

Deccan Education Society's

Kirti M. Doongursee College of
Arts, Science and Commerce (AUTONOMOUS)



Affiliated to
UNIVERSITY OF MUMBAI
National Education Policy (NEP) based
Syllabus for
Program: Bachelor of Science
Course: T.Y.B.SC.
Subject: BOTANY

Choice Based Credit System (CBCS)
with effect from
Academic Year 2025-2026
(NEP 2020)

PROGRAM OUTCOMES

PO	Description
A student completing Bachelor's Degree in Science Program will be able to	
PO1	Disciplinary Knowledge: Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate Programme. Execute strong theoretical and practical understanding generated from the specific graduate Programme in the area of work.
PO2	Critical Thinking and Problem solving: Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	Social competence: Display the understanding, behavioral skills needed for successful social adaptation, work in groups, exhibits thoughts and ideas effectively in writing and orally.
PO4	Research-related skills and Scientific temper: Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	Trans-disciplinary knowledge: Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem.
PO6	Personal and professional competence: Performing dependently and collaboratively as a part of team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	Effective Citizenship and Ethics: Demonstrate empathetic social concern and equity centered national development and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	Environment and Sustainability: Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PROGRAM SPECIFIC OUTCOMES

PSO	Description
A student completing Bachelor's Degree in Science Program will be able to	
PSO 1	Identify and classify major non-vascular and vascular plant groups , with an emphasis on understanding their evolutionary relationships.
PSO 2	Gain insights into plant evolution by studying phylogenetic relationships and examining different classification systems.
PSO 3	Investigate the structural, developmental, and economic aspects of algae, fungi, bryophytes, pteridophytes, gymnosperms, and angiosperms, including their morphology, anatomy, and embryology.
PSO 4	Comprehend key physiological mechanisms in plants , along with their adaptations to diverse environmental conditions.
PSO 5	Understand the impact of environmental elements and natural resources , highlighting their relevance to ecological balance and sustainable development.
PSO 6	Develop the ability to analyze plant extract for their phytochemical and explore the therapeutic uses of biologically active compounds derived from plants.
PSO 7	Acquire skills to work with various microbes , focusing on their industrial applications and roles in solving environmental problems.
PSO 8	Explore the foundation of modern medicine in traditional plant knowledge and understand ethno-medicinal approaches to healing and healthcare.
PSO 9	Learn about genetic inheritance and variation at individual, species, and population levels, and apply genetic principles to enhance plant productivity and quality.
PSO 10	Utilize statistical methods to interpret biological data , enabling comparison and understanding of variations across different datasets.
PSO 11	Stay in tune with the current advancements in molecular biology , including recombinant DNA technology, plant tissue culture, and bioinformatics, and understand their practical applications in plant science and biotechnology.
PSO 12	To develop entrepreneurial skills by applying botanical knowledge for the creation of sustainable, plant-based products and innovations, fostering start-up initiatives.

**Deccan Education Society's
Kirti M. Doongursee College
(Autonomous) Proposed Curriculum as per
NEP 2020 Year of implementation- 2025-26
Name of the Department: BOTANY
Class: TYBSc**

Semester	Course Code	Course Title	Vertical	Credit
V	25BOTMJ511	PLANT DIVERSITY V	Major	2
	25BOTMJ512	FORMS AND FUNCTION V	Major	2
	25BOTMJ513	FORMS AND FUNCTION VI	Major	2
	25BOTMJP51	PRACTICALS BASED ON PLANT DIVERSITY V + FORMS AND FUNCTION V + FORMS AND FUNCTION VI	Major Practical	2
	25BOTIKS514	INDIAN PLANT HERITAGE	IKS	2
	25BOTMR521	CURRENT TRENDS IN PLANT SCIENCES IV	Minor	2
	25BOTMRP51	PRACTICALS BASED ON CURRENT TRENDS IN PLANT SCIENCES IV	Minor Practical	2
	25BOTEL531	INDUSTRIAL BOTANY	Elective	2
	25BOTELP51	PRACTICALS BASED ON INDUSTRIAL BOTANY	Elective Practical	2
	25BOTEL532	FUNDAMENTALS OF HYDROPONICS	Elective	2
	25BOTELP52	PRACTICALS BASED ON FUNDAMENTALS OF HYDROPONICS	Elective	2
	25BOTVSC541	URBAN GARDENING	VSC	2
	25BOTFP5	FP / CEP	FP	2

VI	25BOTMJ611	PLANT DIVERSITY VI	Major	2
	25BOTMJ612	PLANT DIVERSITY VII	Major	2
	25BOTMJ613	FORMS AND FUNCTION VII	Major	2
	25BOTMJ614	FORMS AND FUNCTION VIII	Major	2
	25BOTMJP61	PRACTICALS BASED ON PLANT DIVERSITY VI + PLANT DIVERSITY VII + FORMS AND FUNCTION VII + FORMS AND FUNCTION VIII	Major Practica l	2
	25BOTMR621	CURRENT TRENDS IN PLANT SCIENCES V	Minor	2
	25BOTMRP61	PRACTICALS BASED ON CURRENT TRENDS IN PLANT SCIENCES V	Minor Practica l	2
	25BOTEL631	APPLIED BOTANY	Elective	2
	25BOTELP61	PRACTICAL BASED ON APPLIED BOTANY	Elective Practica l	2
	25BOTEL632	FUNDAMENTALS OF SYSTEMS OF MEDICINE	Elective	2
	25BOTELP62	PRACTICAL BASED ON FUNDAMENTALS OF SYSTEMS OF MEDICINE	Elective Practica l	2
	25BOTOJT6	OJT (On Job Training)	OJT	4

SEMESTER V

Course Code	MAJOR SEM – V: BOTANY-	Credits	Lectures/Week
25BOTMJ511	PLANT DIVERSITY V	2	2
Course Outcomes: After successful completion of this course, students would be able to CO 1: Describe the structure, life cycle, and classification of prescribed algae, bryophytes, and microbiological organisms and angiosperm plants respectively. Define and describe the prescribed microbiological organisms. CO 2: Explain the alternation of generations in prescribed algae, bryophytes; and system of classification of Bentham and Hooker followed in angiosperms. CO 3: Apply the knowledge of study of the life cycle of prescribed algae, bryophyte and importance of angiosperms and microbial culturing. CO 4: Analyze the life cycle patterns of prescribed algae, bryophytes and characteristics of angiosperms of prescribed family. Evaluate the types of microbes culturing.			
Unit	Topics	No of Lectures	
I	MICROBIOLOGY & ALGAE (G.M. SMITH CLASSIFICATION SYSTEM) <u>Microbiology</u> • Types of Microbes: Viruses, Bacteria, Algae, Fungi, Mycoplasma and Actinomycetes. • Culturing: Staining, colony characters. • Pure cultures <u>Algae</u> • General characters of Charophyta and Rhodophyta. • Structure, life cycle, systematic position and alternation of generation of □ <i>Chara</i> □ <i>Batrachospermum</i>.	15	
II	BRYOPHYTA (G. M. SMITH CLASSIFICATION SYSTEM) AND ANGIOSPERMS I. <u>Bryophyta</u> • Outline of Bryophyte classification according to G. M. Smith (up to class). • Structure, life cycle, systematic position and alternation of generation of □ <i>Marchantia</i> □ <i>Funaria</i>	15	

	● Ecology of Bryophyte. ● Bryophyte as indicators. <u>Angiosperm</u> Classification of Bentham and Hooker (Up to class), Merits and demerits of the classification. Bentham and Hooker's system of classification for flowering plants up to family with respect to the following prescribed families. Economic and medicinal importance for members of the families. (Special stress on fruit morphology to be given) ● Cucurbitaceae ● Solanaceae ● Rubiaceae ● Scitamineae	
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Reference books:

1. College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises.
2. Cryptogamic Botany Vol I and II by G M Smith, McGraw Hill publication
3. Book for Degree Students- Algae by B R Vasistha, A.K.Sinha, S Chand Publication.
4. Book for Degree Students- Bryophytes by B R Vasistha, A.K.Sinha, S Chand Publication.
5. Text book of Algae Bilgrami K. S CBS Publications
6. Microbiology-Indian addition-Michael J. Pelzar, JR. McGraw Hill publication
7. Textbook Of Microbiology 5th Edition by Dubey R.C. & Maheshwari D. K.S Chand & Company
8. Microbiology- Indian addition- Michael J. Pelczar, JR. McGrawhill publication.
9. Industrial Microbiology by Cassida, New Age International, New Delhi
10. Industrial Microbiology by Arvind H. Patel, Mac Millan Publications, New Delhi
11. Plant Systematics by Gurcharan Singh, Oxford and IBH Publication.
12. Taxonomy of Vascular Plants by Lawrence George, H M, Oxford and IBH Publication.
13. Modern Plant Taxonomy by N.S. Subrahmanyam, Vikas Publishing House
14. Plant Taxonomy by O.P. Sharma, McGraw-Hill Education Publication
15. Textbook of Plant Taxonomy by Manoj Kumar Singh, Daya Publishing House Publication
16. Plant Taxonomy by Dr. V. Singh, Dr. P.C. Pande, Dr. D.K. Jain. S. Chand Publishing

Course Code	MAJOR SEM – V: BOTANY-	Credits	Lectures/Week
25BOTMJ512	FORMS AND FUNCTION V	2	2

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Describe the monographs of pharmacological and medicinal important plants, anomalous secondary growth patterns in prescribed stems and roots. Define and describe the research methodology, Microsporogenesis and Megasporesogenesis.

CO 2: Explain the therapeutic uses, chemical constituents, and adulterants in medicinal plants; Classify different types of stomata, structural variations, types of ovules, double fertilization and research methodology based on the techniques and requirement of research writing.

CO 3: Differentiate between authentic and adulterated drug samples based on macroscopic and microscopic features; Illustrate the role of anomalous secondary growth in plants and use of research methodology in day to day life. Apply the knowledge of palynology in various fields prescribed in the syllabus.

CO 4: Compare the anomalous secondary growth of plants showing anatomical adaptations and analyze different types of stomata and pollen grains. Understand the research methodology in various research write-up studies.

