GURU JAMBHESHWAR UNIVERSITY OF SCIENCE AND TECHNOLOGY, HISAR
(Established by State Legislature Act 17 of 1995)
'A+' Grade, NAAC Accredited State Govt. University

URGENT

Acad./AC-III/BOS&R-37/2026/ 388
Dated: 5/2/26

To

The Controller of Examinations,
GJUST, Hisar.

Sub: **Approval of revised scheme of examinations and syllabi of 'Botany' subject in B.Sc. Life Sciences (3rd to 6th semester) alongwith the list of pools of various subjects offered by the Department of Botany being run in affiliated degree Colleges w.e.f. academic session 2024-25.**

Sir,

I am directed to inform you that the Vice-Chancellor, on the recommendations of Dean, Faculty of Environmental and Bio Sciences & Technology on 28.01.2026, is pleased to approve the revised scheme of examinations and syllabi of 'Botany' subject in B.Sc. Life Science (3rd to 6th semester) for affiliated degree College(s) w.e.f. academic session 2024-25 under NEP-2020, under Section 11(5) of the University Act, 1995 in anticipation of approval of the Academic Council.

A copy of the scheme of examinations & syllabi of above said course is enclosed herewith.

You are therefore, requested to take further necessary action accordingly.

Yours faithfully

5/2/26

Asstt. Registrar (Academic)
for Dean Academic Affairs

Endst. No. Acad./AC-III/BOS&R-7/2025/ 389 - 414 Dated: 5/2/26

A copy of above is forwarded to the following for information and nccessary action:-

1. Dean, Faculty of Environmental and Bio Sciences & Technology, GJUST, Hisar.
2. Chairperson, Department of Botany, GJUST, Hisar. He is requested to arrange to upload the revised scheme of examinations and syllabi of 'Botany' subject in B.Sc. Life Science (3rd to 6th semester) for affiliated degree College(s) w.e.f. academic session 2024-25 under NEP-2020 on the website of the University.
3. Principals, all Affiliated Degree College(s), GJUST, Hisar alongwith the copy of the revised scheme of examinations and syllabi of 'Botany' subject in B.Sc. Life Science (3rd to 6th semester) for affiliated degree College(s) w.e.f. academic session 2024-25.
4. OSD to Vice-Chancellor (for kind information of the Vice-Chancellor), GJUST, Hisar.
5. P.A. to Registrar (for kind information of the Registrar), GJUST, Hisar.

Assistant Registrar (Academic)
5/2/26

Send for uploading on website & send PDF to Principals of Affiliated Colleges.
10/2/26

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-III

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	C24BOT301T	Diversity of Seed Plants : Gymnosperms & Angiosperms	3	3	20	50	70	2.5
	C24BOT301P	Diversity of Seed Plants: Gymnosperms & Angiosperm Lab	1	2	10	20	30	3
Minor Course	C24MIC342T	Plant Ecology	3	3	20	50	70	2.5
	C24MIC342P	Plant Ecology	1	2	10	20	30	3
Multidisciplinary Course	C24MDC302T	Plants in Everyday Life	2	2	15	35	50	2
	C24MDC302P	Plants in Everyday Life Lab	1	2	10	20	30	3
Skill Enhancement Course	C24SEC327T	Floriculture	2	2	15	35	50	2
	C24SEC327P	Floriculture Lab	1	2	10	20	30	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	C24VAC409T	Role of Plants in Human Welfare	2	2	15	35	50	2
Vocational Course	C24VOC442T	Plant Tissue Culture and Micropropagation	2	2	15	35	50	2
	C24VOC442P	Plant Tissue Culture and Micropropagation Lab	2	4	15	35	50	3

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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
Vocational Course	C24VOC542T	Natural Farming	2	2	15	35	50	2
	C24VOC542P	Natural Farming Lab	2	4	15	35	50	3

SEMESTER-VI

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	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	3	3	20	50	70	2.5
	C24MIC642P	Economic Botany Lab	1	2	10	20	30	3
Vocational Course	C24VOC642T	Plant Breeding	2	2	15	35	50	2
	C24VOC642P	Plant Breeding Lab	2	4	15	35	50	3

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Botany

Diversity of Seed Plants: Gymnosperms & Angiosperms (Semester-III)
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 seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In additional to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks i.e 12.5 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. 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 (Semester-III)

Course Code: C24BOT301P
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. *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).
2. *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 (model/chart/photographs).
5. Mounting of a collected, properly dried and pressed specimen of wild plants with herbarium label.
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.
2. 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.

