

JSS MAHAVIDYAPEETHA

JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE

(Autonomous, 'A⁺' Grade and 'College with Potential for Excellence')

Ooty road, Mysuru-570 025, Karnataka

Ph: 0821-2548236 & 2548380. FAX: 0821-2548238

E-mail: jssautonomous@gmail.com; Website: jsscacs.edu.in



DEPARTMENT OF BOTANY (UG)

**FRAMING OF DURATION FOR DEGREE PROGRAMME AND
REVISION OF SYLLABUS FOR UNDERGRADUATE COURSES &
CONTINUOUS ASSESSMENT AND GRADING PATTERN (CGPA)**

(Ref: Govt order No. ED 166 UNE 2023, Bangalore, dated 05-05-2024)

B.Sc. BOTANY

Syllabus and Scheme of Examination

2026 – 2027

I to VI semesters

ALLOCATION OF CREDITS
JSS COLLEGE OF ARTS, COMMERCE AND SCIENCE, OOTY ROAD, MYSURU-25
DEPARTMENT OF BOTANY

Sem	Course code	Q P Code	Practical/ Theory	TITLE OF THE COURSE DISCIPLINE CORE COURSE (COMPULSORY)	Hrs/ Week L:T:P	Credits	Max marks
I	GB0101	245101	Theory	Diversity of Microbes, Algae, Fungi & Phytopathology	3 Hrs.	3	80+20
	GB0102	--	Practical	Diversity of Microbes, Algae, Fungi & Phytopathology	4 Hrs.	2	40+10
II	GB0201	245201	Theory	Bryophytes, Pteridophytes, Gymnosperms, Paleobotany & Morphology of Angiosperms	3 Hrs.	3	80+20
	GB0202	--	Practical	Bryophytes, Pteridophytes, Gymnosperms, Paleobotany & Morphology of Angiosperms	4 Hrs.	2	40+10
III	GB0301	245301	Theory	Plant Anatomy, Reproductive Biology, Ecology & Conservation Biology	3 Hrs.	3	80+20
	GB0302		Practical	Plant Anatomy, Reproductive Biology, Ecology & Conservation Biology	4 Hrs.	2	40+10
	GB0313		Elective	Horticulture and Floriculture	2 Hrs.	2	40+10
	GB0314		Elective	Mushroom Culture & Biofertilizers	2 Hrs.	2	40+10
IV	GB0401	245401	Theory	Plant Physiology, Cell Biology & Molecular Biology	3 Hrs.	3	80+20
	GB0402		Practical	Plant Physiology, Cell Biology & Molecular Biology	4 Hrs.	2	40+10
	GB0411	245411	Elective	Medicinal Plants & Herbal Technology	2 Hrs.	2	40+10
	GB0412	245412	Compulsory Practical	Nursery, Gardening & Landscaping	4 Hrs.	2	40+10
V	GB0501		Theory	Taxonomy of Angiosperms, Economic Botany & Ethnobotany	3 Hrs.	3	80+20
	GB0502		Practical	Taxonomy of Angiosperms, Economic Botany & Ethnobotany	4 Hrs.	2	40+10
	GB0503		Theory	Plant Breeding and Phytogeography	3 Hrs.	3	80+20
	GB0511		Compulsory Practical	Nursery, Gardening & Landscaping	4 Hrs.	2	40+10
	GB0512		Theory-Skill	Floriculture	2 Hrs.	2	40+10
VI	GB0601		Theory	Genetics, Genetic Engineering, Plant Biotechnology & Evolution	3 Hrs.	3	80+20
	GB0602		Practical	Genetics, Genetic Engineering, Plant Biotechnology & Evolution	4 Hrs.	2	40+10
	GB0603		Theory	Phytochemistry and Herbal Technology	3 Hrs.	3	80+20
	GB0612		Elective	Botanical Products	2 Hrs.	2	40+10

Examiners list

Sl. No	Name	Designation and DOB	Joining Date	Phone number
Internal Examiners				
1	Dr. Kiran B L JSS College, Ooty Road, Mysore	Asst. Prof. & HOD	23-09-2015	9638219347
2	Dr. Pooja N JSS College, Ooty Road, Mysore	Asst. Prof.	30-08-2017	9844210414
External Examiners				
1.	Dr. Shivalingaiah GFGC, K R Nagar	Professor 01/06/1968	08/01/1996	9036766869
2.	Dr. Purushotham S P GFGC, Channapatna-571401	Professor 15/05/1967	02/08/1996	9448115524
3.	Dr. Basavaraju G L Maharani's Science College for Women, Mysore	Professor 21/07/1976	30/01/2004	
4.	Dr. Devika M Saradavilas College, Mysore	Asso. Prof. 14/03/1970	14/12/2005	9880024483
5.	Dr. Pruthviraj Maharani's Science College for Women, Mysore	Asso. Prof.		9448925262
6.	Dr. Nataraju Maharani's Science College for Women, Mysore	Professor		9448033901
7.	Dr. Suresh N S Government Science college, Hassan	Professor 25/02/1975	02/05/2006	9242243601
8.	Dr. Jayalakshmi B Govt College for Women, Mandya	Professor 18/11/1974	14/07/2006	9482640645
9.	Sowmya H K Maharani's Science College for Women, Mysore	Asso. Prof. 18/06/1970	22/12/2007	7338466887
10.	Dr. Thoyajaksha Maharani's Science College for Women, Mysore	Professor 20/07/1970	24/12/2007	9743779983
11.	Sandhya Rani D Govt Science College, Hassan	Professor 24/08/1972	24/12/2007	9448602597
12.	Dr. Pushpalatha H G Govt College for Women, Mandya	Professor 23/12/1979	26/12/2007	9480442844
13.	Dr. Ashok N Pyati Sri Mahadeshwara Govt. First grade college, Kollegala	Professor 22/04/1970	28/12/2007	7204661365
14.	Dr. Deepa Hebbar Maharani's Science College for Women, Mysore	Professor		9632869690
15.	Dr. Lalitha V Maharani's Science College for Women, Mysore	Professor		8105004148
16.	Revanamaba B JSS College for Women, Chamarajanagara	Asst. Prof.		9448528471
17.	Dr. Krishna Yuvarajas college, Mysore.	Professor		

18.	Nayana, K. N. Maharani's Science College for Women, Mysore , Mysuru	Asst. Prof.		9964041544
19.	Dr. Anil Kumar Yuvaraja College, Mysuru	Asst. Prof.		8970945497
20.	Dr. Netra Yuvarajas college, Mysore	Asst. Prof.		9620782198
21.	Dr. Poornima Yuvaraja College, Mysuru	Asst. Prof.		8217642534
22.	Dorothy P St. Philos, Mysuru	Asst. Prof.		8867440178
23.	Chandana C JSSCW, Mysuru	Asst. Prof.		7019663825
24.	Anusha JSSCW, Mysuru	Asst. Prof.		8095170082
25.	Amulya JSS College for Women, Chamarajanagara	Asst. Prof.		8147230361
26.	Yashwanth Sharada Vilas college, Mysuru	Asst. Prof.		8904300482
27.	Jeevitha Saldhana St. Philos, Mysuru	Asst. Prof.		9740674763
28.	Rajashekhara Sharada Vilas college, Mysuru	Asst. Prof.		6360821394

PROGRAM LEARNING OUTCOMES (PLOs) On successful completion of the B.Sc. Botany program, graduates will be able to:

PLO 1: Botanical Knowledge Demonstrate in depth knowledge and integrate concepts across various domains of plant science to understand plant systems holistically.

PLO 2: Scientific Inquiry and Research Skills Formulate hypotheses, design experiments, and interpret data using appropriate scientific approaches, in plant science.

PLO 3: Advanced Laboratory and Field Competencies Employ standard and modern techniques in plant analysis, documentation, and field-based studies.

PLO 4: Environmental and Sustainability Challenges Apply botanical knowledge to biodiversity conservation, ecosystem management, and sustainable utilization of plant resources.

PLO 5: Communication and Documentation Skills Effectively communicate research findings through scientific writing, presentations, and documentation techniques.

PLO 6: Ethical and Professional Standards Practice integrity, professional ethics, and responsibility in scientific and professional activities.

PLO 7: Emerging Trends in Plant Sciences Understand and apply recent advancements and innovations in botany and allied fields.

PLO 8: Higher Education and Employability Demonstrate readiness for advanced studies, research, and diverse career opportunities in plant sciences and related sectors.

Botany
I Semester - Paper I
Theory Syllabus

DIVERSITY OF MICROBES, ALGAE, FUNGI AND PHYTOPATHOLOGY

Code: GBO101

48 Hrs

Credits: 3

(3 Hrs of instruction/ week)

Course outcome

1. Explain microbial diversity, classification systems, and the structure and significance of major microbial groups.
2. Describe the characteristics, classification, structure, reproduction, and importance of algae, cyanobacteria, and lichens.
3. Analyze the classification, characteristics, and life cycles of fungi with their economic importance.
4. Evaluate plant diseases, their causes, symptoms, management, and key phytopathological concepts.

Course Content:

Unit I:

16 hours

Microbial diversity: A brief account of microbes in soil, air, food and water. Brief account of five kingdom (Whittaker) and three domain (Carl Woese) system of classification. **Virology:** History, general characters, classification, Ultrastructure and multiplication of TMV and Bacteriophage (T4); Transmission of Viruses. **Viroids:** General characters and fine structure of PSTVd. **Prions:** General characters and diseases [Creutzfeldt-Jakob disease (CJD), Bovine spongiform encephalopathy (BSE)]. **Mycoplasma:** History and general characters. **Phytoplasma:** Introduction, classification and diseases (Sandal spike disease). **Bacteriology:** Introduction, classification (based on nutrition); Ultrastructure and reproduction (Budding, fission and endospore formation); Genetic recombination (Conjugation, transduction and transformation) and economic importance.

Unit II:

16 hours

Algae and Lichens: Cyanobacteria: General characters and economic importance of Cyanobacteria. Type study: *Nostoc*. General characters, classification and economic importance of algae. Type study: *Chlorella*, *Oedogonium*, *Caulerpa*, *Diatom* (Pennales), *Sargassum* and *Polysiphonia*. **Lichens:** General characters, classification (based on morphology and fungal component), structure, reproduction and economic importance.

