

Department of Botany

Scheme of Examination and Syllabus for Under Graduate Programme

Under Multiple Entry and Exit, Internship and CBCS-LOCF as per NEP-2020 w.e.f. session 2024-25 (in phased manner)

Subject: Botany



Guru Jambheshwar University of Science & Technology Hisar-125001, Haryana

(A+ NAAC Accredited State Govt. University)



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Scheme of Examination and Syllabus for Under Graduate Programme w.e.f. session 2024-25 For affiliated Degree Colleges according to National Education Policy-2020

Subject: Botany

SEMESTER-I

Type of Course	Course Code	Nomenclature	Credits	Contact	Internal	External	Total	Duration
		of		Hours	Marks	Marks	Marks	of Exam
		Paper/Course						(Hr)
Discipline	C24BOT101T	Diversity of	3	3	20	50	70	2.5
Specific Course		Microbes &						
		Lower						
		Cryptogams;						
		Cytology						
	C24BOT101P	Diversity of	1	2	10	15	25	3
		Microbes &						
		Lower						
		Cryptogams;						
		Cytology Lab						
Minor Course	C24MIC142T	Elementary	2	2	15	35	50	2
		Botany						
Multidisciplinary	C24MDC102T	Basics of	2	2	15	35	50	2
Course		Botany						
	C24MDC102P	Basics of	1	2	10	15	25	3
		Botany Lab						
Skill	C24SEC127T	Mushroom	2	2	15	35	50	2
Enhancement		Cultivation						
Course	C24SEC127P	Mushroom	1	2	10	15	25	3
		Cultivation						
		Lab						
Value Added	C24VAC118T	Basics of	2	2	15	35	50	2
Course		Medicinal						
		Plants						

SEMESTER-II

Type of Course	Course Code	Nomenclature	Credits	Contact	Internal	External	Total	Duration
		of		Hours	Marks	Marks	Marks	of Exam
		Paper/Course						(Hr)
Discipline	C24BOT201T	Diversity of	3	3	20	50	70	2.5
Specific Course		Higher						
		Cryptogams &						
		Genetics						
	C24BOT201P	Diversity of	1	2	10	15	25	3
		Higher						
		Cryptogams &						
		Genetics Lab						
Minor Course	C24MIC242T	Cell Biology	2	2	15	35	50	2
Multidisciplinary	C24MDC202T	Nursery and	2	2	15	35	50	2
Course		Gardening						
	C24MDC202P	Nursery and	1	2	10	15	25	3
		Gardening Lab						
Skill	C24SEC227T	Organic	2	2	15	35	50	2
Enhancement		Farming						
Course	C24SEC227P	Organic	1	2	10	15	25	3
		Farming Lab						
Value Added	C24VAC118T	Basics of	2	2	15	35	50	2
Course		Medicinal						
		Plants						

Programme Outcomes

- PO1 Fundamental knowledge of basic biological Sciences, life sciences and botany.
- **PO2** Basic understanding: Knowledge regarding basic concepts and applied aspects of cell biology, Diversity of Microbes & Lower Cryptogams, basics of Botany, nursery, gardening and medicinal plants.
- PO3. Interdisciplinary approach: Learning the relationships among plants, microbes and environment.
- **PO4.** Practical learning: Perform procedures and analysis as per laboratory standards in the areas of cell biology and Botany.
- **PO5** Strong understanding of molecular biology, cytogenetics, microbiology, biochemistry and allied subjects, preparing them for higher education, disciplinary & multidisciplinary research and to be a life-long learner.
- **PO6** Analytical Thinking: Perceive things, events and framing ideas and decisions (intellectual, organizational, and personal) in the light of scientific principles.
- **PO7** Effective Communication: Speak, read and write clearly and make personal growth by connecting with people, ideas, books, media and technology.

Botany Diversity of Microbes & Lower Cryptogams; Cytology (Semester-1) Discipline Specific Course (DSC)

Course Code: C24BOT101T 45 Hrs. (3 Hrs./Week) Credit : 3 Exam Time: 2.5 Hrs.

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

Course Objectives:

- 1. Structure of Bacteria and Viruses.
- 2. General Characters, Life cycle of Algae and their economic Importance.
- 3. General Characters, Structure, Life cycle of Fungi and their economic Importance
- 4. Structure and function of various cellular compartment and organelles.
- 5. Cell-division and cell-cycle.

UNIT - I

Bacteria: Structure, types (gram positive & gram negative), Reproduction and Economic Importance. Viruses: General account of Virus including structure of TMV and Bacteriophage.

UNIT - II

Algae: General characters, Classification up to classes (G.M. Smith, 1955), Economic Importance, and Life Cycle (excluding development) of Nostoc (Cyanophyceae), Volvox, (Chlorophyceae), Ectocarpus (Phaeophyceae).

UNIT - III

Fungi: General characters, Classification up to classes (Alexopoulos and Mims, 1979), Economic Importance, and Life Cycle (excluding development) of *Phytophthora* (Mastigomycotina), *Penicillium* (Ascomycotina), *Puccinia* (Basidiomycotina). General account of Lichens.

UNIT - IV

Cell as a Unit of Life: Cell as a Unit of Life, Prokaryotic and Eukaryotic cells. Basic Structure and Function of Eukaryotic Cell Organelles: Cell Wall, Plasma Membrane, Nucleus, Ribosome, Endoplasmic Reticulum, Chloroplast, Mitochondria. Cell Division: Mitosis and Meiosis.

Diversity of Microbes & Lower Cryptogams; Cytology Lab

Course Code: C24BOT101P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs. External Marks :15 Internal Marks :10 Total Marks: 25

Note:

- 1. Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation.

List of Practical:

1. Electron Micrographs/Models of viruses – T-Phage and TMV, Photograph/ Line drawing of Lytic and Lysogenic Cycle. Types of bacteria from permanent slides/photographs/Charts/ Model.

External Marks :50 Internal Marks :20 Total Marks: 70

- 2. Study of vegetative and reproductive structures of *Nostoc, Volvox, Ectocarpus* through temporary preparations, Charts/ Models and permanent slides.
- 3. Gram Staining and serial dilution technique of bacteria.
- 4. *Puccinia, Agaricus, Phytophthora* Asexual and sexual stage (temporary mounts / permanent slides/ Charts/ Model.).
- 5. Lichens: Study of growth forms of lichens (crustose, foliose and fruticose).
- 6. To study prokaryotic cells (bacteria), viruses, eukaryotic cells with the help of light electron micrographs/ Charts/ Model/Permanent Slide.
- 7. Study of the photomicrographs of cell organelles
- 8. To study the structure of plant cell through temporary mounts.
- 9. Study of mitosis (temporary mounts, Charts/ Model. and permanent slides).
- 10. Study of meiosis (temporary, Charts/ Model, mounts and permanent slides).

Suggested Readings:

- 1. Plant Pathology. 3rd Ed. 2017. R.S. Mehrotra and Ashok Aggarwal. McGraw Hill Education India Pvt Ltd. New Delhi.
- 2. Fundamentals of Plant Pathology .2013. R.S. Mehrotra and Ashok Aggarwal. McGraw Hill Education India Pvt Ltd. New Delhi.
- 3. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West. Press Pvt. Ltd. Delhi. 2nd edition.
- 4. Thakur, A.K. and Bassi, S.K. (2008). Diversity of Microbes and Cryptogams. S. Chand & Co., Delhi.
- 5. Willey, J.M., Sherwood, L., Woolverton, C.J, Prescott, L.M. and Willey, J.M. (2011). Prescott's Microbiology. New York, McGraw-Hill.
- 6. Karp, G., Iwasa, J. & Marshall, W. Karp's Cell and Molecular Biology (9th Ed.). John Wiley & Sons. 2020.
- 7. 2. Alberts, B., Johnson, A.D., Lewis, J., Morgan, D., Raff, M., Roberts, K., & Walter, P. Molecular Biology of the cell (6th Ed.). Garland Science. 2014.

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Students will learn about presence of viruses, bacteria in environment and their structural details.
- CO2 Students will learn about Structure and diversity of algae. They will be able to know about their life cycle and their impact on Human Life.
- CO3 Students will acquire insights into the composition and structure of Fungi with the help of temporary and permanent slides, charts/models.
- CO4 Students will learn about how the cell has evolved and the basic types of cells present.
- CO5 Students will understand the Cell growth and formation of new cells from existing cells.

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	Μ	Μ
CO2	S	S	S	S	Μ	S	S
CO3	Μ	S	S	Μ	S	S	S
CO4	S	Μ	М	S	S	М	S
CO5	S	S	S	S	Μ	S	S

Mapping of COs with POs:

S=Strong, M=Medium, W=Weak

Botany Elementary Botany (Semester-I) Minor Course (MIC)

Paper Code: C24MIC142T 30 Hrs (2 Hrs /Week) Credits: 2 Exam. Time: 2 Hrs

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 1. Introduction to plant science and morphology of plants.
- 2. Abiotic factors and Adaptation in plants.
- 3. Introduction to physio-chemical processes in plants.
- 4. Mineral Nutrition and Plant growth regulators.
- 5. Economic importance of plants

UNIT -I

Botany: Definition, Aim and Scope of Botany, Plant diversity, Plant and Its parts, Morphology of angiosperms with general account of types of Habit, Root, Leaf, Shoot, Flower and Fruit. Adaptation in Plants, Abiotic Factors and their effects on Plants.

