, G.Rangaswamy and D.J.Bhagyaraj. Hall of India Private Ltd. New Delhi.
6. Subramanian .V. (2001). Text book of environmental Science, Narosa International, New Delhi.

PAPER – III (BOT-403B) : HORTICULTURE AND AGRICULTURE BIOLOGY (IE)

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	-	-	-	-	2	2	-	2	2
CO_2	3	-	-	3	-	-	2	-	-	1
CO_3	3	3	3	1	2	2	1	-	-	1
CO_4	3	1	1	1	-	-	1	-	3	-

BOT-403C : ETHNOBOTANY AND PHYTOMEDICINE (IE)

Course Objectives

1. Study the interactions of people and plants ; Learn plant names, both scientific and local name ; Learn the structures, life cycles, and unique characteristics of the tribals.
2. Acquire an understanding of the importance of plants in our daily lives.
3. Identify local ethnobotanically useful species ; Patterns of human plant selection for food, medicine, poison, ritual and religion.
4. Physiology and biochemistry of useful plants ; Qualitative chemical analysis ; Intellectual property rights protocol.

UNIT I

Ethnobotany: Scope and importance, inter disciplinary approaches in Ethnobotany, tribals of Andhra Pradesh and their traditional usage of plants in medicine, food and other purposes. Applications of Ethnobotany. Study of medicinal plants from the following groups: Gymnosperms, Angiosperms (Ranunculaceac, Leguminosae, Apocynaceae, Asclepiadaceae, Solanaceae, Lamiaceae, Liliaceae and Zingeberaceae, etc)

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, Market Potential and Trade of Plant Medicines. Adoption of GATT and TRIP, Intellectual Patent (property) Rights (IPR) & Intellectual Property Protection (IPP) for the plant medicines.

UNIT III

Phytomedicine: Systems of medicine, 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. Macroscopy and microscopy of medicinally useful plant parts such as leaves, stems, underground parts, flowers, fruits and

seeds (Senna, Datura, Cinnamon, Cinchona, Ginger, Clove, Fennel, Nux-vomica & Ipecacuanha).

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. Biological Active Principles of Established Herbal Medicines. Herbal Cosmetics and Dietetics.

Course Outcome

1. Definition, history and scope of ethnomedicine ; Difference between folk and traditional medicines.
2. Use of some routinely used Ayurvedic drugs and formulations.
3. About drug adulteration and methods of detecting the same.
4. Phytochemical and biological screening of herbal drugs ; Preparation of some herbal formulations mentioned in the syllabus.

Suggested Books:

1. Jain, S.K. 1968. Medicinal Plants National Book Trust of India, New Delhi.
2. Jain, S.K. 1981. Glimpses of Indian Ethnobotany, Oxford and IBH Publishing Co., New Delhi.
3. Rao, P.S. Venkaiah, K. & Padmaja, R. 1999. Field guide on Medicinal Plants. A. P. Forest Department.
4. Sinha, R.K. 1997. Global Biodiversity, INA Shree Publications, Jaipur, India.
5. Trivedi, P.C. 2002. Ethnobotany, Avishkar Publishers, Jaipur, India.
6. Arber, A. 2008. Herbal Plants & Drugs. Agro Science Book Centre, New Delhi.
7. Cutler. S.J. & Cutler. H.G. 1999. Biologically Active Natural Products – Pharmaceuticals, Agro Science Book Centre, New Delhi.
8. Harborne, J.B. 1948. Phytochemical methods. Chapman and Hall, London.
9. Kokate, C.K. Purohit, A.P. Gauchely, S.B. 1990. Pharmacognosy, (Narial Prakashan).
10. Khare, C.P. 2000. Indian herbal therapies. Delhi Book Co., Connaught, Circle, New Delhi.
11. Mukherjee, B. 1998.The Wealth of Indian Alchemy & its Medicinal Uses.
12. Nadkarni, K. M.2004. Indian plants & Drugs with their Medicinal Properties. Agro Sci. Publ. Centre, New Delhi.
13. Panda, H. 2003.Medicinal Herbs & Their Uses with Formulations. Daya Publi. House, New Delhi.
14. Sharma, R. 2003. Medicinal plants of India – An Encyclopedia
15. Trease, G.E. and Evans, W.C. 1983. Pharmacognosy. (12^{th} Ed.), Bailine, London.
16. Wallis, T.E. 1999. Text Book of Pharmacognosy, (5^{th} Ed.) CBS Publishers & Distributions,

New Delhi.

