



## 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)**



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

**SEMESTER-II**

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	C24BOT201T	Diversity of Higher Cryptogams & Genetics	3	3	20	50	70	2.5
	C24BOT201P	Diversity of Higher Cryptogams & Genetics Lab	1	2	10	15	25	3
Minor Course	C24MIC242T	Cell Biology	2	2	15	35	50	2
Multidisciplinary Course	C24MDC202T	Nursery and Gardening	2	2	15	35	50	2
	C24MDC202P	Nursery and Gardening Lab	1	2	10	15	25	3
Skill Enhancement Course	C24SEC227T	Organic Farming	2	2	15	35	50	2
	C24SEC227P	Organic Farming Lab	1	2	10	15	25	3
Value Added Course	C24VAC118T	Basics of Medicinal Plants	2	2	15	35	50	2

## **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.**

**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. 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.

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. 2<sup>nd</sup> 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.

#### Mapping of COs with POs:

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

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**

**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. 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. 12<sup>th</sup> 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.

**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

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

**Paper Code: C24MDC102T**  
**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 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.**

**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 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

**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	M	S
CO2	S	S	S	S	M	S	S
CO3	S	M	S	S	S	S	S
CO4	S	S	M	M	S	M	S
CO5	S	S	S	S	S	S	M

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	M	S
CO2	S	S	S	S	S	S	S
CO3	S	M	S	S	S	S	S
CO4	S	S	S	M	S	M	S
CO5	S	S	M	S	M	S	M

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**

**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. 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 distributors, 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

**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

**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.**

**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. 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).

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.

### Mapping of COs with POs:

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

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.

**Mapping of COs with POs:**

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

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	M	S	S	S	S
CO2	S	S	S	S	S	S	M
CO3	S	S	S	M	M	S	S
CO4	S	M	S	S	S	M	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	M
CO3	S	M	S	M	M	S	S
CO4	S	S	M	S	S	M	S
CO5	M	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**

**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:**

6. Promotion of cultivation and conservation of medicinal plants.
7. To create awareness and interest amongst the students about medicinal plants.
8. 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, Ayurved ka Pran: Vanoshadhi vigyan, Vedmata Gayatri Trust, Shaktikunj 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 distributors, 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

**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

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

*Handwritten signature and date:*  
23/3/21