Unit III:

16 hours

Fungi: General characters, classification (Ainsworth's) and economic importance. Type study: *Rhizopus*, *Albugo*, *Penicillium*, *Puccinia* and *Fusarium*. **Phytopathology:** Introduction, classification (based on causal organism) and disease triangle. **Plant diseases:** Host, causal organism, symptoms and management of Little leaf of brinjal, Tobacco mosaic disease, Citrus canker, Tikka disease of groundnut, Late blight of potato, Coffee rust and Algal rust; Biopesticides.

LEARNING RESOURCES

1. Alexopolous, J. & Charles, W. M. 1988. *Introduction to Mycology*. Wiley Eastern, New Delhi.
2. Chopra, G. L. 1973. *Textbook of Algae*. S. Nagin and Co., Jalandhar.
3. Dube, H. C. 1983. *An Introduction to Fungi*. Vikas Publication House, New Delhi.
4. Dutta, A. C. 1998. *Botany for Degree Students*. Oxford University Press.
5. Ganguli, H. C., Das, K. S. & Datta, C. 1935. *College Botany (Vol. II)*. New Central Book Agency (P) Ltd.
6. Mehrotra, R. S. & Aneja, K. R. 1990. *An Introduction to Mycology*. Wiley Eastern Ltd.
7. Pandey, B. P. 2001. *College Botany Vol. I: Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta*. S. Chand and Company Ltd., New Delhi.
8. Pandey, B. P. 2007. *Botany for Degree Students: Diversity of Microbes, Cryptograms, Cell Biology and Genetics*. S. Chand and Company Ltd., New Delhi.
9. Pelczar, M. J. 2001. *Microbiology*, 5th edition. Tata McGraw-Hill Co., New Delhi.
10. Prescott, L., Harley, J. & Klein, D. 2005. *Microbiology*, 6th edition. Tata McGraw-Hill Co., New Delhi.
11. Sambamurthy, A. V. S. S. 2006. *A Textbook of Plant Pathology*. I. K. International Pvt. Ltd., New Delhi.
12. Sambamurthy, A. V. S. S. 2006. *A Textbook of Algae*. I. K. International Pvt. Ltd., New Delhi.
13. Sharma, O. P. 2006. *A Textbook of Thallophyta*. McGraw-Hill Publishing Co., New Delhi.
14. Singh, R. S. 1984. *Introduction to Principles of Plant Pathology*. Oxford & IBH Publication Co. Pvt. Ltd., New Delhi.
15. Singh, V., Pande, P. C. & Jain, D. K. 2006. *A Textbook of Botany*. Rastogi Publications, Meerut.
16. Smith, G. M. 1955. *Cryptogamic Botany: Algae, Fungi and Lichens, Vol. I*. McGraw-Hill Book Co., New York.
17. Srivastava, H. N. 1998. *Algae*. Pradeep Publications, Jalandhar.
18. Srivastava, H. N. 1993. *Fungi*. Pradeep Publications, Allahabad.
19. Sundarajan, S. 1998. *College Microbiology, Vol. I*. Vardhana Publications, Bangalore.
20. Sundararajan, S. 1993. *College Botany, Vols. I & II*. Himalaya Publishing Company, Bangalore.
21. Vashishta, B. R., Sinha, A. K. & Singh, V. P. 2008. *Botany for Degree Students: Algae*. S. Chand and Company Ltd., New Delhi.

Theory Question Paper Scheme
I Semester- Paper I
DIVERSITY OF MICROBES, ALGAE, FUNGI AND PHYTOPATHOLOGY

Code: GBO101

Time: 3 Hrs

Max Marks: 80

I. Define/ Explain any FIVE the following

2 X 5 = 10

3 from Unit I

2 from Unit II

2 from Unit III

II. Answer any SIX of the following

5 X 6 = 30

2 from Unit I

3 from Unit II

3 from Unit III

III. Answer any FOUR of the following

10 X 4 = 40

2 from Unit I

2 from Unit II

2 from Unit III

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 2 = 20	36
II	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39
III	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39

Assessment method

Assessment		Marks
C ₁	Test	10
C ₂	Test	10
C ₃	Semester end exam	80

Theory Model Question Paper
I Semester - Paper I

DIVERSITY OF MICROBES, ALGAE, FUNGI AND PHYTOPATHOLOGY

Code: GBO101

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any SIX of the following

5 X 6 = 30

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

III. Answer any FOUR of the following

10 X 4 = 40

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.

Practical Syllabus
I Semester - Paper I

DIVERSITY OF MICROBES, ALGAE, FUNGI AND PHYTOPATHOLOGY

Code: GBO102

- 64 Hrs

Credits: 2

(1 Practical of 4 Hrs / week)

1. Equipments used in Microbiology lab: Inoculation loop & needle, Hot air oven, Incubator, Pressure cooker.
2. Equipments used in Microbiology lab: Laminar air flow chamber, Haemocytometer, Colony counter
3. Photographs /Charts of Microbiologists and their contribution (Antoni Van Leeuwenhoek, Louis Pasteur, Robert Koch, Iwanowski, Joseph Lister)
4. Staining of bacteria: Simple (positive and negative) and Gram staining.
5. Structure and reproduction of *Nostoc* and *Chlorella*
6. Structure and reproduction of *Oedogonium*
7. Structure and reproduction of *Caulerpa*
8. Structure and reproduction of *Sargassum*
9. Structure and reproduction of *Polysiphonia* and Pennate Diatom
10. Structure and reproduction of *Rhizopus*, *Albugo*
11. Structure and reproduction of *Penicillium* and *Puccinia*,
12. Structure and reproduction of *Fusarium* and Lichens
13. Host, causal organism, symptoms and management of Sandal spike, TMV, Citrus canker, Algal rust (Avocado)
14. Host, causal organism, symptoms and management of Tikka disease of Groundnut, Late blight of Potato and Coffee rust
15. Biopesticides (Neem, *Trichoderma*, *Bacillus subtilis*, NPV)

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

**Practical Question Paper Scheme
I Semester - Practical I**

DIVERSITY OF MICROBES, ALGAE, FUNGI, AND PHYTOPATHOLOGY

Code: GBO102

Time: 3 Hrs

Max. Marks: 40

- | | |
|---|--------|
| I. Perform the experiment A and leave for evaluation | 07 |
| II. Prepare a temporary stained slide of the materials B & C sketch, label and identify with reasons. Leave the preparation for evaluation | 5x2=10 |
| III. Write critical comment on the materials D, E & F | 3x4=12 |
| IV. Identify the slides G, H & I with reason | 2x3=06 |
| V. Record | 05 |

**Practical Question Paper Scheme
I Semester - Practical I**

DIVERSITY OF MICROBES, ALGAE, FUNGI, AND PHYTOPATHOLOGY

Code: GBO102

Time: 3 Hrs

Max. Marks: 40

- | | |
|--|-----------------|
| I. Perform the experiment A and leave for evaluation | 07 |
| [Simple staining (positive and negative)]
(Principle- 1; Procedure- 2; Performance with result- 4) | |
| II. Prepare a temporary stained slide of the materials B & C | |
| Sketch, label, and identify with reasons. Leave the preparation for evaluation (5x2=10)
(B- Cyanobacteria/ Algae, C- Fungi)
(Identification- 1; Preparation- 2; Reasons with labeled diagram- 2) | |
| III. Comment on the materials D, E & F | (3x4=12) |
| D- Fungi, Virus / Bacteria/ Mycoplasma disease and Algae/Lichen (Identification- 1, Causal organism- 1, Symptoms and Management- 2)
E- Equipments; F-Microbiologist/Biopesticides. (Identification- 1; Reasons-3) | |
| IV. Identify the slides G, H & I with reason | (2x3=06) |
| (G- Algae/ Cyanobacteria, H-Fungi/ Lichen and I- Phytopathology)
(Identification- 1; Reasons with labeled diagram- 1) | |
| V. Record | 05 |

Note: Each student shall bring the practical record to the practical examination for evaluation without which he / she shall not be allowed to appear for the practical examination.

Botany
II Semester - Paper II
Theory Syllabus
BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS, PALEOBOTANY AND
ANATOMY OF ANGIOSPERMS

Code: GBO201

48 Hrs

Credits: 3

(3 Hrs of instruction/ week)

Course outcome

1. Summarize the characteristics, classification, and importance of bryophytes and key paleobotanical concepts.
2. Explain the features, classification, stellar evolution, and representative types of pteridophytes.
3. Describe the characteristics, classification, and significance of gymnosperms.
4. Analyze plant tissue structure and anatomy of roots, stems, and leaves, including secondary growth and anomalies.

Course Content:

Unit I

16 hours

Bryophytes: General characters, classification and economic importance of Bryophytes
Type Study - *Riccia*, *Marchantia*, *Anthoceros* and *Polytrichum* (Developmental details not required).

Paleobotany: Geological time scale, fossils and fossilization; Types of fossils.
Type study: *Rhynia* and *Cycadeoidea*

Unit II

16 hours

Pteridophytes: General characters classification and economic importance.
Stellar Evolution. Type study: *Psilotum*, *Selaginella*, *Equisetum*, *Pteris* and *Marsilea*
(Developmental details not required); Heterospory and seed habit (Brief account).

Unit III

16 hours

Gymnosperms: General characters, classification and economic importance of Gymnosperms.
Type study: *Cycas*, *Pinus* and *Gnetum*.

Anatomy of Angiosperms: Epidermal tissue system (Epidermis, trichomes, Stomata and hydathodes) and Secretory tissue (Laticiferous tissues). Vascular bundles, types of vascular bundles. Anatomy of monocot and dicot root, stem and leaf. Secondary growth in dicot stem and Anomalous secondary growth in *Dracaena* stem.