PRACTICAL BOT- 403C : ETHNOBOTANY AND PHYTOMEDICINE

1. **Laboratory Exercises related to BOT- 304IE**
2. Visits to tribal habitats and field Study of medicinal plants used by tribal people.
3. Recording medicinal practices and herbal formulations of tribal medicine.
4. Collection and identification of herbal medicinal plants. Preservation and submission of herbal medicinal samples.
5. Preparation and submission of herbal practice centre tour report. Development of medicinal plant nurseries in botanical garden.
6. Identification of important Medicinal plants and study of Morphological features of the Medicinal plant parts.
7. Field trip to study and identify locally occurring Medicinal plants.
8. Practical Methods of Cultivation, Propagation, Conservation and Protection of important Medicinal plants to develop familiarity.
9. Micro-propagation of Medicinal plants and Production of Callus from different Explants for Specific Biologically active Ingredients.
10. Practical demonstration of collection, processing and storage of Plant Medicines.
11. Microscopic study of locally available Medicinal plant parts such as leaves, stems, underground parts, flowers, fruits and seeds (Senna, Datura, Cinnamon, Cinchona,. Ginger, Clove, Fennel, Nux-vomica & Ipecauanha).
12. Demonstration of drug adulteration, identification of locally available Plant Medicines.
13. Antibiotic sensitive test of crude drugs.
14. Demonstration of drug Formulation and Herbal cosmetics.
15. Organolepitc examination and physical and chemical properties.

Suggested Books for Laboratory Experiments

1. Jain, S.K. 1968. Medicinal plants. National book trust of India, New Delhi.
2. Rao, P.S. Venkaiah, K. & Padmaja, R. 1999. Field guide on medicinal plants. A. P. Forest department.
3. Trivedi, P.C. 2002. Ethnobotany. Avishkar Publishers, Jaipur, India.
4. Document files creation using MS word. Creating document style.
5. Internet – E-mail and mail attachment i. Downloading webpage; Saving a web page; Printing the web page; Document; ii. Search engine; Image
6. Visit to genebank database; NCBI; EMBL

7. Visit to protein database; Swis prot; PDb
8. Use of literature database i. Virtual library; Agricola; Pub med
9. Use of similarity search tools: NBLAST; PBLAST

PAPER – III (BOT-403C) : ETHNOBOTANY AND PHYTOMEDICINE

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	2	3	-	3	3	3	2	3
CO_2	3	1	-	-	-	2	1	2	-	1
CO_3	3	1	-	2	3	3	3	1	-	-
CO_4	3	-	1	-	1	1	2	1	1	-

External Elective / Open Elective

BOT-404A : HYDROPONICS (EE)

Course Objectives

1. Basic knowledge on Hydroponic systems ; aware on Hydroponic materials (media, etc.)
2. Working with Hydroponic equipments.
3. Basic knowledge on Nutrition management.
4. Hydroponic greenhouse management; basic knowledge on Hydroponic crops.

UNIT I

Introduction to Soilless culture of plants: History and origin of Soilless culture, Present status of hydroponics-Contrasts with soil-based culture, Applications & Future developments

UNIT II

Plant Nutrition: Essential, mineral elements-Functions and effects on plants, Deficiency Symptoms of the following Essential Minerals-N, P , Ca, Mg, K, S, Fe , Mn, Cu, Zn , B ,Mo. Environmental & Chemical Factors: Light (quality, ener, Photoperiodism & systems), Temperature (heating & cooling), Humidity and CO_2., pH, PPM/TDS.