UNIT -II

Introduction to Plant Physiology, Basic concept and Importance of Photosynthesis Respiration. Mineral nutrition in Plants; Plant Growth Hormone: Auxin, Gibberellin, Abscisic acid and Ethylene. Ecological & Economic Importance of Plants.

Suggested Readings:

- 1. College Botany, Vol. I &II Ed. 2011, Gangule, Das & Datta, Publisher New Central Book Agency (P) Ltd., New Delhi.
- 2. Elementary Botany, Ed. 1898. Percy Groom, George Bell & Sons, London.
- 3. A text Book of Botany, Ed. 12th 2015, P.S. Trivedi & S.N. Pandey, Vikas Publishing.
- 4. Elementary Botany, Ed. I, 2020, Pushp Sharma: Agrobios.

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Student will be able to understand the basics of plants and their parts like: Root, Stem, Leaves, Flowers and fruits.
- CO2 Student will acquire knowledge about various abiotic factors affecting plants and the adaptations plants acquire for their survival.
- CO3 Student will learn about process of photosynthesis and respiration in plants.
- CO4 Students will learn about the essential and non-essential elements plant growth regulators like: Auxin, ethylene, ABA, Gibberellin.
- CO5 Students will learn the Economic Importance of Plants.

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	Μ	S
CO2	S	S	Μ	S	Μ	S	S
CO3	S	Μ	S	Μ	S	S	S
CO4	Μ	S	М	S	S	S	Μ
CO5	S	S	S	S	S	S	S

Mapping of COs with POs:

S=Strong, M=Medium, W=Weak

External Marks : 35 Internal Marks : 15 Total Marks: 50

Botany Basics of Botany (Semester-I) Multidisciplinary Course (MDC)

Paper Code: C24MDC102T 30 Hrs (2 Hrs /Week) Credits: 2 Exam. Time: 2 Hrs

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 1. Understanding subject, its scope and branches.
- 2. To make students aware about the diversity of plants.
- 3. To gain understanding of structure of plant and its parts.
- 4. To impart knowledge on how plants function and interact with environment and abiotic factors on plant growth.
- 5. Conservation of Plant species

UNIT -I

Definition, Aim and Scope of Botany, Plant diversity, Plant and Human Life. Different forms of Plants, General account on Habit, Plant parts and their Functions. Morphology of plant parts in reference to Stem, Root, Leaf, Flower and Fruit.

UNIT -II

Basics of Plant Physiology, Osmosis, Diffusion, Imbibition

Introduction to Photosynthesis, Its site and Products, Importance of Photosynthesis, Transpiration and Its Significance.

Pollination and Pollinating agents, Xerophytes and Hydrophytes plants with common examples, Abiotic Factors affecting the Plants.

Conservation, Botanical Garden, Ecological & Economic Importance of Plants.

Basics of Botany Lab

Course Code: C24MDC102P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs.

Note:

- 1. Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation.

List of Practical

- 1. To study the parts and working of Light Microscope.
- 2. Study of plant cell structure with the help of epidermal peel mount of *Tradescantia* leaf.
- 3. Demonstration of Hot Air Oven, Digital Weighing Balance, Centrifuge, Hot Plate, Autoclave.
- 4. Demonstration of Dicot and Monocot plants.
- 5. To study the Parts of flower.
- 6. Demonstration of different plant habits.
- 7. Identification of Hydrophytes and Xerophytes.
- 8. Demonstration of the phenomenon of plasmolysis and de-plasmolysis.
- 9. To study the pH of given soil sample by pH strip.
- 10. To prepare Herbarium

External Marks : 35 Internal Marks : 15 Total Marks: 50

External Marks :15

Internal Marks :10

Total Marks: 25

Suggested Readings:

- 1. A Text Book of Botany Vol I & II, by Pandey S.N., Mishra S.P. & Trivedi P.S.
- 2. College Botany, by B.P. Pandey
- 3. Hopkins, W. G., Huner, N. P. A. (2009). Introduction to Plant Physiology, 4th edition. New Delhi, Delhi: Wiley India Pvt. Ltd.
- 4. Arjariya (2022). Basic Botany (In Hindi), Ram Prasad Publications

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Student will learn the scope of botany.
- CO2 Students will be able to understand the diversity of plants.
- CO3 Students will develop a conceptual understanding of plant physiology
- CO4 Student will be able to know the parts of plants and effect of abiotic factors on plants.
- CO5 Economic and Ecological importance of plants.

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	М	S
CO2	S	S	S	S	Μ	S	S
CO3	S	Μ	S	S	S	S	S
CO4	S	S	М	Μ	S	Μ	S
CO5	S	S	S	S	S	S	М

S=Strong, M=Medium, W=Weak

Botany Mushroom Cultivation (Semester-I) Skill Enhancement Course (SEC)

Paper Code: C24SEC127T 30 Hrs (2 Hrs /Week) Credits: 2 Exam. Time: 2 Hrs

External Marks : 35 Internal Marks : 15 Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 1. Why the Need of Mushroom cultivation.
- 2. To know about Medicinal & Nutritional Mushroom.
- 3. To know about Mushroom cultivation steps.
- 4. To know about value added foods from Mushroom.
- 5. Self-employment & Environmental sustainability.

UNIT -I

Introduction, History, Nutritional and Medicinal value of Edible mushrooms, Poisonous Mushrooms. Introduction to Common edible Indian mushrooms - Button mushroom (*Agaricus bisporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajor caju*) and Paddy straw mushroom (*Volvariella volvcea*). Research Centres, Food Preparation - Comments on Value added products of Mushroom.

UNIT -II

Mushroom Cultivation (Button Mushroom) - Composting (Long Method and Short Method), Bed preparation, Factors affecting the mushroom bed preparation - Low cost technology.

Spawning - Medium, Pure culture & Mother Culture, Commercial Spawn production.

Casing - Different types of Casing mixtures, Maintaining of Environment after casing.

Harvesting, Shortening and Grading, Packing, Marketing.

Problems in cultivation - Common diseases, Pests, Nematodes and Management.

Mushroom Cultivation Lab

Course Code: C24SEC127P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs. External Marks :15 Internal Marks :10 Total Marks: 25

Note:

- 1. Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation.

List of Practical

- 1. Orientation to a Mushroom Farm/Field Visit.
- 2. Identification of various Mushroom through Photographs.
- 3. Study of various Equipment used in Mushroom Cultivation.
- 4. Preparation of Pure culture, Mother spawn, Commercial spawn.
- 5. Learn about various Compositing Methods.
- 6. Spawning, Casing, Cropping and Harvesting.
- 7. Cultivation of Button/Oyster Mushroom.
- 8. Identification of insects affecting Button mushroom.
- 9. Diseases caused by Fungi, Bacteria and Abiotic factors.
- 10. Market Survey and Cost benefit analysis.
- 11. Management of Spent mushroom substrate (sms).
- 12. Report preparation on Mushroom Cultivation.

Suggested Readings:

- 1. Kumaresan, V. 2018. Mushroom cultivation. Saras Publication.
- 2. Russell, S. 2014. The essential guide to cultivating mushrooms: Storey publishing LLC.
- 3. Gour, P.Y. 2010. Mushroom Production and Processing Technology. Agrobios India.
- 4. Powell, M. 2010. Medicinal Mushrooms: A clinical guide. Mycology Press.
- 5. Tripathi, D.P. 2005. Mushroom Cultivation. Oxford & IBH Publishing Co. Pvt.Ltd, New Delhi.
- 6. Dhar, B.L. 2005. Edible Mushrooms and their Cultivation. CRC Press.
- 7. Paul Stamets, J.S. & Chilton, J.S. 2004. Mushroom cultivation: A practical guide to growing mushrooms at home, Agarikon Press.
- 8. Chang, S.F. Miles, P.G. & Chang, S.T. 2004. Mushrooms Cultivation, Nutritional value, Medicinal effect and Environmental impact. CRC press.
- 9. Bahl, N. 2000. Handbook on Mushrooms. Oxford & IBH Publishing Co. Pvt. Ltd.

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Students will be able to understand the nutritional and medicinal value of edible mushrooms.
- CO2 Students will develop a conceptual understanding of various procedure and techniques used for mushroom cultivation.
- CO3 Students will gain knowledge about the storage procedure of different types of edible mushrooms.
- CO4 Students will learn about different types of food prepared from mushrooms and their medicinal value.
- CO5 Students will gain knowledge of practical aspects of mushroom cultivation.

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	Μ	S
CO2	S	S	S	S	S	S	S
CO3	S	Μ	S	S	S	S	S
CO4	S	S	S	М	S	М	S
CO5	S	S	Μ	S	Μ	S	М

S=Strong, M=Medium, W=Weak

Botany Basics of Medicinal Plants (Semester-I/Semester-II) Value Aided Courses (VAC)

Paper code: C24VAC118T 30 Hrs. (2 Hrs /week) Credits: 2 Exam. Time: 2 Hrs

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 1. Promotion of cultivation and conservation of medicinal plants.
- 2. To create awareness and interest amongst the students about medicinal plants.
- 3. To increase public awareness about the efficacies of herbal drugs.
- 4. To identify Medicinal plant and Herbal drugs.
- 5. To develop awareness for utilization of herbal medicines for home remedies. And to create employment opportunities.

UNIT I

Introduction to Medicinal plants - Definition, Importance, Present and Future needs of Medicinal plants. Brief account of Traditional Medicinal Systems - Ayurveda, Siddha, Unani and Homeopathy. Cultivation, Nursery Raising and Plantation of Medicinal Plant.

