BHARATHIDASAN UNIVERSITY  **TIRUCHIRAPPALLI -620 024.**

M.Sc. BOTANY

CHOICE BASED CREDIT SYSTEM –

LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS - LOCF)

(Applicable to the candidates admitted from the academic year 2022-23 onwards)

Sem.	Courses	Title	Ins. Hrs.	Credit	Exam. Hrs.	Marks		Total
						Int.	Ext.	
I	Core Course I (CC)	Plant Diversity – I	6	5	3	25	75	100
	Core Course II (CC)	Plant Diversity – II	6	5	3	25	75	100
	Core Choice Course I (CCC)	1. Plant Biotechnology and Genetic Engineering 2. Microbiology and Immunology	6	5	3	25	75	100
	Core Practical I (CP)	Plant Diversity – I & Plant diversity - II	6	3	6	40	60	100
	Elective Course I (EC)	1. Forestry and Wood Technology 2. Horticulture and Landscape Gardening	6	4	3	25	75	100
	Value Added Course I (VAC)	Floriculture	-	2*	3	25	75	100*
		Total	**30**	**22**	**-**	**-**	**-**	**500**
II	Core Course III (CC)	Anatomy Embryology and Morphogenesis	6	5	3	25	75	100
	Core Course IV (CC)	Taxonomy and Economic Botany	5	5	3	25	75	100
	Core Choice Course II (CCC)	1. Mushroom Cultivation Technology 2. Biofertilizers and Biopesticides	5	5	3	25	75	100
	Core Practical II (CP)	Anatomy Embryology and Morphogenesis & Taxonomy and Economic Botany	6	3	6	40	60	100
	Elective Course II (EC)	1. Food Technology 2. Green House Technology	5	4	3	25	75	100
	Non-Major Elective Course I	Horticulture	3	2	3	25	75	100
		Total	**30**	**24**	**-**	**-**	**-**	**600**

III	Core Course V (CC)	Cell and Molecular Biology, Genetics and Plant Breeding	6	5	3	25	75	100
	Core Course VI (CC)	Plant Physiology, Biochemistry and Biophysics	5	5	3	25	75	100
	Core Choice Course III (CCC)	1. Bioinformatics and Bionanotechnology 2. Fermentation Technology	5	5	3	25	75	100
	Core Practical III (CP)	Cell & Molecular Biology and Genetics and Plant Breeding & Plant Physiology, Biochemistry and Biophysics	6	3	6	40	60	100
	Elective Course III (EC)	1. Seed Technology 2. Organic farming	5	4	3	25	75	100
	Non-Major Elective Course II	Herbal Botany	3	2	3	25	75	100
		Total	**30**	**24**	**-**	**-**	**-**	**600**
IV	Core Course VII (CC)	Ecology, Phytogeography and Environmental Biotechnology	6	5	3	25	75	100
	Core Course VIII (CC)	Research Methodology, IPR and Research Ethics	6	5	3	25	75	100
	Entrepreneurship / Industry Based Course	Agribased entrepreneurship	6	5	3	25	75	100
	Project		12	5	-	20	80	100
	Value Added Course II (VAC)	Soil less Culture	-	2*	3	25	75	100*
		Total	**30**	**20**	**-**	**-**	**-**	**400**
		Grand Total	**120**	**90**	**-**	**-**	**-**	**2100**

SUMMARY OF CURRICULUM STRUCTURE OF PG PROGRAMMES

Sl. No.	Types of the Course	No. of Courses	No. of Credits	Marks
1.	Core Course	8	40	800
2.	Core Choice Courses	3	15	300
3.	Core Practical	3	9	300
4.	Elective Courses	3	12	300
5.	Entrepreneurship/ Industry Based Course	1	5	100
6.	Project	1	5	100
7.	Non-Major Elective Courses	2	4	200
Total		**21**	**90**	**2100**
Value Added Courses *		2*	4*	200*

***The value added courses credit will not be included in the total CGPA.**
These courses are extra-credit courses.
Instruction hours for these courses is 30 hours.

PROGRAMME OUTCOME:

The students will be able to:

Establish (i). A fundamental/systematic comprehension of the breadth and guiding principles of academic plant biology, especially as it relates to the plant kingdom, as well as its various applications and connections to other disciplinary fields; (ii). Procedural

expertise that produces various plant biological professionals, including research and development, educators, and technicians in the public, non-public, and private sectors; (iii). Understanding of student's area of specialty concerning its subfields and recent advancements. (iv). Botany curricula are meant to provide students with subject domain knowledge as well as technical skills related to plants in a holistic manner. (v). According to CBCS, it seeks to teach students in all areas of plant sciences through a unique blend of core and optional papers with major interdisciplinary components. (vi). Students are exposed to cutting-edge technology employed in the topic today. They are educated on social and environmental concerns, the importance of plants, and their importance to the national economy.

- Learn about plant diversity and its significance in terms of structure and function for ecological balance.
- Students will understand plant morphology and anatomy, plant identification, and vegetation analysis technological advancements in the field as well as in the laboratory.
- Employ their knowledge of basic plant and biological sciences and their principles.
- Utilize contemporary techniques and tools for biochemical estimation, molecular biology, biotechnology, plant tissue culture experiments, cellular and physiological investigations of plants, and a comprehension of their relevance in human life.
- Use the knowledge acquired from the research to benefit society by tackling health, environmental challenges, malnutrition, etc.,
- Raise public awareness among students about the socioeconomic elements of the country's infrastructure.
- Develop the skills for employment or entrepreneurship opportunities and promotes appropriate oral/written communication as well as observation skills.
- Capable of working effectively in future agricultural, biotechnology, health sciences, environmental management, educational, and research careers.

PROGRAMME OUTCOMES:

- Critical assessment of ideas and arguments via the collection of pertinent information about plants to recognize their place in categorization systems and at the evolutionary level.
- Students can search basic literature, determine works appropriate to a certain topic, and evaluate the scientific merit of these works.
- Students will be able to identify the different properties of many plant groupings, including algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms.
- The Programme will be able to demonstrate how the theory of natural selection is the sole scientific explanation for the unity and variety of life on Earth using data from comparative biology.
- Students can describe the way of working at the genome editing and tissue culture levels in plants.
- They can link environmental physical aspects to the structure of populations, communities, and ecosystems.
- Creates the concept of artificial plant propagation using vegetative methods and makes a living by developing small plant greenhouses.
- Must have a current understanding of scientific tools and methodologies.

First Year **CORE COURSE I** **Semester I**

PLANT DIVERSITY – I

Code: **(Theory)** **Credit: 5**

ALGAE, FUNGI, LICHENS AND BRYOPHYTES

COURSE OBJECTIVES:

- To compare the diversity and classification of non-flowering plant groups.
- To apply the Knowledge on Ecology of Algae
- To illustrate fungi classification.
- To apply the practical knowledge in Understanding the structural and functional diversity Lichens.
- To create opportunities for survey and identification of lower group of plants from various environment.

UNIT– I INTRODUCTION:

Ultrastructure of Prokaryotic and Eukaryotic algal cells and their components. Algal classification (Smith, 1955), Molecular identification of algae. Range of thallus structure, origin and evolution of sex in algae, phylogeny and interrelationships of algae. Lifecycle patterns in algae and alternation of generations, Fossil algae. Economic importance of algae.

UNIT –II ALGAE:

Ecology of Algae: Freshwater algae, marine algae, soil algae, symbiotic algae and parasitic algae. Algae as pollution indicators, algal blooms and algicides. Salient features of major classes: *Prochlorophyceae - Prochloron, Chlorophyceae – Zygnema and Caulerpa, Charophyceae – Chara, Nitella, Xanthophyceae - Vaucheria, Botrydium, Tribonema, Bacillariophyceae – Diatom, Navicula, Fragilaria, Phaeophyceae – Sargassum, Ectocarpus, Fucas,* and *Rhodophyceae – Gracillaria, Gelidium, polysiphonia*

UNIT – III FUNGI:

General features occurrence and distribution. Mode of nutrition in fungi, culture of fungi. Classification of fungi (Alexopoulos and Mims, 1979). General characters of major classes: Mastigomycotina (Albugo), Zygomycotina (Mucor), Ascomycotina (Aspergillus), Basidiomycotina (Agaricus) and Deuteromycotina (Alternaria). Thallus organization, cell structure and fruit bodies. Phylogeny and interrelationships of major groups of fungi. Economic importance of fungi. Homothallism and Heterothallism in fungi. Homokaryon and Heterokaryon, Physiological specialization and physiological races in fungi. Reproduction, life cycle types, parasexual cycles and reduction in sexuality in fungi. Spore dispersal mechanisms.

UNIT – IV LICHENS:

Lichens - General features, classification (Miller, 1984), Distribution, thallus organization, vegetative and sexual reproduction, lichens as indicators of pollution and economic importance of lichens.

UNIT – V BRYOPHYTES

Bryophytes: General features, distribution and classification of Bryophytes (Retailer, 1951), General characters of major groups. *Marchantiales - Marchantia, Jungermaniales - Porella, Anthocerotales - Anthoceros, Sphagnales - Sphagnum, Funariales – Funaria* and *Polytrichales - Polytrichum*. Range of vegetative structure, Evolution of gametophytes and sporophytes. Reproduction - Vegetative and sexual, spore dispersal mechanisms in bryophytes, spore germination patterns in Bryophytes. Ecological and economic importance of bryophytes, Fossil bryophytes.

UNIT - VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the plant diversity-1: algae, fungi, lichens and bryophytes during the Semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources-Research articles, Review materials, Print, Internet, Interaction, Social Media, Webinars and so on.

REFERENCES:

ALGAE:

1. Bold, H.C. and Wyne, M.J. (1978). Introduction of Algae - Structure and Reproduction.Prentice Hall, New Jersey.
2. Chapman, C.J. and Chapman, D.J. (1981). The Algae (2nded.). Macmillan, London. Darley,
3. W.M. (1982). Algal Biology: A Physiological Approach. Blackwell Scientific
4. Publications. Oxford, London.
5. Fritsch, F. E. (1976). Structure and Reproduction of the Algae. Vol. I & II. Cambridge University Press, London.
6. Ian Morris (1967). An Introduction to the Algae. Hutchinson University Library, London.
7. Kumar, H. D. (1989). Introductory Phycology. East-West Press, Madras.
8. Kumar, H. D. and Singh, H. N. (1982). A Textbook of Algae. East-West Press, Madras.
9. Round, F. E. (1981).The Ecology of Algae. Cambridge University Press, London.
10. Sharma, O. P. (1986). Textbook of Algae. Tata McGraw Hill, New Delhi.
11. Smith, G. M. (1976). Cryptogamic Botany. Vol. I. Algae and Fungi. Tata McGraw Hill, New Delhi.
12. Vashishta, B. R. *et al.* (2008). Botany for Degree Students - Algae. S. Chand and Co. Ltd., New Delhi.
13. Venkataraman *et al.* (1974). Algal Form and Function. Today and Tomorrow Publishers, New Delhi.
14. https://www.kngac.ac.in/elearningportal/ec/admin/contents/2_18KP1BO1_20201204033332 39.pdf
15. https://uou.ac.in/sites/default/files/slm/MSCBOT-502.pdf
16. https://ncert.nic.in/textbook/pdf/kebo103.pdf

FUNGI

1. Alexopoulus, C. J. and Mims, C. W. (1979). Introductory Mycology. Wiley Eastern Ltd., New York.
2. Bessey, E. A. (1979). Morphology and Taxonomy of Fungi. Vikas Publishing House Pvt. Ltd., New Delhi.
3. Bold, H. C. *et al.* (1980). Morphology of Plants and Fungi. Harper and Row Publishing Inc., New York.
4. Burnet, J. H. (1971). The Fundamentals of Mycology. ELBS Publications,
5. London.Mehrotra, R. S and Aneja, K. R. (1990).An Introduction of Mycology. Wiley Eastern Ltd., New Delhi.
6. Sharma, P. D. (1987). The Fungi. Rastogi and Co., Meerut.
7. Vashishta, B. R. and Sinha, A. K. (2007).Botany for Degree Students - Fungi. S.

LICHENS

Hale, M. E. Jr. (1983). Biology of Lichens. Edward Arnold, Maryland.

BRYOPHYTES

1. Cavers, F. (1911).The Interrelationship of Bryophytes. Cambridge University Press,London.
2. Ingold, C. T. (1939). Spore Discharge in Land Plants. Oxford, UK.
3. Kashyap, S.R. (1972). The Liverworts of Western Himalayas and Punjab. Plains I & II.
4. Parihar, N. S. (1972). An Introduction to Embryophyta-I: Bryophyta. Central Book Depot, Allahabad.
5. Prem Puri (1973). Bryophytes: A Broad Perspective. Atma Ram and Sons, New Delhi.
6. Smith, G. M. (1971). Cryptogamic Botany. Vol. II. Bryophytes and Pteridophytes. Tata McGraw Hill, New Delhi.
7. Vashishta, B. R. *et al.* (2008). Botany for Degree Students: Bryophyta. S. Chand and Co.Ltd., New Delhi.
8. Watson, E. V. (1971). The Structure and Life of Bryophytes.B.I. Publications, New Delhi.

COURSE OUTCOME:

- Acquire wide knowledge on morphological classification of Algae, Fungi, Bryophytes and Lichens
- Describe the diversity of various plant traits
- Stating the importance of morphological traits in evolution of plant forms
- Employing ecological and economic importance of Algae, Fungi, lichen and bryophytes
- Comparing structural/organization of gametophytes and sporophytes in different classes of bryophytes.

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First Year **CORE COURSE II** **Semester I**

PLANT DIVERSITY – II

Code: **(Theory)** **Credit: 5**

PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

COURSE OBJECTIVES:

- To explain diversity and classification and terrestrial plant forms.
- To differentiate comparative characteristics of steles
- To compare eusporangiate and leptosporangiate
- To knowledge about morphology, anatomy and reproduction of selected Gymnosperms.
- To understand the significance of extinct fossil forms.

UNIT – I PTERIDOPHYTES:

General features and origin of Pteridophytes classification, (Reimer 1956), Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following orders: *Rhyniales, (Rhynia) Psilotales, (Genus-Psilotum) Lycopodiales (Lycopodium), Selaginellales (Selaginella), and Equisetales (Equisetum).*

UNIT – II PTERIDOPHYTES:

Range of morphology, structure, reproduction and evolution of gametophytes and sporophytes of the following orders: *Filicales (Pteris)* and *Salviniales (Marselia).* Stelar evolution in pteridophytes, Heterospory and origin of seed habit. Economic importance of Pteridophytes.

UNIT – III GYMNOSPERMS:

A general account of the characteristic features of Gymnosperms. Origin of Gymnosperms. Classification of Gymnosperms (Sporne, 1965). General structure and interrelationships of *Pteridospermales (Lyginopteris) and Bennetittales (Williamsonia).*

UNIT – IV GYMNOSPERMS:

A general account on the distribution, morphology, anatomy, reproduction and phylogeny of *Cycadales (Cycas) Coniferales (Pinus)* and *Gnetales (Gnetum).* Economic importance of Gymnosperms.