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

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Paper Code: C24MIC342T
45 Hrs (3 Hrs /Week)
Credits: 3
Exam. Time: 2.5 Hrs

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

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In additional to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks i.e 12.5 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. 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.

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)

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.

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7. Krishnamurthy, K.V. An Advanced Text Book on Biodiversity, 2003, Oxford & IBH Publishing Co. Ltd.
8. Kumar, H.D. Modern Concept of Ecology, Latest Ed. Vikas Publishing House.
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

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Plant Ecology Lab (Semester-III)

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).

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:

1. To give an overview of how plants are indispensable to humans.
2. To gives an exposure to the various aspects of plant resource & its utilization.
3. To create awareness and interest among the 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 :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. 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.
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:

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

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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 :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.

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.
5. Planting and Transplanting.
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 Dc. 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.

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

S=Strong, M=Medium, W=Weak

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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 seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In additional to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks i.e 12.5 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. Endosperm : Structure and functions, Dicot and Monocot Embryo, Embryo-endosperm relationship.
Seed Structure (Dicot & Monocot), Polyembryony and Apomixis.

Plant Anatomy & Embryology Lab (Semester-IV)

Course Code: C24BOT401P
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 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:**

1. 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-1, Cells and Tissues, Edward Arnold, London.

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

Paper code:C24VAC409T
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.
3. 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.

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.

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

S = Strong, M = Medium, W = Weak

Botany

Plant Tissue Culture and Micropropagation (Semester IV)

Minor/Vocational Course (VOC)

Paper code: C24VOC442T
30hrs (2hr/week)
Credit: 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 of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this four questions (each question may be of 2-3 parts) will be set consisting of two questions from each unit. Student is required to attempt three questions in all selecting one question from each unit consisting of 10 marks each in addition to compulsory question no 1.

Course Objectives

This course aims to provide fundamental knowledge of the principles and techniques of plant tissue culture and micropropagation and to develop practical skills in aseptic handling, media preparation, and in-vitro culture methods. It seeks to familiarize students with tissue culture laboratory equipment and standard procedures, enable them to perform basic steps of micropropagation including initiation, multiplication, rooting, and hardening, and prepare them for employment or self-employment in plant biotechnology laboratories, nurseries, and agri-biotechnology industries.

Unit I:

Fundamentals of Plant Tissue Culture

Introduction to plant tissue culture: definition, history, and scope; concept of totipotency; cellular differentiation and dedifferentiation; types of plant tissue culture (callus, cell suspension, organ, meristem, embryo); Callus formation, organogenesis and embryogenesis, Protoplast isolation, somatic hybridisation, cybrids and their application

Unit II:

Micropropagation and Applications

Concept and stages of micropropagation (initiation, multiplication, rooting, hardening); nutrient media composition (macro/micronutrients, vitamins, carbon sources, gelling agents); cryopreservation of plant cell and tissue culture and establishment of gene banks. Somaclonal variations and isolation of useful mutant. Production of synthetic seed, importance, limitation and utilization

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Botany

Plant Tissue Culture and Micropropagation Lab (Semester IV)

Minor/Vocational Course

Paper code: C24VOC442P
60hrs (4hr/week)
Credit: 2
Exam Time: 3 hrs

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

Objectives:

To develop hands-on skills in aseptic techniques, media preparation, in-vitro culture, micropropagation, and acclimatization of plants using standard plant tissue culture laboratory practices. Plant Tissue Culture and Micropropagation

