SRI VENKATESWARA UNIVERSITY
TIRUPATI – 517 502 (A.P.)

Restructuring of M.Sc. Botany Course (CBCS)
as per NEP -2020

For the students admitted from the
academic year 2024-2025

SYLLABUS

DEPARTMENT OF BOTANY
SRI VENKATESWARA UNIVERSITY
TIRUPATI – 517 502 (A.P.)

SRI VENKATESWARA UNIVERSITY, TIRUPATI

DEPARTMENT OF BOTANY

RESTRUCTURING OF COURSE (CBCS) AS PER NEP-2020 (NHEQP)

(w.e.f. 2024-2025)

M.Sc. BOTANY

SCHEME OF INSTRUCTION AND EXAMINATION (FINAL)

SEMESTER - I									
S. No.	**Course**	**Code**	**Title of the Course**		**H/W**	**C**	**SEE**	**IA**	**Total marks**
1.	CC	101	Core Course – 1	Algae, Bryophytes, Pteridophytes and Gymnosperms	4	4	70	30	100
2.		102	Core Course – 2(A)	Taxonomy of Angiosperms	4	3	50	25	75
			Core Course – 2(B)	Computer Applications					
4.		103	Core Course – 3(A)	Microbiology	4	3	50	25	75
			Core Course – 3(B)	Ethnobotany					
6.	P	104	Practical I (related to CC 2&3)		6	2	35	15	50
7.	SOC	105	Skilled Oriented Course – 1(A)	Organic Farming	4	3	50	25	75
			Skilled Oriented Course – 1(B)	Plant Cell and Tissue Culture					
9.		106	Skilled Oriented Course – 2(A)	Plant Development and Reproduction	4	3	50	25	75
			Skilled Oriented Course – 2(B)	Herbal Medicine					
11.	P	107	Practical II (related to SOC 1&2)		6	2	35	15	50
				Total :	**36**	**20**	**340**	**160**	**500**
12.	Audit Course	109	Indian Knowledge System - 1		4	0	0	0	0

SEMESTER - II									
S. No.	Course	Code	Title of the Course		H/W	C	SEE	IA	Total marks
1.	CC	201	Core Course – 4	Plant Ecology	4	4	70	30	100
2.		202	Core Course – 5(A)	Plant Biochemistry and Metabolism	4	3	50	25	75
			Core Course – 5(B)	Soil and Seed Science					
4.		203	Core Course – 6(A)	Molecular Plant Physiology	4	3	50	25	75
			Core Course – 6(B)	Forest Protection					
6.	P	204	Practical III (related to CC 5 & 6)		6	2	35	15	50
7.	SOC	205	Skilled Oriented Course – 3(A)	Cell Biology, Genetics and Evolution	4	3	50	25	75
			Skilled Oriented Course – 3(B)	Nano Biotechnology					
9.		206	Skilled Oriented Course – 4(A)	Gardening and Nursery Techniques	4	3	50	25	75
			Skilled Oriented Course – 4(B)	Phytoremediation					
11.	P	207	Practical IV (related to SOC 3 & 4)		6	2	35	15	50
8.	OOTC	308	Open Online Transdisciplinary Course - 2		-	2	-	100	100
			Total :		**36**	**22**	**340**	**260**	**600**
12.	Audit Course	209	Indian Knowledge System - 2		4	0	0	0	0

SEMESTER - III

S. No	Course	Code	Title of the Course		H/ W	C	SEE	IA	Total marks
1.	CC	301	Core Course – 7	Molecular Biology & Techniques	4	4	70	30	100
2.		302	Core Course – 8(A)	Plant Biotechnology	4	3	50	25	75
			Core Course – 8(B)	Environmental Studies & Disaster Management					
4.		303	Core Course – 9(A)	Horticulture	4	3	50	25	75
			Core Course – 9(B)	Microbial Physiology					
6.	P	304	Practical – V (related to CC 8 & 9)		6	2	35	15	50
7.	SOC	305	Skilled Oriented Course – 5(A)	Mushroom Cultivation	4	3	50	25	75
			Skilled Oriented Course – 5(B)	Molecular Plant Pathology					
9.		306	Skilled Oriented Course – 6(A)	Phytodiversity and Conservation	4	3	40	25	75
			Skilled Oriented Course – 6(B)	Advanced Molecular Tools					
11.	P	307	Practical – VI (related to SOC 5 & 6)		6	2	35	15	50
12.	OOTC	308	Open Online Transdisciplinary Course - 2		-	2	-	100	100
	Seminar / tutorials / remedial classes and quiz as part of internal assessment				4	-	-	-	-
				Total :	**36**	**22**	**340**	**260**	**600**

SEMESTER - IV

S.No.	Course	Code	Title of the Course	H/W	C	SEE	IA	Total marks
1.	OOSDC	401	Open Online Skill Development Course	-	8	-	200	200
2.	PW	402	Project Work – Orientation classes	24	12	300	0	300
*	Conducting classes for competitive exams, communication skills, UGC/CSIR and NET/SLET examinations.			12	-	-	-	-
			Total :	**36**	**20**	**300**	**200**	**500**
			Total Semesters :	**144**	**84**	**1320**	**880**	**2200**

OOSDC *– Open Online Skill Development Course (OOSDC) - Students can choose any Two relevant course of his/her choice from the online courses offered by governmental agencies like SWAYAM, NPTEL etc., to get 8 credits (with 4 credits from each course).*

SEMESTER – I

Core Course – 1

BOT-101 : Algae, Bryophytes, Pteridophytes and 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; pigmentation, reserve food and reproduction (veg,) of different groups of Cyanphyceae, Chlorophyceae, Xanthophyceae, Bacillariophyceae, Phaeophyceae & Rhodophyceae. 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 and economic importance, chemical factors controlling Gametophyte; Antheridia, Archegonia. Strobilus and Evolution of Sorus.
Fossil Pteridophytes: Brief account on Psilophytopsida, Psilopsida, Lycopsida, Sphanopsida 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. Economic importance of Gymnosperms.

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. Students are able to explain about structure, classification, reproduction, life cycle and economic importance of Bryophytes.

3. Study and impart knowledge about the Structure, reproduction, life cycle, fossil, fossilization and geological time scale.
4. Students able to explain about structure, classification, reproduction, life cycle and economic importance of Gymnosperms.

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.

Core Course – 2(A)

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. Recognize the plants with the scientific names.
4. To develop skills in identifiying the pants for research work to other departments.

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 ICN 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).

Course 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.

PRACTICAL

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:

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

Core Course – 2(B)

BOT-103 : COMPUTER APPLICATIONS

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 Outcome

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.

PRACTICAL

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

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

Core Course – 3(A)

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 of harmful and useful bacteria; Reproduction and Economic importance of bacteria.

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.

PRACTICAL

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

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

Core Course – 3(B)

BOT-103 : ETHNOBOTANY

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 Outcomes

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.

PRACTICAL

1. Visits to tribal habitats and field Study of medicinal plants used by tribal people.
2. Recording medicinal practices and herbal formulations of tribal medicine.
3. Collection and identification of herbal medicinal plants.
   Preservation and submission of herbal medicinal samples.
4. Preparation and submission of herbal practice centre tour report.
   Development of medicinal plant nurseries in botanical garden.
5. Identification of important Medicinal plants and study of Morphological features of the Medicinal plant parts.
6. Field trip to study and identify locally occurring Medicinal plants.
7. Practical Methods of Cultivation, Propagation, Conservation and Protection of important Medicinal plants to develop familiarity.
8. Micro-propagation of Medicinal plants and Production of Callus from different Explants for Specific Biologically active Ingredients.
9. Practical demonstration of collection, processing and storage of Plant Medicines.
10. 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).
11. Demonstration of drug adulteration, identification of locally available Plant Medicines.
12. Antibiotic sensitive test of crude drugs.
13. Demonstration of drug Formulation and Herbal cosmetics.
14. Organolepitc examination and physical and chemical properties.