UNIT – V PALEOBOTANY:

Concepts of Paleobotany, a general account on Geological Time Scale. Techniques for paleobotanical study. Fossil types and methods of Fossilization. Compressions, incrustation, casts, molds, petrifactions, coal balls and compactions. Age determination carbon dating and methods of fossilization. Distribution of fossil in India.

UNIT - VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Pteridophytes, Gymnosperms and Paleobotany during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Parihar, N.S. (1985). The Biology and Morphology of Pteridophytes. Central BookDepot, Allahabad.
2. Rashid, A. (1986). An Introduction to Pteridophyta.Vani Educational Books, NewDelhi.
3. Sharma, O.P. (1990). Textbook of Pteridophyta.Macmillan India Ltd., India.
4. Smith, G.M. (1971). Cryptogamic Botany Vol. II Bryophytes and Pteridophytes. Tata McGraw Hill, New Delhi.
5. Sporne, K.R. (1972). The Morphology of Pteridophytes. B. I. Publications, Madras.
6. Sundararajan, S. (2007). Introduction to Pteridophyta. New Age International Publishers, NewDelhi.
7. Vashishta, P.C. et al. (2008). Botany for Degree Students: Pteridophytes.S. Chand &Co. Ltd., New Delhi.
8. Maheswari, P. and Vasil, V. 1960. Gnetum: A Monograph. CSIR Publications, New Delhi Sporne, K. R. (1974). The Morphology of Gymnosperms. B. I. Publications, New Delhi.
9. Vasishta, P.C. et al. (2006). Botany for Degree Students: Gymnosperms. S. Chand &Co. Ltd., New Delhi.
10. Nikias,K.J. (1981).Paleobotany, Paleoecology and Evolution. Raeger Publishers,USA.
11. Seward, A.C. (1919). Fossil Plants Vols. I–IV. Cambridge University Press,London.
12. Seward,A.C. (1931).Plant Life through the Ages. Cambridge University Press,London.
13. Shukla, A.C. and Mishra, S.P. (1982). Essentials of Paleobotany (2nded.). Vikas Publishing House Pvt.Ltd., NewDelhi.
14. https://gurukpo.com/Content/B.SC/Pteridophytes_Gymnosperms_&_Palaeobotany.pdf
15. https://www.easybiologyclass.com/pteriophytes-free-online-study-materials-tutorials-lecturenotes-ppts-mcqs/
16. https://www.pteridoportal.org/portal/index.php
17. https://www.conifers.org/
18. https://courses.lumenlearning.com/boundless-biology/chapter/gymnosperms/ https://palaeobotany.org/
19. https://www.nhbs.com/a-textbook-of-bryophytes-pteridophytes-gymnosperms-and-paleobotany-book
20. https://www.amazon.in/Textbook-Bryophytes-Pteridophytes-Gymnosperms-Paleobotany/dp/8188237450
21. https://www.amazon.in/Textbook-Bryophytes-Pteridophytes-Gymnosperms-Paleobotany-ebook/dp/B01H4UAI5U

22. https://www.wileyindia.com/a-textbook-of-bryophytes-pteridophytes-gymnosperms-and-paleobotany.html
23. https://www.uou.ac.in/sites/default/files/slm/BSCBO-103.pdf
24. https://www.ikbooks.com/books/book/life-sciences/botany/a-textbook-bryophytes-pteridophytes-gymnosperms-paleobotany/9788188237456/
25. https://www.saraspublication.com/books/pteridophytes-gymnosperms-and-palaeobotany/
26. https://www.goodreads.com/book/show/30858016-a-textbook-of-bryophytes-pteridophytes-gymnosperms-and-paleobotany

COURSE OUTCOMES:

- Know about diversity and classification of terrestrial plant forms.
- Compare the various characteristic of steles.
- Differentiate Eusporangiate from Leptosporangiate.
- Discuss about Morphology, Anatomy and reproduction of selected pteridophytes and gymnosperms.
- Classify the types of fossil and illustrate the geological time scale.

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First Year **CORE CHOICE COURSE I** **Semester I**

1) PLANT BIOTECHNOLOGY AND GENETIC ENGINEERING

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To employ knowledge on plant tissue culture and its application commercially.
- To expertize the skills on plant tissue culture techniques.
- To state the significance of Recombinant DNA Technology in crop improvement.
- Recognize vectors and gene manupulation techniques in plant biotechnology.
- To devise research in the cutting-edge areas of genetic manipulation and production oftransgenic plants.

UNIT – I PLANT BIOTECHNOLOGY:

Biotechnology – scope and potentialities. Plant tissue culture – totipotency – organization of a tissue culture laboratory. Sterilization methods – plant tissue culture media (MS) and plant hormones – surface sterilization, callus induction, sub culture, suspension culture. Micropropagation. Organogenesis – Applications of plant tissue culture in agriculture and crop improvement.

UNIT – II PLANT BIOTECHNOLOGY:

Somatic embryogenesis – production of synthetic seeds. Production of haploid plants through anther culture – Protoplast isolation, culture and regeneration, methods of fusing protoplasts, somatic hybridization, somatic hybrids and cybrids. Production of plant secondary metabolites. Somaclonal variation. Germplasm storage-Cryopreservation.

UNIT – III GENETIC ENGINEERING:

Genetic engineering – enzymes – nucleases, polymerases, ligases, alkaline phosphatases, reverse transcriptase – SI nucleases. Vectors - use of plasmids, cosmids, phage and transposons as vectors. Gene cloning – cloning in eukaryotes. Amplification of genes by PCR. cDNA synthesis; joining DNA molecules; transfer of rDNA molecules into bacteria and plants. Southern and Western blotting.

UNIT - IV GENETIC ENGINEERING:

Recombinant DNA technology – gene transfer in plants – aims, strategies for development oftransgenic plants – organization of Ti plasmid, *Agrobacterium tumifaciens* mediated gene transfer. DNA transfer by particle bombardment, micro and macro injection methods – lipofection and electroporation.

UNIT - V GENETIC ENGINEERING:

Pest resistant (Bt-cotton); herbicide-resistant plants (Round Up Ready soybean); Transgenic crops with improved quality traits (Golden rice); Improved horticultural varieties (Moondust carnations); Role of transgenics in bioremediation; edible vaccines; Industrial enzymes, Protease); Genetically Engineered Products– Human Growth Hormone; Humulin; Biosafety concerns.

UNIT - VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Plant biotechnology and Genetic engineering during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Dubey, R.C. (2013). A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi.
2. Gupta, P.K. (1994). Elements of Biotechnology. Rastogi Publications, Meerut.
3. Kalyan Kumar De. (1997). Plant Tissue culture. New central Book Agency, Calcutta.
4. Ignacimuthu, S. (1997). Plant Biotechnology. Oxford & IBM Publishing Co., New Delhi.
5. Kumar, H.D. (1991). A Textbook on Biotechnology. East west press, New Delhi.
6. Parihar, P. (2014). A Textbook of Biotechnology. Argobios Publications, Jodhpur
7. Purohit, S.S. (2003). Agricultural Biotechnology. Agrobios Publications, Jodhpur.
8. Trevan, M.D., Boffey, S., Goulding, K.H. and Stanbury, P. (1988). Biotechnology – The Biological Principles. Tata Mc Graw Hill Publishing Co., New Delhi.
9. Smith, R.H. (2008), Plant Tissue Culture – techniques and experiments, Academic press, New York.
10. Suresh Kumar Gahlawat, Raj kumar Salar, Priyanka Siwach, Joginder Sing Duhan, Suresh Kumar, Pawan Kaur, (2017), Plant Biotechnology, Recent Advancements and Developments, Springer Publications.
11. Satyanarayana, U. 92008), Biotechnology, Books and Allied Publishers Ltd., Kolkatta.
12. C.M.Govil, Ashok Aggarwal and Jitender Sharma, (2017), Plant Biotechnology and Genetic Engineering, PHI, Learing Pvt. Ltd.
13. https://nptel.ac.in/courses/102/103/102103013/
14. https://nptel.ac.in/courses/102/103/102103074/
15. https://www.agrimoon.com/principles-of-plant-biotechnology-icar-ecourse-pdf/
16. https://cnx.org/resources/f523305248cf1c5a5e6a320b70d907ff2c73cb4b/PlantBioI-INTRODUCTION.pdf
17. .http://www.unice.fr/EB/USTH%202013/BP04_introduction_biotechnology_part_1.pdf

COURSE OUTCOMES:

On the successful completion of the course, student will be able to:

- Recall or remember the basic concepts and the various techniques of plant tissue culture.
- Developed skill on plant tissue culture techniques.
- Describe the significance of recombinant DNA technology in application to plant biotechnology.
- Explain the significance of Recombinant DNA technology in crop improvement.
- Analyze the vectors and gene manipulation technology and develop the production of transgenic plant.

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First Year	CORE CHOICE COURSE I 2) MICROBIOLOGY AND IMMUNOLOGY (Theory)	Semester I
Code:		Credit: 5

COURSE OBJECTIVES:

- To understand the general features reproduction, culture and economic importance of bacteria and virus.
- To study the structure, biology and nutrition of bacteria and virus.
- To get the skill in microbial techniques
- To explain the antigen – antibody interactions.
- To explain various techniques of monoclonal and engineered antibodies production.

UNIT – I MICROBIOLOGY:

Scope, Branches of Microbiology. Five kingdom concepts by Whittaker (1969) – Prokaryotic and Eukaryotic microbes. General features of viruses – classification, characteristics and ultra-structure, isolation – purification – replication – transmission; Economic importance. Virions and Prions, Phytoplasma (including Mycoplasma).

UNIT – II MICROBIAL DIVERSITY:

Bergey's system of Bacterial classification (1984 - 1991) – Eubacteria, Archaebacteria, Cyanobacteria and Actinomycetes. General account, ultra-structure, nutrition, growth, reproduction and economic importance.

UNIT – III MICROBIAL TECHNIQUES:

Principles of staining – Staining methods (simple and differential) – Control of microbes – sterilization – physical (dry heat, moist heat, UV light, ionizing radiation, filtration) – chemical (phenol and phenolic compounds) – Types of growth media (natural, synthetic, complex, enriched, selective). Bacterial culture techniques (spread plate, streak plate, pour plate, stab culture and slant culture).

UNIT – IV IMMUNOLOGY:

Organization and classification of immune system – immune cells and organs; inmate and acquired immunity; classification of antigens – chemical and molecular nature; haptens, adjuvants; cytokines; major histocompatibility complex.

UNIT – V IMMUNOLOGICAL TECHNIQUES:

Antibodies – Structure and functions; antibodies: genes and generation of diversity; antigen – antibody reactions. Monoclonal antibodies, engineering of antibodies. Immunodiagnostic methods (Immunodiffusion ELISA). Classification of vaccines and development.

UNIT - VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Microbiology and Immunology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Carpenter, P.L. (1967). Microbiology. Saunders Co., Philadelphia, USA.
2. Dubey, R.C. and Maheshwari, D.K. (2007). A Textbook of Microbiology. S. Chand and Co. Ltd., New Delhi.
3. Pelizar, M.J., Chan, E.C.S. and Krieg, N.R. (1993). Microbiology. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
4. Power and Daginwala (1994). General Microbiology. Himalayan Publishing House, Bombay.
5. Schegal, H.E. (1986) General Microbiology. Cambridge University, London.
6. Staley, J.T. et al., (1991). Bergey's Manual of Systematic Bacteriology. Volume I to IV. Williams & Wilkins, London.
7. Stanier, R.Y., Adelberg, E.A. and Ingram, J.L. (1978). General Microbiology Mac Millan & Co., New Delhi.
8. Annadurai, B. (2008). A Textbook of Immunology and Immuno technology. S.Chand and Co. Ltd., New Delhi.
9. Kuby, J. (2000). Immunology. 4th ed. W. H. Freeman and Co., New York.
10. Nandini Shetty. (2008). Immunology Introductory Textbook. New Age International Publishers, New Delhi.
11. Wein and Stewart, J. (1997). Immunology, Churchill Livingston, New York.
12. http://www.malecentrum.sk/data/att/166377.pdf
13. https://alraziuni.edu.ye/uploads/pdf/MICROBIOLOGY-AND-IMMUNOLOGY.pdf
14. https://www.academia.edu/33033502/MICROBIOLOGY_and_IMMUNOLOGY_pdf
15. https://labscientists.files.wordpress.com/2017/12/microbiology-immunology-1.pdf

COURSE OUTCOMES:

- Demonstrate the structure reproduction and nutrition of economic importance of bacteria and virus.
- The students would be aware of the principles behind the production of therapeutic / diagnostic molecules.
- The students would be able to develop skills in practical work and techniques of microbiology.
- The students would be able to understand the concepts and mechanism of Immunodiagnostic methods.
- The students would be aware of immune system structure and functions.

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First Year **CORE PRACTICAL I** **Semester I**

Code: **Credit: 3**

ALGAE, FUNGI, LICHENS AND BRYOPHYTES & PTERIDOPHYTES, GYMNOSPERMS AND PALEOBOTANY

COURSE OBJECTIVES:

- To Microscopic observation of identification of algae, fungi, bryophytes, pteridophytes and gymnosperm.
- To learn about the fossil types.
- To know about the life history, structure and economic importance of Gymnosperms.
- To study the methods of fossilization and fossil plants.
- To gain a knowledge of slide preparation.

ALGAE:

Prochlorophyceae : *Prochloron*
Chlorophyceae : *Zygnema and Caulerpa*
Charophyceae : *Chara, Nitella*
Xanthophyceae : *Vaucheria, Botrydium, Tribonema,*
Bacillariophyceae : *Diatom, Navicula, Fragilaria*
Phaeophyceae : *Sargassum, Ectocarpus, Fucas*
Rhodophyceae **:** *Gracillaria, Gelidium, polysiphonia*

FUNGI:

Mastigomycotina : *Albugo*
Zygomycotina : *Mucor*
Ascomycotina : *Aspergillus*
Basidiomycotina : *Agaricus*
Deuteromycotina : *Alternaria*

BRYOPHYTES:

Marchantiales : *Marchantia*
Jungermaniales : Porella
Anthoceratales : *Anthoceros*
Sphagnales : *Sphagnum*
Funariales : *Funaria*
Polytrichales : *Polytrichum*

PTERIDOPHYTES:

Lycopodium - Stem and cone
Selaginella - Stem and Cone
Equisetum - Stem and cone
Marsilea - Rhizome and sporocarp

GYMNOSPERMS:

Cycas Rachis, Leaflet – T.S; Coralloid root, male cone. Megasporophyll and Microsporophyll. Pinus Needle –T.S. Young stem – T.S; Male and Female cone. Stem – Gnetum - T.S, Male and Female Strobilus – Demonstration only

PALEOBOTANY:

Slides - *Rhynia, Lepidodendron, Lepidocarpon*, *Calamites* and *Williamsonia*
Fossils; Impression, Compression and petrification.