LEARNING RESOURCES

1. Andrews, H. N. 1961. Studies in Paleobotany. John Wiley, New York.
2. Bhatnagar, S. P. and Mitra, A. 1966 Gymnosperms. New age International (P) Ltd. Publishers.
3. Bierhorst, D. W. 1971. Morphology of Vascular Plants. The MacMillan Co., N.Y. and Collier- MacMillan Ltd., London.
4. Chamberlain, C. J. 1935. Gymnosperms- Structure and Evolution. Chicago Press.
5. Chestor, A. A. 1947. Introduction to Palaeobotany. McGraw Hill, London.
6. Coulter, J. M. and Chamberlain, C. J. 1964. Morphology of Gymnosperms. Central Book Depot, Allahabad.
7. Dutta, A. C. 1998. Botany for Degree Students. Oxford University Press.
8. Dutta, S. C. 1966. An Introduction to Gymnosperms. Asia Publications House, Mumbai.
9. Eames, A. J. 1936. Morphology of Vascular Plants (Lower Groups). McGraw Hill, N.Y.
10. Frank, C. 1990. The inter-relationships of the Bryophytes. New Phytologist. Today and Tomorrow's Printers and Publishers.
11. Gangulee, H. C., Kar and Kumar, A. 1982. College Botany- Vol. II. Central Book Agency, Calcutta.
12. Pandey, S. N., Mishra, S. P. and Trivedi, P. S. 2007. A Textbook of Botany- Vol. II. Rastogi Publications, Meerut.
13. Rashid, A. 1999. An Introduction to Pteridophyta. MKM Publisher Pvt Ltd.
14. Shripad, N. A. 1995. Paleobotany. Oxford and I.B.H. New Delhi.
15. Singh, V., Pande, P. C. and Jain, D. K. 2005. Diversity and Systematics of Seed plants. Rastogi Publications, Meerut.
16. Singh, V., Pande, P. C. and Jain, D. K. 2006. A Textbook of Botany. Rastogi Publications, Meerut.
17. Singh G. 2012. *Plant systematics: Theory and Practice*. Oxford and IBH, Pvt. Ltd., New Delhi.
18. Singh V. & Jain - *Taxonomy of Angiosperms* - Rastogi Publications, Meerut
19. Sporne, K. R. 1971. The Morphology of Gymnosperms: The Structure and Evolution of Primitive seed Plants. Hutchinson University Library, London.
20. Sporne, K. R. 1974. Morphology of Pteridophytes. Hutchinson and Co., London.
21. Vashishta, P. C. 1982. Pteridophyta. S. Chand and Co. Ltd., New Delhi.

Theory Question Paper Scheme
II Semester - Paper II

**BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS, PALEOBOTANY AND
ANATOMY OF ANGIOSPERMS**

Code: GBO201

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE the following

2 X 5 = 10

3 from Unit I

2 from Unit II

2 from Unit III

II. Answer any SIX of the following

5 X 6 = 30

2 from Unit I

3 from Unit II

3 from Unit III

III. Answer any FOUR of the following

10 X 4 = 40

2 from Unit I

2 from Unit II

2 from Unit III

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 2 = 20	36
II	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39
III	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39

Assessment method

Assessment		Marks
C ₁	Test	10
C ₂	Test	10
C ₃	Semester end exam	80

Theory Model Question Paper
II Semester - Paper II

**BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS, PALEOBOTANY AND
ANATOMY OF ANGIOSPERMS**

Code: GBO201

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any SIX of the following

5 X 6 = 30

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

III. Answer any FOUR of the following

10 X 4 = 40

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.

Practical Syllabus
II Semester - Practical II

**BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS, PALEOBOTANY AND
ANATOMY OF ANGIOSPERMS**

Code: GBO202

64 Hrs.

Credits: 2

(1 practical of 4 Hrs / week)

1. Morphology, anatomy and reproduction of *Riccia* and *Marchantia*
2. Morphology, anatomy and reproduction of *Anthoceros* and *Polytrichum*
3. Morphology, anatomy and reproduction of *Psilotum* and *Rhynia*
4. Morphology, anatomy and reproduction of *Selaginella* and *Equisetum*
5. Morphology, anatomy and reproduction of *Pteris* and *Marsilea*
6. Morphology, anatomy and reproduction of *Cycas* and *Cycadioidea*
7. Morphology, anatomy and reproduction of *Pinus*
8. Morphology, anatomy and reproduction of *Gnetum*
9. Meristems, simple and complex tissues
10. Anatomy of monocot and dicot root
11. Anatomy of monocot and dicot stem
12. Anatomy of monocot and dicot leaf
13. Visit to Geology Museum/ Fernarium

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

**Practical Question Paper
II Semester - Practical II**

**BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS, PALEOBOTANY AND
ANATOMY OF ANGIOSPERMS**

Code: GBO202

Time: 3 Hrs

Max. Marks: 40

- | | |
|--|--------|
| I. Identify the specimens A, B and C with reasons | 3x3=09 |
| II. Prepare a temporary stained slide of the material D sketch, label and
Identify with reasons. Leave the preparation for evaluation. | -05 |
| III. Comment on the materials E, F and G | 3x3=09 |
| IV. Identify the slides/ Chart H, I, J and K with reasons | 3x4=12 |
| V. Record | -05 |

**Practical Question Paper Scheme
II Semester - Practical II**

**BRYOPHYTES, PTERIDOPHYTES, GYMNOSPERMS, PALAEOBOTANY AND
ANATOMY OF ANGIOSPERMS**

Code: GBO202

Time: 3 Hrs

Max. Marks: 40

- | | |
|---|---------------|
| I. Identify the specimens A, B and C with reasons
(A- Bryophytes; B- Pteridophytes and C-Gymnosperms)
(Identification -1; Reasons with labelled diagram- 2) | 3x3=9 |
| II. Prepare a temporary stained slide of the material D sketch, label and
Identify with reasons. Leave the preparation for evaluation.
(Mounting-2; Identification- 1; Reasons with labelled diagram-2) | 05 |
| III. Comment on the materials E, F and G
(E- Bryophytes; F-Pteridophytes and G-Gymnosperms/ Paleobotany)
(Identification- 1; Reasons with labelled diagram- 2) | 3x3=9 |
| IV. Identify the slides / Chart H, I, J and K with reasons
(H- Bryophytes; I- Pteridophytes; J-Gymnosperms and K-Anatomy of Angiosperms)
(Identification- 1; Reasons with labelled diagram- 2) | 3x4=12 |
| VI. Record | 05 |

Note: Each student shall bring the practical record to the practical examination without which he / she shall not be allowed to appear for the practical examination.

Botany
III Semester - Paper III
Theory Syllabus
PLANT ANATOMY, REPRODUCTIVE BIOLOGY, ECOLOGY AND
CONSERVATION BIOLOGY

Course code: GBO301

48 Hrs.

Credits: 3

(3 Hrs. of instruction per week)

Course outcome

1. Students are able to understand various types of tissues and their functions
2. They will understand the anatomical structures of root, stem and leaf of dicots and monocots
3. To study the development and structure of Male and Female Gametophyte, Embryo, Endosperms in Angiosperms
4. To acquire the knowledge of Experimental Embryology
5. To acquire the basic knowledge of Plant community and their adaptations
6. To study the environmental factors and their impact on Plant community
7. To acquire the knowledge of various Ecosystem and energy flow
8. Understanding the fundamental concepts in ecology, environmental science and phytogeography.
9. Concept development in conservation, global ecological crisis, Sustainable development and pros and cons of human intervention.
10. Enable the student to appreciate bio diversity and the importance of various conservation strategies, laws and regulatory authorities and global issues related to climate change and sustainable development.

UNIT I:

12 hours

Anatomy of Angiosperms:

Epidermal tissue system (Epidermis, trichomes, stomata and hydathodes) and Secretory tissue (Laticiferous tissues). Vascular bundles, types of vascular bundles. Anatomy of monocot and dicot root, stem and leaf.

Secondary growth in dicot stem and Anomalous secondary growth in *Dracaena* stem

Embryology of Angiosperms:

Introduction, scope of embryology. Structural organization of Flower, Flower as a reproductive structure

Microsporangium and Microsporogenesis: Development and structure of mature anther, Anther wall, Tapetum types, structure and functions. Development & Structure of male gametophyte, Pollen embryosac (Nemec phenomenon), Pollinia.

Palynology: Sculpturing, Apertures; A brief account of Geopalynology & Melittopalynology.

Megasporangium and Megasporogenesis: Structure of pistil, placentation, ovule and types;

Development of female gametophyte (*Polygonum* type), structure of mature embryosac and types of embryosac.

UNIT II: Embryology of Angiosperms (contd..) & Plant Ecology

12 hours

Pollination biology: Types, Contrivances and Significance of Self pollination & Cross pollination.

Fertilization: General account on double fertilization; Post fertilization changes. Endosperm and types of endosperm, Ruminant endosperm and Biological importance of endosperm.

Embryogenesis: Development of Dicot embryo (*Capsella bursa pastoris*) and Monocot (*Triticum*) embryo.

Experimental embryology: Introduction, types and significance of Apomixis, Polyembryony and Parthenocarpy.

Contributions from embryologists: P. Maheswari, B.G.L Swamy, K.R. Shivanna and B.M. Johri. A brief introduction to Plant developmental biology.

Plant Ecology:

Introduction to Ecology, Scope and importance

Ecosystem: Introduction, types, Biotic and Abiotic components, Structure of ecosystems - Terrestrial (Forest) and Aquatic (Pond).

Ecosystem functions and processes: Food chain, Food web; Ecological pyramids of energy and biomass. Energy flow in the ecosystem.

Unit III: Plant Ecology- contd...

12 hours

Ecological factors: Climatic factors: Light, Temperature, Wind, Precipitation and Atmospheric humidity. **Edaphic factors:** Soil and its types, soil texture, soil profile, soil formation, soil pH, soil aeration, organic matter, soil humus and soil microorganisms.

Topographic Factors: Altitude and Slope; **Biotic factors:** A brief account, Human as a biological factor.

Ecological groups of plants and their adaptations: Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes halophytes and parasites

Bio-geo chemical cycles: Carbon and Nitrogen Pollution; A brief account on air, water and soil pollution, causes and effects. **Ecological succession:** Definition, types- primary and secondary; General stages of succession. Hydrosere and Xerosere.