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. (12th Ed.), Bailine, London.
16. Wallis, T.E. 1999. Text Book of Pharmacognosy, (5th Ed.) CBS Publishers & Distributions, New Delhi.

PRACTICAL - I

P-104 : Core Course - 2A/2B & 3A/3B

Skilled Oriented Course – 1(A)

SOC – 105 : Organic Farming

Course Objectives

1. To reduce the toxicity of Chemical Fertilizers.
2. To save soil health and promote soil fertility.
3. To popularize the importance of organic fertilization.
4. To bring awareness about organic foods.

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.

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

Panchagavya – Collection, processing, advantages and disadvantages, preparation, types, maintenance, cowdung micro flora, liquid and solid Panchagavya – chemical nature of cow urine.

UNIT-IV

Vermicompost Technology : Production, types of tubs, construction of tubs, preparation, processing, watering of raw material, casting collections, drying, sieving, packing and marketing. Chemical composition of vermin compost – different species of earth worms - vermi wash and its applications.

Course Outcomes

1. Understands the importance of organic fertilizers in preventing environmental pollution.
2. Able to prepare Organic fertilizers and apply it to field level.
3. Develop the skill of preparing farmyard compost.
4. Learn the techniques of isolation and maintenance of biofertilizers.

PRACTICAL

1. Visit to Organic Farms.
2. Preparation of Farmyard manure.
3. Preparation of Enriched compound.
4. Isolation of Rhizobium from soil sample.
5. Vermi Compost preparation.
6. Determination of Nutritional components of Vermi compost.
7. Preparation of Panchagavyo
8. Preparation of inoculants of Biofertilizers.

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

a. Technology by Kannaiyan. S

Skilled Oriented Course – 1(B)

SOC – 105 : Plant Cell and Tissue Culture

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

Plant Cell and Tissue Culture : General introduction, history, scope, concept of cellular differentiation, totipotency. Sterilization techniques, requirements for tissue culure laboratory establishment, Preparation of media, Compository MS medium.

UNIT – II

Organogenesis and adventives embryogenesis : Fundamental aspects of morphogenesis : somatic embryogenesis and androgenesis, mechanism, techniques and utility. Caulogenesis, Rhizogenesis, Callus induction, re-differentiation and de-differentiation.

UNIT – III

Somatic hybridization : Protoplast isolation, fusion and culture, hybrid selection and regeneration, possibilities, achievements and limitations of protoplast research. Significance of hybrids, cybrids, definition and applications.

UNIT – IV

Applications of Plant Tissue Culture : Clonal propagation, artificial seed, somaclones, cell culture system, production of secondary metabolites/natural products, cryopreservation and germ plasm storage, mass propagation, disease free plant production.

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.

PRACTICAL

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:

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. (5th 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. (7thEd.) 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.
20. Gamborg, O. L. & Philips, G.C. (Eds.) 1995. Plant cell, Tissue and Organ culture. Fundamental methods. Narosa publishing house, New Delhi.
21. Hall, R.D. (Ed.) 1999. Plant cell culture protocols, Humana press aInl., New Jersey, USA.
22. Reinert, J. and Yoeman, M.M. 1982. Plant cell and Tissue culture: A laboratory manual. Springer-Verlag.
23. Mascarenhas, A.F. 1991. Hand book of plant tissue culture, ICAR publications, New Delhi.
24. Smith, R.H.2000. Plant tissue culture: techniques and Experiments. Academic press, New York.
25. Gelvin, S.B. and Schilperoort, R.A. (Eds.). 1994. Plant molecular biology manual, (2ndEd.), Kluwer Academic Publishers, Dordrecht, The Netherlands.
26. Glover, D.M. and Hames, B.D. (Eds.) 1995. DNA cloning 1: A practical approach; Core techniques, (2nd Ed.), PAS IRL Press, oxford.
27. Mickloss, D.A. and Freyer, G.A. 1990. DNA science. A first course in Recombinant Technology. Cold spring harbor laboratory press, New York.
28. Frank, H. Stephenson. 2008: calculations in molecular biology and Biotechnology-A guide to mathematics in the laboratory, Academic press.

Skilled Oriented Course – 2(A)

SOC – 106 : 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

Root and Shoot development: Organization of root apical meristem and root development. Differentiation of root; vascular tissue, root hair and Lateral roots formation. Organization of shoot apical meristem and Tissue differentiation in the shoot; xylem regeneration and Phloem differentiation; Secondary growth of root and shoot; Formation and types of wood.

UNIT II

Leaf and flower development: Leaf development and phyllotaxy; Specialized cells and tissue differentiation and organization in leaf. Transition to flowering, inflorescence and floral meristems. Floral Organ differentiation and development in *Arabidopsis* and *Antirrhinum*

UNIT III

Sexual reproduction: Microsporangium, **Microsporogenesis and Male gametophyte development:** Role of Tapetum,; Pollen storage.

Female Gametophyte and fertilization: Megasporangium, Megasporogenesis, Development and Organization of female gametophyte, ultra structure of the Embryo sac cells.

Fertilization: Pollination mechanisms and Vectors, Pollen germination, Pollen tube growth and Guidance, Pollen- Stigma Interactions, Double Fertilization

UNIT IV

Post-fertilization developments: Sexual Incompatibility, Endosperm development, types and functions, Embryogenesis- Dicot embryo development & types; Monocot embryo; Polyembryony; Apomixis; Parthenocarpy. 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.

PRACTICAL

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:

1. Burgess, J. 1985. An introduction to Plant Cell development. Cambridge Univ. Press, Cambridge.
2. Fahn, A. 1982. Plant Anatomy (^{3rd}Ed.), Pergamon Press, Oxford.
3. Fosket, D.E. 1994. Plant growth and Development. A molecular approach, Academic Press, San Diego, USA.
4. Howell, S.H. 1998. Molecular Genetics of Plant Development, Cambridge Univ. Press, Cambridge.
5. Lyndon, R.F. 1990. Plant Development. The Cellular Basis, Unnin Hyman, London.
6. Murphy, T.M. and Thompson, W.F. 1988. Molecular Plant Development, Prentice Hall, New Jersey.