REFERENCES:

1. Agashe, S. N. (1995). Paleobotany, Oxford and IBH Publ. Co. Pvt. Ltd, New Delhi.
2. Hoek, C. van den, Mann, D. G. and Jahns, H. M. (1995). Algae: An introduction to Phycology, Cambridge University Press, UK.
3. Sharma, O.P. (1990). Textbook of Pteridophyta. Macmillan India Ltd., Delhi.
4. Surange, K.R. (1966). Indian fossil Pteridophytes Council of Scientific and Industrial research. New Delhi.
5. https://uou.ac.in/sites/default/files/slm/MSCBOT-502.pdf
6. https://www.aisectuniversityjharkhand.ac.in/PDFDoc/StudyNotes/B.SC%20BOTANY/B.Sc%20Botany%20(Sem%20I)/Sem%20I%20(Bio-diversity%20of%20Cryptogams).pdf
7. https://www.srcollege.edu.in/temp/lms/Manuals/Practical-I.pdf

COURSE OUTCOMES:

- Gain knowledge on slide preparation and staining techniques.
- Understand the history and structure of algae, fungi, lichens and bryophytes.
- Learn about the fossilization and fossil plants.
- Understand the morphology, structure and importance of the various organisms.
- Gain knowledge on characterize features of pteridophytes, Gymnosperms and paleobotany.

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First Year **ELECTIVE COURSE I** **Semester I**

1) FORESTRY AND WOOD TECHNOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To enable the students to understand the importance of forests.
- To make the students contribute meaningfully to the conservation of the forest.
- To be aware of the current global problems in forestry-related to human intervention and the need to develop a sustainable way of life.
- To provide a platform for appreciating biodiversity and the importance of conservation strategies.
- To enable the studies and knowledge about the forest Law.

UNIT – I FORESTRY:

Introduction, Scope and branches of forest and its classification. Natural and man-made forests- Tropical, temperate, Evergreen, Semi-evergreen, deciduous and mangrove. Mono-culture-multipurpose, social and Industrial Forest, gene conservation. Forest Types in south India with special reference to Tamil Nadu.

UNIT – II SILVICULTURE:

Silviculture-definition scope and objective, forest plantations site and species selection planting maintenance and other silvicultute operations-High density-short rotation plantations, Tree, pulpwood and energy yielding tree plantations, forest certification.

UNIT – III FOREST MANAGEMENT:

Forest health and its Management, sustainable forest management and participatory method of forest management, social and agro forestry and its to their role in timber production.

UNIT – IV WOOD SCIENCE:

Taxonomy and its relevance to wood science for Identification of bark, stem, leaf, flower and seed. Formation of wood-cambium and its derivatives, secondary growth, Anatomical structure of wood, Gross anatomical and minute anatomical structures-Sap wood and heart wood, Growth ring, ring porous and diffuse porous wood.

UNIT – V WOOD PROPERTIES:

General and physical features of wood, colour, odour, weight, grain, texture, figure. Variability of anatomical structure-reaction wood, abnormal rings, false rings and discontinues rings, important characteristics to employed in soft wood identification-microscopic characteristics of soft wood, hard wood and Juvenile wood.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Current developments related to the Forestry and Wood Technology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Sagwal, S.S. (2006), A text book of silviculture (Kalyani Publishers, India, Negi,S.S. (2002),Indian trees and their silviculture, Legumes) Garlitt, J.E (1995) Natural Management of wood continuous cover forestry, Research studies press Ltd, England
2. Negi,S.S (200), Indian tress and their Silviculture-Legumes,Bishensingh,Mahendrasingh Publications Debradun, India
3. Garlitt, J.E (1995), Natural Management of wood, continuous cover forestry, Research studies press ltd, England.
4. Erosjostrom E (1993) Wood chemistry fundamentals and application (2nd Edistion) Acadamic press inc.
5. Chundawat, B.S. and Gautham, S.K. (1996) Text Book of Agroforestry Oxford and IBH publishers california, New Delhi
6. Tim pack (2001) The interanational Timber trade, wood head publishing Ltd, England.
7. Kollmann, F.F.P. and cote, W.A. 1998. wood science and technology VOI –I & II springer-verlage New York
8. https://drive.google.com/file/d/1BvDpXcC8YnHBKJvEicalpfhn9pD2WSCs/view
9. https://www.fpl.fs.fed.us/documnts/fplgtr/fpl_gtr190.pdf
10. https://www.britannica.com/science/wood-plant-tissue/Harvesting-of-wood
11. https://is.muni.cz/th/gdxwb/Textbook_glossary_final.pdf

COURSE OUTCOMES:

- Considerable knowledge on forest biodiversity.
- To evaluate the strategies and appreciate uses of tree and plantation patterns in natural forest habits.
- Formulate a strategy towards the social, ecological, economic, cultural and environmental purpose of forest.
- Construction of regeneration of forests.
- Understand the law governing forest.

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First Year **ELECTIVE COURSE I** **Semester I**

2) HORTICULTURE AND LANDSCAPE GARDENING

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To state the fundamentals of horticulture.
- To learn the techniques of propagation methods and growth regulators in horticulture.
- To get familiarized with common ornamental and flowering plants.
- To understand the basic principles of landscape gardening.
- To get employed with common ornamental gardens and lawns.

UNIT – I FUNDAMENTALS OF HORTICULTURE:

Importance, scope and classification of horticulture. Soil types, physical and chemical composition of soil, soil fertility and its maintenance. Manures and fertilizers. Irrigation surface, sub and special irrigation methods. Plant protection.

UNIT – II PLANT PROPAGATION METHODS:

Cutting, layering, budding and grafting. Stock-scion relationship in important horticultural crops. Use of plant growth regulators in horticulture: Induction of rooting, flowering, fruit set, fruit development and control of fruit crops.

UNIT – III COMMERCIAL HORTICULTURE:

Cultivation, harvesting and pro-harvesting of important fruit crops (mango, banana, jackfruit and guava), Flowers (rose, jasmine and chrysanthemum) and vegetable crops (tomato, brinjal and drumstick). New avenues for self-employment in horticulture sector. Nursery management, export of horticultural crops, requirements, methodology, packing and logistics. Processing of vegetables and fruits for grading, value addition and preservation.

UNIT – IV LANDSCAPE DESIGNING:

Landscaping principles-planning designs for house gardens, institutional and industrial gardens, avenue planting, railway planting-trees, shrubs, climbers, herbs and ground covers suited for different situations their culture, training and pruning-tree transplantation.

UNIT – V ORNAMENTAL GARDENS AND LAWNS:

Establishment of garden, Different grasses, maintenance of lawns and turf in play grounds, gardens and golf courses; special types of gardens: traffic islands, vertical garden, roof /terrace garden, vertical garden, bog garden, water garden, planning parks and public garden.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Current developments related to the Horticulture and Landscape gardening during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Manibushan Rao K. 1991. Text book of horticulture. Mac Millan Publishing Co., New York.
2. Edmond JB et al., 1977. Fundamentals of horticulture. Tata McGraw HillLtd., New Delhi.
3. Rao KM. 2000. Text Book of Horticulture, MacMillan India Ltd., NewDelhi.
4. Gopal swamy Iyyangar, 1970. Complete gardening in India, KalyanPrinters, Bangalore.
5. Adams, C., M. Early and J. Brrok (2011). Principles of Horticulture. Routledge, U.K.
6. Sundararajan, J. S., Muthuswamy. J., Shanmugavelu, K. G. and Balakrishnan, R. A Guide to kumar N. Introduction to Horticulture. Rajalakshmi Publications, Nagarcoil, 1994.
7. Kumar, N. (1997). Introduction to Horticulture. Rajalakshmi publications, Nagarcoil.
8. Sheela, V.L (2011). Horticulture. MJP Publication, Chennai.
9. Kumaresan V. Horticulture and plant breeding. Saras publication, Nagarcoil, 2009.
10. https://agritech.tnau.ac.in/horticulture/horti_Landscaping_types%20of%20garden.html
11. https://drive.google.com/file/d/15r62QQaAApeh3jovebRLmH5tdmDPCNhd/view
12. https://agrimoon.com/wp-content/uploads/Principles-of-Landscape-Gardening.pdf
13. https://cpwd.gov.in/Publication/CPWDHortHhandbook.pdf

COURSE OUTCOMES:

At the end of the course, students will be able to Course Outcomes:

- Understand the importance and divisions of horticulture
- Learn the various methods of plant propagation
- Know the art of indoor gardening
- Acquire knowledge on floriculture
- Study the types and components of gardens

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First Year	VALUE ADDED COURSE I FLORICULTURE	Semester I
Code:	(Theory)	Credit: 2*

COURSE OBJECTIVES:

- To state fundamentals and potentials of floriculture.
- To study the sexual and vegetative propagation methods for commercial flowering plants.
- To describe propagation and cultivation of commercial flowering plants.
- To illustrate basic concepts of preservation of cut flowers and floral decorations.
- To understand the entrepreneurship in floriculture.

UNIT – I FUNDAMENTALS OF FLORICULTURE:

Scope, importance and division of floriculture in India. Present status, Future prospects and strategies needed for improvement. Area, production and exports. Soil and climate limiting factors. Irrigation types – surface, sub and special irrigation – Manures, fertilizers and herbicides.

UNIT – II CULTIVATION METHODS:

Sexual and vegetative propagation methods for commercial flowering plants. Cultivation of flowers – rose, marigold, chrysanthemum, jasmine, dahlia, orchid and crossandra. Training and pruning of flowering plants. Ornamental bulbous plants – Cacti, succulents, palms, cycads, ferns and *Selaginella*. Bonsai – Importance and methods of making bonsai.

UNIT – III CUT FLOWER TECHNOLOGY:

Cut flowers – Production, packaging, drying and preservation - Cut flower production techniques for domestic and export market with special reference to rose, marigold, chrysanthemum, anthurium, gladiolus, jasmine, dahlia, tuberose, gerbera, orchid and crossandra

UNIT – IV FLORAL DECORATIONS:

Flower arrangements - Practices and preparation of floral bouquets. Dry decorations – preservation of plant materials for dry decorations, design for dried arrangements – Preparation of floral rangoli and ikebana. Flower arrangements for horticulture shows.

UNIT – V ENTREPRENEURSHIP IN FLORICULTURE:

Marketing of floriculture products – methods, publicity and marketing. Schemes and supporting agencies for entrepreneurship of floriculture. Investment procurement – project formation, feasibility, legal formalities, shop act, estimation and costing, investment procedure, loan procurement, banking processes and export strategies.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Current developments related to the Floriculture during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Randhawa, G. S and Mukhopadhyaya, A. 2004. Floriculture in India. Allied Publishers
2. Pvt. Ltd., New Delhi.
3. Brain M, Flowering Bulbs for the Garden (The Royal Botanical Gardens, KEW in association with COLLINGRIDE),8th Edition, The Himalayan Publishing Group Pvt Ltd, Kew, London, 2013.
4. Chadha KL and Choudhury B, Ornamental Horticulture in India, 6th Edition, ICAR, New Delhi, India, 2014.
5. Lauria A & Ries VH. 2001. Floriculture – Fundamentals and Practices. Agrobios.
6. Prasad S & Kumar U. 2003. Commercial Floriculture. Agrobios.
7. Reddy S, Janakiram B, Balaji T, Kulkarni S & Misra RL. 2007. Hightech Floriculture. Indian Society of Ornamental Horticulture, New Delhi.
8. http://www.apeda.gov.in/apedawebsite/SubHead_Products/Floriculture.htm
9. https://agriexchange.apeda.gov.in/indexp/Product_description_32head.aspx?gcode=0101
10. https://agriexchange.apeda.gov.in/FTP/ftp2015-20E.
11. www.Anilrana13014.webbly.com.
12. https://www.zauba.com/export-INDIAN+FRESH+FLOWERS-hs-code.html.

COURSE OUTCOMES:

- Recognize the fundamentals of floriculture.
- Employ various cultivation practices for flowering plants in commercial scale.
- Practice production, preparation, and packaging of the commercially important cut flowers and flower based decorative products.
- Demonstrate quality planting material of ornamentals and flowering plants.
- Justify commercial floriculture as competent filed to start their own enterprise and turn into job creators instead of becoming job seekers.

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First Year **CORE COURSE III** **Semester II**

ANATOMY, EMBRYOLOGY AND MORPHOGENESIS

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To understand the plant anatomy and relate concepts of cell theories.
- To understand the tissue systems in plants.
- To explain development of male and female gametophyte.
- To record the physiological role of endosperm in the morphogenesis of embryo.
- To acquire importance of plant Anatomy in plant Production system.

UNIT – I ANATOMY:

Introduction, Importance of plant Anatomy, Types of cells and tissues. Meristematic tissue, origin, characters and function. classification and theories of apical meristem- (Apical cell theory, Tunica-Corpus theory, Histogen theory and Korper and Kapee theory). Development of plant body.

UNIT – II TISSUES:

Classification of permanent tissues- simple permanent tissue-Parenchyma, collenchyma, sclerenchyma, complex tissues-xylem and phloem. Origin and ontogeny of xylem and phloem, Vascular cambium-types, divisions, arrangement and seasonal activity, Factors affecting cambial activity. Leaf gap - Unilocular and Trilocular.

UNIT – III EMBRYOLOGY:

Structure of microsporangium, microsporogenesis and development of male gametophyte. Structure of ovule, Megasporogenesis and development of female gametophyte. Pollen-pistil interaction, Double fertilization - Significance, Incompatibility-interspecific, homomorphic and heteromorphic, causes and methods to overcome imcompatibility.

UNIT - IV EMBRYOLOGY:

Structure and Development of endosperm and embryo in Dicots and Monocots. Polyembryony-causes, Apomixis, Apospory and their role in plant improvement programmes. Parthenocarpy, Roll of Biochemical and physical factors in fruit and seed development.

UNIT – V MORPHOGENESIS:

Morphogenesis polarity in isolated cells, plasmodial and coenocytic expression of plants. The role of polarity in external and internal structure of plants. A developmental patterns symmetry in plants-inorganic and organic symmetries, Radial, bilateral and dorsiventral symmetries of plant body. Morphogenesis in *Acetabularia.*

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Current developments related to the Anatomy, Embryology and Morphogenesis during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Cutler, k, 1978, The Applied plant Anatomy, Orient/logman Publishers, New Delhi.
2. Easu, K, 1987, The Anatomy of seed plants, wiley Eastern Ltd,NewDelhi
3. Fahn, A,1989 plant Anatomy pergamon press,oxford,New York
4. Bhojwani, S.S. amd Bhatnagar, S.P. 2000, The embryology of Angiosperms, vikas Publishing house, Pvt,Ltd, New Delhi
5. Johri, B.N,1984, Embryology of Angiosperms, springer verlag, Berlin
6. Paula J, Rudall.2007 Anatomy of flowering plants: An Introduction to structure and development (3rd Edition) Cambridge University press.
7. https://uou.ac.in/sites/default/files/slm/BSCBO-202.pdf
8. http://www.nou.ac.in/Online%20Resourses/24-5/Msc-Part-1,Anatomy%20(1).pdf
9. http://www.vpscience.org/materials/US04CBOT22%20UNIT%20II.pdf
10. https://www.britannica.com/science/morphology-biology

COURSE OUTCOMES:

- Apply knowledge on basic Anatomy.
- Describe structure, function and roles of apical vs lateral meristem in Monocot and Dicot plant growth.
- Compare various concepts of plant development and reproduction methods.
- Demonstrate different cell types and forms of embryos.
- Understand plant embryogenesis.