Unit IV: Biodiversity And Conservation

12 hours

Introduction and concept of biodiversity; **Values of biodiversity:** Ecological, Economic and Social value. **Types of biodiversity:** Species and generic diversity

Endemism: Endemism and types of endemism (Neoendemism and paleoendemism); Biodiversity hot spots and hotspots of India

Brief account of Agro biodiversity, Vavilov centers of cultivated crops

Threats to biodiversity: IUCN threat categories and RED data book. Principles of conservation

In-situ and Ex-situ conservation

Biodiversity legislations in India: Indian forest conservation act, Biodiversity bill 2002.

Earth summits, Role of organization in the conservation of biodiversity - IUCN, UNESCO, WWF and NBPGR

LEARNING RESOURCES

1. Bhojwani and Bhatnagar, Introduction to Embryology of Angiosperms –Oxford & IBH, Delhi
2. Bhojwani Sant Saran, 2014. Current Trends in the Embryology of Angiosperms, Woong-Young Soh, Springer Netherlands
3. Johri, B.M. l., 1984. Embryology of Angiosperms, Springer-Verlag, Netherlands.
4. Pandey S.N. 1997, Plant Anatomy and Embryology
5. A. Chadha, Vikas Publication House Pvt Ltd; Raghavan, V., 2000. Developmental Biology of Flowering plants, Springer, Netherlands.
6. Saxena M. R. – Palynology – A treatise - Oxford & I. B .H., New Delhi.
7. Shivanna, K.R., 2003. Pollen Biology and Biotechnology. Oxford and IBH Publishing Co. Pvt.Ltd. Delhi.
8. Sharma, P.D. 2018. Fundamentals of Ecology. Rastogi Publications.
9. Odum E.P. (1975): Ecology By Holt, Rinert& Winston.
10. Kochhar, P.L. (1975): Plant Ecology. (9th Edn.) New Delhi, Bombay, Calcutta.
11. Kumar, H.D. (1992): Modern Concepts of Ecology (7th Edn.,) Vikas Publishing Co., New Delhi.
- 12.Kumar H.D. (2000): Biodiversity & Sustainable Conservation. Oxford & IBH Publishing Co Ltd. New Delhi.
13. Newman, E.I. (2000): Applied Ecology, Blackwell Scientific Publisher, U.K.
14. Saha T. K., 2017. Ecology and Environmental Biology. Books and Allied Publishers.
15. Joshi P.C. and Namita Joshi (2004): Biodiversity and Conservation, APH Publishing Corporation 1
16. Krishnamurthy K.V. Text Book of Biodiversity, Science Publishers, United States

**Theory Question Paper Scheme
III Semester - Paper III**

**PLANT ANATOMY, REPRODUCTIVE BIOLOGY, ECOLOGY AND
CONSERVATION BIOLOGY**

Code: GBO301

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 2 from Unit I
- 2 from Unit II
- 1 from Unit III
- 2 from Unit IV

II. Answer any SIX of the following

5 X 6 = 30

- 3 from Unit I
- 1 from Unit II
- 3 from Unit III
- 1 from Unit IV

III. Answer any FOUR of the following

10 X 4 = 40

- 1 from Unit I
- 2 from Unit II
- 1 from Unit III
- 2 from Unit IV

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 2 = 4	5 X 3 = 15	10 X 1 = 10	29
II	2 X 2 = 4	5 X 1 = 05	10 X 2 = 20	29
III	2 X 1 = 2	5 X 3 = 15	10 X 1 = 10	27
IV	2 X 2 = 4	5 X 1 = 05	10 X 2 = 20	29

Assessment method

Assessment		Marks
C ₁	Test	10
C ₂	Test	10
C ₃	Semester end exam	80

**Theory Model Question Paper
III Semester - Paper III**

**PLANT ANATOMY, REPRODUCTIVE BIOLOGY, ECOLOGY AND
CONSERVATION BIOLOGY**

Code: GBO301

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any SIX of the following

5 X 6 = 30

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

III. Answer any FOUR of the following

10 X 4 = 40

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.

Practical Syllabus
III semester- Paper III
PLANT ANATOMY, REPRODUCTIVE BIOLOGY, ECOLOGY AND
CONSERVATION BIOLOGY

Code: GBO302

Credits: 2

64 Hrs.

(1 practical of 4 Hrs / week)

Practicals

1. Meristems, simple and complex tissues
2. Anatomy of monocot and dicot root
3. Anatomy of monocot and dicot stem
4. Anatomy of monocot and dicot leaf
5. Study of T.S. of anther. Mounting of pollen grains of Hibiscus, *Vinca rosea*, and Pollinia of *Calotropis* and Pollen germination by hanging drop method
6. Study of placentation (Marginal, Axile, Parietal and Basal) Endosperm (Nuclear, Cellular, Helobial and Ruminant) Structure of ovule and types of ovules (Orthotropous, Anatropous, Hemianatropous, Circinotropous and Campylotropous)
Mounting of endosperm (*Cucumis*)
7. Mounting of embryo (*Crotalaria*)
Study of ecological instruments – Anemometer, Hygrometer, Anemometer, Altimeter and Rain gauge
8. Determination of soil texture of different soil samples; Determination of Water holding capacity of Soil samples and pH of different types of Soils
9. Morphological characters of **Hydrophytes** – *Hydrilla*, *Eichhornia*, Anatomical characters of *Hydrilla* stem; **Epiphytes** – *Vanda*; **Parasites** – *Cuscuta* & *Viscum*;
10. Morphological characters of **Xerophytes** – *Euphorbia tirucalli*, *Casuarina*. Anatomical characters of *Casuarina* stem; **Halophytes** – *Pneumatophores*, *Vivipary*
11. Study of pond/forest ecosystem to record different biotic and abiotic components. Determination of Density and frequency of different types of vegetation samplings by quadrature methods
12. Marking of Biodiversity Bioreserves, Hot spots of India, National parks & Sanctuaries of India and Karnataka; Vavilo centres of cultivated crop plants
13. Application of remote sensing in vegetation analysis using satellite imageries
14. Field visit to study different types of vegetation and the report to be submitted.

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

Practical Question Paper
III Semester - Practical III
PLANT ANATOMY, REPRODUCTIVE BIOLOGY, ECOLOGY AND
CONSERVATION BIOLOGY

Code: GBO302

Time: 3 Hrs.
Max. Marks: 40

- | | |
|--|-----------------|
| I. Perform the experiment A & B | 10 Marks |
| II. Prepare a temporary stained slide, identify and comment on material C | 05 Marks |
| III. Mount the material D . Identify with reasons & leave the preparation for
evaluation | 05 Marks |
| IV. Comment on E & F | 08 Marks |
| V. Mapping of given area of G | 04 Marks |
| VI. Identify H | 03 Marks |
| VII Record | 05 Marks |

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

**Scheme of Practical Question Paper
III Semester - Practical III**

**PLANT ANATOMY, REPRODUCTIVE BIOLOGY, ECOLOGY AND
CONSERVATION BIOLOGY**

Code: GBO302

**Time: 3 Hrs.
Max. Marks: 40**

- I. Perform the experiment A & B** **5x2=10**
- A- Anatomy (Stem, root, leaf and tissues)
(Identification- 1; Preparation- 2; Reasons with labeled diagram- 2)
- B -Soil pH/Water holding capacity of soil/Soil texture
(Identification- 1; Preparation- 2; Reasons with labeled diagram- 2)
- II. Prepare a temporary stained slide, identify and comment on material C** **-5**
- (Hydrophyte/Xerophyte)
(Identification- 1; Preparation- 2; Reasons with labeled diagram- 2)
- III. Mount the material D. Identify with reasons & leave the preparation for evaluation** **-5**
- (Endosperm/Embryo/Pollen grain & pollinia/ Pollen germination by Hanging drop method)
(Identification- 1; Preparation- 2; Reasons with labeled diagram- 2)
- IV. Comment on E & F** **4x2=8**
- (E- Ecological adaptation, F- Ecological instruments)
(Identification- 1; Reasons with labeled diagram- 3)
- V. Mapping of given area of G** **-4**
- (Biodiversity hotspots/ National parks / Sanctuaries/Vavilov centres)
(Identification- 1; Graph- 1; Reasons with labeled diagram- 2)
- VI. Identify H** **-3**
- (Slide/Chart from Reproductive biology)
(Identification- 1; Reasons with labeled diagram- 2)
- VII. Record** **-5**

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

BOTANY
III Semester- Elective Paper
Theory Syllabus
HORTICULTURE AND FLORICULTURE

Course code: GBO313

24 Hrs.

Credits: 2

(2 Hrs. of instruction per week)

Course outcome

1. To understand the techniques of Plant Propagation, Horticulture, Floriculture, Olericulture and Pomology
2. To learn the Applications of Plant Propagation, Horticulture, Floriculture, Olericulture and Pomology

Unit I: HORTICULTURE

12 hours

Introduction, scope and importance, Soil and types of soil (black, red and sandy), Nursery- introduction, objectives

Brief description, their merits and demerits of the following

Infrastructure- Polyhouse, Green house, Mist chamber, Shade house, Glass house, net house, nursery beds- types (flat, raised and sunken),

Media- sand, peat soil, sphagnum moss, vermiculite, perlite, leaf mold, saw dust, grain husk and coco peat)

Propagation methods- sowing/raising of seeds and seedlings and transplanting of seedlings.

Gardening- Types (home, indoor, public, kitchen, herbal, terrace, hydroponics, water bodies, avenue, and navagraha park), Gardening operations (soil laying, manuring, watering)

Unit II: FLORICULTURE & POMOLOGY

12 hours

Floriculture & Pomology: introduction, cultivation practices and varieties of mango, banana, pomegranate, papaya; Cut flowers - rose, gerbera, orchids and chrysanthemum,

Olericulture: introduction, cultivation practices of Solanaceous vegetables (tomato, chilli, brinjal and potato).