UNIT II

Morphology and Medicinal importance of Turmeric, Ginger, Clove, Elaichi. Morphology and Medicinal importance of Tulsi, Aloe, Giloy, Ashwagandha. Morphology and Medicinal importance of Amla, Neem, Mulhethi, Swanjana.

Suggested Readings:

- 1. Chaturvedi A. 2008. Ethnobotany and Taxonomy of Angiosperms. Rashtrasant Tukadoji Maharaj Nagpur University Press.1-295.
- 2. Pandey B.P.1978. Economic Botany. S. Chand and Company LTD. Ram Nagar, New Delhi.1-534.
- 3. Panda H., Handbook of Ayurvedic Medicines, National Institute of Industrial Research, Delhi 7.
- 4. CSIR Cultivation and Utilization of Medicinal Plants.
- 5. Brahmvarchas, Ayurved ka Pran: Vanoshadhi vigyan, Vedmata Gayatri Trust, Shaktikunj Haridwar 2004.
- 6. Chaudhry R. D., Herbal Drug Industry, Eastern Publication
- 7. Atal C. K. and Kapoor B.M., Cultivation and Utilization of Medicinal Plants, RRL Jammu Tawi.1982.
- 8. Raphael Ikan, Natural Products: A Lab Guide, Academic Press, 1991.
- 9. Dutt Ashwin, An Introduction to Medicinal Plants, Adhyayan Publishers and distributers, 2009.

Course Outcomes: The Learning Outcomes of this course are as follows:

- CO1 Students will be able to understand the medicinal value of some common medicinal plants.
- CO2 Students will develop a conceptual understanding of our traditional Medicinal systems.
- CO3 Students will be able to identify and characterize the medicinal plants and particularly the part of plants having medicinal significance.
- CO4 Cultivation methods of medicinal plants
- CO5 Morphology of medicinal plants

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	Μ	S
CO2	S	S	S	S	S	S	S
CO3	S	S	Μ	S	S	S	S
CO4	Μ	Μ	S	S	S	Μ	S
CO5	S	S	Μ	S	Μ	S	S

Mapping of COs with POs:

S=Strong, M=Medium, W=Weak

External Marks: 35 Internal Marks: 15 Total Marks: 50

Botany Diversity of Higher Cryptogams & Genetics (Semester-II) Discipline Specific Course (DSC)

Course Code: C24BOT201T 45 Hrs. (3 Hrs./Week) Credit : 3 Exam Time: 2.5 Hrs.

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

Course Objectives:

- 1. General Characteristics, classification and type study of Bryophyta,
- 2. Classification and types of Pteridophytes and their structure.
- 3. Type study and economic importance of Pteridophytes and Fossil plant Rhynia.
- 4. Introduction to Mendelian and Non-Mendelian Inheritance. History, Structure & types of genetic material.
- 5. Bio-chemical processes: Synthesis of DNA, RNA and Proteins.

UNIT - I

Bryophyta: General characteristics, Classification up to classes (Smith), Structure and Reproduction (excluding development) of *Marchantia* (Hepaticopsida) and *Funaria* (Bryopsida), Ecological and Economic Importance of Bryophytes.

UNIT - II

Pteridophyta: General characters, Classification up to classes (Smith), Structure and Reproduction (excluding development) of *Selaginella* (Lycopsida) and *Pteris* (Pteropsida). Ecological and Economic Importance of Pteridophytes. Fossil Plant: *Rhynia*.

UNIT - III

Genetic Inheritance: Mendelism, Principles of Inheritance (Dominance, Segregation, Independent Assortment), Non-Mendelian Inheritance: Co-dominance, Incomplete Dominance, Epistasis.

UNIT - IV

Genetic Material: DNA structure, Types of DNA, Griffith's and Avery's transformation experiments, Hershey-Chase experiment, RNA and its types, Genetic Code, Replication, Transcription, Translation.

Diversity of Higher Cryptogams & Genetics Lab

Course Code: C24BOT201P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs. External Marks :15 Internal Marks :10 Total Marks: 25

Note:

- 1. Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation.

List of Practical

- 1. *Marchantia* morphology of thallus, W.M. rhizoids and scales, V.S. thallus with gemma cup, W.M. gemmae, V.S. of antheridiophore and archegoniophore, L.S. sporophyte (temporary/permanent slides/ Charts/ Model).
- 2. *Funaria* morphology, W.M. leaf, rhizoids, operculum, peristome, annulus, spores, slides showing antheridial and archegonial heads, L.S. capsule (temporary /permanent slides/ Charts/ Model).
- 3. *Selaginella* morphology, W.M. leaf with ligule, T.S. stem, W.M. strobilus, W.M. microsporophyll and megasporophyll, L.S. strobilus (temporary/ permanent slide/ Charts/ Model).

External Marks :50 Internal Marks :20 Total Marks: 70

- 4. *Pteris* morphology, T.S. rachis, V.S. sporophyll, W.M. sporangium, W.M. spores, T.S. rhizome, W.M. prothallus with sex organs and young sporophyte (temporary/ permanent slide/ Charts/ Model).
- 5. Mendel's laws through seed ratios. Laboratory exercises in probability and chi-square.
- 6. Chromosome mapping using point test cross data.
- 7. Incomplete dominance and gene interaction through seed ratios (9:7, 9:6:1, 13:3, 15:1, 12:3:1, 9:3:4).
- 8. To study the structure of DNA using model or Charts

Suggested Readings

- 1. Parihar, N.S. (1991). An introduction to Embryophyta. Vol. I. Bryophyta. Central Book Depot, Allahabad.
- 2. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R., (2005). Biology. Tata McGraw Hill, Delhi.
- 3. Vashistha, P.C., Sinha, A.K., Kumar, A., (2010). Pteridophyta, S. Chand. Delhi.
- 4. Gardner E.J., Simmons M.J., Snustad D.P. (2008). Principles of Genetics. 8th Ed. Wiley
- 5. Snustad, D.P. and Simmons, M.J. (2010). Principles of Genetics, John Wiley & Sons.
- 6. Verma P S (2010) Genetics. S Chand Publishing.
- 7. Singh B D (2009) Genetics Kalyani Publishers.

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Students will be able to learn about Bryophytes and identify them with their general characteristics.
- CO2 Students will learn about Structure and diversity of Pyteridophytes and life cycle of pteridophytes and their impact on Human Life.
- CO3 Students will acquire insights into fossil pteridophyte *Rhynia*, and its structure with the help of charts/models.
- CO4 Students will learn about principles of Inheritance and Medelian, Non-Medelian Inheritance.
- CO5 Students will understand the discovery of genetic material and their types. They will understand the process of Replication, Transcription, Translation.

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	М	М
CO2	S	S	S	S	М	S	S
CO3	S	S	Μ	Μ	S	S	S
CO4	S	S	S	М	S	S	М
CO5	S	S	Μ	S	S	S	S

Mapping of COs with POs:

S=Strong, M=Medium, W=Weak

Botany Cell Biology (Semester-II) Minor Course (MIC)

Paper Code: C24MIC242T 30 Hrs (2 Hrs /Week) Credits: 2 Exam. Time: 2 Hrs

External Marks : 35 Internal Marks : 15 Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 1. Discovery and Types of the cells.
- 2. Structure and function of various cellular compartment and organelles.
- 3. Structure and role of Nucleus and Chromosome.
- 4. Structure of DNA.
- 5. Cell Division: Mitosis and Meiosis.

UNIT -I

Cell: Discovery, Basic Structure, Cell Theory, Types of cells : Prokaryotic and Eukaryotic. Cell Membrane and Cell Wall, Basic Structure and function of Ribosome, Endoplasmic Reticulum, Golgi Bodies and Lysosome.

UNIT -II

Basic Structure and Function of Nucleus, Mitochondria and Chloroplast. Structure of DNA, Chromosome, General account on Cellular Totipotency General account of cell Division: Mitosis and Meiosis.

Suggested Readings:

- 1. Cell biology. Ed. 2021. K.N. Bhatia and Neelam Dhand, A Trueman's Publication. Jalandhara.
- 2. Cell biology. Ed. 2022, P.S. Verma, S. Chand's Publications, New Delhi.
- 3. Karp, G., Iwasa, J. & Marshall, W. Karp's Cell and Molecular Biology (9th Ed.). John Wiley & Sons. 2020.
- 4. Alberts, B., Johnson, A.D., Lewis, J., Morgan, D., Raff, M., Roberts, K., & Walter, P. Molecular Biology of the cell (6th Ed.). Garland Science. 2014.

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Student will be able to understand the discovery and structure of a cell.
- CO2 Student will acquire insight in various cellular organelles like: cell envelopes, Ribosome, Chloroplast, Mitochondria, ER.
- CO3 Student will learn about remote control of a cell and structure.
- CO4 Student will learn about importance of cellular totipotency.
- CO5 Students will understand the Cell growth and formation of new cells from existing cells.

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	М
CO2	S	S	М	S	Μ	S	S
CO3	S	S	S	Μ	S	S	S
CO4	Μ	М	S	S	S	Μ	S
CO5	S	S	S	S	S	S	S

Mapping of COs with POs:

S=Strong, M=Medium, W=Weak

Botany Nursery and Gardening (Semester-II) Multidisciplinary Course (MDC)

Paper Code: C24MDC202T 30 Hrs (2 Hrs /Week) Credits: 2 Exam. Time: 2 Hrs

External Marks : 35 Internal Marks : 15 Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 1. Understanding the subject, its scope and branches.
- 2. To make students aware about the preparing plantlet from seeds.
- 3. To understand seed viability and common ornamental plants.
- 4. To impart knowledge on Methods of gardening
- 5. Regeneration of plants from vegetative propagation.