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First Year **CORE COURSE IV** **Semester II**

TAXONOMY AND ECONOMIC BOTANY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To acquire the fundamental values of plant systematics.
- To list out basic concepts and principles of plant Taxonomy.
- To employ a suitable method for correct identification and adequate characterization and know the economic importance of plants
- To formulate taxonomic relationship in plant systematic studies and different classification systems.
- To acquire knowledge on economic plant producers.

UNIT – I SCOPE OF PLANT TAXONOMY:

History of plant taxonomy, Definition, Aims, importance and scope of plant taxonomy Development and phases of classification, systems of classification Artificial-Linnean system, Natural Bentham & Hooker, phylogenetic-Armen Takhtajan and APG IV system of classification. Phenetics, Cladistics, concepts of taxonomic hierarchy, Systematic evidence - Morphology, Anatomy, embryology. Numerical taxonomy, Chemotaxonomy, sero taxonomy and molecular taxonomy.

UNIT – II PLANT NOMENCLATURE:

Plant Nomenclature, Principles of ICN and new Regulations. Binomial nomenclature, Typification-Principles of priority, Author citation, Retention, Rejection and Changing of names, Effective and valid publication-Monographs, Periodicals, Flora and manuels -Plant identification. Herbarium techniques, Botanical garden, Botanical survey of India.

UNIT – III SYSTEMATIC STUDY:

Study of important taxonomical characters with suitable examples of following families- *Ranunculaceae, Caryophyllaceae, Rutaceae, Rhamnaceae, Sapindaceae, Lytheraceae, Aizoaceae, Rutaceae, Asteraceae* and *Sapotaceae.*

UNIT – IV SYSTEMATIC ANALYSIS:

Study of taxanomical and reproductive characters with suitable examples of following families-*Nyctaginaceae, Aristolochiaceae, piperaceae, Loranthaceae, Euphorbiaceae, Orchidaceae, Amaryllidaceae, commelinaceae, Palmae* and *Cyperaceae.*

UNIT – V ECONOMIC BOTANY:

Scope of Economic Botany, study of economically important plants and their products (a) Cereals and pulses (b) Fruit and Vegetables (c) Spices and Continents (d) wood timber and Lumber (e) Resins, gum, tannins, cork- (f) Rubber and other latex products (g) Textile products, Fibres- soft and Hard fibres (h) Fumitories and masticatories.

UNIT - VI CURRENT CONTOURS (For continuous internal assessment only):

Current developments related to the Taxonomy and Economic Botany during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Cole, A.J. 1969, Numerical Taxonomy Academic Press, London
2. Bhattacharya, B and Johri. Flowering plant taxonomy and phylogeny Narosa Publishing house, New Delhi
3. Vasishta, P.C., 1994 Taxonomy of Angiosperms.R.S. chand & company
4. Sharma,O.P. 1993, plant taxonomy Data Mc Grow Hill Edistion, New Delhi
5. Lawrence, G.H>M., 1969. Taxonomy of Vascular plants Oxford & IBH publsishing co, New Delhi
6. Subramaniyan, N.S.2009. Modern plant taxobnomy vikas publishing House, Pvt, lLtd New Delhi
7. Sambamurthy, A 2010 Text book, of plant taxonomy wiley Eastern Pvt Ltd& saxena, N.B. and Sabena 7th edistion pragmatic pragati Meerut.
8. Stace, C, 1985. Plant Taxonomy and biosystematics,Edward Arnold, London
9. Takhtajan,A.L. 1997 Diversity and classification of flowering plants Columbia University press,
10. Sokal R.R. and sneath, P.H.A 1963, Principles of Numerical Taxonomy Fremen & co San Francisco
11. Walter,s.Judd Christopher ,s. Campbell Elizabath A,kelog,peter,F Stevens Michael J.Donoghue,2015 plant systematics A phylogntic Approach,Sinauer, USA.
12. https://www.uou.ac.in/sites/default/files/slm/BSCBO-302.pdf
13. https://byjus.com/neet/important-notes-of-biology-for-neet-plant-taxonomy/

COURSE OUTCOMES:

- Aware of different plant systematics.
- Conclude the principles of systematics, including identification, nomenclature, classification and events of evolutionary patterns.
- To prepare taxonomical characters of medically and economically significant plant families.
- Record the evolutionary processes of the plants.
- Acquire knowledge on economic plant produces.

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First Year **CORE CHOICE COURSE II** **Semester II**

1) MUSHROOM CULTIVATION TECHNOLOGY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To study the morphology and types of Mushrooms.
- To know the spawn production technique.
- To aware the identification of edible and poisonous Mushrooms.
- To learn the prospects and scope of mushroom cultivation in small scale industry.
- To understand the Diseases. Post harvesting techniques of Mushrooms.

UNIT – I INTRODUCTION OF MUSHROOM

History and Importance of Mushroom, Indian Mushrooms: Edible and Poisonous Mushroom, Mushroom Classification: Based on occurrence, Morphology and edibility and poisonous properties.

UNIT – II CULTURE PREPARATION:

Isolation of pure culture; Nutrient media for pure culture; Cultivation of Oyster, Button mushroom - Preparation of Pure Culture and spawn cultivation methods and harvesting.

UNIT – III MUSHROOM HOUSE:

Structure and construction of Mushroom House -Layout of traditional and green house method. small scale and large scale production unit. Types of raw material – preparation and sterilization; Mushroom bed preparation – maintenance of mushroom shed.

UNIT – IV NUTRIENT VALUES OF MUSHROOM:

Mushroom cultivation, extraction, isolation, and identification of active principle to determine medicinal usefulness. Medicinal and financial benefits of mushrooms. Protein, carbohydrate, fat, fibre, vitamins and amino acids contents.

UNIT – V CULTIVATION OF MUSHROOM:

Post-harvest technology: Storage-Freezing, dry Freezing, drying, canning, quality assurance and entrepreneurship. Diseases and Pests of Mushroom.

UNIT – VI Current Contours (For continuous internal assessment only):

Current developments related to the Mushroom cultivation technology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, social media, Webinars and so on.

REFERENCES:

1. Tripathi, D.P. (2005.) Mushroom Cultivation. Oxford and IBH Publishing Co. Pvt. Ltd, New Delhi.
2. Tewan and Pankaj Kapoor S.C. 1993. Mushroom cultivation. Mittal Publication. Delhi.
3. Marimuth et al., 1991. Oyster Mushrooms. Dept. of Plant pathology, TNAU, Coimbatore. 4. Nita Bahl. 1988. Hand book of Mushrooms, 2nd Edition, Vol I & II.
4. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms Cultivation, nutritional value, medicinal effect and environmental impact. 2nd ed., CRC press.
5. Mushroom Cultivation in India- B.C.Suman and V.P.Sharma
6. Mushroom Growing for Everyone- G. RoyMushroom Production and Processing- V.N.Pathak, N.Yadav and M.Gaur
7. Suman B. C and V. P Sharma (2007). Mushroom cultivation in India. Daya Publishing House, New Delhi.
8. Kapoor, J. N. (2016) Mushroom cultivation. Indian council of Agricultural research, New Delhi.
9. http://agritech.tnau.ac.in/farm_enterprises/Farm%20enterprises_%20Mushroom.html
10. http://www.tnuniv.ac.in/report/Botany%20Education%20in%20the%2021st%20Century.pdf
11. https://agricoop.nic.in/sites/default/files/ICAR_8.pdf
12. http://nhb.gov.in/pdf/Cultivation.pdf
13. https://www.mushroomcompany.com/resources/background/attramushroom.pdf

COURSE OUTCOMES:

- Students study the morphology and types of Mushrooms.
- They are aware of the identification of edible and poisonous Mushrooms.
- Students will be able produce spawn on their own.
- Learned the prospects and scope of mushroom cultivation in small scale industry.
- Studied the technique of Mushroom cultivation.

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First Year **CORE CHOICE COURSE II** **Semester II**

2) BIOFERTILIZERS AND BIOPESTICIDES

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To understand the importance of biofertilizers and their cultivation methods.
- To learn about bacterial biofertilizers.
- To study about the types of mycorrhiza and its advantages.
- To study biopesticides production and commercialization.
- To impart the knowledge about the types of biopesticides and its advantages.

UNIT – I BIOFERTILIZERS:

Biofertilizers – Introduction, scope and advantages. A general account of Cyanobacterial biofertilizers – organisms – medium (*BG II*) isolation, mass cultivation – field application of cyanobacterial inoculants. Mass cultivation of Azolla – Symbiotic association of cyanobacteria.

UNIT – II BIOFERTILIZERS:

Bacterial biofertilizers – A general account of bacterial bioinoculants. Isolation – Azotobacter – Ashby's mannitol agar – Azospirillum – Semi solid medium (*Bullow and Dobereiner,* 1975). Rhizobium – Yeast Extract Mannitol Agar medium. Culture characteristics. Mass production of Rhizobium, Azotobacter, Azospirillum and Phosphobacteria Phosphate solubilization and mobilization. Mechanism of nitrogen fixation (free-living and symbiotic).

UNIT - III BIOFERTILIZERS:

Mycorrhiza: Scope and advantages of mycorrhiza as biofertilizers. General account of Ecto, Endo and Arbuscular mycorrhizae (AM). Methods of collection wet sieving and decanting method and inoculum production. Culture of mycorrhizae in Modified Melin – Norkrans (MMN) agar medium. National and Regional Biofertilizers Production and Development centres.

UNIT – IV BIOPESTICIDES:

Biopesticides - Definition, types and importance. Plants used as biopesticides – compounds – natural biopesticides – organic farming. Advantages of biopesticides and commercialization.

UNIT - V BIOPESTICIDES:

Mechanism of action and application of biopesticides – bacterial origin (*Bacillus thuringiensis*) – fungal origin (*Trichoderma*) – viral origin (*NPV*).

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Biofertilizer and Biopesticides during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Dubey, R.C. (2008). A Textbook of Biotechnology. S. Chand & Co., New Delhi.
2. Subba Rao, N.S. (1982). Advances in Agricultural Microbiology. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
3. Subba Rao, N.S. (2002). Soil Microbiology. 4th ed. Soil Micro organisms and Plant Growth. Oxford & IBH Publishing Co. Pvt. Ltd., New Delhi.
4. Varma, A. and Hock, B. (1995). Mycorrhiza Springer – Varlag, Berlin.
5. Varma, A., B. (1995). Mycorrhiza Springer – Varlag, Berlin.
6. Yaaco Vokan (1994). Azospirillum / Plant Associations. CRC Press, Boca Raton, FL.
7. Joshi, S.R. (2018). Biopesticides: A Biotechnological Approach. New Age International (P) Ltd., Publishers.
8. Koul, O. and Dhaliwal, G.S. 2012. Biopesticides and Pest Management. Cumpus Books International.
9. http://kamarajcollege.ac.in/Department/Microbiology/II%20Year/005%20Allied%20III%20%20Plant%20Pathology,%20Biofertilizers%20and%20Biopesticides%20-%20III%20Sem.pdf
10. https://courseware.cutm.ac.in/wp-content/uploads/2020/06/Lec-11-Biofertilizer-and-biopesticide.pdf
11. https://www.agrifs.ir/sites/default/files/Handbook%20of%20Biofertilizers%20and%20Biopesticides%20%7BR.M.%20Khobragade%7D%20%5B9788189473150%5D%20%28ABD%20Publishers%20-%202007%29.pdf
12. http://eagri.org/eagri50/SSAC222/lec17.pdf
13. https://eternaluniversity.edu.in/docs/ProductionTechnologyforBioagentsandBiofertilizers.pdf

COURSE OUTCOMES:

- Acquire knowledge on biofertilizers and mass cultivation of different bio fertilizers.
- Gain a knowledge about types of mycorrhizae and its advantages.
- Create awareness on the ill effects of chemical fertilizers and biofertilizers for sustainable agriculture
- Emphasize the applications of biocontrol techniques to control pests
- Protect the plants, enrich the soil increased the yield of crops and protect the health of mankind from the toxic effects of chemical fertilizers

First Year **CORE PRACTICAL II** **Semester II**

ANATOMY, EMBRYOLOGY AND MORPHOGENESIS & TAXONOMY AND ECONOMIC BOTANY

Code: **(Practical)** **Credit: 3**

COURSE OBJECTIVES:

- To identify the role of anatomy in solving taxonomic and phylogenetic problems.
- To understand the shoot structure and functional development aspects of various tissue systems and organs in plants.
- To acquire knowledge on morphogenesis and organogenesis in plants
- To gain a knowledge on anatomical structure of monocot and dicot plants.
- To study about the economic botany of plant families.

ANATOMY:

1. Cell types and tissues – Dissection of shoot apices in aquatic plants such as Hydrilla and vallisneria
2. Primary structure of stem (*Tridax, zea mays*) root (*Acalypha, Sorghum*) and leaf of Dicot (Tridax), Monocot (cypreus)
3. Study of stomatal types through peel method in dicot and monocot leaf.
4. Anamalous secondary growth in *Aristolochia, Bignonia, Nyctanthes and Draceana.*
5. Nodal anatomy of dicot stem to find out unilocunar and multilocunar nodes.
6. Wood structure – TLS and RLS

EMBRYOLOGY:

1. Study of microsporogenesis through sections of anther study of pollen germination.
2. Observation of anther L.S and female gametophyte
3. Dissection of embryo from *Tridax*
4. Dissection of Endosperm haustoria – *Cassia Cucumis*
5. Study the types of Endosperm

MORPHOGENESIS:

1. Study of Morphology and anatomy of fungal gall (Club root of cabbage)
2. Study of insect gall in *Pongamia* leaf.

TAXONOMY AND ECONOMIC BOTANY:

1. To study the diagnostic features, flower characters and economic importance of following families:
2. Polypetalae: *Ranunculaceae, Caryophyllaceae, Rutaceae, Rhamnaceae, Sapindaceae, Lytheraceae* and *Aizoaceae*
3. Gamopetalae: *Rubiaceae, Asteraceae, sapotaceae, Apocynaceae* and *Asclepidaceae*

4. Monochlamydae: *Nyctaginaceae, Aristolochiaceae, Piperaceae, Loranthaceae* and *Euphorbiaceae.*
5. Monocotyledons: *Orchidaceae, Amaryllidaceae, commelinaceae, Palmae* and *Cyperaceae*.
6. Preparation of artificial key for any five families in the syllabus.
7. Submission of thirty herbarium specimen with binomial family and field note book along with tour report.
8. Tour and field study of botanical gardens research institution and natural vegetation under the guidance of staff for three to five days with in state.

REFERENCES:

1. Heywood, V.H. Plant Taxonomy. English Language Book Society, London, 1967.
2. Sambamurty, A.V.S.S. Taxonomy of Angiosperms. I.K. International Pvt. Ltd., New Delhi, 2005.
3. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver & Boyd, London
4. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
5. Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
6. Esau. K.(1980) : Plant Anatomy, (2nd Edition) Wiley Eastern Ltd., New Delhi.
7. https://www.uou.ac.in/sites/default/files/slm/BSCBO-202.pdf

COURSE OUTCOMES:

- Gain a knowledge on anatomical structure of cell types and tissues.
- Understand the primary and secondary growth of plants.
- Acquire knowledge on types of endosperm.
- Observe the structure of female gametophyte.
- Know the taxonomy and economic botany.