7. Pullaih, T., Naidu, K. C., Lakshminarayana, K. & Hanumantha Rao, B. 2007. Plant Development. Regency Publications, New Delhi.
8. Raghavan, V. 1999. Developmental Biology of Flowering Plants, Springer-Verlag, New York.
9. Steeves, T.A. and Sussex, TM. 1989. Patterns in Plant Development (2^{nd}Ed.). Cambridge Univ Press, Cambridge.
10. Waisel, Y., Esnel, A, and Kafkaki U. (Eds.). 1996. Plant Roots. The Hiden Hall (2^{nd} Ed.), New York, USA.
11. Bhojwani, S. S. and Bhatnagar, S.P. 2000. The embryology of Angiosperms (4^{th} Revised and Enlarged Ed.). Vikas Publishing House, New Delhi.
12. The plant cell. Special issue on Reproductive Biology of Plants, Vol. 5. 1993. The American Society of plant physiologist, Rockville, Maryland, USA.
13. Pullaiah, T. Lakshiminarayana, K. & Hanumantha rao, B. 2008.plant reproduction. Scientific publishers, Jodhpur.
14. Raghavan, V. 1997. Molecular embryology of Flowering plants, Cambridge Univ. Press, Cambridge.
15. Shivanna, K.R. and Johri, B.M. 1985. The Angiosperm pollen: the Structure and function. Wiley Eastern Ltd., New York.
16. Shivanna, K.R. and Sawhney, V.K. (Eds). 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge Univ. Press, Cambridge.
17. Chopra, V.L. 2001. Plant breeding: Theory and Practice. Oxford IBH Pvt. Ltd. New Delhi.
18. Chopra, V.L. 2001. Plant breeding: Field Crops, Oxford IBH Pvt. Ltd., New Delhi.
19. Shivanna, K.R. and Rangaswamy, N.S. 1992. Pollen Biology: A laboratory Manual. Springer verlag, Berlin Heidelberg.
20. Shivanna, K.R. and Sawhney, V.K. (Eds.) 1997. Pollen Biotechnology for Crop Production and Improvement. Cambridge University Press, Cambridge

Skilled Oriented Course – 2(B)

SOC – 106 : Herbal Medicine

Course Objectives

1. To know the importance of medicinal plants.
2. To characterize the medicinal plants taxonomically.
3. To learn the processing of leaves, stem, bark and roots of medicinal plants.
4. Preparation of herbal formulatins.

UNIT – I Herbs and Medicine

Systems of medicine , brief history , origin and scope of plant medicines , identification of locally available medicinal plants . various secondary metabolites and biosynthesis.
Macroscopy and microscopy of medicinally useful plant parts such as leaves , stem , bark , roots, flowers , fruits and seeds .

UNIT –II Herbal formulations of plant medicines.

Herbal formulations and dosage forms Herbal infusion , decoctions , lotions , insect repellents , suppositions , tinctures , syrups , plasters , ointments , oils and solutions.

UNIT -III Herbal drug industry

Herbal drug Industry : Present scope and future prospects .
Brief account of herbal based industries and Institutions involved in work on Medicinal and Aromatic Plants in India .
Herbal Practices : Naturopathy , Unani , Ayush , Siddha and Ayurvedic .

UNIT –IV Herbal Cosmetics and Dietics

Herbs to Cure Skin Diseases :Neem , Turmeric , Sandal , Rose water , Rose oil , Coconut milk , Coconut Oil , Aloe vera , CORTICOSTEROIDS : Withania somnifera (Ashwagandhi) to reduce Inflammation .
RETINOIDS : Retin – A rich herbs Carrots , Squash , Sweet potato and Pumpkin .
Dietics : Organoleptic study of Rawolfia , Jatamansi , Ginger , Garlic , Cinnamon , Arjuna , Amla , Castor and Nux-vomica

Course Outcome

1. Candidates will be able to identify the medicinal plants.
2. Develop the skill of herbal formulation.
3. Learn the importance of medicinal plants in Cosmetics and Dieteics.
4. Develop the concept of Alternate Medicine System in India.

PRACTICAL

1. Cultivation of medicine plants.
2. Drug adulteration.
3. Soap preparation for skin disease
4. Organoleptic evaluation of plant drugs
5. Processing and preservation of drugs.
6. Identification of underground, Arial, Subarial plant parts .
7. Preparation of herbal face pac.
8. Preparation of hair oil/pain oil.
9. Preparation of lapam.

Suggested Books

1. A Class book of Botany A.C. Dutta. Oxford University Press
2. Pharmacognosy G.E.Trease and W.C. Evans saunders Edinburgh , New York .
3. Textbook of Pharmocognosy by T.E. Wallis .
4. Cultivation of Medicinal Plants by C.K.etal and B.M. Kapoor .
5. Awadesh N , Ghoeami A and Sharma K , Indigenous Health Care and Ethnomedicine , Sarup and son
6. Glimses of Indian Ethno – Pharmocognosy by P.Pushpangadam . Ulf Nymas . V.George tropical Botanical Gardens and Research Institute .
7. Textbook of Pharmacognosy by C.K.Kokate , Purohit , Ghokale , Niraliprakashan .
8. Pharmacognosy – Tyler , Brady , Robbers
9. Modern Methods of Plant Analysis - Peach and M.V.Tracey , Vol. I and II
10. Practical Pharmocognosy by c.k.Kokate , Vallabh Prakashan .

PRACTICAL – II

P-107 : SOC - 1(A)/1(B) & 2(A)/2(B)

OOTC-108

OPEN ONLINE TRANSDISCIPLINARY COURSE – I

Audit Course - 109

INDIAN KNOWLEDGE SYSTEM – I

SEMESTER – II

Core Course - 4

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 5 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 Outcomes:

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.

Core Course – 5(A)

BOT-202 : PLANT BIOCHEMISTRY AND METABOLISM

Course Objectives

1. To study the method of respiration in plants
2. To study HMP pathway in plants
3. To study importance of growth regulators
4. 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: Synthesis, physiological effects and mechanism of action of Auxins, Gibberellins, cytokinins, Ethylene, Abscissic acid, Brassinosteroids, Polyamines, Jasmonic acid and Salicylic acid.

Course Outcomes

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.

PRACTICAL

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:

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.

Core Course – 5(B)

BOT-202 : SOIL AND SEED SCIENCE

Course Objectives:

1) To understand the properties of soil.
2) To impart the knowledge on the relation between soil and plant growth.
3) To gain knowledge of seed processing and storage.
4) To develop skill of seed testing for different plant species.

UNIT – I

Soil texture, types, properties of soil in relation to plant growth, Sources of macro & micro nutrients in soil, immobilization, mineralization, micronutrients of soil, factors affecting their availability and correction of their deficiencies in plants, common soil test methods for fertilization recommendations.]

UNIT – II

Soil biota, soil microbial ecology, types of organisms in different soil, plants and microbial interactions. Soil characteristics influencing microbial growth, microbial transformation of N, P, K, S, Fe & Mn; Modes of energy transfer in soil, energy balance; Thermal properties of soil, Soil temperature in relation to plant growth, soil temperature management.

UNIT-III

Introduction : Seed as basic input in plants; Seed development in cultivated plants; Seed quality testing methods; Iportance of genetic purity in seed production; Seed production in self and cross pollinated crops; Medicinal plants seed collection, Techniques and equipment in seed processing; Conventional and modern methods of seed storage.

UNIT-IV

Hybrid seed, methods of development of hybrids, maintenance of parental lines of hybrids, seed production agencies, seed viability and longevity, pre and post harvest factors affecting seed viability, physiology of seed germination, seed dormancy, types and methods of breaking seed dormancy; Role of microorganisms in seed quality determination treatment and control of seed burn diseases

Course Outcomes:

Student will be able to

1. Appreciate the importance of soil in ecosystem.
2. Develop knowledge on soil nutrients and its relation to plants.
3. Know the techniques of seed collection and processing
4. Establish seed testing laboratory.

PRACTICAL

1. Estimation of electrical conductivity of different soil samples.
2. Measuring the soil air and temperature of agriculture soil.
3. Estimation of organic matter in different soil samples.
4. Determination of germination percentage of different seeds.
5. Determination of seed moisture.
6. Effect of temperature on breaking seed dormancy.
7. Estimation of organic matter in soil samples.