UNIT -I

Nursery: Definition, Objectives, Scope and Building up of Infrastructure for Nursery.

Planning and Seasonal activities: Planting, Direct seeding and Transplants.

Seed: Structure and Types, Seed dormancy, Causes and Methods of Breaking Dormancy. Factors affecting Seed viability, Seed testing. Know about Common Ornamental Garden Plants.

UNIT II

Gardening: Definition, Objectives and Scope, Different types of gardening - Landscape and Home gardening. Gardening operations: Soil laying, Manuring, Watering, Management of Pests and Diseases. Vegetative propagation: Air-layering, Grafting, Cutting: Selection of cutting, Collecting season, Treatment of cutting, Rooting medium and Planting of cuttings.

Hardening of plants: Green houses, Glass houses, Polyhouses and Shade houses.

Nursery and Gardening Lab

Course Code: C24MDC202P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs. External Marks :15 Internal Marks :10 Total Marks: 25

Note:-

- 1. Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation.

List of Practical

- 1. Study of layout planning and planting in the nursery.
- 2. Preparation of pot mixture, potting and repotting in the nursery.
- 3. Practicing asexual methods of propagation: Budding and Grafting.
- 4. Study the application of fertilizers and manures in the nursery.
- 5. Study the different methods of irrigation in the garden.
- 6. Study of the direct seeding and transplants in the nursery.
- 7. Preparation of green house and poly house for commercial use.
- 8. Preparation of rooting medium and planting of cuttings in the nursery.
- 9. Identification of common ornamental garden plants.

10. Visit to commercial nursery and garden and preparation of herbarium

Suggested Readings:

1. Priya Lokare and Keshamma E, Plant Nursery Development & Management - An Innovative Way of Self Employment, Edition I, 2022, Notion Press Publication.

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Student will learn the techniques for nursery and gardening.
- CO2 Students will be able to understand how to prepares plantlet from seed and seed behavior.
- CO3 Students will develop a conceptual understanding of seed viability and practical knowledge of ornamental plants.
- CO4 Students will be able to know various methods of gardening.
- CO5 Students will gain knowledge for practical utility of methods of vegetative reproduction.

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	М	S	S	S	S
CO2	S	S	S	S	S	S	Μ
CO3	S	S	S	Μ	М	S	S
CO4	S	Μ	S	S	S	Μ	S
CO5	S	S	S	S	S	S	S

S=Strong, M=Medium, W=Weak

Botany Organic Farming (Semester-II) Skill Enhancement Course (SEC)

Paper Code: C24SEC227T 30 Hrs (2 Hrs /Week) Credits: 2 Exam. Time: 2 Hrs

External Marks : 35 Internal Marks : 15 Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 1. To provide basic knowledge of concepts and principles related to organic farming.
- 2. To study the scope, applications and needs of organic farming.
- 3. To develop concepts of conventional farming and organic farming.
- 4. To help students understand various organic farming practices in the national and international level.
- 5. Types and principle of organic farming

UNIT -I

Basics of Organic Farming - Concept and Components of Organic Farming, Aims and Objectives, Need of Organic Farming, Pure organic farming and Integrated farming system, Status of organic farming in India

UNIT -II

Preparation, Nutrient content and Methods for use of following - FYM/Rural compost, Mulching, City compost, Oil cakes, Animal wastes, Vermi-composts, Vermi-wash, Jeevamrit, Beejamrit, Green manures, Bio-fertilizers.

Organic Farming Lab

Course Code: C24SEC227P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs. External Marks :15 Internal Marks :10 Total Marks: 25

Note:

- 1. Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation.

List of Practical

- 1. To study tools and instruments used in organic farming
- 2. Visit to organic farm to study the various components, identification and utilization of organic products.
- 3. Identification of different types of weeds
- 4. Vermicompost preparation
- 5. Soil analysis: pH determination
- 6. Identification of different types of fertilizers including biofertilizers
- 7. Practicing and experiencing in Farmer's Fields.
- 8. Assessment of plantation site, visit of nursery and plantations
- 9. Preparation of different types of nursery bed

Suggested Readings:

- 1. Arun K. Sharma. 2002. A Hand book of organic farming. Agrobios, India.
- 2. Balasubramanian, R., Balakrishnan, K and Siva Subramanian, K. 2013. Principles and practices of organic farming. Satish Serial Publishing House.
- 3. Tarafdar, J.C., Tripathi, K.P and Mahesh Kumar, 2009. Organic agriculture. Scientific Publishers, India.
- 4. Veeresh G.K. (2011). Organic Farming. Publisher: Foundation Books.
- 5. Reddy S. R. (2017). Principles of Organic Farming. Publisher: Kalayani,
- 6. Rateaver B. and Rateavar G (1993). Organic method primer update: A practical explanation: the how and why for the beginner and the experience (Conservation gardening and farming). Publisher: The Rateavers; Spl ed.

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Students will gain hands-on experience through fieldwork and farm visits.
- CO2 The course will address fair-trade practices, social responsibility, and community involvement.
- CO3 Students will gain knowledge about marketing of organic products and economic aspects of organic farming.
- CO4 Students will learn about the principles and philosophy behind organic farming.
- CO5 Learners will understand the importance of sustainability, biodiversity and sustainable development.

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	S
CO2	S	S	S	S	S	S	Μ
CO3	S	Μ	S	Μ	Μ	S	S
CO4	S	S	Μ	S	S	Μ	S
CO5	Μ	S	S	S	S	S	S

S=Strong, M=Medium, W=Weak

Botany Basics of Medicinal Plants (Semester-I/Semester-II) Value Aided Courses (VAC)

Paper code: C24VAC118T 30 Hrs. (2 Hrs /week) Credits: 2 Exam. Time: 2 Hrs

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 6. Promotion of cultivation and conservation of medicinal plants.
- To create awareness and interest amongst the students about medicinal plants.
 To increase public awareness about the efficacies of herbal drugs.
- 9. To identify Medicinal plant and Herbal drugs.
- 10. To develop awareness for utilization of herbal medicines for home remedies. And to create employment opportunities.

UNIT I

Introduction to Medicinal plants - Definition, Importance, Present and Future needs of Medicinal plants. Brief account of Traditional Medicinal Systems - Ayurveda, Siddha, Unani and Homeopathy. Cultivation, Nursery Raising and Plantation of Medicinal Plant.

UNIT II

Morphology and Medicinal importance of Turmeric, Ginger, Clove, Elaichi. Morphology and Medicinal importance of Tulsi, Aloe, Giloy, Ashwagandha. Morphology and Medicinal importance of Amla, Neem, Mulhethi, Swanjana.

Suggested Readings:

- 10. Chaturvedi A. 2008. Ethnobotany and Taxonomy of Angiosperms. Rashtrasant Tukadoji Maharaj Nagpur University Press.1-295.
- 11. Pandey B.P.1978.Economic Botany. S. Chand and Company LTD. Ram Nagar, New Delhi.1-534.
- 12. Panda H., Handbook of Ayurvedic Medicines, National Institute of Industrial Research, Delhi 7.
- 13. CSIR Cultivation and Utilization of Medicinal Plants.
- 14. Brahmvarchas, Avurved ka Pran: Vanoshadhi vigyan, Vedmata Gayatri Trust, Shaktikuni Haridwar 2004.
- 15. Chaudhry R. D., Herbal Drug Industry, Eastern Publication
- 16. Atal C. K. and Kapoor B.M., Cultivation and Utilization of Medicinal Plants, RRL Jammu Tawi. 1982.
- 17. Raphael Ikan, Natural Products: A Lab Guide, Academic Press, 1991.
- 18. Dutt Ashwin, An Introduction to Medicinal Plants, Adhyayan Publishers and distributers, 2009.

Course Outcomes: The Learning Outcomes of this course are as follows:

- CO1 Students will be able to understand the medicinal value of some common medicinal plants.
- CO₂ Students will develop a conceptual understanding of our traditional Medicinal systems.
- Students will be able to identify and characterize the medicinal plants and particularly the part of plants CO3 having medicinal significance.
- CO4 Cultivation methods of medicinal plants
- CO5 Morphology of medicinal plants

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	Μ	S
CO2	S	S	S	S	S	S	S
CO3	S	S	М	S	S	S	S
CO4	Μ	Μ	S	S	S	Μ	S
CO5	S	S	Μ	S	Μ	S	S

Manning of COs with POs

S=Strong, M=Medium, W=Weak

External Marks: 35 Internal Marks: 15 Total Marks: 50



Department of Botany

Scheme of Examination and Syllabus for Under Graduate Programme

Under Multiple Entry and Exit, Internship and CBCS-LOCF as per NEP-2020 w.e.f. session 2024-25 (in phased manner)

Subject: Botany



Guru Jambheshwar University of Science & Technology Hisar-125001, Haryana

(A+ NAAC Accredited State Govt. University)



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Guru Jambheshwar University of Science and Technology Hisar-125001, Haryana ('A+' ΝΑΑC Accredited State Govt. University)



Scheme of Examination and Syllabus for Under Graduate Programme w.e.f. session 2024-25 For affiliated Degree Colleges according to National Education Policy-2020