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First Year **ELECTIVE COURSE II** **Semester II**

1) FOOD TECHNOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To Relate the process in food microbiology.
- To recall the preservation strategies, various traditional and advanced systems of food preservation.
- To comply role of microbes in food poisoning.
- To list the applications of food additives and its functions.
- To state the effects of food adulterants and food hygiene laws and standards.

UNIT – I FOOD MICROBIOLOGY:

Introduction – Scope and microorganisms in food. Food preservation – Principles and methods – perishable, semi-perishable and non-perishable foods. Methods of preservation – Temporary preservation – asepsis, temperature, pasteurization, electromagnetic radiation – Permanent preservation – sterilization, processing by heat, effect of acidification and antiseptics.

UNIT – II PRESERVATION:

Preservation by chemicals – Benzoic acid, parabenzene, sulphur dioxide, sulphites, nitrites, diethylpyrocarbonates (DEPC), hydrogen peroxide – chlorine and CO2. Preservation by antibiotics and irradiation.

UNIT – III PRESERVATION:

Preservation by salting and sugar syrup – Preparation of Jam, Jelly - Role of pectin in jam – Processing of fruits and fruit products – canning of fruits – preparation of fruit juices – squashes – cordials and millet cookies

UNIT – IV FOOD FERMENTATION:

Food fermentation – canning of vegetable products – pickles, sauerkraut. Baked products – bread, Milk products – butter, ghee, lassi, cheese, condensed milk and milk powder. Alcoholic beverages – beer, wine and vinegar.

UNIT – V FOOD ADDITIVES:

Definition, preservatives, antioxidants – coloring agents, emulsifier, stabilizers and thickening, bleaching and maturing agents; clarifying agents, anti-foaming agents. Food adulteration – adulterants and simple detection techniques – Food hygiene – laws and standards (FAO, FSSI).

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to Food technology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through

multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Adams, M.R. and Moss, M.O. (1996). Food Microbiology. New Age International Pvt. Ltd. Publishers, New Delhi.
2. Frazier, W.C. and Westhoff, D.C. (1998). Food Microbiology. 3rd ed. Tata McGraw Hill Publishing Co. Ltd., New Delhi.
3. Giridharilal, Siddappa, G.S. and Tandon, G.L. (1990). Preservation of Fruits and Vegetables, VFTRI, Mysore.
4. Lal, B., Giridharilal, Siddappa, G.S. and Tandon, G.L. (1967). Preservation of Fruits and Vegetables, ICAR Publication, New Delhi.
5. Manorajan Kalia and Sangita Sood. (1992). Food Preservation and Processing. Department of Food Science and Nutrition, College of Home Science, Himachal Pradesh Agricultural University, Palampur.
6. Ranganna, S. (1986). Handbook of Analysis and Quality Control for Fruit, Vegetable Products, CFTRI, Mysore.
7. Vijaya Ramesh, K. (2007). Food Microbiology. MJP Publishers.
8. https://discoverfoodtech.com/food-technology-ebooks/
9. https://ncert.nic.in/textbook/pdf/lehe105.pdf
10. http://ekatmik.balbharati.in/pdfs/1203010496.pdf

COURSE OUTCOMES:

- Acquire knowledge on microbes and their role in processing of plant products in food technology.
- Knowledge on chemical and physical preservatives.
- Formulating preservation techniques on food products for long term storage and consumption.
- Organize edible plant products for commercialization.
- Collect knowledge on food additives, adulterants and lawns and standards.

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First Year **ELECTIVE COURSE II** **Semester II**

2) GREEN HOUSE TECHNOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

To enable the students to

- Acquire knowledge on construction, design and maintenance of a greenhouse.
- Appreciate the nature of soil required, methods of irrigation and plant propagation.
- To evaluate plant nutritional requirement and irrigation methods.
- Learn the techniques pest and disease management.
- To collect knowledge on greenhouse maintenance and safety practices.

UNIT – I FUNDAMENTALS OF GREENHOUSE TECHNOLOGY:

Importance, scope and status of greenhouse. Structure and construction of Greenhouse - location, frame work for various types of green house, covering material, construction of typical glasshouse/poly house/ net house, Construction of floors and layout, Design and development of low cost greenhouse structures. Automated greenhouses, microcontrollers, waste water recycling. Heating: Sources of heat, Cooling: Types of cooling, Environmental control: air temperature, sunlight, carbon dioxide, relative humidity.

UNIT – II GREENHOUSE ROOT MEDIUM:

Properties of root medium for greenhouse and media handling. Media components – peat, bark, sawdust, coir, crop by product, composted garbage, perlite, vermiculite, sand, rock wool and polystyrene foam. Water quality and sanitation – Advanced protected agricultural systems and plastic mulches. Properties of root medium for greenhouse, Media handling, FYM, concentrated organic manures, macro and micronutrient availability.

UNIT – III PLANT NUTRITION FOR GREEN HOUSES:

Plant nutrition: Fertilizers – chemical and organic; Choice of nitrogen fertilizers and time of application; Water quality and sanitation, Methods of irrigation - drip irrigation, micro irrigation; Fertigation, Advanced protected agricultural systems - plastic mulches.

UNIT – IV PEST AND DISEASE MANAGEMENTS:

Identification and control measures of Bacterial, fungal, nematodes and viral diseases in greenhouse plants. Management of pest and diseases – physical, chemical, biological, Integrated Pest Management (IPM).

UNIT – V HEALTH AND SAFETY:

Maintenance of erected structure, operational elements of green house for periodic checking, tightening, greasing. Understanding basic safety checks,

Operation of all vehicles and hazards, renders appropriate emergency procedures. Environmental control: air temperature, sunlight, carbon dioxide, relative humidity.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Green house Technology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Prasad S, Kumar U. Green House Management for Horticultural Crops. Agrobios India, 2012.
2. Pant V, Nelson. Green House Operation and Management. Bali Publication
3. Gupta P K Manures and soil fertilizers.
4. George Acquaah. Horticulture, Principles and Practices. Eastern Economy Edition.
5. Alex Lauric and Victor h Ries. Floriculture, Fundamentals and Practices. Agrobios, India.
6. http://www.agrimoon.com/wpcontent/uploads/Introduction-tosoil-science.pdf
7. http://scialert.net/fulltext/?doi= ijar.2006.364.372&org=10
8. http://www.lindegas.com/en/products_and_supply/fumigants/carbon_dioxide_in_agriculture/greenhouse_applications/index.html

COURSE OUTCOMES:

At the end of the course, students will be able to

- Acquire knowledge on design, construct and maintain a greenhouse.
- Aware of rooting medium and water quality.
- Employ proper nutritional and irrigation techniques for greenhouse cultivation.
- Solve problems related to horticultural diseases, nutrition and post-harvest management of greenhouse plants.
- Aware of healthy and safety issues and checks in greenhouse management.

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First Year **NON-MAJOR ELECTIVE COURSE I** **Semester II**

HORTICULTURE

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To list various aspects of horticulture
- To develop skills in horticultural practices and techniques
- To measure cultivation practices of Horticultural crops
- To construct Ornamental garden, orchard and kitchen garden
- To operate the techniques of lawn making, hedges and edges forming.

UNIT – I SCOPE OF HORITICULTURE:

Introduction, Importance and scope of Horticulture, Divisions of Horticulture, plant propagation methods- cutting (Stem, leaf and root) layering (simple, air layering) Grafting (Approach, cleft and Bud grafting) Stock scion relationship, preparation of pot mixture.

UNIT – II GARDENING:

Type and importance of Gardening-Indoor gardens-kitchen garden, potted plants, Terrarium and Hanging Baskets. Outdoor garden-Public Garden, Hedges, Rockery Topiary, edges, and water garden components of garden- Lawn making, paths, shrubs, climbers, creepers, flower beds and borders.

UNIT – III MANURING:

Manuring types-time and application of manures, Fertilizers and plant regulators-Foilor application of Nutrients, Drip irrigation. Advantages and dis-advantages of important type of fertilizes used in Horticulture crops.

UNIT – IV ORCHARDS:

Planning and layout of orchards –Training and pruning practices-Cultivation methods, soil management, irrigation, cultivation of vegetables –Brinjal, tomato and onion. Cultivation of fruits-Preparation of field, Irrigation methods of banana, Mango and Cashew nut.

UNIT – V FLORICULTURE:

Cultivation method of flower, Chrysanthemum, rose and Jasmine. Making a Cutflower- *Ikebana* Bonsai, Hydrophonics and Aerophonics. Cultivation of medicinal plants-Nilavaembu, Sarpagandha and Catheranthes. Importance of organic cultivation methods in green house and Glass house.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Horticulture during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through

multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Chandha, K.L. 2003 Hand book of horticulture,ICAR, New Delhi.
2. Edmond et al:1987 Fundamentals of Horticulture, Tata MC Graw Hill publishing co: Mumbai
3. Kumar. N 1986, Indrotuction to Horticulture, Rohni Agencies Nagarcoil
4. Kunte,kawthalkar and yawalker,1997.Principles of Horicultural crops and Fruit Growing Agri Horticulture & co
5. Sharma, R.R 2005 propagation of Horticultural crops, Kalyani publisher
6. Adams, C., Early and J. Brrok (2011). Principles of Horticulture. Routledge, U.K.
7. George Acquiah,2004, Horticulture principles and practices IInd Edistion prentice Hall India.
8. Sheela, V. L (2011). Horticulture. MJP Publication, Chennai.
9. https://www.iaritoppers.com/p/horticulture-icar-ecourse-pdf-books.html
10. https://ncert.nic.in/textbook/pdf/ievs101.pdf
11. https://cbseacademic.nic.in/web_material/publication/cbse/24BasicHorticulture-I-XI.pdf
12. https://farmer.gov.in/dacdivision/Machinery1/chap9.pdf

COURSE OUTCOMES:

- State the aesthetic value and the importance of Horticulture.
- List out the components of horticulture.
- Demonstrate the maintenance of Horticulture.
- Understand the planning of layout of orchards.
- Knowledge on culture practice and management of flowering plants.

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Second Year **CORE COURSE V** **Semester III**

CELL AND MOLECULAR BIOLOGY, GENETICS AND PLANT BREEDING

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To describe the structure, organization, function, inter relationships of cell organelles and communication systems
- To relate the molecular concepts in plants.
- To restate the molecular mechanism of gene regulation and gene expression.
- To discuss the Mendelian concepts in plant genetics.
- To acquire knowledge on Plant breeding techniques.

UNIT – I CELL BIOLOGY:

General account of prokaryotic and eukaryotic cells, Cell wall, plasma membrane, ultra structure, chemistry and functions of mitochondria, chloroplast, ribosomes, endoplasmic reticulum, nucleus, Chromosomes – types, fine structure of the eukaryotic chromosome, cell reproduction, events of eukaryotic cell cycle, mitosis and meiosis, mitotic inducers and inhibitors.

UNIT – II MOLECULAR BIOLOGY:

Cell signaling – hormones and their receptors, cell surface receptors, signaling through G-protein coupled receptors and second messengers, signal transduction pathways, light signaling in plants. - DNA replication: methods of replication, enzymes involved, fidelity of replication, extra-chromosomal replicons. DNA damage and repair mechanisms.

UNIT – III MOLECULAR BIOLOGY:

RNA synthesis and processing -Transcription mechanism – factors, transcription activator and repressor, RNA polymerases, RNA editing, splicing and polyadenylation. Transcription inhibitors, post-transcriptional modification of gene. Protein synthesis and processing – initiation, elongation and their factors, termination, amino acylation of tRNA, translational inhibitors, post-translational modification of proteins. Gene regulation – Operon concept – Trp and Ara operon.

UNIT - IV GENETICS:

Mendelian principles (brief study). Non-Mendelian inheritance: cytoplasmic inheritance - Sex determination in plants. Linkage and Crossing over - Stern's hypothesis, Creighton and McClintock's experiments, single cross over, multiple cross over, two-point cross, three-point cross, Linkage map construction. Tetrad analysis (*Neurospora*) Gene pool, allele and genotype frequency. Hardy-Weinberg law and its applications, estimation of allele and genotype frequency of dominant genes, co dominant genes, sex-linked genes and multiple alleles. Genetic equilibrium, genetic polymorphism.

UNIT - V PLANT BREEDING:

Objectives of Plant breeding, plant introduction – history, agencies, procedure, germplasm collection – Selection: mass, pureline and clonal selection. Heterosis and inbreeding depression. Hybridization techniques, role of polyploids in plant breeding, Special breeding techniques – mutation breeding, breeding for abiotic and biotic stresses, Plant breeder's rights and regulations for plant variety protection and farmer rights.

UNIT - VI: CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Cell & Molecular biology, Genetics and plant breeding during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over

the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Ajay Paul (2007). *Text book of Cell and Molecular biology.* Books and Allied (P) Ltd.,Kolkata.
2. Allard, R.W. (1995). *Principles of Plant Breeding*. John Wiley and Sons, Inc., India.
3. Singh, B.D. (1996). *Plant Breeding: Principles and methods*. Kalyani Publications, Chennai.
4. Bruce Alberts, Alexander Johnson, Julian Lewis, Martin Raff, Keith Roberts, Peter Walter (2002). *Molecular biology of the cell* (IV Edn). Garland Science, Taylor and Francis group, New York.
5. Gardner, E.J., Simmons, M.J. and Snustad, D.P. (1991). *Principles of Genetics* (III Edn). John Wiley and Sons Inc., India.
6. Gerald Karp (2008). *Cell and Molecular biology: Concepts and experiments* (V Edn). John Wiley & Sons, India.
7. Ghahal, G.S. and Gosal, S.S. (2002). *Principles and procedures of Plant Breeding*. Narosa Publishing House, New Delhi.
8. Ringo, J. (2004). *Fundamental Genetics*. Cambridge University Press, United Kingdom.
9. Robert J Brooker (2009). *Genetics: Analysis and principles* (III Edn). McGraw Hill, NewDelhi.
10. Sharma, J.R. (1994). *Principles and practices of Plant Breeding*. Tata McGraw-Hill Publishers Company Ltd., New Delhi.
11. Singh, B.D. (1996). *Plant Breeding: Principles and methods*. Kalyani Publications, Chennai.
12. Snustad, D.P. and Simmons M.J. (2010). *Principles of genetics* (V Edn). John Wiley andSons, India.
13. Strickberger (2005). *Genetics* (III Edn). Prentice Hall of India Pvt. Ltd., New Jersey.
14. Elrod Susan, L. (2010), Genetics (4th Ed.), Tata McGraw Hill, New Delhi.
15. Sheeler, P and Blanchi, D.E. (2002), Cell and Molecular Biology, John Wiley and Sons,Singapore.
16. Lodish, et. al. (2004), Molecular Cell Biology, COH freeman & Co, New York.
17. Animations: https://www.videezy.com/free-video/genetics
18. LectureNotes:https://www.mysciencework.com/publication/download/lecture-notes- cellbiology
19. Plant Breeding; https://www.youtube.com/watch?v=1WuwwYcDHMg
20. PPT slides: https://www.slideshare.net/earshadshinichi/cell-biology-the-cell-its-structure-andhistory
21. Video lecture: https://www.youtube.com/watch?v=OIN4keY8q3k
22. http://www.cellmolbiol.org
23. https://en.wikipedia.org/wiki/Genetic_linkage
24. https://www.khanacademy.org/.../a/linkage-mapping
25. https://www.plantbreeding.org/content/online.