Unit	Topics	No of Lectures
I	PHARMACOGNOSY, MEDICINAL BOTANY AND ANATOMY I. <u>Pharmacognosy and Medicinal Botany</u> • Monographs of drugs with reference to biological sources, geographical distribution, common varieties, macro and microscopic characters, chemical constituents, therapeutic uses, adulterants- <i>Strychnos</i> seeds, <i>Senna</i> leaves, Clove buds, <i>Curcuma longa</i>. <u>Anatomy I</u> • Anomalous secondary growth in the Stems of <i>Bignonia</i>, <i>Salvadora</i>, <i>Dracaena</i>. Storage roots of Beet, Radish. • Types of Stomata– Anomocytic, Anisocytic, Diacytic, Paracytic and Gramineous .	15
II	EMBRYOLOGY, PALYNOLOGY AND RESEARCH METHODOLOGY <u>Embryology:</u> ☐ Structure of anther and microsporogenesis ☐ Structure of ovule and megasporogenesis ☐ Double fertilization <u>Palynology :</u> • Pollen morphology	15

	<u>RESEARCH METHODOLOGY</u> ● Review of literature- concept, significance, referencing-offline and online. ● Scientific paper writing: Mechanics of writing, precautions and plagiarism check ● Publication basics: - Meaning, types. ● Meaning and protection of IPR, Trade secret, Patent and Copyright.	
Reference books: 1. Pharmacognosy and Phytochemistry by J. S. S. Purohit & S. P. Vyas, CBS Publishers & Distributors 2. Pharmacognosy: A Textbook of Natural Products by G. S. Khandelwal, Nirali Prakashan 3. A textbook of Pharmacognosy by C.S.Shah, J.S.Quadry. Publisher: Messrs B.S. Shah, 1971 4. Pharmacognosy by S.B.Gokhale, C.K.Kokate, A.P.Purohit. Nirali publication 5. Pharmacognosy by Trease and Evans- 16th Edition, publisher Elsevier Ltd. 6. Essentials of Pharmacognosy by A.K. Bansal, Ane Books India 7. Medicinal Plants" by C.K. Atal and B.M. Kapoor, A.H. Wheeler & Co. publishing 8. Textbook of Pharmacognosy" by T.E. Wallis, J. & A. Churchill (1960) Publication. 9. Medicinal Plants: Chemistry and Properties" by Elizabeth M. Williamson, Wiley-Blackwell Publication 10. Botany for Degree Students" by A.C. Dutta, Oxford University Press (Sixth Edition) Publication 11. Medicinal Botany: Plants Affecting Human Health" by Michael Wink, Springer Publication 12. Introduction to Medicinal Plants by K. K. Gaur, Eastern Book Corporation 13. Plant Anatomy" by K.V. Krishnamurthy, S. Chand Publication 14. A textbook of Palynology by Bhattacharya K., Majumdar M.R. and Bhattacharya S.G., Publisher New Central Book Agency. 15. Plant Anatomy: An Applied Approach" by B. M. Johri, Springer Publication 16. Plant Anatomy and Embryology" by B. M. Johri, Springer Publication 17. The Anatomy of Woody Plants" by K. E. Esau, John Wiley & Sons publication 18. Research Methodology: Methods and Techniques by C.R. Kothari & Gaurav Garg, New Age International Publishers (Fifth Edition, 2024). 19. A textbook of Pharmacognosy by T.E.Wallis- 5th edition, CBS publisher 20. Research Methodology by C R Kothari, New Age International publishing 21. An introduction to Embryology of Angiosperms by P Maheshwari, McGraw Hill Book Co. 22. Embryology of plants by Bhojwani and Bhatnagar, S. Chand & Company Ltd. 23. A textbook of Palynology by K. Bhattacharya, New Central Book Agency Pvt.Ltd., London 24. Pollen Morphology and plant Taxonomy by G. Erdtman, Hafner Publ. Co., N.y. 25. Pollen Morphology of Angiosperm by P.K.K. Nair. Journal of Palynology 26. Introduction of Paleobotany by Chester A. Arold. Surjeet publication 27. Essential of Paleobotany by A.C.Shukla and S.P.Misra. Vikas publication 28. Palaeobotany: Plants of the Past, Their Evolution, Paleoenvironment, and Application in Exploration of Fossil Fuels by Shripad N. Agashe, Oxford & IBH Publishing 29. Paleobotany: The Biology and Evolution of Fossil Plants by Edith L. Taylor, Thomas N. Taylor, Michael Krings, Academic Press publisher 30. Plant Anatomy by B.P.Pandey, publisher: S.Chand and company Ltd.		

Course Code	MAJOR SEM – V: BOTANY-	Credits	Lectures/Week
25BOTMJ513	FORMS AND FUNCTION VI	2	2
Course Outcomes: After successful completion of this course, students would be able to CO 1: Identify and describe the structure and function of nucleus and giant chromosome; Define genetic mapping, genetic linkage, gene mutations, construction of genomic DNA, chromosome, c-DNA libraries, and biomolecules such as carbohydrates, lipids, proteins with examples. CO 2: Explain the characteristics of the genetic code and its role in protein synthesis, process of genetic map construction, types of gene mutations, and cloned sequences in c-DNA libraries, Enzyme classification and enzyme activity. CO 3: Exemplify enzymatic metabolic disorders like Phenylketonuria (PKU), enzyme activity, prescribed genetic code, gene mutations, biomolecules, enzymes and Tissue culture study. CO 4: Distinguish the translation process in prokaryotes and Eukaryotes, structures and functions with respect to study of cytology and genetics. Analyze the biochemical importance of various plant mechanisms and prescribed study in Plant Tissue Culture.			
Unit	Topics	No of Lectures	
I	CYTOLOGY, MOLECULAR BIOLOGY AND GENETICS. <u>Cytology and Molecular Biology</u> • Structure and function of nucleus. • Structure and function of giant chromosomes. • The genetic code: Characteristics of the genetic code. • Translation in Prokaryotes and Eukaryotes. <u>Genetics</u> • Genetic mapping in eukaryotes: discovery of genetic linkage, construction of genetic maps. • Gene mutations: definition, types of mutations, mutagens. • Metabolic disorders—:- Phenylketoneurea.	15	

II	PLANT BIOCHEMISTRY AND PLANT TISSUE CULTURE <u>Plant Biochemistry</u> ● Structure of biomolecules: Classification, Types and Examples of Carbohydrates, Lipids and Protein. ● Enzymes: Properties, classification, Lock and Key model and Induce fit hypothesis. <u>Plant Tissue Culture</u> ● Aspects of Micro-propagation with reference to Floriculture: Detailed study of Orchid Cultivation	15
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	● Plant cell suspension cultures for the production of secondary metabolites: With special reference to Shikonin production. ● Somatic Embryogenesis and Artificial Seeds. ● Protoplast Fusion and Somatic Hybridization: Concept, Definition, and methods of Protoplast Fusion, Applications of Somatic Hybridization.	
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Reference books:

1. Plant Biotechnology by K. Ramawat, Springer publication
2. A Textbook of Biotechnology by S. Chand, R. C. Dube., S. Chand Publishing
3. Biotechnology by Satyanarayana, Books & Allied Ltd Publisher (2 January 2020) ISBN: 978-8187134909
4. Molecular Biology by Verma and Agrawal, S. Chand Publishing (2020) ISBN: 978-8121931915
5. Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios by Devi P., Agrobios Publication.
6. Practical Biochemistry by David Plummer, McGraw Hill Publication.
7. Cell and Molecular Biology by S. C. Rastogi, New Age International Pvt Ltd Publication (2006) ISBN: 978-8122414875
8. Cytology by T. S. Verma and V. K. Agarwal
9. Cell Biology by C. B. Pawar
10. Cell and Molecular Biology by P. K. Gupta, Rastogi Publications (2003) ISBN: 978-8171336463
11. Principle of Genetics by Gardner E.J., Michael J., 8th edition, Wiley publication
12. Cell Biology by C.B. Powar. Himalaya Publishing House
13. Biochemistry by Dr. U. Satyanarayana and Dr. U. Chakrapani, Books & Allied (P) Ltd.
14. Plant Tissue Culture: Theory and Practice by S.S. Bhojwani and M.K. Razdan, Elsevier Science publication
15. Fundamentals of Molecular Biology by Veer Bala Rastogi, PHI Learning Publication
16. Fundamentals of Molecular Biology by G. K. Pal and Ghaskadabi, Books & Allied (P) Ltd.
17. Cell Biology, Molecular Biology, Genetic, Evolution and Ecology by Verma and Agarwal, S. Chand Publishing (2022) ISBN: 978-9355010919
18. Cell and Molecular Biology by Robertis and DeRobertis, Lippincott Williams & Wilkins Publication
19. Molecular Cell Biology by Lodish S. Baltimore, W.H. Freeman and Company Publication
20. Molecular Biology of Gene by Watson J. D., Pearson Education Publication
21. Biochemistry and Molecular Biology of Plants by Buchanan B. B., American Society of Plant Biologists (ASPB) Publication
22. Molecular and Cell Biology by Wolfe S.L., Jones and Bartlett Publication

Course Code	MAJOR SEM – V: - Course Title-Botany practical	Credits	Lectures/Week
25BOTMJP51	PRACTICAL PAPER – PLANT DIVERSITY V + FORMS AND FUNCTION V + FORMS AND FUNCTION VI	2	4

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Identify and study morphological and physiological characteristics of lifecycles of prescribed algae, Macroscopic/ Microscopic characters and Chemical tests for active constituents of the plants.

CO 2: Explain the prescribed families based upon their morphological characteristics of the plants of angiosperm according to Bentham and Hooker's system of classification, Study of anomalous secondary growth in the stems of few plants using double staining technique and understanding the types of Stomata.

CO 3: Experiment with the study of morphological peculiarities and apply the economic importance of the members of the Angiosperm families. Illustrate the effect of temperature/ pH/ substrate on the activity of amylase and aeromicrobiota by petriplate exposed method and antimicrobial activity of the microbial organisms in day to day life.

CO 4: Analyze the genus and species with the help of flora, methodology of research- Review report writing, Smear preparation from *Tradescantia* buds, mitosis using pre-treated root tips of prescribed plant root. Distinguish the problems based on three-point crosses, construction of chromosome maps, plasmid DNA isolation and Separation of DNA using AGE and Growth curve of *E. coli*.