Suggested Books

1. Fundamentals of Soil Science, 2018 by Shivanand Tolaner – CBS Publishers.
2. Seed Technology, 2018 – by R.L. Agarwal – Oxford & IBH Publishing Co Pvt Ltd.
3. Text Book of Soil Science, 2006 by R.K.Mehra, Published by ICAR.
4. Advances in Seed Science & Technology, 2023 by Vanangamudi et al. South India Book Traders.
5. The nature and Properties of Soil, 2017 by Raymond R. Weil – Nyle C Brady, Pearson Publishers.
6. A Competitive Book of Seed Science and Technology 2020 by Gayatri Kumawat, Mukesh Kumar Bhutna, Jam Brothers Publishers.

Core Course – 6(A)

BOT-203 : MOLECULAR PLANT PHYSIOLOGY

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

UNIT II

Photosynthesis: Photosynthetic pigments, Photosyste 0.ms & 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 and Physical synthesis and Bio-synthesis of Nano particles. Characterization and 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.

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. 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.
3. They identify the soil types, mineral deficiency in plants and suitability of Crops to concern environmental conditions.
4. 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.

PRACTICALS

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

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 Nanomed icine. University of Texas south western medical centre, Dallar, USA, CRC Press.
24. Sambrook, J., Fritsch, EF & Maniatis, T. 1989. Molecular cloning, A laboratory Manual. (2nd Ed.), Cold spring harbor laboratory press, New York.
25. Schuler, M.A. & Zielinski, R.E. 1989. Methods in plant molecular biology. Academic press Inc., San Diego, CA, USA.
26. Dixon, R.A. (Ed). 1987. Plant cell culture: A practical approach. IRL. Press, oxford.
27. Becker, J.M. Caldwell, G.A., 1990. Biotechnology- A laboratory course. Academic press, New York, USA.

Core Course – 6(B)

BOT-203 : FOREST PROTECTION

Course Objectives

1. To inculcate the awareness to students related to forest and its importance.
2. To create the interest among students regarding regeneration of forest plants.
3. To aware the economic importance of forest.
4. To train in the methods of preservation of forest for future generation.

UNIT – I

Florestic regions - Forest types of India – Different agroclimatic zones of India – Geographical distribution of Trees – Native and Exotic trees, Endemism and Endemic Trees – Impact of Global Warming and Climatic Change on Forest Plants – Forest Degradation – Natural calamities affects the forst and bioportified trees – Biovitamins of forest, Medicinal trees.

UNIT – II

Forest Biometry – Infuence of Forest on Environment – Climate, Edaphic, Physiographic and Biotic factors – Regeneration of Forest Plants; Concept and Objectives of Regeneration – Methods of Regeneration – Advantages and Disadvantages – Preparation, Maintenance and Management of site – Factors affecting Regeneration – Natural and Artificial Regeneration – Forest Plantation.

UNIT – III

Timber Harvesting – Production and Productivity of Forests – Non Wood Forest Products – Harvesting, Post Harvesting, Handling, Marketing of Agroforestry Products – Timber Yielding Trees – Apiculture - Technology used to save Forests (NDRS) – Watershed Management and Improvement of Water availiability – Forest Research Institutes and their objectives.

UNIT – IV

Forest Conservation and Protection; and Laws – Definition and Concept of Conservation – *In situ* and *Ex situ* Conservation – National Forest Policy – Forest Conservation Rules and Amendments – Quarantine Laws – Forest Resource Exchange – Forest Fires – Prevention and Management of Social Forestry – Diseases for Forest and Controlled Measures.

Course Outcomes

1. By studying this course student get awareness regarding the forest types and distribution and natural calamities affect the forest.
2. After completion of this course, student knows how to multiply the forest through regeneration of forest trees.
3. Student well aware related to forest products, produced by the forest, hence he/she also know how to collect the products to improve economic status.
4. Once student got the knowledge on forest economy, he try to conserve the forest by learning the methods and aquaintain the information by preventing diseases to the forest from this course.

PRACTICAL

1. Visit to forest area in Seshachalam hills.
2. Measurement of diameter and girth of forest tree species.
3. Estimation the heigh of forest plants.
4. *In vivo* conservation of selected tree taxa.
5. Identifying the endemic plants of Tirumala Hills.
6. Developing Forest Nursery.
7. Vegetative propagation of Silviculture plants using Mist Chambers.
8. Root training and integrated plant nutrient management.

Suggested Books

9. Forest Management 2015 by Davis L.S, CBS Publishers & Distributors.
10. The Hidden Magic of Forest – Rs.849-00
11. Hand Book on Forest Biology, Rs.669-00
12. Indian Forest and Forestry by Rohit Balyani 2011, Pointer Publishers.
13. Forest Management by C.K. Sreedharam, Rs.872—00
14. A Text Book on Economic Botany by AVSS Sambamurthy, N.S.Subramanyam (1989) published by Wiley Eastern Limited, New Delhi – 2
15. Forest Trees of South India (2020) by S.G. Neginhal Notion Press Publishers.
16. The Hidden Life of the Trees: What they feel and how they communicate by Petr Woilenben and Pradip Krishen (2016) Penguin Random House India Pvt. Ltd.

204P - PRACTICAL – I (examination)
(Practical related to Core Course 5 & 6)
Skilled Oriented Course – 3(A)
SOC – 205 : CELL BIOLOGY, GENETICS AND EVOLUTION

Course Objectives

1. To enable students to understand the basic principles of construction of genetic maps in Prokaryotes and Eukaryotes.
2. To make the students to understand structure and functions of major plant cell organelles, chromatin organization, cytoskeletion and cell cycle regulation
3. To make the students to understand basis and process of inheritance of genes and their mapping in eukaryotes and microbes
4. To make the students to understand the processes of organic evolution and speciation.

Unit - I

Structural Organization of Plant Cells: Structure and Function of Cell wall, Plasmodesmata, Plasma Membrane; Structure and Functions of Endoplasmic Reticulum, Golgi Apparatus, Lysosomes, Vacuoles, Chloroplast and Mitochondria. Cytoskeleton - elements, organization and function.

Unit - II

Nucleus: Interphase Nucleus, Nuclear membrane. Nucleosome structure and levels of Chromatin organization in Chromosomes, Euchromatin and heterocromatin, Structural organization of Centromere and Telomere. Sex chromosomes in plants. Cell cycle and its regulation, sex linked inheritance and diseases; types of chromosomes.

Unit – III

Eukaryotic Genetics: Mendelian principles, complementation test, Epistatic Gene interactions; Linkage and Crossing over, Gene Mapping using three point test cross, Cytoplasmic Inheritance.

Microbial genetics: Mapping of genes using Transformation, Conjugation and Transduction. Tetrad Analysis,

Mutations: Gene Mutations - Types, Physical and Chemical Mutagens, Molecular basis of Gene Mutations.

Unit - IV:

Principles of Evolution : Origin of Life, Theories of organic evolution, Synthetic theory, Natural selection, Mechanisms of Speciation. Adaptive radiation; Isolating mechanisms; Speciation; Allopatricity and Sympatricity; Convergent evolution; Hardy – Weinberg Law, factors influencing equilibrium and gene frequencies; Centres of genetic diversity, Origin and Evolution of Wheat & Maize.

Course Outcomes

1. Students will be able to describe the function and structure of major plant cell organelles and Cytoskeleton,
2. Student will be able to describe the structure of nuclear pore complex, Levels of chromatin organization and chromosomes, cell cycle regulation
3. Student will be able to Explain the process of inheritance of genes and interactions, Mapping of eukaryotic and microbial genes and mutagenesis
4. Students will be able to explain the origin of life and processes for the evolution of species and their diversity.