UNIT III

Nutrient Solutions and Media: Inorganic salts (fertilizers)-Macronutrients, Micronutrients, Formulating, monitoring, and analyzing, Plant Nutrition, pH adjustment, selecting fertilizers and nutrient monitoring; Media used for Hydroponics: Ex-clay, Rock wool, Coir, Perlite, Pumice, Vermiculite, Sand, Gravel, Brick shards, Polystyrene packing peanuts, wood fiber; Weed management, diseases and pest control, Pollination, making clones of plants.

UNIT IV

Techniques in Hydroponics and Cultivation of crop plants: Techniques in Hydroponics – Static solution culture, Continuous – flow Solution culture, Aeroponics, Passive sub-irrigation, Ebb and flow or flood and drain irrigation, Deep water culture; Protocols for – Tomato cultivation through Dutch bucket method, Chilly cultivation through NFT system, Spinach through Raft system , Fodder system.

Course Outcomes

1. Describe the advantages/disadvantages of controlled environment agriculture and hydroponic crop production in the agricultural production of various food crops.
2. Demonstrate an understanding of basic principles of plant biology, entomology, plant nutrition and disorders, irrigation and fertilization, and environmental conditions necessary for growing greenhouse hydroponic vegetable crops.
3. Understand plant cultivation, harvesting, pest management, and food safety techniques for growing hydroponic tomatoes; understand the considerations involved with different types of greenhouses and structural components, control systems, and site selection in order to grow a successful crop.
4. Understand the knowledge base, food safety issues, marketing, and financial considerations needed to start a hydroponic crop production business.

Suggested Books :

1. Keith Roberto. How to Hydroponics. The future garden press New York. 4th Edition.
2. Howard M. Resh**.** Hobby Hydroponics. CRC Press USA.
3. Prasad S and Kumar U. *Green House Management for Horticultural Crops*. Agrobios India
4. Dahama A K. Organic Farming for Sustainable Agriculture. Agrobios India.
5. Subbarao N.S. (1995). *Biofertilizers in Agriculture and Forestry*. Oxford and IBH publishing Company Pvt. LTd. New Delhi
6. B. A. Kratky. A Suspended Net-Pot, Non-Circulating Hydroponic Method for Commercial Production of Leafy, Romaine, and Semi-Head Lettuce. UH–CTAHR.

Internal Elective

PAPER – IV (BOT-404A) : HYDROPONICS (EE)

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	-	3	2	3	2	3	-	2	-
CO_2	3	-	1	-	-	2	2	-	2	-
CO_3	3	2	-	3	2	-	-	2	2	3
CO_4	3	2	2	-	-	-	1	1	2	1

External Elective / Open Elective

BOT-404B : NANO BIOTECHNOLOGY (EE)

Course Objectives

1. To inculcate the awareness in the production of nano scale devices.
2. To create interest in the utilization of nano devices in medicinal and agricultural field.
3. To study the nano biofertilizers and nanobiopesticides and their applications.
4. To know the role of nanoparticles in the field of Medicines and Engineering.

UNIT I

Nanotechnology: Concepts, definition, origin, Milostones and opportunities; Preparation – Chemical synthesis (wet, Mechanical, Form-in place and Gas phase) Biological synthesis (Green and Microbial synthesis). Diversity of Metal nanoparticles (Gold, Silver, Nickle, Silicon, Cobalt, Calcium, Iron, Magnesium); Characterization; Tools and techniques (UV-Visible spectra; SEM; EDAX, TEM, AFM, FTIR AND MNR) Lithographing techniques (Photo, Electron beam and Dip-Pen methods).