Sr No.	Name of Experiment	Total hours
Paper I		60 hour
1.	Study of aeromicrobiota by petri plate exposure method: Fungal culture, Bacterial culture.	
2.	Study of antimicrobial activity by the disc diffusion method.	
3.	Study of Growth curve of <i>E. coli</i> .	
4.	Study of stages in the life cycle of <i>Chara</i> in fresh/ preserved materials or permanent slide.	

5.	Study of stages in the life cycle of <i>Batrachospermum</i> in fresh/ preserved materials or permanent slide.	
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6.	Study of stages in the life cycle of <i>Marchantia</i> in fresh/ preserved materials or permanent slide.	
7.	Study of one plant from each of the following Angiosperm families as per Bentham and Hooker's system of classification with Morphological peculiarities and economic importance of respective families. ● Cucurbitaceae ● Rubiaceae ● Scitamineae Identify the genus and species with the help of flora.	
Paper II		
8.	Macroscopic/ Microscopic characters and Chemical tests for active constituents of <i>Eugenia caryophyllata</i> and <i>Curcuma longa</i>	
9.	Study of anomalous secondary growth in the stems of the following plants using double staining technique. (Fresh or permanent slides) ● <i>Bignonia</i> ● <i>Salvadora</i> ● <i>Dracaena</i> Study of anomalous secondary growth in the root of the following plants using double staining technique. ● Beet ● Radish Types of Stomata: Anomocytic, Anisocytic, Diacytic, Paracytic, Gramineaceous	
10.	Review report writing Method of Scientific Paper Writing	
Paper III		
11.	Smear preparation from <i>Tradescantia</i> buds	
12.	Problems based on three-point crosses, construction of chromosome maps.	
13.	Study of mitosis using pretreated root tips of <i>Allium cepa</i> .	
14.	Multiple shoot culture, hairy root culture, somatic embryogenesis.	

15.	Preparation of stock solutions for preparation of MS medium. (Note: Concept of preparation of specified molar solutions should be taught and problems based on preparation of stock solutions for tissue culture media will be given).	
16.	Effect of substrate on the activity of amylase	

Course Code	IKS SEM – V: BOTANY-	Credits	Lectures/Week
25BOTIKS514	INDIAN PLANT HERITAGE	2	2

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Describe the Indian Knowledge Systems (IKS) with respect to Ayurveda such as Concept, classification, overview and the study of ethnobotany such as musical instruments and its types.

CO 2: Understand the Overview of ancient Indian texts related to plant sciences (Vedas, Upanishads, Ayurveda, Samhita and exemplify the Food Science with respect to Spices, Pickle, Fermented food, Probiotic, Monsoon Vegetables, Millets.

CO 3: Apply the principles of Ayurveda & plant-based healing – Panch mahabhutas, Tri-doshas and Tri-malas, and Sapta-dhatu, also study of conservation through Sacred Grooves, Nakshatra Garden and Traditional Festivals.

CO 4: Analyze the formulations, therapies in Ayurveda, Ashtang Ayurved, Panchakarma, Panchnidana and importance of wood.

Unit	Topics	No of Lectures
I	AYURVEDA • Concept, classification and importance of Indian Knowledge Systems (IKS). • Overview of ancient Indian texts related to plant sciences (Vedas, Upanishads, Ayurveda, and Samhita). • Principles of Ayurveda and plant-based healing – Panch mahabhutas, Tri-doshas and Tri-malas, and Sapta-dhatu. • Ayurvedic literature, Nyasa and Vaisheshikha schools; Tri-Samhita. • Formulations and Therapies in Ayurveda. • Ashtang Ayurved, Panchakarma and Panchnidana.	15

II	ETHNOBOTANY ● Plant based musical instruments : □ String instrument : Veena and Sitar □ Percussion : Tabala and Mridangam □ Wind : Bansuri (Flute) ● Food Science: Spices, Pickle, Fermented food, Probiotic, Monsoon Vegetables, Millets. ● Tradition of food: Confluence of Agricultural seasons and Festival cycles. ● Conservation: Sacred Groves and Nakshatra Garden.	15
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	● Uses of Wood □ As Ancient Building materials □ Decorative pieces and toys □ Furniture	
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Reference books:

1. The Ayurvedic Pharmacopoeia of India (Volume V, Part I) by Ministry of Health and Family Welfare Department of Ayurveda
2. The practical guide to Healthy Living by Danny Cavanagh and Carol Willis,
3. Ayurvedic Healing: A Comprehensive Guide by Dr. David Frawley and O.M.D, Motilal Banarsidass Publication
4. Charak Samhita – 4 volumes by P.V. Sharma, Chaukhamba Orientalia Publication
5. S.J Traders- Ayurved Sar Sangrah ||आयुर्वेद सारसंग्रह| Hindi Edition | by Baidyanath Ayurveda.
6. Rasa Yoga Ratnakaramu by Pammi Satyanarayana Sastry (In English), Dr. Achanta Lakshmi pathi Ayurveda Library Trust Publication
7. Ethnobotany and medicinal plants of the Indian subcontinent by J.K. Maheshwari, Scientific Publication (India)
8. Feast and Fasts: A History of Food in India by Colleen Taylor Sen, Reaktion Books Publication
9. Traditional Knowledge System in India by Amit Jha, Atlantic Publication& Distributors
10. Ancient Indian Science and its Relevance to the Modern World by Prof. K.E. Govindan, Bharatiya Vidya Bhavan Publication
11. Science and Tradition by A.K. Raina, B.N. Raina, B.N. Patnaik, Monima Chadha, S. Chand Publishing.
12. Prominent Musical Instruments- Technique and Tradition
13. Ethnobotany of India (Indigenous Knowledge & Practices) Vol. II Paperback – 30 November 2024 by Dr Ruchita Shrivastava, Mr Mukul Machhindra Barwant
14. Textbook of food science and technology by Vijaya khader. Publisher: Indian council of Agricultural Research
15. Food science by A.S.Bawa, P.S. Raju, O.P. Chauhan. Publisher: New India Publishing Agency

Course Code	MINOR SEM – V: BOTANY-	Credits	Lectures/Week
25BOTMR521	CURRENT TRENDS IN PLANT SCIENCES IV	2	2
Course Outcomes: After successful completion of this course, students would be able to CO 1: Memorize and describe the prescribed Dyes, Herbal Cosmetics, enzymes application, Essences, Flavours, Perfumes, monographs and types of gardens.. CO 2: Categorize and interpret the types of dyes, essence, perfumes and herbal cosmetics, monograph and types of garden. CO 3: Examine and experiment the application based study of herbal dyes, Herbal Cosmetics, herbal essences, monograph and enzymes application. Implement the various types of gardens. CO 4: Distinguish and estimate the Plant based industrial product such as Milk and meat alternatives. Mind-map the Monographs of drugs and chemical constituents. Analyze the gardens based upon the themes.			
Unit	Topics	No of Lectures	
I	PLANT BASED INDUSTRIES • Dyes: Botanical source, properties and applications of herbal dyes – Annatto, Henna, Spinach and <i>Indigofera</i> dyes. • Herbal Cosmetics: Botanical source, properties and applications of Nagarmotha, Sandalwood, <i>Aloe vera</i> as herbal cosmetic plants. • Essences, Flavours and Perfumes: Botanical source, Properties and applications of herbal essences – Rose, Tuberose, Orange, Jasmine. • Enzymes application: Source, properties and applications of cellulase, bromelain and papain • Plant based Milk and Meat alternatives: □ Milk: Soya and Almond milk. □ Meat: Jackfruit and Tofu	15	
II	PHARMACOGNOSY AND MEDICINAL BOTANY AND HORTICULTURE. <u>Pharmacognosy and Medicinal Botany</u> • Monographs of drugs with reference to biological sources, geographical distribution, common varieties, macro and microscopic characters, chemical constituents, therapeutic uses, adulterants- <i>Strychnos</i> seeds, <i>Senna</i> leaves, Clove buds, <i>Curcuma</i> rhizomes <u>Horticulture</u> • Types of Garden: Mughal Garden , Buddhist Garden, Botanical Garden , Vertical Wall Garden, Indoor Garden- (Dish Garden & Bottle Garden) and Theme Park	15	

Reference books:

1. Natural Dyes for Sustainable Textiles (The Textile Institute Book Series) by Padmashree Vankar and Dhara Shukla. Woodhead publication.
2. Textbook of Herbal Cosmetics by Vimladevi. CBS publication.
3. Plant-Based Nutrition: A Holistic Approach to Health" by Julieanna Hever, MS, RD, Book Publishing Co. (2020)
4. Plant-Based Food: A Comprehensive Guide to Eating Whole, Healthy Foods" by Mark Hawthorne, Avery Publishing Group (2017)
5. Pharmacognosy and Phytochemistry by J. S. S. Purohit & S. P. Vyas, CBS Publishers & Distributors
6. Pharmacognosy: A Textbook of Natural Products" by G. S. Khandelwal, Nirali Prakashan
7. Essentials of Pharmacognosy by A.K. Bansal, Ane Books India publication
8. Medicinal Plants by C.K. Atal and B.M. Kapoor, A.H. Wheeler & Co. publication
9. Textbook of Pharmacognosy by T.E. Wallis, J. & A. Churchill publisher (1960)
10. Medicinal Plants: Chemistry and Properties" by Elizabeth M. Williamson, Wiley-Blackwell publication
11. Botany for Degree Students by A.C. Dutta, Oxford University Press publisher (6th Edition)
12. Medicinal Botany: Plants Affecting Human Health" by Michael Wink, Springer publication
13. Introduction to Medicinal Plants" by K. K. Gaur, Eastern Book Corporation
14. Plant Anatomy by K.V. Krishnamurthy, S. Chand Publishing
15. The Anatomy of Woody Plants by K. E. Esau, W.H. Freeman publication (1977)
16. Textbook on Horticulture by Rajaneesh Singh, Bijendra Kumar Singh. New India Publishing Agency publisher
17. Introductory Ornamental Horticulture and Landscape Gardening by Rajaneesh & Bijendra Kumar Singh. New India Publishing Agency publisher
18. Vertical Gardening: More Garden in Less Space (Large Print): Gardening Basics for Beginners Series, CreateSpace Independent Publishing Platform publication
19. Bottle Gardening by Peter McHoy, Southwater publication
20. Theme Gardens by Barbara Damrosch, Rodale Books publication
21. Veganbell's Indian Vegan Cookbook: 90 Easy, Plant based recipes by Neelam Pokhrel. ISBN: 935406404.