Practical

1. Determination of mitotic index.
2. Study of Chromosomal Behavior during Mitosis in root tips of Onion.
3. Study of chromosomal behavior during meiosis with special emphasis on Prophase-I using flower buds of Onion.
4. Study on the effect of Colchicine on Mitosis.
5. Study on Structural hybrids in *Rhoeo discolor*.
6. Study of problems with specific examples in Eukaryotic and Microbial Genetics
7. Genetics spotters.

Suggested books :

1 Alberts, B., Bray, D., Lewis, J. Raff, M., Roberts, K., and Watson. J.D. 1999. Molecular Biology of the cell. Garland Publishing Inc., New York.

2. Buchanan, B.B., Gruissem, W. and Jones, R.L. 2000. Biochemistry and Molecular Biology of Plants. American Soc. of pl. physiologist, Maryland, USA.

2 Elrod, S. and Stansfield, W.2002. Genetics, Schaum's Outlines. Tata Mc Graw Hill, New Delhi.

3 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.

4 Rastogi,.V. B. 1997.Organic Evolution. Pitambar Publishing, India

5 Russel, P.J. 1998. Genetics (5th Ed.) The Benjamin / Cummings Publishing Co., Inc., USA.

6 Snustad, D.P. and Simmons, M.J. 2000. Principles of Genetics (2nd Ed.) John Wiley & Sons Inc., USA.

7 Stebbins, G. L., 1973. Process of Organic Evolution. Prentice – Hall Pvt. Ltd., New Delhi.

8 Tamarin, R. H. 1999. Principles of Genetics. Mc Graw Hill, New Delhi

9 De Robertis, E. D. P. and De Robertis, E.M.F. Jr. 2001. Essentials of cell and Molecular Biology, Holt lea and Febiger, New York.

10 Lodish, H, Berk, A. Zipursky, S.L., Matsudaira, P.Baltimore, D. and Dernll, J. 2000. Molecular cell Biology (4th Ed.), W. H. Freeman and Co., New York, USA.

11.Elrod, S. and Stansfield, W. 2002. Genetics, Schaum's Outlines. Tata Mc Graw Hill, New Delhi.

12. 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.

13. Russel, P.J. 1998. Genetics (5th Ed.) The Benjamin / Cummings Publishing Co., Inc., USA.

Skilled Oriented Course – 3(B)

SOC – 205 : NANO BIOTECHNOLOGY

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.

Practical

1. Preparation of plant extractions by using various plant parts.
2. Phytosynthesis of metal nanoparticles
3. Characterization of phytosynthesized nanoparticles by U.V.Vis Spectrophotometer, SEM.
4. Production of stabilized Nanoparticles.
5. Effect of Nanoparticles on Seed germination.
6. Effect of Nanoparticles on Citrus canker disease.
7. Assessment of antifungal activity on *Cercospora arachidichola.*
8. Dye degradation capacity of Nanoparticles.
9. Antioxidant activity of Nanoparticles.
10. Determination ;of Minimum Inhibition Concentration of Nanoparticles on *E.coli*
11. Preparation of plant based Nano fertilizers.

Skilled Oriented Course – 4(A)

SOC – 206 : GARDENING AND NURSERY TECHNIQUES

Course Objectives

1. Analyze the greenhouses 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.
2. Management practices of nursery practices record keeping, nursery standards; Plant nutrition and its management in nursery
3. Propagation by cuttings, layering, grafting, budding, specialized structures, and micropropagation; 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.

PRACTICAL

1. Selection of site and building nursery.
2. Collection and handling of horticulture seeds.
3. Processing the seeds to procure healthy and viable count.
4. Preparation of farmyard compost.
5. Raising Nursery bed.

6. Germinating the seeds.
7. Determining the percent germination.
8. Irrigating and maintaining techniques of nursery.

Suggested Books:

1. Fundamentals of Horticulture, Edmond, J.B., Sen., T.L., Andrews, F.S and Halfacre R.G, 1963. Tata McGraw Hill Publishing Co., New Delhi.
2. Introduction to Horticulture, Kumar, N. 1990. Rajyalakshmi Publications, Nagarcoil, Tamilnadu.
3. Bose T.K. & Mukherjee, D., 1972, Gardening in India, Oxford & IBH Publishing Co., New Delhi.
4. Sandhu, M.K., 1989, Plant Propagation, Wile Eastern Ltd., Bangalore, Madras.
5. Kumar, N., 1997, Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. institution)
6. Randhawa, G.S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers.
7. Christopher Brickell, 1992, The Royal Horticultural Society Encyclopedia of Gardening.Dorling Kinderlsey, London.
8. Plant Propagation. Principles and Practices, Hartman, HT and Kester, D.E.1976, Prentice Hall of India Pvt. Ltd. Bombay.
9. Plant Propagation. Sadhu, M.K. 1996. New Age International Publishers,New Delhi.

Skilled Oriented Course – 4(B)

SOC – 206 : PHYTOREMEDIATION

Course Objectives

- Understand the concpt and global approaches of phytoremediation and the significant role of microbes in photoremediation.
- Comprehend the design of phytoremediation strategies and technologies with the knowledge on different mechanisms used by plants and microbes for detoxification of pollutants.
- Gain the knowledge on different contaminants of aquatic environment and use of major aquatic plants for photoremediation.
- Have detailed information on hand about different soil contaminants and their phytoremediation.
- Know the use of transgenic approaches and nanoparticle technology applicationfor phytoremediation.

UNIT – I

Introduction of Phytoremediation, Types and process of phytoremediation : Advantages and limitation of phytoremediation, Need and Scope of phytoremediation. Glbal approaches of phytoremediation – American approach, European approach and Japanese approach. Role and importance of microbes in phytoremediation.

UNIT – II

Evaluation of Phytoremediation technologies – Phytoextraction, Rhizofilteration, Phytostabilizations, Rhizodegradation, Phytovolatization. Designing of phytoremediation strategies – site assessment, choosing right plans, soil amendments, implementation and moniforing. Physiological, molecular and biochemical mechanisms utilized by plants and microbes for uptake, transport and detoxification of pollutants.

UNIT – III

Contaminents in aquatic environment – physical, chemical and biological contaminants. Major aquatic plant species for phytoremediation – Free floating, submerged, emergent and rather plant species. Mechanisms for removal of contaminants (inorganic and organic) by aquatic plants. Phytoremediation of soil contaminants – Herbicies and Pesticides, Mineral fertilizers, Hydrocarbons (trichloro ethylene, carbon tetrachloride), Textile Dyes. Heavy metals (Arsenic, Lead, Mercury), Explosive nitro-aromatic compounds (TNT, RDX).

UNIT – IV

Factors affecting the phytoremediation. Hyperaccumulator and Non-hyperaccumulator plants for environmental waste management. Transgenic approach for phytoremediation. Application of nanoparticle technology in phytoremediation.

Course Outcome

1. Know the importance of plants in Phytoremediation**.**
2. Develop the skill to identify the heavy metal hyper accumulating plants.
3. Understand the contribution of microorganisms in Phytoremediation.
4. Differentiate the role of physical, chemical and biological contaminants in soil.

PRACTICAL

1. Collection of soil samples from agriculture and industrial locations.
2. Identification of Hyper accumulating plants.
3. Propagation of plants with heavy metal.
4. Preparation of aqueous solutions with Cu, Fe, Ag, Zn.
5. Raising the plants in Heavy metal contaminated water or soil.
6. Estimating the amount heavy metal accumulation in plants.
7. Measuring the biomass of plants with heavy metal stress.