Subject: Botany

SEMESTER-III

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam
Discipline Specific Course	C24BOT301T	Diversity of Seed Plants : Gymnosperms & Angiosperms	3	3	20	50	70	2.5
M	C24BOT301P	Diversity of Seed Plants: Gymnosperms & Angiosperm Lab	1	2	10	20	30	3
Minor Course	C24MIC342T	Plant Ecology	4	4	30	70	100	. 3
Multidisciplinary Course	C24MDC302T	Plants in Everyday Life	2	2	15	35	50	2
0	C24MDC302P	Plants in Everyday Life Lab	1	2	10	15	25	3
Skill	C24SEC327T	Floriculture	2	2	15	35	50	2
Enhancement Course	C24SEC327P	Floriculture Lab	1	2	10	15	25	3

SEMESTER-IV

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hr)
Discipline Specific Course	C24BOT401T	Plant Anatomy & Embryology	3	3	20	50	70	2.5
	C24BOT401P	Plant Anatomy & Embryology Lab	1	2	10	20	30	3
Value Added Course	C24VAC309T	Role of Plants in Human Welfare	2	2	15	35	50	2

SEMESTER-V

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact Hours	Internal Marks	External Marks	Total Marks	Duration of Exam (Hr)
Discipline Specific Course	C24BOT501T	Plant Physiology- Metabolism and Ecology	3	3	20	50	70	2.5
	C24BOT501P	Plant Physiology- Metabolism and Ecology Lab	1	2	10	20	30	3

2 | Page

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SEMESTER-VI

Type of Course	Course Code	Nomenclature of Paper/Course	Credits	Contact_ Hours	Internal Marks	External Marks	Total Marks	Duration of Exam
Specific Course	C24BOT601T	Plant Biotechnology & Economic Botany	3	3	20	50	70	2.5
	C24BOT601P	Plant Biotechnology & Economic Botany Lab	1	2	10	20	30	3
Minor Course	C24MIC642T	Economic Botany	4	4	30	70	100	3

3 | Page

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Botany

Diversity of Seed Plants: Gymnosperms & Angiosperms (Semester-111) Discipline Specific Course (DSC)

Course Code: C24BOT301T 45 Hrs. (3 Hrs./Week) Credit : 3 Exam Time: 2.5 Hrs.

External Marks :50 Internal Marks :20 Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

Course Objectives:

- 1. Understanding conceptual grasp of Gymnosperms and Angiosperms.
- 2. To know fundamental features of Gymnosperms, Angiosperms and Plant taxonomy.
- 3. To know practical aspects related to identification, structure, economic values of Gymnosperms and Angiosperms.
- 4. Knowledge about Taxonomy, including the rules of Nomenclature, other essential aspects and diversity of families.

UNIT - I

Gymnosperms : General characters and Economic Importance, Classification up to classes (Smith). Morphology, Anatomy and Reproduction of *Cycas* and *Pinus* (excluding developmental details).

UNIT - II

Taxonomy and Systematics, Types of classification : Artificial, Natural and Phylogenetic, Bentham & Hooker classification, its Merits and Demerits.

Botanical Nomenclature, International Code for Botanical Nomenclature (ICBN), Taxonomic Keys.

UNIT - III

Herbarium : Preparation steps and types, Type concept, Botanical Gardens, Introduction to Botanical Survey of India.

Flower and Its Parts (semi technical description), Types of Inflorescence, Simple and Compound Leaves, Phyllotaxy.

UNIT - IV

Diagnostic features and economic importance of the following families: Malvaceae, Solanaceae, Lamiaceae, Asteraceae, Fabaceae, Poaceae.

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Diversity of Seed Plants: Gymnosperms & Angiosperms Lab

Course Code: C24BOT301P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs.

External Marks :20 Internal Marks :10 Total Marks: 30

Note:

- Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
 Report on excursion tours with a base and write related descriptions/ notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation (if any).

List of Practical:

- Cycas- Morphology (coralloid roots, leaf, megasporophyll), T.S. coralloid root, T.S. rachis, W.M. microsporophyll, W.M. microspores, L.S. ovule, T.S. root (temporary/ permanent slide).
 Pinus- Morphology (long and dynastic based on the state of the stat
- Pinus- Morphology (long and dwarf shoots, male cones and female cones), W.M. dwarf shoot, T.S. needle, T.S. stem, L.S./T.S. male cone, W.M. microsporophyll, W.M. microspores (temporary slides), L.S. female cone (temporary/ permanent slide).
- 3. Study of vegetative and floral characters of the locally available members (one/two) of following families (Description, V.S. flower, T.S. of ovary, Floral diagram, Floral formula and systematic position (Bentham & Hooker's system of classification):
- Malvaceae, Solanaceae, Lamiaceae, Asteraceae, Fabaceae, Poaceae. 4. To study about different types of inflorescence (modulabout different types)
- To study about different types of inflorescence (model/chart/photographs).
 Mounting of a collected properly dried and pressed spacing of wild plant
- Mounting of a collected, properly dried and pressed specimen of wild plants with herbarium label.
 Excursion/Field Visit: Report on assuming town with a latence of wild plants.
- 6. Excursion/Field Visit: Report on excursion tours with photographs, collection, preservation and preparation of herbarium sheets and specimens related to Angiosperms.

Suggested Readings:

- 1. Vashishta, P.C., Sinha, A.K., Kumar, A., (2010). Gymnosperms, S. Chand. Delhi, India.
- Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India
- 3. Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
- 4. Gangulee, Das and Datta (2011). College Botany (Volume I/II), New Central Book Agency
- 5. Pandey, B.P. (2001). A Textbook of Botany-Angiosperms, S. Chand. Delhi, India.
- 6. Singh, G. (2021). Plant Systematics: An Integrated Approach, CRC Press.
- 7. Sharma, O.P. (2017). Plant Taxonomy, Mc Graw Hill Publication.
- 8. Simpson, M.G. (2006). Plant Systematics. Elsevier Academic Press, San Diego, CA, U.S.A.

18/10 2 73/2

Botany Plants in Everyday Life (Semester-III) Multidisciplinary Course (MDC)

Paper code: C24MDC302T 30 Hrs. (2 Hrs /week) Credits: 2 Exam. Time: 2 Hrs

External Marks: 35 Internal Marks: 15 Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- To give an overview of how plants are indispensable to humans.
 To gives an exposure to the plants are indispensable to humans.
- To gives an exposure to the various aspects of plant resource & its utilization.
 To create awareness and interest.
- To create awareness and interest among the students about plants.
 Promotion of cultivation and example a students about plants.
- 4. Promotion of cultivation and conservation of plants.

UNIT I

Plant services to humans in everyday life : Introduction to science of Botany, Plant resources in everyday life. Role of plants: Air purifier (photosynthesis); Plants used in rituals/festivals; Pollution control: Plants used in Pollution control and Phytoremediation; Pollution indicator (lichens), Nutrient source (litter manure, organic manure), Aesthetic value of Plants.

UNIT II

Plant resources and utilization (brief description of plants and/or plant parts used). Cereals: Rice, Wheat, Legumes: Bengal gram (Chana), Green gram (Mung), Soybean, Spices: Turmeric, Beverages: Tea; Sugar yielding plant: Sugarcane, Medicinal plants: Tulsi, Neem, Giloy, Edible oils: Groundnut, Mustard, Fibres: Cotton, Jute

Plants in Everyday Life Lab (Semester-III) Multidisciplinary Course (MDC)

Course Code: C24MDC302P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs.

External Marks :15 Internal Marks :10 Total Marks: 25

Note:

- 3. Students should draw Figures or diagrams and write related descriptions/notes in their practical note books.
- 4. Report on excursion tours with photographs, collection, preservation (if any).

List of Practical:

- 1. To demonstrate how plants purify air.
- 2. To study plants used in local festivals.
- 3. To learn the basic utilization of fiber plants.
- 4. To identify and understand the medicinal value of plants.
- 5. To creatively understand plant aesthetics and arrangements.
- 6. To demonstrate how plants remove pollutants from water.
- 7. To study use of plants and/or plant parts : cereals and legumes.

6 | Page

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- 8. To demonstrate the sprouting process and its nutritional benefits.
- 9. To study edible oil extraction from Groundnut/Mustard Seeds.
- 10. To identify pollution levels in an area using lichens as bio-indicators.
- 11. To test the growth of plants using organic manure (kitchen waste compost) vs chemical fertilizers.
- 12. To study use of plants and/or plant parts : Spices, Beverages, Sugar yielding plant, Medicinal plants.

Suggested Readings:

- Kochhar, SL (2012). Economic Botany in the Tropics. MacMillan India Ltd., New Delhi. 1.
- Hill, AF (1952). Economic Botany: A Textbook of Useful Plants and Plant Products. McGraw Hill Publishing 2. Company Ltd., New Delhi. 3.
- Trivedi, PC (2006). Medicinal Plants: Ethnobotanical Approach. Agrobios, India.
- Upadhyay, R (2023). Botany for B.Sc. students, Economic Botany, 4. Ethnomedicine and phytochemistry/Commercial Botany and phytochemical Analysis. S. Chand and Company Ltd. Publishers, India.
- Wickens, GE (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The 5. Netherlands.

Course Outcomes: The Learning Outcomes of this course are as follows:

CO1 Analyze the utilization of various plant resources in day-to-day life.

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- CO2 Recall various economically and medicinally important plant species used in day-to-day life.
- CO3 Explain the uses of economically important plants and illustrate the processing of various plant parts.
- CO4 Create awareness on conservation of medicinal plants and use of natural plant products.