Course Code	MINOR SEM – V: - Course Title-Botany practical	Credits	Lectures/Week
25BOTMRP51	PRACTICAL PAPER-CURRENT TRENDS IN PLANT SCIENCES IV	2	4

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Memorize and describe the study of plants as a source of natural dyes, herbal cosmetics, herbal essence, flavors and perfumes.

CO 2: Categorize and interpret - Study of plants as a source of herbal essence, flavors and perfumes. Exemplify the Dish Garden, Bottle Garden and Vertical wall

CO 3: Implement and perform experiment on preparation of bio enzyme, Preparation of plant based alternatives for milk, meat and oil extraction.

CO 4: Estimate the Macroscopic/ Microscopic characters and Chemical tests for active constituents of the following plants- *Strychnos* seeds, *Senna* leaves, Clove buds, *Curcuma* rhizome

Sr No	Name of the experiment	Total hrs.
1.	Extraction and application of natural dyes from plant material.	60 hours
2.	Study of Plants used in herbal cosmetics, e.g. Shoe flower, Ashwagandha, Asparagus, Coconut, Jojoba, Tulsi.	
3.	Preparation of Herbal cosmetics.	
4.	Extraction of essential oils using Clevenger's apparatus.	
5.	Study of plants used for herbal essence flavor and perfumes	
6.	Preparation of Bio-enzyme from plant material.	
7.	Preparation of plant based milk and curd	
8.	Preparation of plant based meat.	
9.	Macroscopic/ Microscopic characters and Chemical tests for active constituents of <i>Strychnos</i> seeds	
10.	Macroscopic/ Microscopic characters and Chemical tests for active constituents of <i>Senna</i> leaves	
11.	Macroscopic/ Microscopic characters and Chemical tests for active constituents of Clove buds	
12.	Macroscopic/ Microscopic characters and Chemical tests for active constituents of <i>Curcuma</i> rhizome	
13.	Dish Garden	
14.	Bottle Garden	

15.	Vertical wall Garden	
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Course Code	ELECTIVE - SEM – V: BOTANY-	Credits	Lectures/Week
25BOTEL531	INDUSTRIAL BOTANY	2	2

Course Outcomes:

After successful completion of this course, students would be able to.

CO 1: Describe the Dyes: Botanical source and properties of herbal dyes, Herbal Cosmetics, enzyme application, essences, flavors and perfumes. Define commercial production in relation to propagation in prescribed plants.

CO 2: Categorize and interpret the types of dyes, essence, perfumes and herbal cosmetics. Exemplify the Commercial production of the prescribed crops in relation to propagation, post plantation care, harvesting, post-harvest management and varieties.

CO 3: Examine the application based study of herbal dyes, Herbal Cosmetics, herbal essences, enzymes application and the commercial production and post-harvest management of prescribed plants.

CO 4: Distinguish and identify the Plant based Milk and Meat alternatives, analyze the study of commercial production Cereal, Pulses, Vegetable, Fruit, Spices, Cash crops and Mushroom,

Unit	Topics	No of Lectures
I	PLANT BASED INDUSTRIES • Dyes: Botanical source, properties and applications of herbal dyes – Annatto, Henna, Spinach and <i>Indigofera</i> dyes. • Herbal Cosmetics: Botanical source, properties and applications of Nagarmotha, Sandalwood, <i>Aloe vera</i> as herbal cosmetic plants. • Essences, Flavours and Perfumes: Botanical source, Properties and applications of herbal essences – Rose, Tuberose, Orange, Jasmine. • Enzymes application: Source, properties and applications of cellulase, bromelain and papain • Plant based Milk and Meat alternatives: □ Milk: Soya and Almond milk. □ Meat: Jackfruit and Tofu	15

II	COMMERCIAL PRODUCTION: Commercial production of the following in relation to propagation, post plantation care, harvesting, post-harvest management and varieties. 1. Cereal Rice and Jowar 2. Pulses: Moong and Channa 3. Vegetable: Tomato 4. Fruit: Garcinia and Mango 5. Spices and Cash crops: Betle leaf and black Pepper 6. Mushroom cultivation	15
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Reference books:

1. Natural Dyes for Sustainable Textiles (The Textile Institute Book Series) by Padmashree Vankar and Dhara Shukla. Woodhead publication.
2. Textbook of Herbal Cosmetics by Vimladevi. CBS publication.
3. The Plant-Based Food Revolution by Heather S. Menzies, Greystone Books publication
4. Plant-Based Nutrition: A Holistic Approach to Health by Julieanna Hever, MS, RD, Hachette Books publication
5. Plant-Based Food: A Comprehensive Guide to Eating Whole, Healthy Foods by Mark Hawthorne, BenBella Books publication
6. Fundamentals of Cereal Crop Production Paperback by Pall, Springer publication
7. Pulse Crop Production: Principles and Technologies by Majumdar D.K., CRC Press publication
8. Fundamentals of Vegetable Crop Production by Beena Nair, New India Publishing Agency publication
9. Fruit Production: Major Fruits Hardcover by R. R. and Krishna Hare Sharma, Agrobios publisher (India)
10. Mushroom production and utilization by S.K. Singh and P.K. Jha. Springer publication
11. The Complete Book on Spices & Condiments (with Cultivation, Processing & Uses) 2nd Revised Edition by NIIR Board of consultant & Engineers, NIIR Project Consultancy Services (NPCS) publication
12. Agriculture and Cash Crops Hardcover by Parameshwar H., Oxford & IBH publication
13. Economic Botany by B.P. Pandey. S. Chand publishing
14. Economic Botany: A comprehensive study by S.L. Kochhar. Publisher: Cambridge University Press (India)
15. Plants in our world: Economic Botany by Beryl Simpson and Molly Education, Publisher: McGraw-Hill Education.

Course Code	ELECTIVE - SEM – V: - Course Title- Botany practical	Credits	Lectures/Week
25BOTELP51	INDUSTRIAL BOTANY	2	4

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Memorize and describe the study of plants as a source of natural dyes, herbal cosmetics, herbal essence, flavors and perfumes, study of Cultivation, Varieties and post-harvest products - Cereal:- Rice and Jowar, Pulses:- Moong and Chana, Vegetable:- Tomato and Methi, Fruit:- Kokum and Mango, Spices and Cash crops:- Betle leaf and black Pepper, Mushroom,

CO 2: Categorize and interpret - Study of plants as a source of herbal essence, flavors and perfumes. Exemplify the cultivation and post-harvest management Cereal:- Rice and Jowar, Pulses:- Moong and Chana, Vegetable:- Tomato and Methi, Fruit:- Kokum and Mango, Spices and Cash crops:- Betle leaf and black Pepper, Mushroom,

CO 3: Implement and experiment preparation of bio-enzyme, preparation of plant based alternatives for milk meat and oil extraction.

CO 4: Analyze Cultivation, Varieties and post-harvest products of Cereal: Rice and Jowar, Pulses:- Moong and Chana, Vegetable:- Tomato and Methi, Fruit:- Kokum and Mango, Spices and Cash crops:- Betle leaf and black Pepper, Mushroom.

Sr No .	Name of the experiment	Total hours
1.	Extraction and application of natural dyes from plant material.	60 hours
2.	Study of Plants used in herbal cosmetics, Nagarmotha, Sandalwood, <i>Aloe vera</i> , Jojoba.	
3.	Preparation of Herbal cosmetics.	
4.	Extraction of essential oils using Clevenger's apparatus.	
5.	Study of plants used for herbal essence flavor and perfumes	
6.	Preparation of Bio-enzyme from plant material.	
7.	Preparation of plant based milk and curd.	
8.	Preparation of plant based meat.	
9.	Study of Varieties, Economic importance and post-harvest products of Cereal:- Rice and Jowar.	
10.	Estimation of fibre.	

11	Study of Cultivation, Varieties, Economic importance and post-harvest products of Pulses: - Moong and Channa.	
12	Study of Varieties, Economic importance and post-harvest products of Vegetable – Tomato	
13	Mushroom cultivation	
14	Study of Varieties, Economic importance and post-harvest and commercial products of Fruit:- Kokum and Mango	
15	Spices and Cash crops- Betle leaf and Black Pepper.	

Course Code	ELECTIVE - SEM – V: BOTANY-	Credits	Lectures/Week
25BOTEL532	Fundamentals of Hydroponic	2	2

Course outcomes:

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

CO1: Memorize and describe Soilless/hydroponic production- basic principles, history, background, types, advantages and disadvantages, Environmental factors, plant pest and disease, prescribed plant nutrition, formulation of nutrient solution, types of hydroponic/soilless systems in polyhouse, production of herbs, leafy vegetables, Brinjal, Potatoes, Broccoli, vines and commercial production of strawberry.

CO2: Explain the cultivation practice followed in hydroponic systems, its nutrition, growth factors, types of substrates, types of soilless systems, commercial production of Brinjal, Potatoes, Broccoli, strawberry, vine crops, microgreens and baby greens.

CO3: Experiment with application based systems for production of plants in hydroponic / soilless cultivation practice, factors affecting the plant growth, pest and disease, commercial cultivation of Brinjal, Potatoes, Broccoli, strawberry, vine crops- tomatoes, cucumber and pepper.

CO4: Distinguish the importance of hydroponic/soilless cultivation practice based upon the types and the requirement of specific system for cultivation of microgreens, baby greens, Brinjal, Potatoes, Broccoli, Strawberry and vine crops- Tomatoes, Pepper, Cucumber by analysing the nutrition uptake through formulations and the study of pest and disease effective for cultivation practices.