1. To familiarize students with the plant tissue culture laboratory, basic equipment, safety measures, and standard laboratory practices.
2. To learn the cleaning, washing, drying, and sterilization of glassware used in plant tissue culture experiments.
3. To prepare nutrient media (Murashige and Skoog medium) for in-vitro culture of plant tissues.
4. To sterilize culture media, glassware, and instruments using autoclave and other sterilization methods.
5. To study the preparation of explants and to perform surface sterilization for aseptic culture initiation.
6. To learn the operation and working principles of the laminar airflow cabinet for aseptic inoculation.
7. To perform aseptic inoculation of explants onto nutrient media under sterile conditions.
8. To initiate callus culture from suitable plant explants using appropriate growth regulators.
9. To study shoot multiplication in in-vitro cultures using cytokinins.
10. To induce rooting in regenerated shoots using auxins.
11. To perform sub-culturing of in-vitro plant cultures for maintenance and multiplication.
12. To acclimatize and harden in-vitro regenerated plantlets for transfer to soil conditions.
13. To identify common sources of contamination in tissue culture and to study their management and control.
14. To maintain proper labeling, record-keeping, and documentation of tissue culture experiments.

Books Suggested

1. Bhojwani, S.S. and Razdan, M.K., *Plant Tissue Culture: Theory and Practice*, Elsevier.
2. George, E.F., Hall, M.A. and De Klerk, G.J., *Plant Propagation by Tissue Culture*, Springer.
3. Gamborg, O.L. and Phillips, G.C., *Plant Cell, Tissue and Organ Culture*, Springer.
4. Razdan, M.K., *Introduction to Plant Tissue Culture*, Oxford & IBH.

Course Outcomes

After successful completion of the course, students will be able to:

1. Understand the basic principles and techniques of plant tissue culture and micropropagation.
2. Prepare and sterilize nutrient media and laboratory equipment.
3. Perform aseptic inoculation and maintenance of in-vitro cultures.
4. Execute the stages of micropropagation including initiation, multiplication, rooting, and hardening.
5. Apply tissue culture skills for employment or self-employment in plant biotechnology and allied sectors.

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

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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 seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In additional to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks i.e 12.5 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. Mineral Nutrition : Role and deficiency symptoms of Macro & Micronutrients, Girdling Experiment

UNIT - II

Respiration : Aerobic and Anaerobic respiration, Glycolysis, TCA cycle, Electron Transport Chain, Oxidative phosphorylation. 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 - III

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.

Plant Physiology-Metabolism and Ecology Lab (Semester-V)

Course Code: C24BOT501P
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. Demonstration of Imbibition by Plaster of Paris Method.
2. Demonstration of Osmosis by potato osmoscope method.
3. Demonstration of Plasmolysis and Deplasmolysis.
4. Comparison of Stomatal and Cuticular transpiration by four Leaf /Cobalt chloride method .
5. Demonstration of transpiration by Ganong/Farmer potometer.
6. Effect of Light, Dark and Carbon Dioxide concentration on the rate of photosynthesis.
7. Demonstration of aerobic respiration.
8. Demonstration of anaerobic respiration
9. Evolution of heat during respiration.
10. Determination of Density, Abundance and Frequency of species by quadrat method.
11. Study of anatomical features of Hydrophytes and Xerophytes in relation to their habitats.

Suggested Readings:.

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

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Botany
Natural Farming (Semester V)
Minor/Vocational Course (VOC)

Paper code: C24VOC542T
30hrs (2hr/week)
Credit: 2
Exam Time: 2Hrs

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 of five short questions covering the entire syllabus consisting of 3 marks each. In addition to this, four questions (each may have 2-3 parts) will be set consisting of two questions from each unit. Students are required to attempt three questions in all, selecting one question from each unit, consisting of 10 marks each in addition to the compulsory question no. 1.

Course Objectives
This course aims to provide fundamental knowledge of natural farming principles, techniques, and sustainable agricultural practices. It seeks to develop practical skills in soil fertility management, pest and disease control using botanical and biological methods, water conservation, and crop management. The course prepares students for employment or self-employment in organic farming, horticulture, and sustainable agriculture initiatives.

Unit I:

Fundamentals of Natural Farming
Definition, history, and scope of natural farming; principles of organic and chemical-free agriculture; soil fertility management using compost, vermicompost, green manure, and biofertilizers; importance of crop rotation, intercropping, and mulching; role of beneficial microorganisms in maintaining soil health; advantages over conventional farming.

Unit II:

Practices and Applications of Natural Farming
Natural pest and disease management using botanical extracts, traps, and biocontrol agents; water conservation and management techniques (rainwater harvesting, drip irrigation); use of locally available resources for farm inputs; sustainable crop production practices; benefits to environment, human health, and economy; challenges and future prospects of natural farming.