COURSE OUTCOMES:

On the completion of this paper, students will be able to:

- Apply knowledge on various organelles present in the plant cell
- Acquire knowledge on inheritance of characters and structure of genetic material

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Second Year **CORE COURSE VI** **Semester III**

PLANT PHYSIOLOGY,

BIOCHEMISTRY AND BIOPHYSICS

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To name the physiological pathway involved in plant nutrition.
- To describe the metabolic phenomenon involved in plant growth hormones.
- To explain structure and classification of biomolecules synthesized in plants.
- To examine enzymatic reactions in plant kinetics.
- To recall the concepts of thermodynamics involved in plant biology.

UNIT – I LANT PHYSIOLOGY:

Introduction to Plant Physiology, – Water Relations – Water Transport Processes – Diffusion, Osmosis, Water Potential – Transpiration and its Significance, Mechanism of stomatal movement. Mineral Nutrition: Nutrient Uptake and Transport Mechanism. Photosynthesis: Photosynthetic Apparatus, Photochemical reactions, Electron Transport Pathway, Photophosphorylation.C3 cycle and C4 Pathway–Crassulcean Acid Metabolism, HMP, Photorespiration and dark respiration.

UNIT – II PLANT PHYSIOLOGY:

Plant Physiology Respiration Glycolysis, TCA Cycle, Electron Transport in Mitochondria, oxidative Phosphyorylation –ATP bioenergetics Cyanide Resistance Respiration. Nitrogen Metabolism: Biological Nitrogen Fixation, Reduction of N2 to Ammonia Nif Genes, Nitrate and Ammonium Assimilation. Growth and Development: Physiological Role and Mechanism of Action of Plant Growth Regulators: auxins, Cytokinins, Gibberellins Abscissic Acid and Ethylene. Physiology of Flowering- Photoperiodism and Vernalization. Seed Dormancy and Seed Germination, Senescene and Fruit Ripening.

UNIT – III BIOCHEMISTRY:

Classification of carbohydrates, Amino Acids and Proteins: Structure, Characteristics and Classification of Amino Acids – protein and Non Protein Amino Acid Biosynthesis, Primary, Secondary, Tertiary and Quaternary Structure of proteins, Classification and Biosynthesis of lipids, Fatty Acids and nucleic acids, Oxidation of Fatty Acids, Nucleic Acids.

UNIT – IV BIOCHEMISTRY:]

Enzymes - General aspects (Classification, Nomenclature and Structure) Enzymatic, Catalysis Michaells Menton Equation and its Significance Kinetics Regulatory mechanisms, Isoenzymes.

UNIT – V BIOPHYSICS:

Thermodynamics, Laws- Redox Potential – Redox coupling, energy transductions in biological systems, Bioenergetics – ATP, Entrophy and Enthalpy Photo Biology: Dual Nature of Light, Characteristics of solar Radiation, Solar Energy, Efficiency of Atoms, Absorption Spectra in Molecules – Energy states and Deexcitation.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Plant physiology, Biochemistry and Biophysics during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

PLANT PHYSIOLOGY

1. Jain V.K. (1990) Plant Physiology S. Chand & Co New Delhi –edition ar H.D. and Singh H.N. (1990 Plant metabolism)
2. Fang F.K. (1982) Light Reaction path of Photosynthesis Vol. 35 molecular biology, Biochemistry and Biophysics – Springer.
3. Malik C.P. and Srinivastra (1995) Plant Physiology
4. Verma S.K. (1999) Plant Physiology S. Chand & Co, New Delhi
5. Palner J.J. (ed) 1984 the physiology and biochemistry of Plant respiration – Cambridge University Press, U.K.
6. Delvin R.M. (1969) Plant Physiology Holt, Rinechart & Winston & Affiliated east west Press (P) Ltd New Delhi
7. S. Salisbury F.B & C.W. Ross (1999) Plant Physiology CBS Publishers & Printers, New Delhi.

BIOCHEMISTRY

8. Lehninger A.L. (1985) Biochemistry Worth Publishers
9. Freifelder D (1985) Essentials of Modern biochemistry – Jones & Bariet.
10. Breet. C.T. and Hillman, J.R. (1985) Biochemistry of plant cell walls - Cambridge University Presses U.K. Bio Physics

BIO PHYSICS

11. Lchinager A.I (1971) Bioenergetics The Molecular basis Biological Energy Transformation – Addition wiley.
12. Casey E.J(1962) Biophysics – Concepts and mechanism – Van Nonstmd reinfold Co & East – West press, New Delhi
13. Daniel M. and Peter R.C (1989) basic biophysics – Agro Botanical Publishers (India)
14. http://www.esalq.usp.br/lepse/imgs/conteudo_thumb/Handbook-of-Plant---Crop-Physiology-Revised---Expanded-by-Mohammad-Pessarakli--2001-.pdf
15. https://www.jstor.org/stable/i40135622
16. https://ses.library.usyd.edu.au/bitstream/handle/2123/3578/Agriculture_2008.pdf?sequence=1&isAllowed=y
17. https://bookauthority.org/books/best-biophysics-books

COURSE OUTCOMES:

On the successful completion of the course students will be able to:

- Understand various process of plant transport mechanism and metabolic reaction.
- Revise the pathway of light and dark reaction process in plant physiology.
- Illustrating the classification on biomolecules.
- Restate the role of enzymes in plant metabolism and energy synthesize phenomenon.
- Acquire knowledge on thermodynamics related to plant physiology.

Second Year **CORE CHOICE COURSE III** **Semester III**

1. BIOINFORMATICS AND BIONANOTECHNOLOGY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To describe basics of bioinformatics.
- To state significance on protein and nucleic acid databases
- To analyze technically on protein modelling and sequencing.
- To design new tools, such as peptides nanosheets for medical and biological purposes
- To restate research in the cutting-edge areas of bio nanotechnology to foster biotechnological innovations.

UNIT – I BIOINFORMATICS:

Introduction of Bioinformatics – Definition- scope of Bioinformatics – Computational Biology and Bioinformatics – Sequence of software in Bioinformatics – Bioinformatics and the internet – World Wide Web – internet protocols – internet browser – search engines – applications of internet – pharmacoinformatics.

UNIT – II BIOINFORMATICS:

Types of databases – nucleotide sequence databases – GenBank, EMBL and DDBJ, Protein sequence databases – SWISSPROT and TrEMBL – Secondary databases – PROSITE, PRINTS and BLOCKS. Protein structure databases – PDB, CATH and CSD – Literature databases –PubMed and Scopus – Databases and analysis tools - BLAST and FASTA.

UNIT – III BIOINFORMATICS:

Protein structure prediction – secondary structure prediction (Chou Fasman method), tertiary structure prediction (comparative modeling, Ab initio prediction, homology modeling) – Introduction to sequence analysis – global and local alignment, pairwise analysis, multiple sequence alignment – Phylogenetic tree – cladogram and phylogram.

UNIT – IV BIONANOTECHNOLOGY:

Bionanotechnology -Introduction and historical background - Nanoscience and Nanotechnology- Nanostructures in nature, Carbon Nanostructures - Green synthesis of Nanoparticles – Characterization of nanoparticles – Cell as nanobio machine – concepts in nanobio-machines for information processing and communications.

UNIT – V BIONANOTECHNOLOGY:

Overview and concept of microbial nano-particle production - Application of Nanotechnology: Biomedical Applications– DNA based Nanomaterials as biosensors – nanomaterials for drug delivery- drug discovery, diagnosis, DNA microarray. Nanomaterials in food, fabric industries and nanomaterial for environment.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Bioinformatics and Bionanotechnology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Prakash S. Lohar, (2009). Bioinformatics. MJP Publisher.
2. Zhumur Ghosh and Bibekanand Mallick (2005). Bioinformatics: Principle andapplications, Oxford University press.
3. Shanmugam, S. (2011). Nanotechnology. MJP Publishers.
4. Curran, B.G., R.J. Walker and S.C. Bhatia, (2010). Bioinformatics. CBS Publishers &Distributors Pvt. Ltd. New Delhi.
5. Ignacimuthu, S., (2006). Basics of Bioinformatics. Narosa Publishing house, New Delhi.
6. Shah, M.A. and Toker Ahmad, (2010). Principles of nanoscience and nanotechnology.Narosa Publishing house.
7. Subbiah Balaji (2010). Nanobiotechnology. MJP Publishers.
8. Richard Booker and Earl Boysen, (2005). Nanotechnology. Wiley India Pvt., Ltd.
9. Charles P. Poole Jr., and Frank J. Owens., (2006). Introduction to nanotechnology. JohnWiley & Sons (Asia). Pvt. Ltd.
10. Christof. M. Nieneyer (Ed.), Chad A. Mirkin (Ed), 2004, Nanobiotechnology: concepts,applications and perspectives, Wiley Publishers.
11. https://www.classcentral.com/course/swayam-bioinformatics-algorithms-and- applications10031
12. https://nptel.ac.in/courses/102/106/102106065/
13. https://www.slideshare.net/sardar1109/bioinformatics-lecture-notes 2 PPT Slides:
14. https://www.slideshare.net/Hamidicup/bioinformatics-lecture-1

COURSE OUTCOMES:

On the completion of this paper, students will be able to:

- Value basics of bioinformatics applications.
- Inventory on wide resource of databases, sources and its applications.
- Assess protein modelling in view of advanced applications in therapeutic and biotechnological advancement.
- Recognize the application of bioinformatics in nanoscience.
- Knowledge and production of DNA based nanomaterials.

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Second Year **CORE CHOICE COURSE III** **Semester III**

2. FERMENTATION TECHNOLOGY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To list out the knowledge on various types of fermenter.
- The apply fermentation process to manipulate microbes for improvement.
- To understand the function of fermenter in different cell culture techniques.
- To learn and control the functional process of bioreactor.
- To learn the basic aspects of bioinformatics in fermentation technology.

UNIT – I FERMENTATION:

Major types of organisms used in fermentation. Microbial growth kinetics, Batch culture, Continuous culture, Fed-Batch-Types, applications, fermentation kinetics.

UNIT – II CULTURE OF MICROBES:

Isolation, preservation and improvement of industrially important microorganisms, media for industrial fermentations – media formulations, development of inoculum for industrial fermentations.

UNIT – III FERMENTERS:

Fermenter design and types – basic functions of a fermenter for microbial and animal cell culture- alternative vessel design, common measurements and control systems. Sensors – solutions to common problems in fermentation, anaerobic fermentation.

UNIT – IV DESIGN OF FERMENTERS:

Control of fermentation requirements for control, design of a fermentation control systems, sensors and controllers, control of incubation, aeration and agitation**.**

UNIT – V MONITORING FERMENTATION:

Computers in fermentation, modelling, software sensors, control and supervision of fermentation processes. – off – line / online measurements – PID.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Fermentation Technology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Emt. el-mansi & CFA. Bryce Fermentation Microbiology & Biotechnology, Taylor & Francis Ltd. (2004).
2. Stanbury, P. F., A. Whitaker & S. J. Hall. Principles of fermentation technology Oxford Press.
3. https://biokamikazi.files.wordpress.com/2013/09/principles_of_fermentation_technology-stanburry_whittaker.pdf
4. https://www.himpub.com/documents/Chapter941.pdf
5. https://vulms.vu.edu.pk/Courses/BT603/Downloads/Principles%20of%20Fermentation%20Technology%20by%20Stanbury,%20Whitaker%20and%20Hall%20(3rd%20Ed.pdf
6. https://vidyamandira.ac.in/pdfs/e_learning/ds_microbio/FERMENTATION%20MEDIA,%20FERMENTATION%20PROCESS%20AND%20DOWNSTREAM%20PROCESSING%20%20BCBA%20P7%20T.pdf

COURSE OUTCOMES:

- Appraising knowledge in fermentation technology is achieved.
- Recognize culture techniques of different industrially important microorganism.
- The course states the appropriate fermentation parameters to be followed at industrial scale.
- Manage to control and operate fermenter.
- Operation of fermenter and its control through online and off line system m will be explored.

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Second Year **CORE PRACTICAL III** **Semester III**

CELL & MOLECULAR BIOLOGY AND GENETICS AND PLANT BREEDING & PLANT PHYSIOLOGY, BIOCHEMISTRY AND BIOPHYSICS

Code: **(Practical)** **Credit: 3**

COURSE OBJECTIVES:

- To understand the structure of the plant cell.
- To gain a knowledge on process of the cell cycle.
- To get training in the hybridization techniques.
- To understand the basic practical concepts and techniques of Genetics and Plant breeding.
- To understand various concepts involved in Biochemistry and Biophysics.

CELL & MOLECULAR BIOLOGY AND GENETICS & PLANT BREEDING:

1. Karyotype of Monocot and Dicot (Mitosis)
2. Genetic Cross Analysis (Mono and Dihybrid)
3. Isolation of Plant Genomic DNA And RNA
4. Analysis of Nuclear DNA By Agarose Gel Electrophoresis
5. Workout Problems Related to Linkage, Crossing Over and Gene Mapping, Human Pedigree Analysis.
6. Workout Problems in Population Genetics - Gene and Genotype Frequency, Hardy Weinberg Equilibrium.
7. Hybridization Techniques in Self and Cross Pollinated Plants
8. Visit A Plant Breeding Station to Familiarize With Breeding Programmes. Submit A Report of The Visit.

PLANT PHYSIOLOGY

1. Determination of Water Potential in Different Tissues.
2. Determination of Chlorophyll A, Chlorophyll B, and Total Chlorophyll by the Arnon's Method. Determination of Carotenoids
3. Estimation of Protein By Lowry's Method
4. Estimation of Total Phenols
5. Hill Reaction – Demonstration

BIOCHEMISTRY

1. Extraction And Estimation of Lipid
2. Determination of Reducing Sugars in (Grapes) Fruit
3. Estimation of Amino Acids By Ninhydrin
4. Separation and Identification of Amino Acids by Chromatography
5. Separation of Dyes By Paper / TLC Methods
6. Extraction of Amylase and Determination of Its Activity
7. Determination of Km Value, V-Max Michael's Constant For Amylase
8. Determination of Peroxidase Activity

BIOPHYSICS

1. Principle And Methodology of Ph Meter, Spectrophotometer, Centrifuge, Electrophoretic Apparatus, Permanent Slide Preparation

REFERENCES:

1. Gerald Karp. 2002 Cell and Molecular Biology, John Wiley & Sons, New York.
2. Gupta, P.K. 2004. Cell and Molecular Biology. Rastogi Publications. Third Edition.
3. Vijendra Das L.D. 2006. Genetics and Plant Breeding, New Age International, New Delhi 288 pages.
4. Herbert Kendall Hayes. 2007. Methods of Plant Breeding, Kosta press, USA , 448 pages.
5. Sharma, J.R. 1994. Principles and Practices of Plant Breeding. Tata McGraw Hill Publishing Co.Ltd., New Delhi.
6. Lea,P.U. and Leegood,R.C. 2001. Plant Biochemistry and Molecular Biology. John Wiley and Sons, New York.
7. Daniel,M. 1989. Basic Biophysics for Biologists. Agro-Botanical Publishers, Bikaner.