Unit	Topic	No. of Lectures
I HYDROPONIC	Soilless/hydroponic production- Basic principles, terminology, history, background, types (organic and inorganic), Advantages and Disadvantages and common crops. Environmental factors and plant growth: Light, temperature, CO₂, RH and cooling Systems Plant nutrition – Supplying essential nutrients, nutrient and water uptake, soil culture vs. hydroponics. Nutrient disorders and symptomology, formulation of Hydroponic nutrient	15

		solutions, pH, EC and volume interactions between substrate and nutrition.	
		Growing substrates: Sand, gravels, coco-peat, stones, hydrotons, coirs etc. Effect of environmental factors on plant growth.	
II COMMERCIAL SOILLESS CULTIVATION		Hydroponic cultivation system in Polyhouse – Definition, concept, types- Nutrient Film Technique, Horizontal Flat Bed System, Dutch water bucket, Aquaponics, Aeroponics. Leafy green production: Herbs, leafy vegetables and cultivars- (Growth, stage, requirements and production systems). Leafy green production II: Microgreens and baby greens production. Commercial soilless cultivation of fruit crops - Strawberry cultivation. Commercial soilless Cultivation of vegetable crops - Brinjal, Potatoes and Broccoli. Commercial soilless cultivation of vine crops – Tomatoes, Pepper and Cucumber. Pest and disease: Disease in hydroponic production, species identification and control strategies.	15

References

1. Soilless Culture: Theory and Practice by Michael Raw and J. Heinrich Lieth. ISBN: 978-0-444-52975-6. Elsevier B.V. Publication.
2. The complete guide to Thriving Hydroponic system by Sensorex Inc. USA Publication.
3. Hydroponic Food Production by H.M. Resh. Woodbridge Press Publishing Company. ISBN 0-88007-222-9.
4. Guidelines for Protected Cultivation by Department Of Horticulture. Govt. of Andhra Pradesh.
5. Floriculturist (Protected Cultivation) by M. Siraj Anwar. Secretary, National Council of Educational Research and Training; DTP Cell, Publication Division.
6. Microgreens for Nutritional Security by Dr. Vineetha Kumari, Dr. Shirisha Junuthula, Mr. Ravi Teja Mandapaka. National Institute of Agricultural Extension Management. Govt. of India.
7. Hydroponics – A Standard Methodology for Plant Biological Researches by Toshiki Asao. Published by InTech.
8. Hydroponics: A Boon for Vegetable Crops by Pragti Negi. Just Agriculture e-newsletter.
9. Hydroponic Lettuce Handbook by Dr. Melissa Brechner, Dr. A.J. Both. Cornell University.
10. A Textbook on Modern Cultivation Practices of Vegetables by Editors- Chetan Kumar Nagar, Naman Paliwal. Career Point Ltd.
11. Simplified Hydroponic Booklet by Prof. Francesco Orsini. Creative Commons Attribution. ISBN: 9788854971738.
12. Gardening: Hydroponics - Learn the “Amazing Art” of Growing: Fruits, Vegetables, & Herbs, without Soil BY Michael I. Rich. ASIN: B01DEBPF56. ISBN: 1983837040.
13. Hydroponics Technology for Horticultural Crops BY Murtaza Hasan, Naved Sabir, Awani Kumar Singh, MC Singh, Neelam Patel, Manoj Khanna, Tarun Rai and Pooran Pragnya. Centre for Protected Cultivation Technology. ICAR-Indian Agricultural Research Institute.

Course Code	ELECTIVE - SEM – V: BOTANY-	Cred its	Lectures/Week
25BOTELP52	Practical in Fundamentals of Hydroponics	2	2

Course outcomes:

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

CO1: Memorize and describe Soilless/hydroponic production- basic principles, history, background, types, advantages and disadvantages, Environmental factors, plant pest and disease, prescribed plant nutrition, formulation of nutrient solution, types of hydroponic/soilless systems in polyhouse, production of herbs, leafy vegetables, Brinjal, Potatoes, Broccoli, vines and commercial production of strawberry.

CO2: Explain the cultivation practice followed in hydroponic systems, its nutrition, growth factors, types of substrates, types of soilless systems, commercial production of Brinjal, Potatoes, Broccoli, strawberry, vine crops, microgreens and baby greens.

CO3: Experiment with application based systems for production of plants in hydroponic / soilless cultivation practice, factors affecting the plant growth, pest and disease, commercial cultivation of Brinjal, Potatoes, Broccoli, strawberry, vine crops- tomatoes, cucumber and pepper.

CO4: Distinguish the importance of hydroponic/soilless cultivation practice based upon the types and the requirement of specific system for cultivation of microgreens, baby greens, Brinjal, Potatoes, Broccoli, Strawberry and vine crops- Tomatoes, Pepper, Cucumber by analysing the nutrition uptake through formulations and the study of pest and disease effective for cultivation practices

Sr. No.	Title	No. of Hours
1	Study of Types of Hydroponic Systems I: NFT – Vertical and Horizontal.	60
2	Study of Hydroponic Systems II: Dutch Bucket, Aeroponics and Aquaponics.	
3	Study of growing substrates used in Hydroponic/Soilless Cultivation.	
4	Study of effect of environmental factors on plant growth.	
5	Study of Formulation of nutrient / fertilizers for Hydroponic cultivation	
6	Study of types of polyhouse.	
7	Study of equipment used in Polyhouse for Hydroponic cultivation	

8	Hydroponic/Soilless Cultivation of microgreens, baby greens and leafy vegetables	
9	Soilless cultivation of Brinjal, Potatoes and Broccoli	
10	Hydroponic/ Soilless cultivation of Vine crops- Tomatoes, Cucumber and Pepper	
11	Hydroponic cultivation of fruits- Strawberry	
12	Visit to Hydroponic unit/ case study/ project presentation	

Course Code	VSC SEM – V: - Course Title-Botany practical	Credits	Lectures/Week
25BOTVSC541	URBAN GARDENING	2	4

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Describe the types of indoor garden: (bottle garden, dish garden), kitchen garden – types, requirement, and settings.

CO 2: Illustrate the plants suitable for indoor vertical wall gardening, plants suitable for outdoor vertical gardening, dish garden,

CO 3: Apply the techniques of indoor garden and modern methods of agriculture, hanging garden, rock garden, terrace garden and micro greens.

CO 4: Analyze the setting up of vertical vegetable garden, bonsai, basket farming- plants, micro greens and modern methods of agriculture – hydroponics.

Sr No.	Name of the experiment	Total hours
1.	Study of types of seeds and sowing techniques.	60 hours
2.	Study of types of indoor garden: bottle garden, dish garden and potted plants.	
3.	Study of vertical wall garden: Setting requirements, types of pots and potting media	
4.	Study of Bonsai: Styles Pots and method of preparation	
5.	Study of Hanging Garden	
6.	Study of Terrace Garden	
7.	Study of kitchen garden – requirements and settings.	
8.	Study, setting up a vertical vegetable garden and basket farming- plants.	
9.	Study of cultivation of micro greens.	
10.	Modern methods of agriculture – hydroponics (soil less cultivation).	
11.	Water and bog garden	
12.	Rock garden (Rockery)	
13.	Cacti and succulents	
14.	Excursion	
15.	Project.	

Reference books

1. Seed Sowing and Saving: Step-by-Step Techniques for Collecting and Growing More Than 100 Vegetables, Flowers, and Herb. Storey's gardening skill by Carole B. Turner, Storey publication
2. Indoor Gardening for Beginners: The Complete Guide to Growing Herbs, Flowers, Vegetables and Fruits in Your House by Jason Johns.
3. Bonsai: The Complete Step-by-Step Guide on How to Cultivate and Care for Beginners. Elite Novelty Print LLC by Kitaro Takagi, Elite Novelty Print LLC
4. Garden Up: your One Stop Guide To Growing by Ekta Chaudhary, Penguin Random House India Pvt. Ltd.
5. Vertical Vegetables & Fruit: Creative Gardening Techniques for Growing Up in Small Spaces. Storey Books; Revised ed. Edition by Rhonda Massingham Hart.
6. Hydroponic Food Production: A Definitive Guidebook for the Advanced Home Gardener and the Commercial Hydroponic Grower by Howard M. Resh, CRC Press publication
7. Rock Garden Design and Construction by Jane Mc Gary, Timber Press publication
8. The Complete Book of Cacti & Succulents by Terry Hewitt, Firefly Books publication
9. Gardeners' World" Complete Book of Water Gardens by Sue Fisher, BBC Books publication
10. Water Gardens: A Practical Step-By-Step Guide by Yvonne Rees and Neil Sutherland, The Crowood Press publication
11. A Naturalist's Guide to the Garden Flowers of India by Pradeep Sachdeva, HarperCollins India publisher
12. Urban Horticulture by Tina Marie Waliczek and Jayne M. Zajicek, CABI publication
13. Urban Horticulture: Necessity of the Future by Shashank Shekhar Solankey and Shirin Akhtar

Course Code	FP/ CEP SEM – V: - Course Title-Botany	Credits	Lectures/Week
25BOTFP5	Field Project/ Community engagement Programme	2	-

SEMESTER VI

Course Code	MAJOR SEM – VI: BOTANY-	Credits	Lectures/Week
25BOTMJ611	PLANT DIVERSITY VI	2	2
Course Outcomes: After successful completion of this course, students would be able to CO 1: Memorize the study of Basidiomycetes and Pteridophytes: Classification and General characters. CO 2: Express the Life cycle of <i>Agaricus</i> , <i>Puccinia</i> , <i>Lycopodium</i> , <i>Equisetum</i> and <i>Marselia</i> and also biological, Physical and chemical methods of disease control. CO 3: Experiment with Fungi and study of plant pathology of Basidiomycetes identify the plant diseases with relation to causing organism, symptom, disease cycle and control measures for Tikka disease of ground, Citrus canker, and leaf curl virus in papaya. CO 4: Organize and analyze the general characters of Basidiomycetes and differentiate stages of alternation of generation of prescribed Fungi (<i>Agaricus and Puccinia</i>), Pteridophytes (<i>Lycopodium</i> , <i>Equisetum</i> and <i>Marselia</i>).			
Unit	Topics	No of Lectures	
I	FUNGI AND PLANT PATHOLOGY <u>Fungi</u> - Basidiomycetes: Classification and General characters - Life cycle of <i>Agaricus</i> - Life cycle of <i>Puccinia</i> <u>Plant pathology</u> - Study of Physical, chemical and biological control methods of plant diseases. - Study of plant diseases with relation to causing organism, symptom, disease cycle and control measures of following diseases - Tikka disease of ground - <i>Cercospora</i> - Citrus canker – <i>Xanthomonas citri</i> - Leaf curl- leaf curl virus in papaya.	15	
II	PTERIDOPHYTA (G.M. SMITH CLASSIFICATION SYSTEM TO BE FOLLOWED) <u>Pteridophyta</u> - Classification, general characters; and Life cycle of <i>Lycopodium</i> <i>Equisetum</i> <i>Marselia</i> - Types of sori and evolution of sori in Pteridophyta.	15	