Natural Farming Lab (Semester V)
Minor/Vocational Course

Paper code: C24VOC542P
60hrs (4hr/week)
Credit: 2
Exam Time: 3 Hrs

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

Objective:
To develop hands-on skills in sustainable, chemical-free farming practices, including soil fertility management, pest control, water conservation, and crop management using locally available resources.

Natural Farming Lab Practicals – Minor/VOC

1. To prepare compost using plant residues, vegetable waste, and cow dung for improving soil fertility.
2. To prepare vermicompost using earthworms and learn worm handling, feeding, and harvesting techniques.
3. To grow and incorporate green manure crops into soil for enhancing organic matter and soil fertility.
4. To test soil samples for pH, texture, moisture, and nutrient content using simple laboratory methods.
5. To prepare plant-based pest repellents using neem, garlic, chili, and marigold and study their effectiveness.
6. To demonstrate mulching using dry leaves, straw, or husk for moisture retention, temperature control, and weed suppression.
7. To perform intercropping or companion planting in pots and observe growth and pest resistance benefits.
8. To treat and germinate seeds using natural methods such as soaking in cow urine, neem extract, or water.
9. To demonstrate small-scale water conservation techniques including drip irrigation and rainwater harvesting in pots.
10. To maintain proper documentation and records of composting, vermicomposting, soil testing, plant growth, and pest management experiments.

Books Suggested

1. Subhash Palekar – *Zero Budget Natural Farming*
2. F. H. King – *Farmers of Forty Centuries*
3. N. K. Singh – *Organic Farming and Sustainable Agriculture*
4. V. P. Singh – *Principles and Practices of Organic Farming*

Course Outcomes (COs)
After successful completion of the course, students will be able to:

1. Understand the principles and benefits of natural and sustainable farming.
2. Prepare compost, vermicompost, and biofertilizers for soil fertility management.
3. Apply botanical and biological methods for pest and disease control.
4. Implement water conservation and sustainable crop management practices.

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

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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 seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In additional to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks i.e 12.5 marks.

Course Objectives:

1. To familiarize the students about the fundamentals of plant biotechnology
2. To understand Recombinant DNA technology and their applications
3. To learn the concept of plant tissue culture and its scope
4. To understanding economic importance of the cereals, vegetables and pulses
5. 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). Medicinal plants : *Cinchona*, *Rauwolfia* and *Opium* (Botanical name, family, part used, morphology and uses); Rubber : *Hevea* (morphology, processing, and uses).

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Plant Biotechnology & Economic Botany Lab (Semester-VI)

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.
2. Ashok Bendre and Ashok Kumar, 2000. Economic Botany, Rastogi Publications, U.P.
3. Bhojwani, S.S. and Razdan, M.K., (1996). Plant Tissue Culture: Theory and Practice. Elsevier Science 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.
5. Channarayappa. 2007. Molecular Biotechnology – Principles and Practices. Universities Press (India) Private Limited, Hyderabad.
6. Chawala, H. S. 2002. Introduction to Plant Biotechnology. Oxford & IBH Publishing Company, New Delhi.
7. Dubey, R. C. 2001. A Textbook of Biotechnology. S. Chand & Company Ltd., New Delhi.
8. Jha, T.B. and B. Ghosh. 2005. Plant Tissue Culture – Basic and Applied. Universities Press (India) Private Limited, Hyderabad.
9. 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. New Delhi. 3rd edition.

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	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

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

Paper Code: C24MIC642T
45 Hrs (3 Hrs /Week)
Credits: 3
Exam. Time: 2.5 Hrs

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

Note: The examiner is required to set seven questions in all. The first question will be compulsory consisting of five short questions covering the entire syllabus consisting of 2.5 marks each. In additional to that six more questions will be set, two questions from each unit. The students shall be required to attempt four questions in all selecting one question from each unit in addition to compulsory Question No. 1. All questions shall carry equal marks i.e 12.5 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, Ethnomedicine: Ashwagandga and Tulsi Pulses: Arhar and Moong

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, Scientific name, family, morphology, use of plants and/or plant parts of: Rubber: *Hevea* (morphology, processing, and uses).

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.