Suggested Books :

1. Ram Chandra, N.K. Dubey, Vineet Kumar, 2018. Phytoremediation of Environmental Pollutants, CRC Press.
2. Jean-Louis Morel, G.Echevarria, N.Goncharova, 2006. Phytoremediation of Metal contaminated soils. Springer.
3. James E.Landmeyer, 2012. Introduction of Phytoremediation of Contaminated Ground Water. Historical Foundation, Hydrologic control and Contaminant Remediation. Springer.
4. A.Singh and O.P.Ward,(Eds). 2004. Applied Bioremediation and Phytoremediation. Springer-Verlag.
5. Abid A. Ansari, Sarvajeet Singh Gill, Suy R. Lanza, Lee Newman 2018. Phytoremediation – Management of Environmental Contaminants. Vol.6, Springer.
6. Ivan A. Golubev, 2011. Hard Boo41 k of Phytoremeiation, Nova Science Publishers, New York.
7. Bhupinder Dhir, 2013. Phytoremediation : Role of aquatic plnts in environmental cleanup. Springer.
8. Introduction to Phytorediation, 2000. National Risk Management Research Laboratory. Ohio.53

PRACTICAL – II (EXAMINATION)
(SOC related to 3 & 4)

OOTC-208 : OPEN ONLINE TRANSDISCIPLINARY COURSE – 2

AUDIT COURSE – 209: INDIAN KNOWLEDGE SYSTEM - 2

SEMESTER – III

Core Course - 7

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 Nucleic acids structure, properties and mechanism of DNA replication and damage repair pathways, and Chromatin organization Cell Cycle regulation
2. Describe gene organization, mechanism of Transcription and Translation, and processing of gene products in Prokaryotes and Eukaryotes
3. Explain the mechanisms of regulation of gene expression in Prokaryotes and Eukaryotes.
4. Explain the basic principles of Microscopy, Nucleic acid and protein separation and identification Techniques and methods

Suggested Readings:

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* (5th 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 (4th 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.
11. A.K. Sharma and A. Sharma, Chromosome techniques, Butterworth's Publications
12. Glick, B.R. and Thompson, J.E. 1993. Methods in Plant Molecular Biology Biotechnology. CRC Press, Boca Raton, Florida.
13. Sadasivam, S. & Manikam, A. 1992. Biochemical methods. Wiley Eastern Ltd.

14. Sawhney, S. K. and Ranbir Singh (Eds).2000.lntroductory Practical Biochemistry, Narosa Publishers, New Delhi.
15. Shaw, C.H. (Ed.). 1988. Plant Molecular Biology: A Practical Approach, IRL Press, Oxford.
16. An Introduction to practical biochemistry by D.T. Plummer (Mc Graw Hill).
17. 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
18. Biochemistry by Lubert Stryer (5th Ed.) (Freeman-Toppan)
19. 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.
20. Frank, H. Stephenson. 2008: Calculations in Molecular Biology and Biotechnology-A Guide to Mathematics in the Laboratory, Academic Press

Core Course – 8(A)

CC-302 : 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.

PRACTICAL

1. Preparation of Stock solutions and Media.
2. Production of Aseptic seedlings.
3. Induction of callus and histological/cytological studies of callus.
4. Direct organogenesis and somatic embryogenesis from Tobacco explants.
5. Enzymatic isolation and culture of protoplasts.
6. Fusion of protoplasts using PEG.
7. Preparation of synthetic seeds using sodium alginate. Estimation of IAA using Salkowski reagent.
8. Isolation of Genomic DNA.
9. Agarose Gel Electrophoresis of DNA and Southern Blotting.
10. Isolation of Yeast RNA and Quantification by Spectrophotometry.
11. Isolation of Plasmid DNA.
12. Ligation of DNA fragments.
13. Bacterial Transformation and Identification of Transformants.

Suggested Books:

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.
20. Gamborg, O. L. & Philips, G.C. (Eds.) 1995. Plant cell, Tissue and Organ culture. Fundamental methods. Narosa publishing house, New Delhi.
21. Hall, R.D. (Ed.) 1999. Plant cell culture protocols, Humana press aInl., New Jersey, USA.
22. Reinert, J. and Yoeman, M.M. 1982. Plant cell and Tissue culture: A laboratory manual. Springer-Verlag.
23. Mascarenhas, A.F. 1991. Hand book of plant tissue culture, ICAR publications, New Delhi.
24. Smith, R.H.2000. Plant tissue culture: techniques and Experiments. Academic press, New York.
25. Gelvin, S.B. and Schilperoort, R.A. (Eds.). 1994. Plant molecular biology manual, (2^{nd}Ed.), Kluwer Academic Publishers, Dordrecht, The Netherlands.
26. Glover, D.M. and Hames, B.D. (Eds.) 1995. DNA cloning 1: A practical approach; Core techniques, (2^{nd} Ed.), PAS IRL Press, oxford.
27. Mickloss, D.A. and Freyer, G.A. 1990. DNA science. A first course in Recombinant Technology. Cold spring harbor laboratory press, New York.
28. Frank, H. Stephenson. 2008: calculations in molecular biology and Biotechnology- A guide to mathematics in the laboratory, Academic press.

Core Course – 8(B)

CC-302 : ENVIRONMENTAL STUDIES AND DISASTER MANAGEMENT

Course Objectives:

1. To provide knowledge on natural sources and their utility.
2. To provide basic conceptual understanding of importance of environmental protection.
3. To understand approach of disaster management.
4. Developing skill to respond disaster.

UNIT – I : Resource Management

Global distribution of natural resources, need of water, air and soil; Threat to these resources; Approches to surface water management, rain water harvesting and storage; Environmental pollution, causes and strategies for air, water and soil pollution.

UNIT – II : Society and Environment

Sustainiable development, concept, components and strategies. Social impact of growing human population and affluence, food security, hunger, poverty, malnutrition, Social impact of water crises, global climate change; Environmental ethics, public awareness,. People participation in resource conservation and environmental protection.

UNIT – III : Types of Disasters

Concept and definition, types of natural and man-made disasters, risk assessment, dimensions of disasters, disaster impact assessment, types of disaster impact : flood, drought, cyclone, tsunami, earthquake and volcanoes, Nuclear and Industrial hazards.

UNIT –IV : Disaster Management

Concept of disaster management, disaster management cycle and developmental considerations; coping with man-made disasters, awareness and motivation, training in disaster management; disaster preparedness, disaster responses and its management and reducing the impact of disaster. Planning for disaster preparedness, disaster mitigation, principles, approaches, techniques.

Learning Outcome:

1. Understand the availability of+ environmental resources.
2. Know the importance of resources in sustainability of life.
3. Get awareness about disaster and its mitigation process.
4. Prepare the people to be safe from disasters.

PRACTICAL

1. Frequency of natural disaster world wide data collection.
2. Estimation of loss by man-made disaster data collection.
3. Raising awareness about potential hazards.
4. Preparing public for different types of disaster management.
5. Study of cyclone effect on soil profile and plantation.

Suggested Books

1. Environmenal Ecology – 2020 by Vaishali Anand – Mc Grawhill Publishers.
2. Fundamentals of Environmental Studies 2020 by Saritha Kumar – Sultan Chand Publ.
3. Disaster Management and Prepared 2012 by Nidigauba Dhawan and Sardar Khan, CBS Publishers.
4. Natural Disasters and Management 2017 – Publisher by Telugu Akademy.
5. A Text of Disaster Management – 2021, A.K.Srivasava – Scientific Publishers.

Core Course – 9(A)

CC-303 : HORTICULTURE

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.
3. Study of Plant Propagation.
4. Deals with seed production technology of horticultural crops.