Reference books:

1. College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises.
2. Cryptogamic Botany Vol I and II by G M Smith, Mcgraw Hill publication
3. Botany for Degree Students – Fungi by B. R. Vasistha and A.K.Sinha, S. Chand Publishing
4. The Textbook of Fungi by O.P. Sharma, McGraw-Hill Education publisher
5. An Introduction to Pteridophyta by A.C. Dutta, Oxford & IBH Publishing
6. Pteridophytes and Gymnosperms by P.C. Vashishta, S. Chand Publishing

Course Code	MAJOR SEM – VI: BOTANY-	Credits	Lectures/Week
25BOTMJ612	PLANT DIVERSITY VII	2	2
Course Outcomes: After successful completion of this course, students would be able to CO 1: Describe the Chamberlain Classification of Gymnosperms. Memorize and study and identify the prescribed field plants of families in angiosperms and botanical gardens. CO 2: Explain paleobotany, life cycle of prescribed gymnosperms. Enumerate angiosperms with respect to Major botanical garden of India and Bentham and Hooker's system of classification. CO 3: Apply the knowledge of general characters and alternation of generation of Gymnosperms and study of identification of plants as per Bentham and Hooker's system of classification and type of botanical garden. CO 4: Study in detail the lifecycle of two gymnosperms. Learn about the fossil <i>Pentoxylon</i> and various prescribed families in angiosperms along-with botanical garden of India.			
Unit	Topics	No of Lectures	
I	GYMNOSPERM (CHAMBERLAIN'S CLASSIFICATION SYSTEM TO BE FOLLOWED) • General characters of Coniferophyta • Life cycle of <i>Thuja</i> • Life cycle of <i>Gnetum</i> Paleobotany- Study of fossils – <i>Pentoxylon</i>	15	

II	ANGIOSPERM II <u>Angiosperm</u> ● Botanical garden of India–Lalbaugh Botanical Garden, Bengaluru. ● Botanical survey of India and regional branches of India ● Bentham and Hooker’s system of classification for flowering plants up to family with respect to the following prescribed families and economic importance, medicinal importance and fruit morphology for members of the families. □ Combretaceae □ Asclepiadaceae □ Labiatae □ Graminae (Poaceae)	15
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Reference books:

1. Botany for Degree Students – Gymnosperm by B R Vasistha, A.K.Sinha, S Chand Publication.
2. College Botany Vol I and II by Gangulee Das and Dutta Central Education enterprises.
3. Pteridophytes and Gymnosperms by P.C. Vashishta, S. Chand Publishing
4. Plant Systematics by Gurcharan Singh, Oxford and IBH Publ.
5. Taxonomy of Vascular Plants by Lawrence George, H M, Oxford and IBH Publ.
6. Angiosperms by Chopra G.L. and S. Nagin, McGraw-Hill Education publication
7. Modern Plant Taxonomy by N.S. Subrahmanyam, Vikas Publishing House
8. Plant Taxonomy by O.P. Sharma, McGraw-Hill Education
9. Textbook of Plant Taxonomy by Manoj Kumar Singh
10. Plant Taxonomy by Dr. V. Singh, Dr. P.C. Pande, Dr. D.K. Jain

Course Code	MAJOR SEM – VI: BOTANY-	Credits	Lectures/Week
25BOTMJ613	FORMS AND FUNCTION VII	2	2
Course Outcomes: After successful completion of this course, students would be able to CO 1: Identify and describe the physiological process involved in solute transport, mineral nutrition and nitrogen metabolism. Memorize various techniques of bioremediation, phytoremediation and biostatistics. CO 2: Understand solute transport of plants, pressure flow model, and mineral nutrition and prescribed metabolism with effects of various hormones. Explain the process of bioremediation and different factors affecting it, concept of bioinformatics. CO 3: Experiment and implement the solute transport munch hypothesis, plant hormones and nitrogen metabolism. Apply the techniques in environment protection with respect to the type of organisms used in the process of bioremediation and in biostatistics. CO 4: Reveal and analyze the physiological study in plant metabolism to create solutions towards the problem faced in the environment. Distinguish biostatistical methods and tools of bioinformatics.			
Unit	Topics	No of Lectures	
I	PLANT PHYSIOLOGY ● Solute transport: Active and Passive transport. ● Pressure flow model (Munch's hypothesis): Phloem loading and unloading. ● Mineral Nutrition: Role of Macro and Micro nutrients, physiological functions and deficiency symptoms. ● Nitrogen Metabolism: Nitrogen cycle, root nodule formation. Physiological effects and commercial applications of Auxins, Gibberellic acid, Cytokinin and Absciscic acid.	15	

II	ENVIRONMENTAL BOTANY, BIOSTATISTICS AND BIOINFOMATICS <u>Environmental sciences</u> ● Bioremediation: Principles, factors affecting and types of bioremediations. ● Phytoremediation: Metals, Organic pollutants. Plant succession: Hydrosere and Xerosere – Formation of Barren Space, Succession on the Land Citing Different Seres leading up to the Climax, Succession in water habitat. <u>Biostatistics</u> ● Test of significance student's <i>t</i>-test – Paired and Unpaired.	15
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	● ANOVA (one way). <u>Bioinformatics:</u> Introduction, concept and data bases ● Study of tools of bioinformatics ☐ BLAST ☐ RasMol ☐ MSA	
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Reference books:

1. Biostatistics by P.N. Arora and P.K. Malhan, Himalaya Publishing House
2. Fundamentals of Biostatistics by Veer Bala Rastogi, Jaypee Brothers Medical Publications
3. Environmental Biology by P.D. Sharma, Rastogi Publications
4. Basics of Biostatistics and application by Animesh K. Dutta. Publisher: The info Library- 2020
5. Environmental Studies by Erach Bharucha, University Press Publications
6. Environmental science by Santra, New Central Book Agency Publications
7. Plant Physiology by Salisbury and Ross, Cengage Learning publication
8. Introduction to Plant Physiology by Noggle and Fritz. Publisher: Atma Ram and Sons (1967).
9. Plant Physiology by S. Mukharji and Ghosh A.K. Publisher: Central Book Agency.
10. Introduction to Plant Physiology by William G. Hopkins & Norman P.A. Hüner, John Wiley & Sons publication
11. A Textbook of Environmental Science by Arvind Kumar, S. Chand Publishing
12. Introduction to Bioinformatics-Attwood T. K. & D. J. Parry –Smitn Publisher –Addison Wesley Longman Limited.
13. Bioinformatics & Molecular evolution-Higgs. Paul G.-Wiley Publisher.
14. Bioinformatics-Sequence and Genome- David W. Mount-Cold Spring Harbreir Laboratory.
15. Bioinformatics-Ranga M. M. Publisher Agrobios India(1 Jan 2007)
16. Bioinformatics and Molecular Evolution by Higgs Paul G., Wiley publisher
17. Bioinformatics – Sequence and Genome by David W. Mount. Publisher: Cold Spring Harbor Laboratory
18. A textbook of Bioremediation-Sankalp Tikkoo-Publisher Dominant
19. Environmental studies by Manoj Tiwari, Kapil Khulbe. Publisher I.K.International
20. Principle of Ecology by P.S. Verma and V.K. Agrawal

Course Code	MAJOR SEM – VI: BOTANY-	Credits	Lectures/Week
25BOTMJ614	FORMS AND FUNCTION VIII	2	2

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Learn various processes of DNA sequence analysis and construction of DNA libraries, Chromosomal libraries and c-DNA libraries. Learn about Essential oils, fatty oils and herbal drugs.

CO 2: Explain the principles of DNA sequencing methods such as Maxam-Gilbert, Sanger's method and Pyro sequencing. Explain characters and uses Essential oils, fatty oils, and Vegetable fat.

CO 3: Experiment with extraction of Essential oils, fatty oils, vegetable fats and evaluation of qualitative and quantitative analysis of herbal drugs. Implement the knowledge gained in the identification of and analysis of specific cloned DNA sequences.

CO 4: Infer on the differences and similarities between different methods of DNA sequencing. Identify the challenges and opportunities in the field of economic botany with respect to the types of Oils and herbal drugs.

Unit	Topics	No of Lectures
I	PLANT BIOTECHNOLOGY ● DNA sequence analysis– Maxam – Gilbert Method and Sanger's method, Pyro Sequencing. ● DNA barcoding: Basic features, nuclear genome sequence. ● Construction of genomic DNA libraries, Chromosome libraries and c-DNA libraries. ● Identification of specific cloned sequences in c-DNA libraries. ● Analysis of genes and gene transcripts –Restriction enzyme, analysis of cloned DNA sequences.	15
II	ECONOMIC BOTANY Study extraction, characterization and uses of ● Essential Oils: Extraction, perfume oils, oil of rose, sandalwood, patchouli, champaca, grass oils: Citronella. ● Fatty oils: Drying oil (linseed, soyabean), semidrying oils(cotton seed, sesame oil) and non-drying oils (olive oil and peanut oil, Coconut and Palm oil) ● Vegetable Fats: Kokum Butter, Coco Butter □ Quality control of herbal drugs □ Qualitative & Quantitative analysis for evaluation herbal drugs □ Challenges and opportunities	15

Reference books:

1. A Textbook of Biotechnology by S. Chand, R. C. Dube., S. Chand Publishing
2. Biotechnology by Satyanarayana, Books & Allied Ltd Publisher (2 January 2020) ISBN: 978-8187134909
3. Molecular Biology by Verma and Agrawal, S. Chand Publishing (2020) ISBN: 978-8121931915
4. Principle and Methods of plant Molecular Biology, Biochemistry and Genetics Agrobios by Devi P., Agrobios Publication.
5. Plant Biotechnology by B.D. Singh, Kalyani publication
6. DNA barcoding plants: taxonomy in a new perspective by K. Vijayan and C. H. Tsou, Springer publication
7. Economic Botany in the Tropics by S.L. Kochhar, Macmillan India publication
8. Economic Botany by H.P. Pandey , S. Chand (1999)
9. Economic Botany by Hill Albert F. Publication: Surjeet
10. Textbook of Economic Botany by B.P. Pandey, Rastogi Publications
11. Pharmacognosy by C.K. Kokate, A.P. Purohit and S.B. Gokhale, Nirali Prakashan Publications
12. Quality Control and Evaluation of Herbal Drugs by Pulok K. Mukherjee, CRC Press Publications
13. Principle of Plant Biotechnology: An introduction to Genetics Engineering in plant by S.H.Mantell and J.A. Mathews. Black well Scientific Publication