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

Course Code: C24MIC642P
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 plant parts /products from the point of view of economic importance (as per theory syllabus). (Wheat, Black Gram, Soybean, Sugarcane, Potato, Tea, Cardamom, Black pepper, Mustard, Jute, Tobacco, Saal, Ashwagandha).
2. Habit sketch of plants included in theory syllabus.
3. L.S/T.S. of Grains.
4. Products and By products of Sugarcane.
5. Study T.S. tuber of Potato to show localization of starch grains.
6. To study Millets (specimens/digital resources and grains).
7. Specimens/photographs of Tobacco products.
8. Extraction methods (Specimen/digital resources) of Mustard oil.
9. Processing of tea (Specimen/digital resources).
10. Excursion and Submission of Dry specimens/Collection/Project Work (mandatory).

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.

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

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Plant Breeding (Semester VI)
Minor/Vocational Course (VOC)

Paper Code: C24VOC642T
30 hrs (2 hr/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 and shall consist of five short questions covering the entire syllabus, each carrying 3 marks. In addition, four questions (each question may be of 2-3 parts) will be set, consisting of two questions from each unit. The students are required to attempt three questions in all, selecting one question from each unit, each carrying 10 marks, in addition to the compulsory question.

Course Objectives
This course aims to provide fundamental knowledge of the principles and methods of plant breeding and crop improvement. It seeks to familiarize students with conventional breeding techniques, selection methods, and hybridization procedures, and to develop basic skills related to crop improvement and seed production. The course also aims to prepare students for employment or self-employment in agriculture, seed industry, plant breeding programs, and allied sectors.

Plant Breeding

Unit I:

Principles of Plant Breeding
Origin and evolution of crop plants; objectives and scope of plant breeding; domestication of plants; centres of origin and diversity; concept of variability; types of variation; role of heredity and environment in crop improvement; plant introduction and acclimatization; selection methods including mass selection and pure line selection; role of plant breeding in food security and sustainable agriculture.

Unit II:

Methods of Plant Breeding and Applications
Hybridization: objectives, types, and methods; breeding methods for self-pollinated crops; breeding methods for cross-pollinated crops; breeding methods for vegetatively propagated crops; heterosis and its exploitation; basics of seed production and seed certification; role of plant breeding in development of high-yielding, disease-resistant, and stress-tolerant crop varieties; limitations and future prospects of plant breeding.

Botany
Plant Breeding Lab (Semester VI)
Minor/Vocational Course

Paper Code: C24VOC642P
60 hrs (4 hr/week)
Credits: 2
Exam Time: 3 Hrs

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

Objectives
To develop practical skills related to plant breeding techniques, selection methods, hybridization procedures, and basic seed technology for crop improvement.

Plant Breeding Practicals
1. To study the objectives and scope of plant breeding through selected crop examples.
2. To study variation in qualitative and quantitative characters in crop plants.
3. To identify and study different crop varieties and their distinguishing features.
4. To study floral biology and pollination mechanisms in crop plants.
5. To perform emasculation techniques in selected crop plants.
6. To perform artificial hybridization and bagging techniques.
7. To study different selection methods used in plant breeding.
8. To study heterosis using suitable crop examples.
9. To study seed structure and types of seeds in crop plants.
10. To study methods of seed collection, processing, and storage.
11. To study seed viability and germination testing methods.
12. To study the basics of seed certification and seed quality control.
13. To study improved crop varieties developed through plant breeding.
14. To maintain practical records related to plant breeding experiments.

Books Suggested

1. Singh, B.D., *Plant Breeding: Principles and Methods*, Kalyani Publishers.
2. Allard, R.W., *Principles of Plant Breeding*, Wiley.
3. Poehlman, J.M. and Sleper, D.A., *Breeding Field Crops*, Springer.
4. Acquaah, G., *Principles of Plant Genetics and Breeding*, Wiley-Blackwell.

Course Outcomes
After successful completion of the course, students will be able to:
1. Understand the basic principles and objectives of plant breeding.
2. Explain conventional methods used for crop improvement.
3. Perform basic plant breeding practices such as selection and hybridization.
4. Understand the importance of seed production and seed quality.
5. Apply plant breeding knowledge for employment or self-employment in agriculture, seed industry, and allied sectors.

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

19/11/25