Flower arrangement: floral greetings, bouquet, vegetable carvings and dry flowers and ikabana, flower arrangement in functions, Bonsai and terrarium

Suggested readings

1. Bose, T. K. and Mukherjee, D. 1972. Gardening in India, Oxford & IBH Publishing Co., New Delhi.
2. Kader, A. A. 2002. Post- Harvest Technology of Horticultural Crops. UCANR Publications, USA
3. Jules, J. 1979. Horticultural Science. W.H. Freeman and Co., San Francisco, USA
4. Kumar, N. 1997. Introduction to Horticulture. Rajalakshmi Publications, Nagercoil.
5. Randhawa, G. S. and Mukhopadhyay, A. 1986. Floriculture in India. Allied Publishers
6. Swaminathan, M. S. and Kochhar, S. L. 2007. Groves of Beauty and Plenty: An Atlas of Major Flowering Trees in India. Macmillan Publishers, India

Theory Question Paper Scheme
III Semester - Elective Paper
HORTICULTURE AND FLORICULTURE

Code: GBO313

Time: 2 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following **2 X 5 = 10**

3 from Unit I

4 from Unit II

II. Answer any TWO of the following **5 X 2 = 10**

2 from Unit I

1 from Unit II

III. Answer any TWO of the following **10 X 2 = 20**

1 from Unit I

2 from Unit II

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 1 = 10	36
II	2 X 4 = 8	5 X 1 = 05	10 X 2 = 20	33

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

**Theory Question Paper Scheme
III Semester - Elective Paper
HORTICULTURE AND FLORICULTURE**

Code: GBO313

Time: 2 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any TWO of the following

5 X 2 = 10

- 8.
- 9.
- 10.

III. Answer any TWO of the following

10 X 2 = 20

- 11.
- 12.
- 13.

BOTANY—III SEMESTER
Elective paper
Theory Syllabus
MUSHROOM CULTURE & BIOFERTILIZER

Course code: GBO314

24 Hrs.

Credits: 2

(2 Hrs. of instruction per week)

Course outcome

1. To enable the students to identify edible and poisonous mushrooms
2. To learn spawn production and mushroom cultivation
3. To motivate the students to take mushroom cultivation as a means for self employment and income generation
4. To learn types, methods and importance of biofertilizers

Unit I: MUSHROOM CULTURE TECHNOLOGY

12 hours

Introduction and scope of mushroom cultivation.

Edible and poisonous mushrooms: Common edible mushrooms- Button mushroom (*Agaricus bisporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajorcaju*) and paddy straw mushroom (*Volvariella volvcea*).

Spawn production- culture media preparation- production of pure culture mother spawn, and multiplication of spawn. Composting technology, mushroom bed preparation. Spawning, spawn running, harvesting. Cultivation of oyster and paddy straw mushroom. Problems in cultivation- diseases, pests and nematodes, weed moulds and their management strategies.

Preservation of mushrooms- freezing, dry freezing, drying, canning, quality assurance and entrepreneurship. Nutritional and medicinal values of mushrooms.

Post harvest technology: Value added products of mushrooms.

Unit II: BIOFERTILIZER

12 hours

Introduction, General account about the microbes used as biofertilizer.

Bacteria: *Rhizobium*- isolation, identification, mass multiplication, carrier based inoculants,

Actinorrhizal symbiosis. Azotobacter: classification, characteristics- crop response to Azotobacter inoculum, maintenance and mass multiplication.

Cyanobacteria- *Anabaena azollae* and *Azolla* association, nitrogen fixation, factors affecting growth, blue green algae and *Azolla* in rice cultivation.

Suggested readings

1. Bhal, N. 2000. Handbook on Mushrooms. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
2. Marimuthu, T. 1991. Oyster Mushroom. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore
3. Pandey, R. K. and Ghosh, S. K. 1996. A Hand Book on Mushroom Cultivation. Emkey Publications.
4. Pathak, V. N., Yadav, N. and Gaur, M. 2000. Mushroom Production and Processing Technology. Vedams Ebooks Pvt Ltd., New Delhi.
5. Tewari, Kapoor, P. S. C. 1988. Mushroom cultivation, Mittal Publications, Delhi.
6. Tripathi, D. P. 2005. Mushroom Cultivation, Oxford & IBH Publishing Co., New Delhi.
7. Vayas, S. C, Vayas, S. and Modi, H. A. 1998. Bio- fertilizers and organic Farming. Akta Prakashan, Nadiad.

Theory Question Paper Scheme
III Semester - Elective Paper
MUSHROOM CULTURE & BIOFERTILIZER

Course code: GBO314

Time: 3 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any TWO of the following

5 X 2 = 10

- 8.
- 9.
- 10.

III. Answer any TWO of the following

10 X 2=20

- 11.
- 12.
- 13.

Theory Question Paper Scheme
III Semester - Elective Paper
MUSHROOM CULTURE & BIOFERTILIZER

Course code: GBO314

Time: 3 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following **2 X 5 = 10**

3 from Unit I

4 from Unit II

II. Answer any TWO of the following **5 X 2 = 10**

2 from Unit I

1 from Unit II

III. Answer any TWO of the following **10 X 2 =20**

1 from Unit I

2 from Unit II

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 1 = 10	36
II	2 X 4 = 8	5 X 1 = 05	10 X 2 = 20	33

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

BOTANY
IV semester – Paper IV
Theory Syllabus
PLANT PHYSIOLOGY, CELL BIOLOGY & MOLECULAR BIOLOGY

Course code: GBO401

Credits: 3

48 Hrs.

(3 Hrs. of instruction per week)

Course outcome

1. To understand the underlying principles of various physiological processes and metabolism in plants
2. To study the roles of minerals in plant metabolism
3. To study plant growth and development
4. To study the ultra structure of cell organelles
5. To acquire the knowledge of underlying principles of different microscopes
6. To learn chromosomal aberrations and their significance
7. To acquire the knowledge on chemistry, structure, types of genetic material and protein synthesis
8. To learn the concepts of gene and mechanism of gene regulation
9. To acquire the knowledge on chemistry, structure, types of genetic material and protein synthesis
10. To learn the concepts of gene and mechanism of gene regulation

Course Content:

Unit I:

12 hours

PLANT PHYSIOLOGY: Plant and water relations- Imbibition, diffusion, osmosis and their significance; Cell as an osmotic system; Short distance transport-Active and passive absorption of water; Long distance transport- Ascent of sap; TCT theory. Absorption of mineral salts – carrier concept. **Transpiration** Definition, types, structure of stomata, mechanism of stomatal movement (K^+ ion), antitranspirants, significance of transpiration and Guttation; Phloem transport- Munch's hypothesis Mineral nutrition Essential elements, macro (NPK) and micro (Zn, Mo, B) nutrients, role of essential elements. **Phytohormones** Application of auxins, gibberellins, cytokinin, ABA, ethylene. Tropic movements Phototropism, thigmotropism, geotropism and hydrotropism. **Photoperiodism** (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization

Unit II:

12 hours

PLANT METABOLISM: Enzymes- Structure and properties, Mode of action. Photosynthesis Photosynthetic apparatus and pigments, Mechanism of light and dark reactions- C_3 , C_4 and CAM pathways and C_2 cycle (Photorespiration), factors affecting photosynthesis. Respiration Aerobic respiration- Glycolysis, Krebs's cycle, Terminal oxidation; Anaerobic respiration. Alcoholic and lactic acid fermentation. **Nitrogen metabolism-** Biological nitrogen fixation; Nitrate reduction, synthesis of amino acids. **Proteins** Classification, primary, secondary, tertiary and quaternary. **Vitamins** Types and their functions.

Unit III:**12 hours**

CELL BIOLOGY: Cell structure and function Prokaryotic and Eukaryotic cell; Cell organelles Cellwall, Cell membrane, Nucleus, Mitochondria, Chloroplast, Endoplasmic reticulum, Golgi apparatus, Lysosomes, Microbodies and Ribosomes Chromosome structure Nucleosome concept. Karyotype and ideogram and their significance; Special types- Salivary gland and Lamp brush chromosomes Chromosomal aberrations Structural-Deletions, Duplications, Inversion and Translocation; Numerical-Euploidy and Aneuploidy; Polyploidy, induction of polyploidy in plants and role of polyploidy in evolution.

Unit IV:**12 hours**

MOLECULAR BIOLOGY: Nucleic acids- Chemistry, structure, types and functions of DNA and RNA, DNA replication Mechanism of DNA replication (Semi-conservative method) Central Dogma Central Dogma of molecular biology Gene concept, Genetic code, Fine structure of Gene, Wobble hypothesis. **Protein synthesis-** prokaryotes & eukaryotes; **Cell Division-** Cell cycle, Mitosis, Meiosis and their significance.

LEARNING RESOURCES

1. Bajracharya, D. 1999. Experiments in Plant Physiology- A Laboratory Manual. Narosa Publishing House, New Delhi.
2. Becker, W. M., Kleinsmith, L.J., Hardin. J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco
3. Cooper G. M. and Hausman R. E., 2009. The Cell: A Molecular Approach. 5th edition. ASM Press and Sunderland, Washington, D.C., Sinauer Associates, MA.
4. Day, P. M. and Harborne, J. B. 2000. Plant Biochemistry. Harcourt Asia (P) Ltd., India and Academic Press, Singapore.
5. De Robertis, E. D. P. and De Robertis, E. M. F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
6. Hopkins W.G., Huner, N. P. 2009. Introduction to Plant Physiology. John Wiley and Sons, U.S.A.
7. Lawlor, D.W. 1989. Photosynthesis, metabolism, control and Physiology. ELBS/ Longmans- London.
8. Mayer, B.S. Anderson, D. B. and Bohning, R. H. and Fratianne, D. G. 1973. Introduction to Plant Physiology. 2nd edition Van Nostrand. Co.
9. Mukherjee, S. and Ghosh, A. K. 1998. Plant Physiology, Tata McGraw Hill Publishers Ltd., New Delhi.
10. Noggle, G. R. and Fritz, G. J. 1989. Introductory Plant Physiology. Prentice Hall of India.
11. Plummer, D. 1989. Biochemistry- The Chemistry of life. McGraw Hill Book Co
12. Salisbury, F.B and Ross, C. W. 1999. Plant Physiology. CBS Publishers and Printers, New Delhi.
13. Steward. F.C. 1964. Plants at Work (A summary of Plant Physiology) Addison- Wesley Publishing Co., London.
14. Taiz, L. and Zeiger, E. 2010. Plant Physiology. Sinauer Associates Inc., U.S.A.
15. Brown, T. A. 2010. Gene Cloning and DNA Analysis, 6th edition, Wiley and Blackwell publishers
16. Brown, T. A. 1990. Gene Cloning. Chapman and Hall.
17. Rashid, A. 2009. Molecular physiology and Biotechnology of Flowering plants. Narosa Publishing House Pvt. Ltd., New Delhi
18. Singh, S. K. 2007. Cytology, Genetics and Molecular Biology. Commonwealth Publishers
19. Sinha, U. and Sinha, S. 1998. Cytogenetics. Plant Breeding and Evolution, Vikas Publications.
20. Verma, P. S. and Agarwal, P. K. 1998. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Company Ltd.