Course Code	MAJOR SEM – VI: - Course Title-Botany practical	Credits	Lectures/Week
25BOTMJP61	PRACTICALS BASED ON PLANT DIVERSITY VI + PLANT DIVERSITY VII + FORMS AND FUNCTION VII + FORMS AND FUNCTION VIII	2	4
Course Outcomes: After successful completion of this course, students would be able to CO 1: Describe the life cycle of prescribed fungi, pteridophyta and gymnosperms. CO 2: Understand the diagnostic characters of prescribed families with respect to morphological peculiarities as per the Bentham and Hooker’s system of classification. CO 3: Experiment and interpret the plant biostatistics for its statistical significance using the principle of bio-statistics in one way ANOVA and utilize the tests of ecological parameters in given water sample and isolation of plasmid. CO 4: Perform and inspect the physiological estimations in given plant samples for its phosphate, phosphorous, iron and analyze various techniques in plant biotechnology and plant tissue culture such as DNA sequencing by Sanger’s Method, Pyro Sequencing Method, DNA barcoding of plant material by using suitable data.			
Sr No .	Name of the experiment	Total hours	
Paper I			
1.	Study of stages in the life cycles of the following fungi from fresh / preserved material and permanent slides ☐ <i>Agaricus</i> ☐ <i>Puccinia</i>		
2.	Study of stages in the life cycles of the following Pteridophyta from fresh / preserved material and permanent slides ☐ <i>Lycopodium</i> ☐ <i>Equisetum</i> ☐ <i>Marselia</i> Types of sori and evolution of sori in Pteridophyta		
Paper II			
3.	Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides ☐ <i>Thuja</i> ☐ <i>Gnetum</i>		

4.	Study of one plant from each of the following Angiosperm families as per Bentham and Hooker's system of classification. ☐ Combretaceae ☐ Asclepiadaceae	
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	☐ Labiatae ☐ Graminae	60 Hours
Paper III		
5.	Estimation of Phosphate phosphorus (Plant acid extract)	
6.	Estimation of Iron (Plant acid extract)	
7.	Student’s t-test (Paired and Unpaired), ANOVA (One Way)	
8.	Estimation of the following in given water sample:- Dissolved oxygen demand Biological oxygen demand Hardness	
9.	BLAST	
10.	RasMol	
11.	MSA	
Paper IV		
12.	DNA sequencing by Sanger’s Method and Pyro Sequencing Method	
13.	DNA barcoding of plant material by using suitable data	
14.	Plasmid DNA isolation and Separation of DNA using AGE	

Course Code	MINOR SEM – VI: BOTANY-	Credits	Lectures/Week
25BOTMR621	CURRENT TRENDS IN PLANT SCIENCES V	2	2
Course Outcomes: After successful completion of this course, students would be able to CO 1: Learn various processes of bioremediation, phytoremediation and plant succession. Describe essential oils, fatty oils and herbal drugs. CO 2: Explain the plant succession with respect to Hydrosere and Xerosere, phytoremediation, Essential oils, fatty oils, vegetable fats and quality control of herbal drugs. CO 3: Experiment with extraction of Essential oils, fatty oils, vegetable fats and evaluation of qualitative and quantitative analysis of herbal drugs. Implement the types of bioremediation, phytoremediation and change in the land forms (plant succession). CO 4: Distinguish and Inspect the various the factors responsible for bioremediation, phytoremediation, plant succession and the challenges and opportunities in the field of economic botany with respect to the types of Oils and herbal drugs.			
Unit	Topics	No of Lectures	
I	ENVIRONMENTAL BOTANY • Bioremediation: Principles, factors affecting and types of bioremediation. • Phytoremediation: Metals, Organic pollutants. • Plant succession: Hydrosere and Xerosere – Formation of Barren Space, Succession on the Land Citing Different Series leading up to the Climax, Succession in Water habitat.	15	
II	ECONOMIC BOTANY Study extraction, Characterization and uses of • Essential Oils: Extraction, perfume oils, oil of rose, sandalwood, patchouli, champaca, grass oils: Citronella. • Fatty oils: Drying oil (linseed, soyabean), semidrying oils(cotton seed, sesame oil) and non-drying oils (olive oil and peanut oil, Coconut and Palm oil) • Vegetable Fats: Kokum Butter, Coco Butter □ Quality control of herbal drugs □ Qualitative & Quantitative analysis for evaluation herbal drugs	15	

Reference books:

1. Environmental Biology by P.D. Sharma, Rastogi Publications
2. A Textbook of Environmental Science by Arvind Kumar, S. Chand Publishing
3. Environmental Studies by Erach Bharucha, University Press Publications
4. Environmental science by Santra, New Central Book Agency Publications
5. Economic Botany in the Tropics by S.L. Kochhar, Macmillan India Publications
6. Textbook of Economic Botany by B.P. Pandey, Rastogi Publications
7. Pharmacognosy by C.K. Kokate, A.P. Purohit & S.B. Gokhale, Nirali Prakashan
8. Quality Control and Evaluation of Herbal Drugs by Pulok K. Mukherjee, CRC Press Publications
9. Textbook of Pharmacognosy and Phytochemistry by Biren Shah & A.K. Seth, Elsevier Publications
10. Economic Botany by Pandey H.P. Publication S. Chand (1999)
11. Economic Botany by Hill Albert F. Publication: Surjeet
12. Textbook of Economic Botany by B.P. Pandey, Rastogi Publications
13. Environmental Biology by P.D. Sharma, Rastogi Publications

Course Code	MINOR SEM – VI: - Course Title-Botany practical	Credits	Lectures/Week
25BOTMRP61	PRACTICALS BASED ON CURRENT TRENDS IN PLANT SCIENCES V	2	4
Course Outcomes: After successful completion of this course, students would be able to CO 1: Learn and memorize the economic importance of Study of types of Fatty oils and Vegetable fats: linseed, soyabean, oil, cotton seed, sesame oil, olive oil, peanut oil, Coconut oil, Palm oil, Kokum Butter, Coco Butter and method of extraction of oil by distillation process. CO 2: Observe and explain the process of Saponification of Vegetable fats, TLC of <i>Patchouli</i> and <i>Citronella</i> oil. CO 3: Perform and inspect the prescribed estimations in given plant samples. CO 4: Distinguish the tests of ecological parameters in a given water sample for its Dissolved oxygen demand, Biological oxygen demand, Hardness, Salinity and Chlorinity.			
Sr No .	Name of the experiment	Total hours	
1.	Estimation of Organic carbon by Walkley and Black's method	60 hours	
2.	Estimation of Phosphate phosphorus (Plant acid extract)		
3.	Estimation of Iron (Plant acid extract)		
4.	Estimation of the following in given water sample		
5.	Dissolved oxygen demand		
6.	Biological oxygen demand		
7.	Hardness		
8.	Salinity and Chlorinity		
9.	Estimation of Total phenolics from the given sample plant sample.		
10.	Estimation of Total Tannins from the given sample plant sample.		
11.	Demonstration of Extraction of Essential oil by distillation method.		
12.	Determination of Saponification of Vegetable fats.		

13.	Study of TLC of <i>Patchouli</i> and <i>Citronella</i> oil	
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14.	Study of types of Vegetable fats ☐ Linseed ☐ Soya bean ☐ Cotton seed ☐ Sesame oil ☐ Olive oil ☐ Peanut oil ☐ Coconut oil ☐ Palm oil	
15.	Study of types of Fatty oils ☐ Kokum Butter ☐ Coco Butter	

Course Code	ELECTIVE - SEM – VI: BOTANY-	Credits	Lectures/Week
25BOTEL631	APPLIED BOTANY	2	2

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Learn various types of lipids and secondary metabolites, environmental factors different types of ecological factors affecting plant growth and types of speciation.

CO 2: Relate the earlier studied processes of photosynthesis with photosynthetic pigments; understand the Ecological factor, Secondary metabolites and different types of fiber and there sources.

CO 3: Students will gain the knowledge of application of fiber in paper industry. Apply various preservation techniques (e.g., drying, freezing, canning, and pickling) to enhance the shelf life and quality of fruits and vegetables. They will also learn the traditional and commercial method of preparing jam, jellies, fruit juices and pickles.

CO 4: Students will be able to analyze different ecological interaction of biotic components. Analyze drying and freezing techniques based on product type, nutrient retention, energy use, and end-product quality. They will also be able to evaluate the effectiveness of food preservatives and antioxidants in maintaining the safety, colour, and nutritional value of stored food products.