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	M	S
CO2	S	S	S	S	S	S	S
CO3	S	S	M	S	S	S	S
CO4	M	M	S	S	S	M	S
CO5	S	S	M	S	M	S	S

S=Strong, M=Medium, W=Weak

Floriculture (Semester-III) Skill Enhancement Courses (SEC)

Paper code: C24SEC327T 30 Hrs. (2 Hrs /week) Credits: 2 Exam. Time: 2 Hrs

External Marks: 35 Internal Marks: 15 **Total Marks: 50**

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1. **Course Objectives:**

The Learning Objectives of this courses are as follows:

- 1. To learn about the importance of the Floriculture, its importance and career opportunities
- 2. To study tools, equipments and other material used in preparation of nursery beds; care and maintenance of nursery plants
- 3. To identify different plant varieties, commercial flowers and their packaging
- 4. To study the effect of environmental factors on flowers
- 5. Status and prospects of Floriculture in India

UNIT-1

History, Importance and Scope of Floriculture; Nursery management: Seed and Vegetative propagation.

Some routine garden operations: Soil sterilization, Seed sowing, Pricking, Planting and Transplanting, Shading.

Common Garden Flowering plants: Dianthus, Gladiolus, Chrysanthemum, Bougainvillea, Dahlia, China Rose; Cacti and Succulents.

UNIT-II

Principles of garden design: English and Mughal; Features of Garden (Garden wall, Fencing, Hedge, Edging, Lawn, Borders).

Factors affecting flower production (Soil, Temperature, Light); Production and packaging of cut flowers.

Gardens of India (Acharya JC Bose Indian Botanical Garden, Kolkata; Amrit Udyan, Delhi)

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Floriculture Lab. (Semester-III)

Course Code: C24SEC327P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs.

External Marks :15 Internal Marks :10 Total Marks: 25

Note:

- 1. Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation.

List of Practicals:

- 1. Study of Tools/Equipments used in plant propagation techniques.
- 2. Demonstration of Nursery preparation.
- 3. Soil sterilization, Seed sowing, Pricking.
- 4. Vegetative methods of propagation.
- Planting and Transplanting. 5.
- 6. Cultivation of Plants in Pots.
- 7. Identification and Cultivation of important cut flowers.
- 8. Study of some important Ornamental/Cacti/Succulents plants.
- 9. Visit to some Important Gardens and Commercial Nurseries.

Course Outcome:

CO1 Students will be able to identify the different ornamental plant varieties and their nutritional/soil type requirement as well as their management in nurseries and green houses.

CO2 Learners will be capable to know techniques used in floriculture and propagation.

CO3 Students will learn about various tools and ornamental exhibits used in floriculture.

CO4 Students will be trained in environment control and management strategies of floriculture

CO5 Students will acquire knowledge regarding non-conventional multiplication of ornamental plants.

Suggested Readings

- 1. S.K. Bhattacharjee and Lakshman Chandran De. 2010. Advanced Commercial. Floriculture, Vols. I and II Aavishkar Pub., Second Revised and Enlarged Edition, 798.
- 2. S.Prasad and U. Kumar. 2010. A Handbook of Floriculture). Agrobios (India)
- 3. John M. Dole and Harold F. Wilkins. 2004. Floriculture: Principles and Secies : Prentice Hall; 2 edition (2nd Edition)
- 4. Allan M. Armitage and Judy M. Laushman. 2008 Speciality Cut Flowers: The Production of Annuals, Perennials, Bulbs and Woody Plants for Fresh and Dried Cut Flowers. Timber Press; REV
- 5. Advances in ornamental Horticulture, S.K. Bhattacharjee. 2006, Pointer Publishers.
- 6. Post-Harvest Technology of flowers and ornamental plants. S.K. Bhattacharjee 2005, Pointer Publishers.
- 7. Advanced Commercial Floriculture, S.K. Bhattacharjee 2010. Aaviskar Publishers.
- 8. Plant Propagation by M.K. Sadhu 1989. New Age International Publishers.

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	S	C
CO2	S	S	S	M	S	S	S
CO3	S	S	M	S	S	S	5
CO4	M	M	S	S	S	S	S
CO5	S	S	M	S	S	S	S

Mapping of COs with POs.

S=Strong, M=Medium, W=Weak

9 | Page

Mr. hale

Plant Ecology (Semester-III) Minor Course (MIC)

Paper Code: C24MIC342T 45 Hrs (3 Hrs /Week) Credits: 4 Exam. Time: 3 Hrs

External Marks: 70 Internal Marks: 30 Total Marks: 100

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

Course Objectives:

To explore the principles of plant ecology.

To examine the interactions between plants and their environment.

Gain a comprehensive understanding of plant ecology, including the interactions between plants and their abiotic and biotic environments.

To understand the influence of ecological factors on plant distribution.

To understand phytogeography of India.

UNIT-I

Introduction to Ecology: History of Ecology; Concept and type of ecology, Level of organization, Scope and importance of Ecology. Ecological factors: Water: States of water in the environment, precipitation types. Light and temperature, Adaptation of hydrophytes and xerophytes, Concept of Sustainability

UNIT-II

Ecosystem: Structure; energy flow, Trophic organization; Food chains and food webs, Ecological pyramids, Biogeochemical cycling: Cycling of carbon, nitrogen and phosphorous; Phytogeographical regions of India, Endemism

UNIT-III

Environmental Issues and Policies: Environmental pollution: types, causes, effects and controls of air, water and soil. Global environmental issues: Climate change, ozone layer depletion.. Environment Laws: Environment Protection Act; Convention on Biological Diversity (CBD)

UNIT-IV

Biodiversity and Conservation: Biodiversity: Definition, levels (genetic, species and ecosystem diversity) and values; Biodiversity hot spots. Threats to biodiversity: Habitat loss, poaching of wildlife, man wild life conflicts, biological invasions. Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

Suggested Readings:

- 1. Ecology, Environmental Science and Conservation J.S. Singh, S.R. Gupta & S.P. Singh S. Chand Publishing.
- 2. Environmental Biology (Principles of Ecology). Dr. P S Verma & Dr. V K Agarwal. S. Chand Publishing.
- 3. A Textbook of Plant Ecology (Including Ethnobotany & Soil Science). P S Chandel & R S Shukla. S. Chand Publishing.
- 4. Ecology and Utility of Plants. P S Chandel & R S Shukla. S. Chand Publishing.
- 5. College Botany Vol. I, II, III. B. P. Pandey. S. Chand Publishing. 12. College Botany Practical. Vol- I, II. S.C. Santra, A.P. Das auth.T.P. Chatterjee New Central Book Agency.
- 6. . Ambasht, R.S. & Ambasht, N.K. A Text Book of Plant Ecology, Latest Ed., CBS Publication & Distributors.

10 | Page

18/25/20

- 7. Krishnamurthy, K.V. An Advanced Text Book on Biodiversity, 2003, Oxford & IBH Publishing Co. Ltd.
- Kumar, H.D. Modern Concept of Ecology, Latest Ed. Vikas Publishing House.
 Odum F.P. Fundamentals of Decision of Concept of Conce
- 9. Odum, F.P. Fundamentals of Ecology, Latest Ed., Saunders
- 10. Sharma, P.D. Elements of Ecology, Latest Ed., Rastogi Publications
- 11. Shukla, R.S. & Chandel, P.S. Plant Ecology, Latest Ed., S. Chand and Co.
- 12. Verma, P.S. & Agarwal, U.K. Concept of Ecology, Latest Ed., S. Chand & Company.

Course Outcomes: The course outcomes of this course are as follows:

CO1 Student will be able to understand the relationship of organism with their environment

- CO2 Student will acquire knowledge about various ecological factors affecting plants
- CO3 Student will learn about abiotic and biotic components
- CO4 Students will be able to distinguish between hydrosere and xerosere
- CO5 Students will learn the adaptations plants acquire for their survival

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	·S	S	S	S	S	M	S
CO2	S	S	M	S	M	S	S
CO3	S	M	S	M	S	S	S
CO4	M	S	M	S	S	S	M
CO5	S	S	S	S	S	S	S.

S=Strong, M=Medium, W=Weak

Plant Ecology Lab

Course Code: C24MIC342P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs.

External Marks : 20 Internal Marks : 10 Total Marks : 30

Note:

- 1. Students should draw figures or diagrams and write related descriptions/notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation (if any).

List of Practical:

- 1. Study of Anatomical features of Hydrophytes and Xerophytes in relation to their habitats.
- 2. Study of Morphological adaptations of Hydrophytes and Xerophyte.s
- 3. Study of Biotic interactions of the following : Stem parasite, Root parasite, Epiphytes using museum specimens/live plants.
- 4. Excursion (Local and outstation) to familiarize students with ecology of different sites.
- 5. Visit/Study the various types of Ecosystems.
- 6. To prepare map showing Phyto-geographical regions of India.
- 7. To study hot-spots of biodiversity.
- 8. Study of instruments used to measure microclimatic variables : Soil thermometer, Maximum and Minimum thermometer, Anemometer, Psychrometer/Hygrometer, Rain gauge and Lux meter.
- 9. Determination of pH of two soil samples.
- 10. Determination of Density, Abundance and Frequency of species by Quadrat method.
- 11. To study bio-geochemical cycles (C,N,P).
- 12. Excursion and Submission of Field cum Project Work (mandatory).

11 | Page

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Botany Plant Anatomy & Embryology (Semester-IV) Discipline Specific Course (DSC)

Course Code: C24BOT401T 45 Hrs. (3 Hrs./Week) Credit : 3 Exam Time: 2.5 Hrs. External Marks :50 Internal Marks :20 Total Marks: 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

Course Objectives:

1. Understanding conceptual knowledge of Plant Anatomy and Embryology.

- 2. To know fundamental features of Plant Tissues, Organs; Secondary and Anomalous growth.
- 3. To know practical aspects related to Anatomy and Embryology.
- 4. Knowledge about various aspects of Plant embryology.