Theory Model Question Paper

IV Semester - Paper IV

PLANT PHYSIOLOGY, CELL BIOLOGY & MOLECULAR BIOLOGY

Code: GBO401

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE the following

2 X 5 = 10

2 from Unit I

2 from Unit II

1 from Unit III

2 from Unit IV

II. Answer any SIX of the following

5 X 6 = 30

3 from Unit I

1 from Unit II

3 from Unit III

1 from Unit IV

III. Answer any FOUR of the following

10 X 4 = 40

1 from Unit I

2 from Unit II

1 from Unit III

2 from Unit IV

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 2 = 4	5 X 3 = 15	10 X 1 = 10	29
II	2 X 2 = 4	5 X 1 = 05	10 X 2 = 20	29
III	2 X 1 = 2	5 X 3 = 15	10 X 1 = 10	27
IV	2 X 2 = 4	5 X 1 = 05	10 X 2 = 20	29

Assessment method

Assessment		Marks
C ₁	Test	10
C ₂	Test	10
C ₃	Semester end exam	80

Theory Question Paper Scheme

IV Semester - Paper IV

PLANT PHYSIOLOGY, CELL BIOLOGY & MOLECULAR BIOLOGY

Code: GBO401

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any SIX of the following

5 X 6 = 30

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

III. Answer any FOUR of the following

10 X 4=40

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.

IV Semester- Practical-IV

Practical Syllabus

PLANT PHYSIOLOGY, CELL BIOLOGY & MOLECULAR BIOLOGY

Code: GBO402

Credits: 3

64 Hrs.

(1 practical of 4 Hrs/week)

Practicals

Major experiments

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Calculation of stomatal index and stomatal frequency of a mesophyte and a xerophyte.
3. Hill reaction; Effect of temperature, pH and concentration of enzyme on the activity of catalase

Experiment on the relation between transpiration and absorption

4. To study the effect of light intensity on O₂ evolution in photosynthesis
5. Comparison of the rate of respiration in any two plant parts
6. Separation of chlorophyll pigments by paper chromatography

Minor experiments

7. Suction due to transpiration, Respiration in roots, Cobalt chloride test
8. Demonstration: Bolting, Effect of auxins on rooting, Mohl's half leaf apparatus, Ganong's light screen, Arc Auxanometer, Kuhne's fermentation vessel, Heliotropic chamber, Clinostat.

9. **Instruments:** Spectrophotometer, Centrifuge, Colorimeter

Photographs: Mineral nutrition deficiency symptoms, Photoperiodism, Light spectrum, Growth hormones

10. Study of Photographs and charts from molecular biology and cell biology: DNA replication, Lac Operon, genetic disorder: sickle cell anemia
11. Study of fixatives and stains & Study of mitosis e.g., Onion root tip
12. Study of meiosis: Onion/ Chlorophytum flower buds.
13. Study of micrometry, karyotype and ideogram study

Photographs/charts – Cell organelles (Nucleus, Mitochondria, Chloroplast), Salivary gland chromosome, lamp brush chromosome, DNA replication, Lac operon, Thalassemia and sickle cell anemia

Practical Question Paper

IV Semester - Practical IV

PLANT PHYSIOLOGY, CELL BIOLOGY & MOLECULAR BIOLOGY

Code: GBO402

Time: 3 Hrs.

Max. Marks: 40

- | | |
|---|---------------|
| I. Perform the experiment A | -7 |
| II. Perform the experiment B and C | 4x2=8 |
| III. Comment on D, E and F | 3x4=12 |
| IV. Prepare a temporary squash of the material G | -8 |
| V. Record | -5 |

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

Scheme of Practical Question Paper

IV Semester - Practical IV

PLANT PHYSIOLOGY, CELL BIOLOGY & MOLECULAR BIOLOGY

Code: GBO402

Time: 3 Hrs.

Max. Marks: 40

- | | |
|---|--------|
| I. Perform the experiment A | -7 |
| (Physiology major experiment) | |
| (Identification- 1; Procedure- 4; Result/Inference- 2) | |
| II. Perform the experiment B and C | 4x2=8 |
| (Physiology minor experiment and Karyotype and Ideogram) | |
| (Identification- 1; Procedure- 2; Result/Inference- 1) | |
| III. Comment on D, E and F | 4x3=12 |
| (D-Demo experiment, Instrument/growth hormone /Mineral nutrition; E-Cell biology;
F-Molecular biology) | |
| (Identification- 1; Reasons- 3) | |
| IV. Prepare a temporary squash of the material G | -8 |
| (Mitosis/ Meiosis) | |
| (Identification- 1; Procedure- 4; anyone stage - 3) | |
| V. Record | -5 |

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

BOTANY
IV Semester
Elective paper
Theory Syllabus

MEDICINAL PLANTS AND HERBAL TECHNOLOGY

Course code: GBO411

24 Hrs.

Credits: 2

(2 Hrs. of instruction per week)

Course outcome

1. To understand basic aspects of Herbal technology
2. To learn about isolation and characterization of secondary metabolites

Unit I:

12 hours

HERBAL MEDICINES: History and Scope, Definition of medical terms; Role of medicinal plants in Siddha systems of medicine; Cultivation, harvesting, processing, storage, marketing and utilization of medicinal plants

Unit II:

12 hours

PHARMACOGNOSY: Systematic position medicinal uses of the following herbs in curing various ailments; Tulsi, Ginger, Fenugreek, Indian Goose Berry and Ashoka. Medicinal plant banks, micropropagation of important species (*Withania somnifera*, neem and tulsi). Herbal foods, future of pharmacognosy.

Suggested readings

1. Chopra, R. N., Nayar, S. L. and Chopra, I. C. 1956. Glossary of Indian medicinal plants, C.S.I.R, New Delhi.
2. Kanny, Lall, Dey and Bahadur, R. 1984. The indigenous drugs of India, International Book Distributors.
3. Arber, A. 1999. Herbal Plants and Drugs. Mangal Deep Publications.
4. Sivarajan, V. V. and Indra, B. 1994. Ayurvedic Drugs and their Plant Source. Oxford IBH publishing Co.
5. Miller, L. and Miller, B. 1998. Ayurved and Aromatherapy. Motilal Banarsidass Publications, Delhi.
6. Green, G. 2000. Principles of Ayurveda. Thomsons, London.
7. Kokate, C. K., Purohit, A. P. and Gokhale, S. B. 1999. Pharmacognosy. Nirali Prakashan.

Theory Model Question Paper
IV Semester
Elective Paper
MEDICINAL PLANTS AND HERBAL TECHNOLOGY

Code: GBO411

Time: 2 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any TWO of the following

5 X 2 = 10

- 8.
- 9.
- 10.

III. Answer any TWO of the following

10 X 2=20

- 11.
- 12.
- 13.

Theory Question Paper Scheme
IV Semester
Elective Paper
MEDICINAL PLANTS AND HERBAL TECHNOLOGY

Code: GBO411

Time: 2 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following **2 X 5 = 10**

3 from Unit I

4 from Unit II

II. Answer any TWO of the following **5 X 2 = 10**

2 from Unit I

1 from Unit II

III. Answer any TWO of the following **10 X 2 = 20**

1 from Unit I

2 from Unit II

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 1 = 10	36
II	2 X 4 = 8	5 X 1 = 05	10 X 2 = 20	33

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

BOTANY
IV Semester
Compulsory Elective Practical paper Syllabus
NURSERY GARDENING AND LANDSCAPING

Course code: GBO404
Credits: 2

64 Hrs.
(4 Hrs. of instruction per week)

Learning objectives

The program is aimed to teach students the basic knowledge required to develop entrepreneurship skills in the development of Nursery, Gardening and Landscaping. This course would train students to initiate a remunerative enterprise owing to a high demand of skilled professionals in this field.

Course outcome

1. To describe and differentiate between the types of gardens.
2. To execute several nursery and gardening operations.
3. Practice different methods for propagation of plants.
4. Assess growing conditions of different horticultural plants, their general requirements and understand their role in landscaping.