UNIT II

Nanotechnology and Biometerial sciences: Generation of Bio-metals (I, II, III) General Characters; Micro and Nano fabrications; Scientific applications: nanomaterials , Nanostructures and Nano-tools (Nano-scales, dendrimers, Quantum dots) and its applications, Molecular manufacturing: Electronic, information and communication technology. Nano Biotechnology & health**:** Nanomaterial in the body (Routes of entry intestinal tract, Skin and Lungs.

UNIT III

Nano Biotechnology and Nanomedicine: Biomedical applications**;** Drug delivery; importable devices; Biomedical sensors and Biosensors; Quantum dot technology in cancer diagnosis and treatment; DNA based Nano materials; Nanoparticle probes for Bioimaging; Novel drug delivery systems; Micropheres and microcapsules; polymer therapeutics; dendrimeers; Hydrogels and Orthopedic biomaterials. Environmental Impacts: Toxic mechanisms integrated concept of risk Assessment of Nanoparticles.

UNIT IV

Nano Biotechnology in Agriculture: Nano Bio-fertilizers ($Ca^{2+,}$ $Mg^{2+,}$ Fe^{2+} & Zn Nanoparticles) Nano Pesticides; control of plant diseases; fungal diseases (Blast diseases of Rice; Smut of

maize; Leaf spots of groundnut; Late blight of potato; Downy mildew of grapes); Bacterial diseses (Citrus caker, Leaf blight of rice; Blight of Bean; Spot of tomato) and Viral diseases (Tungro of rice; Sugarcane Mosoic; Yellow leaf curl of tomato; Bentch top of banana; Mosoic of ground nut) Nano boosters and applications in seed dormancy, Germination for plant growth and developments.

Course Outcomes

1. The students are able to know the production of nanoscale devices through different ways like physical, chemical and biological. Hence, he can choose the non toxic way of nano device synthesis.
2. After getting knowledge in the best way of preparation of nano devices in a cost effective and environmentally benign manner, he can utilize his knowledge in medicine as well as in improvement of Crop production by using less pesticides and less fertilizers.
3. They gain knowledge in the preparation of bio-agricultural products.
4. They can learn the applications of nano material in Medicinal and Engineering fields.

Suggested Books:

1. Nanoscience and Technology 2009 by T.K. Chandhra Bhanu & Vasudeva Batnagar, Published by Campus Book International; New Delhi.
2. Nanotechnology in Biology & Medicine-2006 Edited by Tvan Vo-Dinh; Published by CRC Press; New York.
3. Nanotechnology, 2010 by Subbaiah Balaji; MSP Publishers, Chennai.
4. Mayrard A.D. 2005. Inventory of Research on the Environmental, Health and Safety Implications of Nanotechnology, Washington D.C, USA.
5. Hand book of NanoScience and Nanotechnology -2014 by Jayantha Barman.
6. Introduction to Nanotechnology 2014. Wiley Publishers- Charles P.Poole, Frank J.D Wens.
7. Bionanotechnology: Lesson from Nature- 20014 by Davis.Goodsell.
8. Nanobiotechnology: Concepts, Applications and perspectives by Christof M.Niemeyer and chand A, Mirkin 2004.
9. Bionanotechnology: global prospects, by David. E.Reisner 2008 by CRC Press.
10. Fundamentals of nanotechnology, by Gabor L.horuak, John J.More, H.F. tibbals.Joy deep dutta 2008 CRC Presss.

PAPER – IV (BOT-404B) : NANO BIOTECHNOLOGY (EE)

CO-PO Mapping Matrix/ Programme Articulation Matrix:

	PO_1 Knowledge	**PO_2** Analysis	**PO_3** Design	**PO_4** Development	**PO_5** Modern Tools	**PO_6** Society	**PO_7** Environment	**PO_8** Ethics	**PO_9** Team work	**PO_{10}** Communicatio
CO_1	3	2	3	3	2	-	-	3	2	-
CO_2	3	1	2	1	1	-	3	2	2	-
CO_3	3	-	-	2	3	2	1	1	-	3
CO_4	3	-	1	-	1	2	-	-	-	2