UNIT I

Plant Tissues : Meristematic and Permanent Tissues (Simple & Complex), Theories of Shoot apex. Anatomical structure of Dicot and Monocot Root, Stem and Leaf, Stomatal apparatus and their morphological types. UNIT II

Vascular cambium : Structure and Function, Secondary growth in Stem, Wood (Heartwood & sapwood). Anomalous secondary growth in *Dracaena* and *Boerhaavia*.

UNIT III

Structure of Anther and Pollen Grain, Structure and Types of Ovule, Placentation - Types. Structure and Types of Embryo sac, Pollination mechanism and adaptations, Double Fertilization.

UNIT IV

Endosperm : Structure and functions, Dicot and Monocot Embryo, Embryo-endosperm relationship. Seed Structure (Dicot & Monocot), Polyembryony and Apomixis.

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Plant Anatomy & Embryology Lab

Course Code: C24BOT401P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs. External Marks :20 Internal Marks :10 Total Marks: 30

Note:

- 5. Students should draw Figures or diagrams and write related descriptions/ notes in their practical note books.
- 6. Report on excursion tours with photographs, collection, preservation (if any).

List of Practical:

- 1. Study of meristems through permanent slides/charts/photographs.
- 2. To study about Meristematic and Permanent Tissues (Simple & Complex).
- 3. Preparation of double stained permanent slide of T.S. root and shoot (monocot and dicot)
- 4. Stem: Monocot: Zea mays; Dicot: Helianthus; Secondary: Helianthus (Permanent slides).
- 5. Root: Monocot: Zea mays; Dicot: Helianthus; Secondary: Helianthus (Permanent slides).
- 6. Leaf: Dicot and Monocot leaf (slides/charts/models/photographs).
- 7. Structure of anther (young & mature), Tapetum (Permanent slides).
- 8. Types of ovules: Anatropous, Orthotropous, Circinotropous, Amphitropous/Campylotropous.
- 9. Female gametophyte: Polygonum (monosporic) type of Embryo sac (Permanent slides/photographs).
- 10. Ultrastructure of mature egg apparatus cells through photographs.
- 11. Pollination types and seed dispersal mechanisms (Charts/Photographs).
- 12. Dissection of embryo/endosperm from developing seeds.
- 13. Calculation of percentage of germinated pollen.
- 14. Measurement of pollen size.

Suggested Readings:

- Bhojwani, S.S. & Bhatnagar, S.P. (2011). Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi. 5th edition.
- 2. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin/Cummings Publisher, USA.
- 3. Fahn, A. 1974. Plant Anatomy, 2nd Edition. Pergamon Press, Oxford.
- 4. Proctor, M. and Yeo, P. 1973. The Pollination of Flowers. William Collins Sons, London.
- 5. Cutter, E.G. 1969. Plant Anatomy Part-I, Cells and Tissues, Edward Arnold, London.

Khy hhi

Botany Role of Plants in Human Welfare (Semester-IV) Value Aided Courses (VAC)

Paper code: C24VAC709T 30 Hrs. (2 Hrs /week) Credits: 2 Exam. Time: 2 Hrs

External Marks: 35 Internal Marks: 15 Total Marks: 50

Note: The examiner is required to set five questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt three questions in all selecting one from each unit in consisting of 10 marks in addition to the compulsory Question No.1.

Course Objectives:

- 1. To understand the essential role of plants in maintaining human health and well-being.
- 2. To explore the ecological, medicinal, nutritional, economic, and cultural significance of plants.
- 3. To promote awareness about the sustainable use of plant resources for future generations.
- 4. To encourage conservation of plant biodiversity for global and local welfare.

UNIT I

Medicinal plants and traditional healing systems (Ayurveda, Siddha, Unani), Role of plants in modern medicine (active principles and their sources), Herbal nutraceuticals and dietary supplements, Plants in mental health and aromatherapy, Role of plants in immunity boosting and disease prevention, Case studies: Neem, Tulsi, Aloe vera, Giloy, Ashwagandha, etc.

UNIT II

Role of plants in climate regulation and ecosystem services, Phytoremediation and air/water purification, Sacred groves and religious importance of plants, Plants in art, literature, rituals, and folklore. Economic value: Timber, fibers, resins, oils, and dyes, Urban greenery and its psychological & environmental benefits

Suggested Readings:

- 1. Kochhar, S.L. (2012). Economic Botany in the Tropics. MacMillan India Ltd., New Delhi.
- 2. Jain, S.K. (2005). Manual of Ethnobotany. Scientific Publishers.
- Upadhyay, R. (2023). Botany for B.Sc. Students Economic Botany and Ethnomedicine. S. Chand Publishing.
- 4. Wickens, G.E. (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers.
- 5. Pandey, B.P. (2018). Economic Botany. S. Chand Publishing.

13/25

Course Outcomes (COs):

CO1: Describe the role of medicinal and aromatic plants in traditional healing systems like Ayurveda, Siddha, and Unani.

CO2: Explain the use of plant-based active compounds in modern medicine and health supplements.

CO3: Understand the ecological services plants provide, including climate regulation, air/water purification, and phytoremediation.

CO4: Appreciate the socio-cultural and spiritual relevance of plants in religion, folklore, literature, and rituals.

CO5: Evaluate the economic and psychological importance of plants in daily life, including timber, fibers, oils, dyes, and urban greenery.

	COs / POs	PO1	PO2	PO3	PO4	POS	POG	POT	
	CO1	S	S	M	S	М	S	s.	
•	CO2	S	S	M	S	S	M	Q	
	CO3	М	S	S	М	S	S	Q	
	CO4	S	М	S	S	M	M	c	
	CO5	S	S	S	M	S	S	c c	

Mapping of COs with POs:

S = Strong, M = Medium, W = Weak

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15 | Page

Botany Plant Physiology-Metabolism and Ecology (Semester-V) Discipline Specific Course (DSC)

Course Code: C24BOT501T 45 Hrs. (3 Hrs./Week) Credit : 3 Exam Time: 2.5 Hrs.

External Marks : 50 Internal Marks : 20 Total Marks : 70

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

Course Objectives:

- 1. Understanding conceptual grasp of plant water relations and photosynthesis and respiration.
- 2. To know fundamental features of growth of plants affected by day length ,temperature and plant hormones.
- 3. To know the practical aspects related to physiological phenomenon and the ecosystem .
- 4. Knowledge about interaction of plants with ecosystem.

UNIT - I

Plant water relations : Osmosis, Diffusion, Imbibition, Plasmolysis, Photosynthesis : Photosynthetic pigments (chlorophyll a, b Xanthophylls, Carotenes), Photosystem I & II, Electron transport and ATP synthesis, C_3 , C_4 and CAM pathway of carbon fixation.

UNIT - II

Mineral Nutrition : Role and deficiency symptoms of Macro & Micronutrients, Girdling Experiment, Respiration : Aerobic and Anaerobic respiration, Glycolysis, TCA cycle, Electron Transport Chain, Oxidative phosphorylation.

UNIT - III

Physiological role of Auxins, Gibberellins, Cytokinins, ABA and Ethylene. Photoperiodism (SDP, LDP, Day neutral plants). Brief Account of Phytochrome, Vernalization, Senescence and Plant Movements.

UNIT - IV

Introduction to Ecology, Ecosystem structure, Food Chain and Food Webs, Ecological pyramids, Biogeochemical Cycles (Carbon and Nitrogen). Ecological Succession : Process and Types (Hydrosere and Xerosere), Ecological adaptations of Hydrophytes and Xerophytes.

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Plant Physiology-Metabolism and Ecology Lab

Course Code: C24BOT501P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs.

External Marks : 20 Internal Marks: 10 Total Marks : 30

Note:

- Students should draw Figures or diagrams and write related descriptions/notes in their practical note books. 3.
- Report on excursion tours with photographs, collection, preservation (if any). 4.

List of Practical:

- 13. Demonstration of Imbibition by Plaster of Paris Method.
- 14. Demonstration of Osmosis by potato osmoscope method.
- 15. Demonstration of Plasmolysis and Deplasmolysis.
- 16. Comparison of Stomatal and Cuticular transpiration by four Leaf /Cobalt chloride method .
- 17. Demonstration of transpiration by Ganong/Farmer potometer.
- 18. Effect of Light, Dark and Carbon Dioxide concentration on the rate of photosynthesis.
- 19. Demonstration of aerobic respiration.
- 20. Demonstration of anaerobic respiration
- 21. Evolution of heat during respiration.
- 22. Determination of Density, Abundance and Frequency of species by quadrat method.
- 23. Study of anatomical features of Hydrophytes and Xerophytes in relation to their habitats.

Suggested Readings:.

Physiology. Sinauer Associates Inc., U.S.A. 5th Edition. 1.Taiz, L., Zeiger, E., (2010). Plant

2.Hopkins, W.G., Huner, N.P., (2009). Introduction to Plant Physiology. John Wiley & Sons, U.S.A. 4th Edition. 3.Bajracharya, D., (1999). Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.

4.Kormondy, E.J. (1996). Concepts of Ecology. Prentice Hall, U.S.A. 4th edition.

5.Odum, E.P. 1983: Basic Ecology, Saunders, Philadelphia.

6.Mackenzie, A. et al. 1999: Instant Notes in Ecology, Viva Books Pvt. Ltd., New Delhi.

7.Sharma, P.D., 2010 Ecology and Environment. Rastogi Publications, Meerut.

Course Outcomes:

CO 1: The students will learn plant water-relations and transpiration.