Practicals

- | | |
|---|----------|
| 1. Tools and Equipments in Gardening | 01 Week |
| Methods of preparation of nursery beds and sowing of seeds. Media for propagation of plants in Nursery Beds, Pots and Mist chamber | 01 Week |
| 2. Study and practice of different propagation methods viz., cutting, layering, division, grafting and budding. | 01 Week |
| 3. Introduction and practicing Bonsai training, pruning and wiring. | 01 Week |
| 4. Study of different types of gardens (indoor and outdoor) and key features of gardens (Paths & Avenues, Hedges & Edges, Lawn, Flowerbeds, Arches & Pergolas, Fencing, Water bodies, Rock garden). | 02 Weeks |
| 5. Study of Vertical Gardening and Roof top gardening | 01 Week |
| 6. Methods for selection and enlisting of suitable plants for different locations and in different types of gardens. | 01 Week |
| 7. Identification of key horticultural plants, Herbs including different types of grasses – foliage and flowering, Shrubs including hedge plants - foliage and flowering, Avenue trees – foliage and flowering, Climbers, Lianas, Epiphytes, Creepers, Trailers, Aquatic plants, Succulents, Weeds. | 02 Weeks |
| 8. Study of important gardens of India (any five). | 01 Week |

9. Methods of Landscape designing of Residential areas and Public Gardens, Aquatic Garden, Rock Garden, Industrial gardens. 01 Week
10. Concept and Application of Computer aided Designing (CAD) for landscape designing/ Preparation of landscape designs for school and college using CAD technology. 01 Week
11. Study of Interior designing with plants- Terrarium, miniature landscape. 01 Week
12. Preparation and application of herbal pesticides. 01 Week
13. Demonstration of different composting methods for Biofertilizers. 01 Week
14. Visit to a nursery/ Tissue culture Laboratory/ horticulture garden/ Aqua culture Laboratory 01 Week

Suggested readings

1. A handbook of Landscape: CPWD
2. Gopalaswamiengar, K. S., Parthasarathy, G., Mukundan, P. (1991). Complete Gardening in India. India: Gopalaswamy Parthasarathy, 'Srinivasa'.
3. Hartmann, H. T., Kester, D. E., Hartmann, H. T., Kester, D. E. (1975). Plant Propagation: Principles and Practices. India: Prentice-Hall.
4. Hodge, G., Hodge, G. (2014). Practical Botany for Gardeners: Over 3,000 Botanical Terms Explained and Explored. United Kingdom: University of Chicago Press
5. Littlepage, R., Littlepage, R. (2017). Fundamentals of Garden Design: An Introduction to Landscape Design. (n.p.): CreateSpace Independent Publishing Platform.
6. Roy, R. K., Roy, R. K. (2013). Fundamentals of Garden Designing: A Colour Encyclopedia. India: New India Publishing Agency.
7. The Royal Horticultural Society Gardening Manual. (2000). United Kingdom: Dorling Kindersley.

Practical Question Paper
IV Semester
Compulsory Elective Practical
NURSERY, GARDENING AND LANDSCAPING

Code: GBO412

Time: 3 Hrs.

Max. Marks: 40

- I. Perform the experiment A** -7
II. Perform the experiment B and C 4x2=8
III. Comment on D, E and F 4x3=12
IV. Prepare a temporary G -8
V Record -5

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

Scheme of Practical Question Paper
IV Semester
Compulsory Elective Practical
NURSERY, GARDENING AND LANDSCAPING

Code: GBO412

Time: 3 Hrs.

Max. Marks: 40

- I. Perform the experiment A** -7
(Media for propagation of plants/ Bonsai)
(Identification- 1; Preparation- 4; Reason- 2)
II. Perform the experiment B and C 4x2=8
(Propagation methods viz., cutting, layering, division, grafting and budding)
(Identification- 1; Reason- 3)
III. Comment on D, E and F 4x3=12
(Identification of key horticultural plants/ Biopesticide/ Biofertilizer/Tools)
(Identification- 1; Reason- 3)
IV. Prepare a temporary G -8
Terrarium/Vertical gardening (Identification- 1; Preparation- 3; Reason- 4)
V. Record -5

Note: Each student should bring the valued practical record & field visit report to the practical examination without which he or she shall not be allowed to appear for the examination.

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

BOTANY
V Semester
Theory Syllabus
TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY & ETHNOBOTANY
Course code: GBO501 **48 Hrs.**
Credits: 3 **(3 Hrs. of instruction per week)**

Course Code:

After completing this course, students will be able to:

- 1:** Explain plant morphology and key principles of taxonomy.
- 2:** Describe major dicot and monocot plant families.
- 3:** Analyze economically and medicinally important plants and their uses.
- 4:** Explain plant diseases, their development, and management strategies.

Course Content:

Unit I: **16 hours**

Contribution of Carolus Linnaeus, Plant Nomenclature-Binomial system, ICBN /ICN – principles, rules, typification, ranks, categories and taxonomic hierarchy; author citation, valid publication, rejection of names, principle of priority and its limitations. A brief account of classical and modern Taxonomy; Systems of classification; Broad outline of Bentham and Hooker's, Engler and Prantl's System of classifications with merits and demerits. A brief account of APG IV system of classification. Important Botanical Gardens of India and World; Botanical Survey of India, Field and Herbarium Techniques - important herbaria; Hortus Malabaricus.

Unit II: **16 hours**

Study of following plant families: Dicots: Magnoliaceae, Brassicaceae, Malvaceae, Rutaceae, Fabaceae (with sub families), Myrtaceae, Apiaceae, Asteraceae, Rubiaceae, Apocynaceae, Solanaceae and Euphorbiaceae. Monocots: Liliaceae, Arecaceae, Poaceae, Musaceae, and Orchidaceae

Unit III: **16 hours**

Economic Botany: Cereals & Millets: Rice, Wheat, Maize, Ragi, Sorghum. **Pulses:** Cow pea, Red gram, Green gram, Black gram, Pea, Chick Pea. **Fibre plants:** Cotton, Jute, Coir, **Spices:** Cardamom, Clove, Cinnamon, Pepper, **Beverages:** Coffee and Tea, **Perfumes:** Jasmine, Patchouli, Sandal, **Dyes:** Indigo, Bixa, Lawsonia, **Narcotic Plants:** 1. Opium, 2. Cannabis, 3. Tobacco **Insecticides:** Neem, Pyrethrin, Nicotine, **Oil yielding plants:** Ground nut, Coconut, Safflower, Sunflower, **Timber:** Rose wood, Teak, Honne. A Brief account of Medicinal plants and their uses.

Contribution of Ethnobotanist; Janaki Ammal and S K Jain: Introduction and significance of Ethnobotany :- 1. *Phyllanthus emblica* 2. *Hemidesmus indicus* 3. *Strychnos nux-vomica* 4. *Withania Somnifera* 5. *Terminalia chebula*. 6. *T. bellirica*, 7. *T. arjuna*, 8. *Rauwolfia serpentine* 9. *Acontium heterophyllum*, 10. *Cinchona officinalis*, 11. *Atropa belladonna*, 12. *Digitalis purpurea* 13. *Tylophoro asthamatica* and 14. *Vetiveria zizanioides*

LEARNING RESOURCES

1. Coiton, C.M. 1996. Ethnobotany- Principles and Applications. Wiley and Sons.
2. Datta SC, Systemic Botany, 4th Ed, WileyEastern Ltd., New Delhi, 1988.
3. Eames A.J. Morphology of Angiosperms, McGraw Hill, NewYork.
4. Hall, B.G. (2011). Phylogenetic Trees Made Easy: A How-to Manual. Sinauer Associates, Inc. USA
5. Heywood, P. Plant Taxonomy, Edward Arnold, London.
6. Jeffrey C.J. and A. Churchil. An introduction to taxonomy. London.
7. Jeffrey, C. (1982). An Introduction to Plant Taxonomy., Cambridge University Press, Cambridge.
8. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. Donogue, M.J.,2002. Plant Systematics: A phylogenetic Approach, 2nd edition. Sinauer Associates, Inc., USA.
9. Lawrence- Taxonomy of Vascular Plants, Oxford & IBH. NewDelhi.
10. Manilal, K.S. and M.K. Muktesh Kumar. 1998. A Handbook of Taxonomy Training. DST, New Delhi.
11. Manilal. K.S. and A.K. Pandey. 1996. Taxanomy and Plant Conservation. C.B.S. Publishers & Distributors. New Delhi.
12. Singh V. & Jain- Taxonomy of Angiosperm. Rastogi Publications, Meerut.
13. Sivarajan V.V Introduction of Principles of Taxonomy., Oxford & IBH NewDelhi.
14. Any local/ state/ regional flora published by BSI or any other agency.

Theory Question Paper Scheme

V Semester - Paper V

TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY & ETHNOBOTANY

Code: GBO501

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE the following

2 X 5 = 10

3 from Unit I

2 from Unit II

2 from Unit III

II. Answer any SIX of the following

5 X 6 = 30

2 from Unit I

3 from Unit II

3 from Unit III

III. Answer any FOUR of the following

10 X 4 =40

2 from Unit I

2 from Unit II

2 from Unit III

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 2 = 20	36
II	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39
III	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39

Assessment method

Assessment		Marks
C ₁	Test	10
C ₂	Test	10
C ₃	Semester end exam	80

Theory Model Question Paper

V Semester - Paper V

TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY & ETHNOBOTANY

Code: GBO501

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any SIX of the following

5 X 6 = 30

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

III. Answer any FOUR of the following

10 X 4=40

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.

BOTANY

V Semester- Practical-V

Practical Syllabus

TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY & ETHNOBOTANY

Code: GBO502

64 Hrs.

Credits: 2

(1 practical of 4 Hrs / week)

Practicals

1. Study of the plants belonging to the families: Brassicaceae and Malvaceae
2. Rutaceae and Fabaceae (with sub families)
3. Myrtaceae and Apiaceae
4. Asteraceae and Rubiaceae
5. Apocynaceae, Solanaceae, and Euphorbiaceae
6. Monocot families ; Liliaceae and Arecaceae
7. Poaceae, Musaceae and Orchidaceae
8. Economic Botany as per the syllabus
9. Ethno botany as per the syllabus
10. As a part of curriculum, compulsory field trip to study the local flora of area

Note: Compulsory Botanical Tour of about 2 to 3 days to be conducted to study the different types of vegetation to collect herbarium specimens. Botanical Tour report and 5 herbarium sheets has to be submitted during the practical examination.

Practical Question Paper

V Semester - Practical V

TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY & ETHNOBOTANY

Code: GBO502

Time: 3 Hrs.

Max. Marks: 40

- | | | |
|-------------|---|---------------|
| I. | Assign the plants A, B and C to their respective families giving reasons | 4X3=12 |
| II. | Describe the plant D in technical terms. | -6 |
| III. | Draw a floral diagram with floral formula of E | -5 |
| IV. | Comment on F and G | 3X2=6 |
| V. | Comment on H and I | 3X2=6 |
| VI. | Record | -5 |

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

Scheme of Practical Question Paper

V Semester - Practical V

TAXONOMY OF ANGIOSPERMS, ECONOMIC BOTANY & ETHNOBOTANY

Code: GBO502

Time: 3 Hrs.