UNIT I

Introduction, Scope and importance of Horticulture, Branches of Horticulture; Soil types and preparation and treatment; Outdoor garden types and arrangements annuals, biennials. Perennials with common examples and culture: influence of environment, training, pruning and transplanting.

UNIT II

Scope and Importance of Plant Propagation, Role of Nurseries in Horticulture Development, Types of Plant Propagation Nurseries, Physical and Financial Resources for Nursery, Mother Plants: Selection and Maintenance.

Sexual and Asexual Propagation, Seed Production and Seed Propagation, Vegetative Propagation, Cutting, Budding, Layering and Grafting in Horticultural Plants, Micro-Propagation and Hardening of Nursery Plants

UNIT III

Sanitation, Drainage; Training and Pruning in Nursery, Potting, Re-potting, De-potting and Mulching in Nursery; Plant Growth Regulators in Nursery: Types, Role, Methods of applications and preparation; Packing and Transport of Nursery Plants, Customer Services in Nursery Plants.

UNIT IV

Selection and Collection of Regional Ornamental Plants; Regional Demand and Supply Situation in Ornamental Plants; Selection and Preparation of Library Plants; Location Specific Library Plant Arrangement; Bonsai: History, styles, plant selection, pruning, nipping, wiring and maintenance.

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.
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.
4. Identify and prescribe sustainable options in horticulture that benefit the environment while maintaining productivity and economic viability ; Bonsai making and maintenance.

PRACTICAL

1. Establishment of nursery, different containers, soil transplantation techniques.
2. Methods of raising lawns.
3. Plant propagation – layering, cutting, grafting.
4. Layout of garden, plan of a rock garden, glass house, kitchen garden, artificial pond.
5. Visit to nurseries.

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.

Core Course – 9(B)

CC-303 : MICROBIAL PHYSIOLOGY

UNIT - I

Nutrition: Elementary nutrient requirements of microbes; nutritional groups of bacteria; autotrophy, photoautotrophy and bacterial photosynthesis; chemoautotrophy and autotrophic metabolism; heterotrophy – photoheterotrophy and chemoherotrophy, heterotrophic, metabolism in bacteria, nutritional mutants and their use in metabolic studies.

Microbial Growth: Building of macromolecules from elemental nutrients, supramolecules, cell components and cells: cell cycle in microbes and generation times: batch culture phases and importance of each phase, continuous, synchronous culture, factors influencing the microbial growth.

Nature and properties of spores – Physiology and biochemistry of sporulation and germination of spores.

UNIT – II

The concepts of microbial metabolism, primary and secondary metabolism and their significance.

Bioenergeties: Concepts of free energy and thermodynamic principles in biology, energy transformation. ATP cycle, standard free energy of hydrolysis of phosphate compounds, energy transducers, redox potentials, free energy changes in redox reactions.

Photosynthesis: Oxygenic and anoxygenic photosynthesis, photosynthetic pigments, basic photochemistry of PS I and PS II and photosynthetic electron transport; modes of CO_2 fixation, halobacterial photosynthesis, sulphur, nitrogen and iron assimilating bacteria. Chloroplast mediated electron transport; chemolithotrophic electron transport systems. Biolumenescence.

UNIT –III

Aerobic respiration : TCA cycle- intracellular location and reactions of the cycle, amphibolic nature of the cycle, energetics of the cycle, the glyoxalate cycle. Mechanisms of substrate-level phosphorylation; respiratory electron transport in mitochondria and bacteria along with its components (carriers); mechanism of oxidative phosphorylation, uncouplers, inhibitors.

Anaerobic respiration : Nature of fermentation, the relationship of oxygen to growth and fermentation, biochemical mechanisms of lactic acid, ethanol, butanol , citric acid and acetone fermentations, study of fermentations, relationships between fermentation and energy production; nitrate and sulphate respiration.

UNIT – IV

Protein metabolism: Assimilation of inorganic nitrogen and sulphur, biochemistry of nitrogen fixation; hydrolysis of proteins-exo-and-endo-proteinases, outlines of biosynthesis and catabolism of amino acids in microbes (deamination, decarboxylation and transamination reactions). Urea cycle.

Nucleotide metabolism : Biosynthesis of bases, nucleosides and nucleotides including deoxyribonucleotides, regulation of nucleotide synthesis; break down of nucleic acids – exo- and endo-nucleases (RNases and DNases) and phosphodiesterases, salvage pathways; catabolism of purines and pyrimidines.

PRACTICAL

1. Bacterial growth curve determination.
2. Bacterial biomass estimation in different carbon sources.
3. Sporulation and spore staining techniques.
4. Ethanol production by Saccharomyces cerevisiae.
5. Effect of pH on growth of microorganisms.
6. Effect of Temperature on growth of bacteria.
7. Enumerating bacteria growth by Colony Count Absorbance and Viable Count.

Suggested Books:

1. Microbial Physiology and Metabolism.1995,by D.R. Caldwell. Wm.C. Brown Publ.
2. Microbial Physiology. 1999,3rd ed, by A.G. Moat & J.W.Foster. Wiley- Liss.
3. Principles of Biochemistry. Lehinger. 2000
4. Foundations in Microbiology .1996, by K. Talaro & A. Talaro, Wm.C. Brown Publ.
5. Microbiology . 2000. By Prescott et al. Wm. C. Brown Publ.
6. Molecular Cell Biology. 2000-by Lodish et al.
7. General Microbiology, 1999 by Stainer et al., Macmillan Educational Ltd.

P-304 : PACTICAL – I (EXAMINATION)
Papers related to CC – 8 & 9

Skilled Oriented Course – 5(A)
SOC – 305 : MUSHROOM CULTIVATION

Course Objectives

1. To study methods of growing edible mushrooms and isolation of Mushroom culture and Culture maintenance.
2. To study basic mushroom substrate preparation, composting and study spawn generation techniques, inoculation methods.
3. To study method of harvesting of Mushrooms.
4. To study diseases and pests of mushrooms; disease and pest management of mushrooms.

UNIT – I
History of Mushroom, cultivation, mushroom status in Andhra Pradesh and other states of India; Biology and Ecology of mushrooms; Wild mushroom collection.

UNIT – II
Introduction to mushrooms, morphology, classification, edible mushrooms and poisonous mushrooms. Life cycle of *Valverellia* sp., *Pleauritus* sp., *Agaricus* sp., *Calocybe* sp. and *Leutinus* sp.

UNIT – III
Spawn preparation : Facilities required for spawn preparation, Preparation of spawn substrate; Preparation of pure culture, culture maintenance, storage of spawn.

UNIT – IV
Mushroom Cultivation – Conditions of 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.

PRACTICAL

Suggested laboratory exercises

1. Maintenance of mushroom cultivation labs.
2. Sterilization of substrate material
3. Spawn preparation
4. Preparation of mushroom beds
5. Treatment of Casins material
6. Process of Casins
7. Management of Spawn-run
8. Harvesting of mushrooms.

Suggested Books

1. Nita Bhal (2000). Hand book on Mushrooms, 2nd ed. Vol.I & II. Oxford and IBH publishing Co Pvt Ltd., New Delhi.
2. Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH publishing Co Pvt Ltd., New Delhi.
3. Pandey, E.K.S.K. Ghosh, 1996 A hand book on mushroom cultivation, Emkey Publications.
4. Tewari Pankaj Kapoor, S.S. (1988). Mushroom Cultivation, Mittal Publications, New Delhi
5. Tavina Rehman Borah, Akoijam Ratankumar Singh, Pampi Paul et al. (2020). Spawn production and mushroom cultivation technology, ICAR, Meghalaya.
6. V.N.Pathak, Nagendra Yadav and Maneesha Gaur (2000). Mushroom Production and Processing Technoogy / Vedams Ebooks Pvt Ltd, New Delhi.
7. Pathak, V.N. and Yadav, N (1998). Mushroom production and processing technology. Agrobios.
8. Hand book of Mushroom Cultivation, Processing and Packaging by Eiri Staff.
9. Mushroom Cultivation in India Hardcover – 2007 by Suman and Sharma

Skilled Oriented Course – 5(B)

SOC – 305 : MOLECULAR PLANT PATHOLOGY

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 Outcome

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 Eco friendly management and IPM instead of Chemical methods.