COURSE OUTCOMES:

- Knowledge of the basic structures and cell biology-related mechanisms in on eukaryote cell.
- Explain about hybridization techniques.
- Understand the basic practical concepts and techniques of Genetics and Plant breeding.
- Gain a knowledge on various concepts involved in Biochemistry and Biophysics.
- Acquire knowledge on Isolation of Plant Genomic DNA And RNA.

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Second Year **ELECTIVE COURSE III** **Semester III**

1. SEED TECHNOLOGY

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To study seed structure development and dispersal.
- To learn the techniques of seed production and processing.
- To know about seed vigour and factors affecting germination.
- To understand seed testing and seed certification.
- To acquire knowledge on hybrid seed production techniques.

UNIT – I SEED DEVELOPMENT & MORPHOLOGY:

Seed development (sporogenesis, fertilization, embryogenesis & seed formation) in a typical dicot and monocot crop. Endosperm types and functions, cotyledons - Seed coat structure, permeability, seed dormancy and factors causing dormancy of seeds - Seed dispersal strategies, types of seeds; economic importance of seeds.

UNIT – II SEED PRODUCTION AND PROCESSING:

Seed as basic input in agriculture; importance of genetic purity in seed production; seed production in self and cross pollinated crops; methods of hybrid seed development; custom seed production in India- Seed processing: Introduction and importance; Equipment's used for seed cleaning, drying, grading, destoning & gravity separating. Seed treatments (physical and chemical), benefits and precautions. Seed storage – introduction, steps, factors affecting storage; insect, rodent and bird control of storage houses.

UNIT – III SEED GERMINATION AND VIGOUR:

Seed germination – introduction & types; germination requirements in agriculture and horticulture crop seeds. Factors affecting seed germination, role of promoters and inhibitors. Seed vigour – concept, factors affecting seed vigour, physiological and genetic basis of seed vigour. Methods of measuring seed vigour; seed & seedling vigour in relation to crop establishment and yield.

UNIT – IV SEED TESTING AND SEED CERTIFICATION:

National seed testing rules and organizations; seed sampling, heterogeneity test, sample receipt and registration. - Moisture test, tetrazolium test – principles, procedure and evaluation; methods to break seed dormancy. - Seed certification – concept, purpose and phases of seed certification, certification agency, certified seed level, certification tag and validity period of certification. Seeds Act, rules & law enforcement; seed control order & seed policy; role of "Quality Control" for import and export of seeds.

UNIT – V HYBRID SEED PRODUCTION:

Heterosis: definition, expression and estimation of hybrid vigour; utilization of heterosis in agricultural, horticultural and other crop plants for crop improvement. Pre requisites for hybrid seed production; mechanisms and management of

pollination in autogamous and allogamous crops; genetic constitution of varieties, hybrids and basic principles in seed production. Techniques of hybrid seed production - emasculation and crossing: use of self-incompatibility, modification of sex; types of male sterility and exploitation in hybrid development and its use in hybrid seed production; development and maintenance of A, B and R lines. Fertility restoration; use of chemical hybridizing agents, problems of non synchrony in flowering of parental lines and methods to overcome; planting ratios and population density in relation to hybrid seed yield; salient features of hybrid seed production of various crops viz., rice, sorghum, bajra, maize, sunflower, cotton and other major vegetables.

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Current developments related to the Seed technology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Bhojwani SS & Bhatnagar SP. 1999. The embryology of Angiosperm. Vikas publications. 2. Copeland LO & McDonald MB.2001. Principles of seed science and Technology. 4th Ed. Chapman & Hall.
2. Agarwal RL. 1997. Seed Technology. 2nd Ed. Oxford & IBH.
3. Kelly AF. 1998. Seed Production of Agricultural Crops. Longman.
4. McDonald MB Jr & Copeland Lo. 1997. Seed Production: Principles and Practices. Chapman & Hall.
5. Barton LV. 1985. Seed Preservation & Longevity. International Books and Periodicals Supply Service. New Delhi.
6. Justice OL & Bass LN. 1978. Principles and Practices of seed storage. Castle House Publ. Ltd.
7. Nema NP. 1986. Principles of Seed Certification and Testing. Allied Publications.
8. Tunwar NS & Singh SN. 1988. Indian Minimum Seed Certification Standards. CSCB, Ministry of Agriculture, New Delhi.
9. https://www.coabnau.in/uploads/1614660953_GPB-4.4.TheoryNote.pdf
10. https://www.agrimoon.com/wp-content/uploads/PRINCIPLES-OF-SEED-TECHNOLOGY.pdf
11. https://drive.google.com/file/d/1DMIwt6NJ72hN4rTnWXW9DpyaZBDFRujr/view
12. https://drive.google.com/file/d/1KJg8Upc8B2U0pBw5zj537iNDpFrQsoKx/view

COURSE OUTCOMES:

- Appraise knowledge and understanding seed technology.
- Practice knowledge about seed production and processing.
- To relate factors responsible for seed vigour.
- Aware of seed testing and quality control.
- Pursue knowledge on hybrid seed production, types and maintenance.

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Second Year **ELECTIVE COURSE III** **Semester III**

2. ORGANIC FARMING

Code: **(Theory)** **Credit: 4**

COURSE OBJECTIVES:

- To encourage and enhance biological cycles within farming system involving microorganisms, soil flora and fauna, plants and animals.
- To learn plant nutritional requirements and the role of chemical fertilizers.
- To study the nutritional source of organic farming.
- To study important biofertilizers.
- To employ knowledge on vermicompost production and its application.

UNIT – I ORGANIC FARMING:

Definition, objective and scope. Types and importance of organic farming – Integrated Farming system, Mixed farming – Soil reclamation – Weed management.

UNIT – II PLANT NUTRIENTS:

Plant nutrients – functions of nutrients in plant growth and development of crops – Nutrient uptake and utilization by plants. Chemical fertilizers – Advantage and Disadvantage of their use – Microorganisms in organic farming – Sustainable agriculture, pesticide and fungicide residues.

UNIT – III SOURCES OF NUTRIENTS:

Sources of nutrients for Organic agriculture – (a) Organic Manure (FYM / Rural compost, urban compost, oil cakes, Animal waste, vermicompost). (b) Green Manure (Green manure with Leguminous crops in crop rotation). (c) non leguminous Nitrogen contributing plants. (d) Liquid manure. Role of cyanobacteria in organic farming

UNIT – IV IMPORTANCE OF BIOFERTILIZERS:

Importance of Biofertilizers in soil productivity – (a) nitrogen fixing (symbiotic and asymbiotic) (b) Phosphate and Potassium solubilizing bacteria and fungi (Mycorrhiza), Preparation, dosage and method of applications of biofertilizers.

UNIT – V PREPARATION OF VERMICOMPOST:

(a) Pit construction (b) Raw materials (c) Availability of species of earthworm (d) Method of preparation (e) Quality of improvement of finished vermicompost – Field application. Vermiculite and vermiwash, Biopesticides – Advantages and applications.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Organic farming during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Annadurai, K. and Palaniappan, S.P. (2018). Organic Farming. Scientific Publishers (India).
2. Dubey, R.C. (2005). A Textbook of Biotechnology. S. Chand & Co. Ltd., New Delhi.
3. Juneja, A.C. (2015). Biofertilizers and Organic Farming. Satyam Publishers and Distributors.
4. Mamta Bansal (2018). Basics of Organic Farming. Publishers and Distributors Pvt. Ltd.
5. Natarajan, T. (2010). Organic Farming for Business. Swastik Publication.
6. Reddy, S.R. (2017). Principles of Organic Farming. Kalyani Publishers.
7. Satha , T.V. (2004). Vermiculture & Organic farming. Daya Publishers.
8. Subba Rao, N.S. (2000). Soil Microbiology. Oxford & IBH Publishers, New Delhi.
9. Vayas, S.C., Vayas, S. and Modi, H.A. (1998). Biofertilizers and Organic Farming. Akta Prakashan, Nadiad.
10. Walia, S.S. and Nanwal, R.K. (2018). Principles of Organic Farming. New Delhi Publishing Agency – Nipa.
11. https://www.fao.org/fileadmin/templates/nr/sustainability_pathways/docs/Compilation_techniques_organic_agriculture_rev.pdf
12. https://www.jaivikkheti.in/DMS/Production%20Technology%20of%20Organic%20Inputs.pdf
13. htpps://www.nabard.org/demo/auth/writereaddata/File/OC%2038.pdf

COURSE OUTCOMES:

- The students would be aware of differences between organic and chemical fertilizers.
- Imparts knowledge about the biological cycles in farming system.
- Knowledge on organic nutritional resources.
- Creates awareness in the conservation of microbial diversity of agricultural system
- Enable the students to create awareness in protecting the environment.

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Second Year **NON MAJOR ELECTIVE II HERBAL BOTANY** **Semester III**

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To apply knowledge on traditional plants and Indian medicinal systems.
- Record therapeutic compounds from various plant parts.
- To learn various plant based drugs and cultivation practices.
- To recognize plant tribal medicine and their role in model medicine.
- To use ethnomedicine on challenging diseases and the role of traditional plants.

UNIT – I HISTORY OF MEDICINAL PLANTS:

Brief history of medicinal plants. Indian systems of medicines - Siddha, Ayurvedha and Unani systems. Classifications of crude drugs, Chemistry of drugs. Drugs from roots (*Catheranthus* and *Rauwolfia*). Drugs form bark (*Cinchona*). Drugs from wood (*Ephedra*).

UNIT – II SOURCES OF DRUGS:

Drugs from leaves (*Aloe, Atropa, Eucalyptus, Ocimum, Datura* and *Cassia*). Drugs from flower, (*Eugenia*). Drugs from fruits and seeds (wood apple and Coriander, Trigonella Neem). Underground stem (Ginger).

UNIT – III APPLICATIONS OF DRUGS:

A brief account of drugs acting on the central nervous system, drugs used in disorders of gastrointestinal tract and cardiovascular drugs. Cultivation of medicinal plants in India. Breeding methods applied to medicinal herbs, plant tissue culture as source of biomedicine. Drug adulteration. Methods of drug evaluation.

UNIT – IV PLANTS AND TRIBAL MEDICINE:

Significance of the following plants in ethno botanical practices (along with their habitat and morphology) a) *Azadiractha i*ndica b) *Ocimum sanctum* c) *Vitex negundo*. d) Gloriosa superba e) *Tribulus terrestris* f) *Pongamia pinnata* g) *Cassia auriculata* h) *Indigofera tinctoria*. Role of ethnobotany in modern medicine with special example *Rauvolfia sepentina, Trichopus zeylanicus*.

UNIT – V ETHNO MEDICINE:

Ethnobotany: Introduction, concept, scope and objectives. Ethnobotany as an interdisciplinary science. The relevance of ethnobotany in the present context. Major ethnic groups in Tamil Nadu. (Any five). Ethnobotany as a source of drug. a) Reserpine b) Artemisin c) Gugulipid d) Cocaine e) Strychnine Methodology of Ethnobotanical studies. a) Field work b) Herbarium c) Ancient Literature d) Temples and sacred places. Plants used by the tribals: a) Food plants b) intoxicants and beverages c) Resins and oils and miscellaneous uses.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Herbal Botany during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Sana Loue, Research Ethics: Theory and Practice,
2. Jasanoff, S.. The Ethics of Invention: Technology and the Human Future
3. R Subramanian, Professional Ethics, Oxford University Press.
4. Premvir Kapoor, Professional Ethics and Human Values, Khanna Book Publishing
5. R.R. Gaur, R. Sangal, G.P. Bagaria. A Foundation Course in Human Values and Professional Ethics, Excel Books, Delhi.
6. Deborah E. Bouchoux, Intellectual Property: The Law of Trademarks, Copyrights, Patents, and Trade Secrets, Delmar Cengage Learning
7. http://www.freebookcentre.net/Biology/Botany-Books.html
8. https://www.infobooks.org/free-pdf-books/alternative-therapy/medicinal-plants/
9. http://www.digitalbookindex.org/_search/search010botmedicinalplantsa.asp
10. https://www.academia.edu/29109909/Botany_pdf
11. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3847409/
12. https://www.bgci.org/files/Worldwide/Publications/PDFs/medicinal.pdf
13. https://www.indianmedicinalplants.info/herbs/index.php/download-e-book
14. https://www.arvindguptatoys.com/arvindgupta/medicinal-nbt.pdf

COURSE OUTCOMES:

- Value awareness on Indian medicine system.
- Apply knowledge and concepts of ethanomedicine.
- Employ the chemistry of drug interactions towards the challenging disease.
- Justifying the importance of medicinal plants.
- Appreciate traditional medicinal knowledge leading modern drug discovery.

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Second Year **CORE COURSE VII** **Semester IV**

ECOLOGY, PHYTOGEOGRAPHY AND ENVIRONMENTAL BIOTECHNOLOGY

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- To apply knowledge qualitative and quantitative knowledge on ecosystem.
- To discuss the ecological chain among population.
- To measure the global environmental changes and conservation strategies
- To value the principle and concepts of Phytogeography.
- To operate bioremediation, biomonitoring and to get awareness on environmental education.

UNIT – I ECOLOGY:

Ecosystem Structure and function of ecosystem: energy flow. Characteristics of communities Analytical Quantitative – Frequency, density, Abundance, Cover and Basal area. Qualitative – Physiognomy, Phenology, Stratification, sociability, vitality and Life form. Method of study of communities- Raunkiaer's Life form, Physiological methods- Sampling units, Quadrat method, Transect method, Point method.

UNIT – II ECOLOGY:

Population Ecology: Characteristics of a population (Population size and Density, Dispersion, Age structure Natality (Birth Rate), Mortality (Death rate), Biotic potential, Life Tables, Population growth curves. Ecological Succession - Causes, trends of succession, Types of succession- Primary, secondary and allogenic, Process of succession- Nudation, Invasion, competition and coactions-reaction, stabilization. Concept of climax- Monoclimax and Polyclimax theories.

UNIT – III ECOLOGY:

Global environmental change -Atmosphere composition and structure, Global warming- Green house gases and Ozone depletion. Remote sensing and Geographic Information System (GIS). Conservation strategies: IUCN categorization- *In-situ* conservation (National parks, Biosphere reserves, Wildlife sanctuaries) *Ex-situ* conservation – (Seed bank, Botanical gardens). Sacred groves.

UNIT – IV PHYTOGEOGRAPHY:

Principles and importance of plant geography- Phytogeographic regions of India. Agro-climatic regions of India, Patterns of distribution – Disjunction and Variance. Theories of present day distribution of plants- Continental drift hypothesis- Gondwana land factors involved in distribution. Factors involved in distribution – Endemism, Age and Area hypothesis; Dispersaland Migration and their aims and methods.