Unit	Topics	No of Lectures
I	APPLIED PLANT SCIENCES <u>Physiology II</u> ● Lipid metabolism: Biosynthesis and Degradation of fatty acids and glycerol, Respiratory metabolism in germinating seeds, β-Oxidation, Types of lipids. ● Secondary metabolites: Sources, Properties and uses of Glycosides, flavonoids and secondary pigments. <u>Ecology</u> ● Environmental factors: Light (Photosynthetic pigments), Edaphic factors – soil. Biotic factors – Interaction between organisms (Mutualism, Commensalism, Parasitism, Predacious plants) ● Types of Speciation – Allopatric, Peripatric, Parapatric and Sympatric, <u>Economic botany</u> ● Fiber: Types, Sources and uses. Paper industry.	15

II	POST HARVEST TECHNOLOGY AND ENTREPRENEURSHIP DEVELOPMENT PROGRAM ● Storage of Plant Produce –Preservation of Fruits and Vegetables ● Drying (Dehydration) – Natural conditions – Sun drying, ● Artificial Drying – Hot Air Drying, Vacuum Drying, Osmotically Dried Fruits, Crystallized or Candied Fruits, Fruit Leather, Freeze Drying) ● Freezing (Cold Air Blast System, Liquid Immersion method, Plate Freezers, Cryogenic Freezing, Dehydro-Freezing, Freeze Drying), ● Canning ● Pickling (in Brine, in Vinegar, Indian Pickles) ● Sugar Concentrates (Jams, Jellies, Fruit juices) ● Food Preservatives ● Use of Antioxidants in Preservation	15
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Reference books:

1. Plant Biochemistry by P.M. Dey and J.B. Harborne, Academic Press Publications
2. Biochemistry by U. Satyanarayana, Books & Allied (P) Ltd.
3. Plant Physiology and Biochemistry by S.S. Dubey, S. Chand Publishing
4. Fundamentals of Ecology, 5th Edition Eugene Odum
5. Introduction to Plant Physiology by William G. Hopkin, John Wiley & Sons Publications
6. Post-Harvest Technology of Horticultural Crops by K.P. Sudheer and V. Indira, New India Publishing Agency
7. Food Science by B. Srilakshmi, New Age International
8. Handbook of Post-Harvest Technology by A. Chakraverty, Arun S. Mujumdar, G.S.V. Raghavan, H.S. Ramaswamy, CRC Press Publications
9. Food Preservation and Processing by B. Sivasankar, Prentice Hall of India publication
10. Preservation of Fruits and Vegetables by Girdhari Lal, Siddappa and Tandon, ICAR (Indian Council of Agricultural Research) publication
11. Horticultural Marketing and Post-Harvest Technology by Meena R.K. Pointer publishers
12. Marketing of vegetables in India by Vigneshwara Varmundy. Daya publishing house.
13. College botany by Hirendrachandra Ganguly, Kumud Shanker Das Chotosh Dutta

Course Code	ELECTIVE - SEM – VI: - Course Title- Botany practical	Credits	Lectures/Week
25BOTELP61	PRACTICALS BASED: APPLIED BOTANY	2	4

Course Outcomes:

After successful completion of this course, students would be able to

CO 1: Performing enzymatic assay and biochemical analysis to detect plant metabolites and to learn the basics of enzymology according to the factors affecting the activity of an enzyme.

CO 2: Students will be able to understand the basic biochemical and physiological techniques to analyze plant components in the nitrogen metabolism and assess the influence of growth regulators on seed germination.

CO 3: Applying traditional and modern preservation techniques to prepare value-added products such as dehydrated pan, squash, jam, jelly, and pickles, while ensuring quality, hygiene, and shelf stability. They will also gain hands-on experience in processing and storing these products for practical and commercial use.

CO 4; Analyze the nutritional value, ingredient composition, and shelf-life stability of ready-to-eat food items like Upma, Poha, and Kheer, as well as evaluate the quality, proportion, and flavor balance in the preparation of dried spice mixes such as Pav-bhaji masala, Sambhar masala, and Garam masala.

Sr No .	Name of the experiment	Total hours
1.	Estimation of proteins by Biuret method	60 hours
2.	Effect of temperature on the activity of amylase.	
3.	Effect of pH on the activity of amylase.	
4.	Determination of alpha-amino nitrogen.	
5.	Effect of GA on seed germination.	
6.	Estimation of reducing sugars by DNSA method	
7.	Preparation of dehydrated pan (Mouth freshener).	
8.	Preparation of • Squash • Jam. • Jelly • Pickle	
9.	Preparation of ready to eat food items – Upma, Poha, Kheer	
10.	Preparation of Dried spice mix – Pav-bhaji masala, Sambhar masala, Garam masala	

11.	Study of Antioxidants in preservation.	
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Course Code	ELECTIVE - SEM – VI: BOTANY-	Credits	Lecture s/Week
25BOTEL632	Fundamentals of Systems of Medicine	2	2
Course Objectives After successful completion of this course, students would be able to CO1: Memorise and describe the basics and history various systems of medicine CO2: Explain the different systems like Aurveda, Unani, Homeopathy, allopathy and alternative medicines. CO3: Apply the knowledge of Various various systems of medicine and alternative therapy like Acupuncture, Acupressure, Massage therapy, Yoga. Reiki,Tai chi and aromatherapy. CO4: Analyze and apply ayurvedic remedies and alternative therapy for day to day life.			
Unit	Topics	No of Lectures	
I	Fundamentals of Systems of Medicine 1: 1. Introduction and history of medicine 2. Ayurveda - Shusrut Samhita, Charak Samhita, Philosophy 3. Unani -Introduction History , Principal and concept 4. Homeopathy - Principal and concept	15	
II	Fundamentals of Systems of Medicine 2: 1. Allopathy- Pharmaceutical medicine, Psychotherapy, Surgery , radiation therapy, Physical rehab 2. Alternative therapy – Acupuncture, Acupressure, Massage therapy, Yoga. Reiki, Tai chi and aromatherapy 3. Infectious and contagious disease -Symptoms and prevention	15	
References: 1. The practical guide to Healthy Living, Danny Cavanagh and Carol Willis, Ayurveda UK publication 2. Ayurvedic Healing by Dr. David Frawley and O.M.D, Motilal Banarasidass Publishers 1989. 3. Unani: The system of Medicine, Prof. Rais-Ur-Rahman; Advisor, Department of Ayush, Ministry of Health and Family Welfare, Govt of India. 4. Homeopathic Principles and Practice of Medicine, Dr. V.K. Chauhan, B. Jain Publishers.			

Course Code	ELECTIVE - SEM – VI: - Course Title- Botany practical	Credits	Lectures/Week
25BOTELP62	PRACTICALS BASED: APPLIED BOTANY	2	4

Course Objectives

After successful completion of this course, students would be able to

CO1: Memorise and describe the basics and history various systems of medicine

CO2: Explain the different systems like Ayurveda, Unani, Homeopathy, Allopathy and alternative medicines.

CO3: Apply the knowledge of Various systems of medicine and alternative therapy like Acupuncture, Acupressure, Massage therapy, Yoga. Reiki, Tai chi and aromatherapy.

CO4: Analyze and apply ayurvedic remedies and alternative therapy for day to day life.

Sr No	Name of the experiment	Total hours
1.	Determination of Prakurti and preparation of Dincharya and Ritucharya	60 hours
2.	Concept of Ahara : Tridosh based diet and Viruddha Ahara planning	
3.	Identification of common medicinal herbs	
4.	Preparation of simple ayurvedic remedies	
5.	Use of Basic medical instruments- Thermometer, BP apparatus, Glucometer, stethoscope etc.	
6.	Study of Vital Statistics of Body Height, weight, Pulse, BMI, BP etc	
7.	First aid for various situations	
8.	Types of Infectious diseases	
9.	Types of Contagious diseases	
10.	Aromatherapy and oils used for aromatherapy	
11.	Types of Yogasanas and Pranayams	
12.	Visit to a medical centre.(Any one)	

Course Code	OJT SEM – VI: BOTANY-	Credits	Lectures/Week
25BOTOJT6	On Job Training	4	-

Evaluation Scheme for Third Year UG) Sem V and IV, under NEP (2 credits)

Major, Minor, Elective:-

I. Internal Evaluation for Theory Courses – 20 Marks

- 1) **Continuous Internal Assessment (CIA)** Assignment - Tutorial/ Case Study/ Project / Presentations/ Group Discussion / Ind. Visit. – 10 marks
- 2) **Continuous Internal Assessment (CIA)** ONLINE Unit Test – 10 marks

II. External Evaluation for Theory Courses – 30 Marks

Duration: 1 Hour

Theory question paper pattern: All questions are compulsory.

Question	Based on	Marks
Q.1	Unit I	15
Q.2	Unit II	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

III. Practical Examination

- All papers together carry 50 Marks.
- Duration: 2 ½ Hours for each practical course.
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam.

Practical Question Paper Pattern:

- All questions are compulsory.

Question	Based on	Marks
1	Experiment No.1	10
2	Experiment No.2	9
3	Experiment No.3	8
4	Experiment No.4 / Identification	8
5	Certified Journal	5
6	Field Report	5
7	Viva	5

IKS:-

I. Internal Evaluation for Theory Courses – 20 Marks

- 1) **Continuous Internal Assessment (CIA)** Assignment - Tutorial/ Case Study/ Project / Presentations/ Group Discussion / Ind. Visit. – 10 marks
- 2) **Continuous Internal Assessment (CIA)** ONLINE Unit Test – 10 marks

II. External Evaluation for Theory Courses – 30 Marks

Duration: 1 Hour

Theory question paper pattern: All questions are compulsory.

Question	Based on	Marks
Q.1	Unit I	15
Q.2	Unit II	15

- All questions shall be compulsory with internal choice within the questions.
- Each Question may be sub-divided into sub questions as a, b, c, d, etc. & the allocation of Marks depends on the weightage of the topic.

VSC:-

I. Practical Examination

- Each core subject carries 50 Marks.
- Duration: 2 ½ Hours for each practical course.
- Minimum 80% practical from each core subjects are required to be completed.
- Certified Journal is compulsory for appearing at the time of Practical Exam.

Practical Question Paper Pattern:

All questions are compulsory.

Question	Based on	Marks
1	Experiment No.1	10
2	Experiment No.2	9
3	Experiment No.3	8
4	Experiment No.4 / Identification	8
5	Certified Journal	5
6	Field Report	5
7	Viva	5

CEP, FP and OJT:-

- Student will be awarded 2 credits on completion of 60 hours CEP/FP
- Student will be awarded 4 credits on completion of 120 hours OJT.

PASSING STANDARD NEP Third Year:

- The learners /students shall obtain minimum of 40% marks in the Internal Assessment and External Assessment (Semester End Examination) COMBINED, to pass the course in a particular semester. A learner / student will be said to have passed the course if She/he passes the Internal Assessment + Semester End Examination COMBINED.
- To pass the examination attendance is compulsory in both internal and external (theory plus practical) examination.

NOTE:

Field excursions for habitat studies are compulsory. Field work of not less than eight hours duration is equivalent to one period per week for a batch of 15 students.

- A candidate will be allowed to appear for the practical examinations only if he/she submits a certified journal of T.Y.B.Sc. or a certificate from the Head of the department / Institute to the effect that the candidate has completed the practical course of T.Y.B.Sc. as per the minimum requirements. In case of loss of journal, a candidate must produce a certificate from the Head of the department/Institute that the practicals for the academic year were completed by the student. However, such a candidate will be allowed to appear for the practical examination, but the marks allotted for the journal will not be granted.