CO 2: The students will know about the mineral required for the nutrition of plants.

CO 3: The students get the knowledge of mechanism of photosynthesis and respiration.

CO 4: The students will learn the role of plant hormones in the growth, photoperiodism, Vernalization, Senescence and Plant Movements.

CO5: The students will understand the role of Ecosystems, Biogeochemical Cycles and Ecological Succession and Phytogeographical regions of India.

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
COI			1				
CO2							
CO3							
CO4							
CO5	3						

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Plant Biotechnology & Economic Botany (Semester-VI) Discipline Specific Course (DSC)

Course Code: C24BOT601T 45 Hrs. (3 Hrs./Week) Credit : 3 Exam Time: 2.5 Hrs.

External Marks :50 Internal Marks :20 **Total Marks: 70**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

Course Objectives:

1. To familiarize the students about the fundamentals of plant biotechnology

- 2. To understand Recombinant DNA technology and their applications

- To learn the concept of plant tissue culture and its scope
 To understanding economic importance of the cereals, vegetables and pulses
 To acquire knowledge of Beverages, Oils, Fibres, Rubber and medicinal plants.

UNIT - I

Recombinant DNA Technology, Restriction endonucleases, Cloning vector - Plasmid, Bacterial artificial chromosome (BACs), Yeast artificial chromosome (YACs), cDNA library, PCR and its application, Blotting techniques - Northern, Southern and Western blotting, DNA fingerprinting

UNIT - II

Molecular DNA marker (RAPD and RFLP), DNA sequencing; Plant tissue culture, Cellular totipotency, Micropropagation, Haploid production (Androgenesis & Gynogenesis), Brief account of Embryo culture, Biology of Agro-bacterium

UNIT - III

Concept of centres of origin, their importance with reference to Vavilov's work. Cereals : Wheat and Rice-Origin, morphology, uses; Vegetables : Potato and Tomato (Origin, morphology, uses); Pulses : Gram, Pea, and Soybean (Botanical name, family, part used, morphology and uses); Spices : Clove, Ginger, Turmeric and Black pepper (Botanical name, family, part used, morphology and uses).

UNIT - IV

Beverages: Tea and Coffee (morphology, processing, and uses); Oils : Groundnut, mustard and coconut (Botanical name, family, part used, morphology and uses); Fibres : Cotton and Jute (morphology, processing, and uses); Medicinal plants : Cinchona, Rauwolfia and Opium (Botanical name, family, part used, morphology and uses); Rubber : Hevea (morphology, processing, and uses).

18 | Page

11/wh

PlantBiotechnology & Economic Botany Lab

Course Code: C24BOT601P 30 Hrs. (2 Hrs./Week) Credit : 1 Exam Time: 3 Hrs.

External Marks :20 Internal Marks :10 Total Marks: 30

Note:

- 1. Students should draw Figures or diagrams and write related descriptions/notes in their practical note books.
- 2. Report on excursion tours with photographs, collection, preservation (if any).

List of Practical:

- 1. Study of economically important plants: Wheat, Rice, Gram, Pea, Soybean, Black pepper, Ginger, Clove, Turmeric, Tea, Coffee, Cotton, Jute, Groundnut, Coconut and Mustard, Potato, Tomato, Opium, Rauwolfia, Cinchona.
- 2. To prepare any one of the tissue culture medium.
- 3. To prepare the slants and Petri plates for plant tissue culture.
- 4. Study of techniques of sterilization, culturing and sub-culturing of cell, tissues and organs.
- 5. Demonstration of anther culture, protoplast isolation and culture, embryo culture using suitable models /charts / photographs etc.
- 6. Brief introduction to the components and working of the instruments (oven, autoclave, incubator, centrifuge, laminar air flow and spectrophotometer); Familiarization with basic equipment's in tissue culture.
- 7. To study the structure of DNA using model or Charts.
- 8. Isolation and quantification of genomic DNA from bacteria (E. coli), animals or Plants
- 9. Study of Blotting techniques: Southern, Northern and Western, DNA fingerprinting, DNA sequencing, PCR through photographs.
- 10. Study of methods of gene transfer through photographs: Agrobacterium-mediated, direct gene transfer by electroporation, microinjection, micro-projectile bombardment.
- 11. Isolation of plasmid DNA
- 12. Restriction digestion and gel electrophoresis of plasmid DNA.
- 13. Study of biotechnology products: Samples of antibiotics and vaccines; Photographs of transgenic plants Bt Cotton; Bt Brinjal.

Suggested Readings:

- 1. Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
- Ashok Bendre and Ashok Kumar, 2000. Economic Botany, Rastogi Publications, U.P. 2.
- Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science 3. Amsterdam. The Netherlands.
- 4. Balasubramanian, D., C. F. A. Bryce, K. Dharmalingam, J. Green and K. Jayaraman. 2004. Biotechnology. Universities Press (India) Private Limited, Hyderabad.
- Channarayappa. 2007. Molecular Biotechnology Principles and Practices. Universities Press (India) 5. Private Limited, Hyderabad.
- Chawala, H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New 6. Delhi.
- 7. Dubey, R. C. 2001. A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi.
- Jha, T.B. and B. Ghosh. 2005. Plant Tissue Culture Basic and Applied. Universities Press (India) Private 8. Limited, Hyderabad.
- P.K Gupta, 2019. Elements of Biotechnology. Rastogi Publications, U.P.
- 10. Verma V, 1974. A Textbook of Economic Botany. Emkay Publications, Delhi.

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11. Plummer, D.T. (1996). An Introduction to Practical Biochemistry. Tata McGraw- Hill Publishing Co. Ltd.

Course Outcomes: The course outcomes of this course are as follows:

- CO1: Student will be able to understand recognize the role plants in human welfare with special emphasis on economic significant plants
- CO2: Students will learn about economic importance of plants, their distribution patterns
- CO3: Students will be familiar with principle and various methods, techniques of plant tissue culture CO4: Students will acquires knowledge about various types of cloning vectors used in the genetic engineering and various methods of genetic transformation of the plant cells.
- CO5: Students will get an understanding of Agrobacterioum mediated transformation of plant and DNA sequencing,

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1			105	104	1.00		
CO2					A CONTRACTOR	1	
CO3				1		-	-
CO4	-			1			-
C05				-			

20 | Page

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Economic Botany (Semester-VI) Minor Course (MIC)

Paper Code: C24MIC642T 45 Hrs (3 Hrs /Week) Credits: 4 Exam. Time: 3 Hrs

External Marks: 70 Internal Marks: 30 **Total Marks: 100**

Note: The examiner is required to set nine questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2 marks each. In addition to this, eight more questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. The student/candidate is required to attempt five questions in all selecting one from each unit consisting of 10 marks each in addition to the compulsory Question No.1. All questions carry equal marks.

Course Objectives:

To understand economic importance of diverse plants that offer resources to human life.

To explain the cultivation, production and processing of economic important plants

To understand the concept of plant resources

To explore potential applications of plants derived products

To known about the plants used as-food, medicinal value and also plant source of different economic value .

UNIT-I

Introduction and origin of cultivated plants. Plant resources: Concept, status, utilization, and concerns. Brief account on millets. Study of economically important plants: Scientific name, family, morphology, parts used

and uses of: Cereals: Wheat, Legumes: Black Gram and Soybean, Sugar and starches: Sugarcane and Potato

UNIT-II

Scientific name, family, morphology, use of plants and/or plant parts of: Spices: Cardamom and Black pepper, Beverages: Tea, Oil and Fats: Mustard, Fibre yielding plant: Jute, Narcotics: Tobacco,

UNIT-III

Brief knowledge of botany and use of following plants: Fruits: Mango (Varieties, fruit quality), Vegetables: Potato and Tomato Flower: Marigold and Rose (Cultivation methods), Timber: Saal

UNIT-IV

Scientific name, family, morphology, use of plants and/or plant parts of: Rubber: Hevea (morphology, processing, and uses), Ethnomedicine: Ashwagandga and Tulsi Pulses: Arhar and Moong

Suggested Readings:

- 1. Ecology and Utility of Plants. P S Chandel & R S Shukla. S. Chand Publishing Co.
- 2. Economic Botany. B P Pandey. S. Chand Publishing.
- 3. A Textbook of Plant Ecology (Including Ethnobotany & Soil Science). P S Chandel & R S Shukla. S. Chand Publishing.
- 4. Ecology and Utility of Plants. P S Chandel & R S Shukla. S. Chand Publishing.
- 5. College Botany Vol. I, II, III. B. P. Pandey. S. Chand Publishing.
- 6. Kochar, S.L. 1998. Economic Botany in the Tropics. Mac Millan India Ltd. Delhi
- 7. Wickens, G.E. (2001). Economic Botany: Principles & Practices. The Netherlands: Kluwer Academic Publishers.

Course Outcomes: The course outcomes of this course are as follows:

- CO1 Student will be able to understand the importance of plants.
- CO2 Student will acquire knowledge of plant products and their uses.
- CO3 Student will understand the process of plant cultivation and harvesting.
- CO4 Students will be able to apply knowledge of economic to real world scenarios.
- CO5 Students will learn about innovative solutions for plant based industries.

21 | Page

MS 10 / 1/25

Mapping of COs with POs:

Outcomes	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	S	S	M	S
CO2	S	S	M	S	M	S	S
CO3	S	M	S	M	S	S	S
CO4	M	S	M	S	S	S	M
CO5	S	S	S	S	S	S	5

S=Strong, M=Medium, W=Weak

22 | Page