UNIT – V ENVIRONMENTAL BIOTECHNOLOGY:

Biodegradation of xenobiotics using microbes. Biomonitoring - Types of Bioremediation: in situ and ex situ, Bioremediation of xenobiotics in environment - ecological consideration, decay behavior and degradative plasmids, molecular techniques in bioremediation. Phytoremediation. Bioleaching, Organic (chlorinated hydrocarbons, pesticides, surfactants) and inorganic (metals, radionuclides, phosphates, nitrates). Environmental awareness and Education; Environmental Ethics.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Ecology, phytogeography and environmental biotechnology during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Singh, J.S., Singh, S.P. and Gupta, S. 2006, Ecology, Environment and Resource Conservation, Anamaya Publications, New Delhi.
2. Sharma, P.D. 2013, Ecology and Environment, XI edition, Rastogi Publications, Meerut.
3. Ambasht R.S., 1978 The Book of Plant Ecology, Students friends Co.
4. Odum, E.P. Gary W. Barrelt, 2004, Fundamentals of Ecology (15th edition), ThomsonAsia Pvt. Ltd.
5. Krebs, 1985, Ecology, C.J.Haper and Row, New York.
6. Sinha, R.K. and Dalbirshigh, 1997, Global biodiversity, INA shree publishers, Jodhpur.
7. Dash, M.C. 2004, Fundamentals of Ecology, Tata McGraw Hill, New Delhi.
8. Russell K. Monson, 2014, Ecology and the Environment, Springer Dordrecht, Heidelberg, New York.
9. Cain, S.A . 1944. Foundations of Plant Geography Harper & Brothers, N.Y.
10. Mani, M.S 1974 : Ecology &Biogeography of India Dr. W. Junk Publishers,he Haque
11. Good, R. 1997: The Geography of flowering Plants (2ndEdn.,)Longmans, Green & Co.,Inc., London & Allied Science Publishers, New Delhi- 495ppE- Materials
12. Willings W.D.1964 Plants and Ecosystem, Wasworti Publishing Co.
13. Daubenmire R.F,1973 Plant and Environment. John Willey.
14. Chatterji, A.K. (2011). Introduction to Environmental Biotechnology. Prentice Hall IndiaPvt., Ltd., New Delhi.
15. https://www.ohio.edu/plantbio/staff/mccarthy/dendro/ecology.htm https://www.lcps.org/cms/lib4/VA01000195/Centricity/Domain/14721/Ecology%20Note s.pdf
16. https://www.coursehero.com/file/8469123/PHYTOGEOGRAPHY-Lecture-34/ https://swayam.gov.in/
17. https://swayam.gov.in/nd1_noc19_ge23/preview https://www.classcentral.com/course/swayam-ecology-and-environment-14021 https://www.agrimoon.com/principles-of-plant-biotechnology-icar-ecourse-pdf/

COURSE OUTCOMES:

On the completion of this paper, students will be able to

- To list out the basic concepts of ecosystem and energy flow.
- Acquire knowledge on population dynamics.
- Devise the causes and consequences of climate change.
- Value the principles and concepts of Phytogeography.
- Measure the biodegradation and bioremediation processes.

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Second Year **CORE COURSE VIII** **Semester IV**

RESEARCH METHODOLOGY, IPR AND RESEARCH ETHICS

Code: **(Theory)** **Credit: 5**

COURSE OBJECTIVES:

- Identify the research problem in their domain of interest.
- To employ skills on technical and scientific writing
- To evaluate Intellectual Property Rights in view of research ethics.
- To understand the philosophy and ethics in research.
- To understand a patent rights and IPR developments.

UNIT – I MEANING OF RESEARCH PROBLEM:

Meaning of research problem, Sources of research problem, Criteria Characteristics of a good research problem, Errors in selecting a research problem, Scope and objectives of research problem. Approaches of investigation of solutions for research problem, data collection, analysis, interpretation, Necessary instrumentations.

UNIT – II LITERATURE STUDIES AND TECHNICAL WRITING:

Effective literature studies approaches and analysis Plagiarism Effective technical writing, how to write report, Paper Developing a Research Proposal. Format of research proposal, a presentation and assessment by a review committee.

UNIT – III IPR:

Nature of Intellectual Property: Patents, Designs, Trade and Copyright. Process of Patenting and Development: technological research, innovation, patenting, development. International Scenario: International cooperation on Intellectual Property. Procedure for grants of patents, Patenting under PCT

UNIT – IV PATENT RIGHTS AND NEW DEVELOPMENTS IN IPR:

Patent Rights: Scope of Patent Rights. Licensing and transfer of technology. Patent information and databases. Geographical Indications. New Developments in IPR: Administration of Patent System. New developments in IPR; IPR of Biological Systems, Computer Software etc. Traditional knowledge Case Studies, IPR and IITs

UNIT - V PHILOSOPHY, ETHICS AND SCIENTIFIC CONDUCT:

Introduction to philosophy: definition, nature and scope, concept, branches, Ethics: definition, moral philosophy, nature of moral judgments and reactions. Ethics with respect to science and research, Intellectual honest and research integrity, Scientific misconducts: Falsification, Fabrication, Manipulation, and plagiarism Redundant publications: duplicate and overlapping publications, salami slicing, Selective reporting and misrepresentation of data.

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Research methodology, IPR and Research ethics during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
2. Stuart Melville and Wayne Goddard, "Research methodology: an introduction for science & engineering students"
3. Ranjit Kumar, 2nd Edition, "Research Methodology: A Step by Step Guide for beginners"
4. https://www.researchgate.net/publication/322500352_Research_Ethics
5. https://mrcet.com/downloads/digital_notes/CSE/Mtech/I%20Year/RESEARCH%20METHODLOGY.pdf
6. https://iare.ac.in/sites/default/files/MTECH-CAD.CAM-R18-RM-IP-NOTES.pdf
7. https://www.brunel.ac.uk/research/Documents/Resethics-hb.pdf
8. https://plato.stanford.edu/entries/ethics-internet-research/
9. http://www.ascdegreecollege.ac.in/wp-content/uploads/2020/12/Research-Methodology-CRC.pdf
10. https://prog.lmu.edu.ng/colleges_CMS/document/books/EIE%20510%20LECTURE%20NOTES%20first.pdf
11. https://www.tandfonline.com/doi/full/10.1080/14615517.2013.850307
12. https://satoriproject.eu/media/2.d.2-Internet-research-ethics.pdf

COURSE OUTCOMES:

- To organize the research of interest.
- Apply knowledge on resources and databases available for research.
- Manage IPR for research innovations.
- Understand the patent rights.
- To apply research ethics in publications and research outputs.

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Second Year	**ENTREPRENEURSHIP INDUSTRY BASED COURSE AGRIBASED ENTREPRENEURSHIP**	**Semester IV**
Code:	**(Theory)**	**Credit: 5**

COURSE OBJECTIVES:

- To explain the concept of entrepreneurship.
- Understand the basics of agriculture economy.
- Evaluate the key skills involved in running agro based business.
- Acquire the knowledge on agricultural trade and agricultural policy.
- Consider enterprise business planning and marketing.

UNIT – I BASIC CONCEPTS:

Introduction to agriculture, forms of agriculture, production, need for import and export, analysis of marketable surplus, analysis of import and export statistics of agricultural products in India, macroeconomic forces, Role of agriculture in Indian economy; problems and policy changes relating to farm supplies, farm production, agro processing, agricultural marketing,

UNIT – II POLICY AND TECHNOLOGY ADVANCEMENTS:

Overview of world agricultural trade, issues impacting international agricultural trade, agricultural policy, technology advancement on agricultural products

UNIT – III BASIC REQUIREMENTS FOR QUALITY CONTROLS:

Import requirements-causes, identifying agri products for import, import substitution, regulation of imports, quality standards, scanning the countries for importing the required agri products, import planning, documents required,

UNIT – IV PLANNING DOCUMENTATION AND LEGAL DIMENSIONS:

Identifying foreign markets for agri export, marketing plan for exports, export documents and procedure, terms of payment and export finance, legal dimensions

UNIT – V EXPORT AND IMPORT TRADING:

Institutional infrastructure for export promotion in India, export assistance, State trading in imports and exports, working of the State trading organizations in India

UNIT – VI CURRENT CONTOURS (For Continuous Internal Assessment Only):

Current developments related to the Agribased Entrepreneurship during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Reddy, S R and Reddi Ramu 5th edition 2016, Agronomy of Field CropsKalyani , Ludhiana.
2. Chidda Singh, singh,P and Singh R, Modern Techniques of Raising field crops-oxford publishing house, New Delhi.
3. Rajendra Prasad 2004 text book of Field Crop Production Volume i, Volume ii 4 Panda S C 2014 Agronomy of Fodder a forage crop, kalyani publishers Ludhina
4. Omri Rawlins, N. 1980. Introduction to Agribusiness. Prentice Hall of India Pvt. Ltd., New Delhi.
5. file:///C:/Users/ELCOT/Downloads/Agri-Enterpreneurship-New%20Book.pdf

COURSE OUTCOMES:

- Learn the methods and techniques used to start a agribased business.
- Business facts and concepts used in the agriculture industry from production to retail.
- Record operations and financial process.
- Identify markets, map resources and conduct business planning
- Construct a business and manage relationships.

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Second Year **PROJECT** **Semester-IV**

Code: **Credit: 5**

Each candidate shall be required to take up a Project Work and submit it at the end of the final year. The Head of the Department shall assign the Guide who, in turn, will suggest the Project Work to the student in the beginning of the final year. A copy of the Project Report will be submitted to the University through the Head of the Department on or before the date fixed by the University.

The Project will be evaluated by an internal and an external examiner nominated by the University. The candidate concerned will have to defend his/her Project through a Viva-voce.

ASSESSMENT /EVALUATION /VIVA-VOCE:

1. PROJECT REPORT EVALUATION (Both Internal & External):

I. Plan of the Project - 20 marks

II. Execution of the Plan/collection of Data / Organisation of Materials / Hypothesis, Testing etc and presentation of the report. - 45 marks

III. Individual initiative - 15 marks

2. VIVA-VOCE / INTERNAL& EXTERNAL - 20 marks

TOTAL **- 100 marks**

PASSING MINIMUM:

	Vivo-Voce 20 Marks	**Dissertation 80 Marks**
Project	40% out of 20 Marks (i.e. 8 Marks)	40% out of 80 marks (i.e. 32 marks)

A candidate shall be declared to have passed in the Project work if he/she gets not less than 40% in each of the Project Report and Viva-voce but not less than 50% in the aggregate of both the marks for Project Report and Viva-voce.

A candidate who gets less than 40% in the Project must resubmit the Project Report. Such candidates need to defend the resubmitted Project at the Viva-voce within a month. A maximum of 2 chances will be given to the candidate.

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Second Year **VALUE ADDED COURSE II** **Semester IV**

SOIL LESS CULTURE

Code: **(Theory)** **Credit: 2**

COURSE OBJECTIVES:

- To organize the techniques of growing plants without soil and to the relevant terminology
- To prepare a sufficient background on: a) the physical and chemical properties of horticultural substrates and b) the specific characteristics of the most important of them.
- Describe nutritional media and management in soilless culture.
- To learn disinfection methods and maintenance.
- To state the importance on application of soilless cultivation systems in commercial greenhouse production.

UNIT – I HYDROPONIC SYSTEMS:

Scope, importance and Introduction to soilless cultivation of plants - History of solution culture - Present status of soilless culture. Systems involving solely water as a substrate (deep water culture, floating hydroponics, NFT, plant plane hydroponics, aeroponics). Systems involving an aggregate as a substrate (bag culture, container culture, trough culture, thin layer systems, various alternative systems).

UNIT – II EQUIPMENTS IN HYDROPONICS:

Installations used to prepare and deliver nutrient solution, sensors, equipment for the lay-out of the crop, equipment for irrigation and nutrient solution recycling. Substrates: Physical properties of substrates - bulk density, particle size distribution, porosity, water release curves, hydraulic conductivity. Chemical properties of substrates - determination of water soluble and exchangeable nutrients, CEC, AEC, organic matter content, pH, EC.

UNIT – III SOILLESS CULTURE MEDIA:

Container media - Description of substrates -sand, gravel, rockwool, expanded minerals, pumice, zeolite, pyroclastic materials, peat, coir, tree bark, sawdust, wood fibres, etc. Container media analyses, Total and available nutrients, Microbiology and phytosanitation in container media.

UNIT – IV NUTRIENT MANAGEMENT IN HYDROPONICS:

Effects of pH, EC and nutrient ratios on plant growth, yield and quality. Management of nutrient solution in open systems. Monitoring and adjusting the nutrient supply. Introduction to nutrient solution recycling. Methods of nutrient solution recycling. Plant culture: Monitoring and controlling the climate (temperature, light, humidity, and carbon dioxide).

UNIT – V DISINFECTION IN CLOSED HYDROPONIC SYSTEMS:

Nutrient solution disinfection (heating, UV-irradiation, chemical treatments by means of ozone, hydrogen peroxide, chlorine, iodine, etc., membrane filtration, slow sand filtration).. Irrigation control in hydroponics: Characteristics of irrigation systems (capacity, uniformity). Delivery Systems (overhead systems, drip irrigation, subirrigation). Irrigation scheduling (preset schedule, sensor-based schedule, transpiration-based schedule).

UNIT – VI CURRENT CONTOURS (For continuous internal assessment only):

Current developments related to the Soiless culture during the semester concerned to be kept abreast of continuously and cumulatively through collection, discussion and evaluation from news and events over the world collected through multiple reliable informative sources – Research articles, review materials, print, Internet, Interaction, Social media, Webinars and so on.

REFERENCES:

1. Resh, Howard M. Hydroponic food production: a definitive guidebook for the advanced home gardener and the commercial hydroponic grower 7th edition. ISBN: 978-1-4398-7867-5
2. Marschner, H. 1995. Mineral Nutrition of Higher Plants (2nd ed.). Academic Press, London. Mengel, K. and Kirkby, E.A. 2001. Principles of Plant Nutrition (5th ed). Kluwer Academic Publishers, Dordrecht.
3. Raviv, M and Lieth, J.H. (eds.) 2008. Soilless Culture, Theory and Practice. Elsevier, London. Schwartz, M. 1995. Soilless Culture Management. Springer-Verlag, Berlin. Proceedings of the World Congress on Soilles
4. https://vric.ucdavis.edu/pdf/hydroponics_soillesscultureofgreenhouse%20vegetables.pdf
5. https://www.mdpi.com/2311-7524/8/4/292/pdf?version=1648804842
6. https://www.academia.edu/11141043/Soilless_Culture_Use_of_Substrates_for_the_Production_of_Quality_Horticultural_Crops

COURSE OUTCOMES:

Successful completion of this course will provide students with the following:

- Examination on water, nutrients, and environmental factors management to influence plant growth and yield.
- Justify different soilless culture systems, and their pros and cons
- Recall common management practices for leafy greens and fruit crops.
- Construction of designing, calculating, and formulating hydroponic nutrient solutions
- Practice in diagnosing and correcting common crop nutritional, pest and disease, and physiological problems.

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