Practical

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:

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

Skilled Oriented Course – 6(A)

SOC – 306 : PHYTODIVERSITY 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 Phytodiversity: Status in India, World Centers of Primary Diversity, Types of Biodiversity, Causes for Rarity, loss of Species, *Extinction*, Red data book, Exploration. Introduction of species, Status species-based on IUCN; and Genetic Diversity in crops, Sustainable Agriculture in Biodiversity; 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. India as a mega diversity center; Agrodiversity-centers of origin; Biodiversity Act.

UNIT II

Remote Sensing applications in phytodiversity 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; Phytogeographical regions and forest types of India.

UNIT III

Principles of 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 Outcomes

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

PRACTICAL

1. Study of the Species Diversity in Fields and Forests.
2. Study of phytodiversity 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 on 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:

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.
26. Bajracharya, D. 1999. Experiments in Plant Physiology: A laboratory manual. Narosa Publishing House, New Delhi.
27. Cooper, T.G. 1977, Tools in Biochemistry. John Wiley, New York, USA.
28. Copeland, R,A. 1996. Enzymes: A practical introduction to Structure, Mechanism, and Data analysis. VCH Publishers, New York.
29. Dennison, C. 1999. A guide to protein isolation. Kluwer Academic Publsihers, Dordrecht, The Netherlands.
30. Devi, P. 2000. Principles and methods of plant molecular biology, Biochemistry and Genetics, Agrobios, Jodhpur. India.
31. Dryer, R.L. and Lata, G.G. 1989. Experimental Biochemistry, Oxford University Press, New York.
32. Hames, B.D. (Ed). 1998. Gel Electrophoresis of proteins: A Practical approach. (3rd Ed.). RA,S Oxford University Press. Oxford UK
33. Harborne, J. B. 1981. Phytochemical methods: A guide to modern techniques of plant analysis. Chapman & Hall, London.
34. Meidner, H. 1984. Class experiments in Plant physiology, George Allen & Unwin Publishers, Boston, USA.
35. Moore, T.C. 1974. Research Experiences in Plant Physiology: A Laboratory manual. Springer Verlag, Berlin.
36. Ninfa A.J. and Ballou, D.P. 1998. Fundamental Laboratory Approaches for Biochemistry and Biotechnology, Fitzgerald Science Press, Inc., Maryland, USA.
37. Plummer, D.T. 1988. An Introduction to Practical Biochemistry. Tata McGraw Hill Publisf, iriCo. Ltd., New'Delhi.
38. Scott R.P.W. 1995. Techniques and Practice of Chromatography. Marcel Dekker, Inc., New York.
39. Wilson, K. and Goulding, K.H. (Eds.). 1986. A Biologists guide to principles and ltechniques of practical biochemistry. Edward Arnold, London, UK.
40. Wilson, K. and Walker, J. 1994. Practical Biochemistry: Principles and Techniques, (4th Ed.). Cambridge University Press, Cambridge, UK.

Skilled Oriented Course – 6(B))

SOC – 306 : ADVANCED MOLECULAR TOOLS

Learning Objectives

- Learn about working principles and mechanism of working of Cryo-EM, FRET, AFM and Confocal microscopy.
- Gain knowledge pertaining to different types and working principles of electrophoresis, spectroscopy and ECL.
- Understand the principles and applications of RELP, blotting techniques, PCR and DNA finger printing techniques.
- Explore information related to the functional identification of genes through insertional mutagenesis, RNAI, CRISPR-Cas9 genome editing, TILLING and Microscopy.
- Gain adequate information on 2-D Gel Electrophoresis, LC-MS, protein sequencing, protein micro-arrays and antibody based protein detection assays.

UNIT – I

Advances in Microscopy : Working principle, magnification, resolution and application of Cryo-Electronic Microscopy, Fluorescence Resonance Energy Transfer (FRET) Microscopy, Atomic Force Microscopy and Confocal Microscopy.

UNIT – II

Electrophoretic, Spectrophotometric and Autoradiographic Techniques Electrophoresis : Principles involved in disc and slab typs. Mechanisms of staining and destaining of enzyme gels, isoelectric focusing. Time resolved florescence spectroscopy, CD Spectroscopy and applications. General principle and applications of Enhanced Chemiluminescence.

UNIT – III

Recombinant DNA Techniques : Principles and applications of RELP, Blotting technique, PCR and DNA finger printing techniques.

UNIT – IV

Functional Genomics: Experimental techniques for functional identification of genes : Insertional mutagenesis, RNAi, CRISPR-Cas9 genome editing, TILLING, DNA Microarray and SAGE.

Proeomics : Protein sample preparation and separation through 2D – Gel Electrophoresis, Liquid Chromatography and Mass Spectrometry (LC-MS), Protein Sequencing, Protein Microarrays. Yeast two hybrid assay, immuoprecipitation, pull down assays and co-immunoprecipitation assays.

Course Outcome

1. Understand the different techniques of Molecular Biology.
2. Develop the skill – autoradiography technique.
3. Learn the techniques significances of different microscopic technique.
4. Able to amplify DNA through PCR technique.

PRACTICAL

1. Preparation and processing samples for FRET (Fluroscence Resonance Energy Transfer) microscopy.
2. Isolation of DNA from yeast.
3. Agarose Gel electrophoresis of DNA sample.
4. Determining the bonding pattern of DNA.
5. Estimating the molecular mass of isolated DNA Nitrocellulose membrane blotting of DNA.
6. Chemical transformation technique sing molecular kits.

Suggested Readings:

1. Upadyaya, A, Upadyaya, K. and Nath, N. Biophysical Chemistry – Principle and Techniques, Himalaya Publishing House, New Delhi.
2. Keith Wilson and John Walker (Ed.) 2005. Principles and Techniques of Biochemistry and Molecular Biology (6th Ed.) Cambridge University Press, New York.
3. Christopher A. Cuttis, 2004. Plant Genomics and Proteomics. John Wiley & Sons, New Jersey.
4. Jolls, O and Jornvall. H (eds.) 200. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.
5. Lewin, B. 2006. Gene VIII. Oxford University Press, New York, USA.
6. Brown, T.A. 1999. Genomics 3. John Wiley & Sons, New York, USA.
7. Primerose S.B. & Twyman, R.M. 2003. Principles ;of Genomic Analysis and Genome (7th Ed.), Blackwell Science.
8. Gustafson, J.P. 2000. Genomes, Kulwer Academic Plenum Publs., New York, USA.
9. Jolls, O and Jornvall, H (eds.) 2000. Proteomics in Functional Genomics. Birkhauser Verlag, Basel, Switzerland.

PRACTICAL – II (EXAMINATION)

(Papers related SOC – 5 & 6)

SEMESTER - IV

S.No.	Course	Code	Title of the Course
1.	OOSDC	401	Open Online Skill Development Course
2.	PW	402	Project Work – Orientation classes
*	Conducting classes for competitive exams, communication skills, UGC/CSIR and NET/SLET examinations.		