Max. Marks: 40

- | | | |
|-------------|---|---------------|
| I. | Assign the plants A, B and C to their respective families giving reasons | 4X3=12 |
| | (A- Polypetalae, B- Gamopetalae and C- Monochlamydeae / Monocot) | |
| | (Identification-1, Reasons-3) | |
| II. | Describe the plant D in technical terms. | -6 |
| | (Identification to family-1, Species-1, Terminologies-4) | |
| III. | Draw a floral diagram with floral formula of E | -5 |
| | (Floral diagram -3, Floral formula -2) | |
| IV. | Comment on F and G (Economic Botany) | 3X2=6 |
| | (Identification-1, Part used-1, Uses-1) | |
| V. | Comment on H and I (Ethno botany) | 3X2=6 |
| | (Identification-1, Part used-1, Uses-1) | |
| VI. | Record | -5 |

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

BOTANY
V Semester
Theory Syllabus
PLANT BREEDING AND PHYTOGEOGRAPHY

Course code: GBO503

48 Hrs.

Credits: 3

(3 Hrs. of instruction per week)

Course Code:

After completing this course, students will be able to:

- 1:** Explain plant breeding objectives, methods, and acclimatization.
- 2:** Describe hybridization, heterosis, mutations, polyploidy, and biotechnology in crop improvement.
- 3:** Analyze crop improvement achievements and plant breeding institutes in India
- 4:** Explain phytogeography, plant distribution, and vegetation types of India and Karnataka.

Course Content:

Unit I:

16 hours

Plant Breeding: A brief history, aims and objectives of Plant breeding. Types of plant breeding, incompatibility and male sterility. Important achievements and undesirable consequences of plant breeding. Centers of origin and domestication of crop plants, plant genetic resources; Acclimatization, Selection methods- for self-pollination, cross pollination and vegetatively propagated plants.

Unit II:

16 hours

Hybridization: Self, cross and vegetative propagation in plants – Procedure, advantages and limitations. Inbreeding depression and Heterosis, genetic basis of inbreeding depression and heterosis; hybrid seed production. Crop improvement and breeding, role of mutations and polyploidy in plant breeding. Role of biotechnology in crop improvement. Plant breeding work done in India - paddy and cotton. Plant breeding institutes in India.

Unit III:

16 hours

Phytogeography: biogeography of India with special reference to Karnataka. Polar oscillations and glaciations. Centre of origin of plant - Vavilov's concept, types. Phytogeographical regions concept, phytogeographical regions of India and Karnataka, Climatic zones, tectonics, continental movements. Types of plant distribution - discontinuous distribution. Vegetation types of Karnataka, Western Ghats Composition and distribution of evergreen, semi-evergreen, deciduous, scrub, mangroves, shola forests and grasslands.

LEARNING RESOURCES

1. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. New Jersey, U.S. Blackwell Publishing
2. Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.
3. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford —IBH.
4. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & Sons
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th edition. New York, NY: W.H. Freeman and Co.
6. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings.
7. Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
8. Welsh, J.R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
9. Poehlman, J.M. (1957). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., Westport, Connecticut
10. Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons.
11. DeRobertis, E.D.P. and DeRobertis, R.E. 2009. Cell and Molecular Biology, 8th edition. Lippincott, Williams and Wilkins, Philadelphia.
12. Becker W.M., Kleinsmith L.J. and Bertoni G.P. 2009. The World of the Cell. 7th edition. Pearson, Benjamin Cummings Publishing, San Francisco.
13. Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company
14. Alberts, B., Bray, D., Hopkin, K., Johnson, A.D., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2013). Essential cell biology (4th ed.). Garland Publishing.
15. Verma, P.S. (2004). Cell Biology, Genetics, Molecular Biology: Evolution and Ecology. India: S. Chand Limited.
16. Stewart C N Jr. (2008) Plant Biotechnology and Genetics Principles techniques and applications John Wiley and Sons inc. U.S.A.

Theory Question Paper Scheme

V Semester - Paper VI

PLANT BREEDING AND PHYTOGEOGRAPHY

Code: GBO503

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE the following

2 X 5 = 10

3 from Unit I

2 from Unit II

2 from Unit III

II. Answer any SIX of the following

5 X 6 = 30

2 from Unit I

3 from Unit II

3 from Unit III

III. Answer any FOUR of the following

10X4 = 40

2 from Unit I

2 from Unit II

2 from Unit III

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 2 = 20	36
II	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39
III	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39

Assessment method

Assessment		Marks
C ₁	Test	10
C ₂	Test	10
C ₃	Semester end exam	80

Theory Model Question Paper

V Semester - Paper VI

PLANT BREEDING AND PHYTOGEOGRAPHY

Code: GBO503

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any SIX of the following

5 X 6 = 30

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

III. Answer any FOUR of the following

10X4 = 40

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.

BOTANY
V Semester
Theory Skill- Syllabus
FLORICULTURE

Course code: GBO512
Credits: 2

24 Hrs.
(2 Hrs. of instruction per week)

Course Code:

After completing this course, students will be able to:

- 1:** Explain the scope and importance of floriculture and landscaping.
- 2:** Describe nursery management and plant propagation techniques
- 3:** Apply garden design principles, bonsai, and landscaping practices
- 4:** Analyze commercial floriculture, flower cultivation, and postharvest management

Course Content:

Unit I:

16 hours

Introduction: History of gardening; Importance and scope of floriculture and landscape gardening; Nursery Management and Routine Garden Operations: Sexual and vegetative methods of propagation; Soil sterilization; Seed sowing; Pricking; Planting and transplanting; Shading; Stopping or pinching; Defoliation; Wintering; Mulching; Topiary; Role of plant growth regulators; Ornamental Plants: Flowering annuals; Herbaceous perennials; Divine vines; Shade and ornamental trees; Ornamental bulbous and foliage plants; Cacti and succulents; Palms and Cycads; Ferns and Selaginellas.

Unit II:

16 hours

Cultivation of Flowering Plants: Cultivation of plants in pots; Indoor gardening; Bonsai; Principles of Garden Designs in brief. Features of a garden (Garden wall, Fencing, Steps, Hedge, Lawn, Flower beds, Shrubbery, Borders, Water garden. Some Famous gardens of India; Landscaping places of public importance: Landscaping highways and Educational institutions; Commercial Floriculture: Factors affecting flower production; Production and packaging of cut flowers; Flower arrangements; Methods to prolong vase life; Cultivation of important cut flowers (Carnation, Aster, Chrysanthemum, Dahlia, Gerbera, Gladiolus, Marigold, Rose, Lilium, Orchids); Diseases and Pests of ornamental plants.

LEARNING RESOURCES

1. Randhawa, G.S. and Mukhopadhyay, A. (1986).Floriculture in India. Allied Publishers.
2. Adams, C., M. Early and J. Brrok (2011). Principles of Horticulture. Routledge, U.K.

Theory Question Paper Scheme
V Semester – Theory Skill Paper
FLORICULTURE

Code: GBO403

Time: 2 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following **2 X 5 = 10**

3 from Unit I

4 from Unit II

II. Answer any TWO of the following **5 X 2 = 10**

2 from Unit I

1 from Unit II

III. Answer any TWO of the following **10 X 2 = 20**

1 from Unit I

2 from Unit II

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 1 = 10	36
II	2 X 4 = 8	5 X 1 = 05	10 X 2 = 20	33

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

**Theory Question Paper Scheme
V Semester – Theory Skill Paper
FLORICULTURE**

Code: GBO512

Time: 2 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any TWO of the following

5 X 2 = 10

- 8.
- 9.
- 10.

III. Answer any TWO of the following

10 X 2=20

- 11.
- 12.
- 13.

BOTANY
VI Semester
Theory Syllabus
GENETICS, GENETIC ENGINEERING, PLANT BIOTECHNOLOGY & EVOLUTION

Course code: GBO601

Credits: 3

48 Hrs.

(3 Hrs. of instruction per week)

Course Code:

After completing this course, students will be able to:

- 1:** Explain Mendelian genetics and inheritance patterns
- 2:** Describe principles and applications of genetic engineering.
- 3:** Apply plant biotechnology techniques for crop improvement.
- 4:** Explain evolutionary concepts, evidences, and speciation.

Course Content:

Unit I:

16 hours

Mendelian genetics: monohybrid cross, Dihybrid cross, test and back cross, incomplete dominance in *Mirabilis jalapa*. **Co-dominance** in *Rhododendron*, Multiple alleles in **ABO Blood**, Epistasis in fruit colour in summer squashes. **Interaction of genes-** Complementary gene action -flower color in sweet pea; Supplementary interaction - Anthocyanin pigmentation in Snapdragon. **Epistasis** - fruit color in summer squash; Multiple factor inheritance - ear size in Maize; Cytoplasmic inheritance in Maize. **Linkage and crossing over** - linkage in maize, and crossing over - Cytological evidence for Crossing over. Sex linked inheritance (*Drosophila*). Genetic model plant- *Arabidopsis thaliana*.

Unit II:

16 hours

Genetic engineering: Introduction - Scope and importance of Genetic engineering, principles and applications of Genetic engineering in agricultural, medical, industrial and environmental sectors. Enzymes in genetic engineering (DNA polymerases, restriction enzymes, ligases, kinases, endonucleases, phosphatase, reverse transcriptase). Vectors - Plasmids (pBR322), Cosmids, Shuttle Vector, YAC & BAC. Gene transfer techniques (microinjection, biolistic method, electroporation, CaCl₂ mediated gene transfer).

Plant Biotechnology: History and introduction to plant tissue culture, techniques and its applications. Plant tissue culture media (MS media composition and preparation), organogenesis, micropropagation and application; Isolation and fusion of protoplast and somatic hybridization, cybrids, Synthetic seeds. Production of haploids and virus free plants. Secondary metabolites production. Applications of plant biotechnology.

Unit III:

16 hours

Evolution: A brief account of origin of life, Miller-Urey experiment. Theories - Lamarckism, Darwinism & Neo Darwinism. Evidences for evolution (palaeontology, comparative anatomy, divergent and convergent evolution and industrial melanism); Hardy-Weinberg principle and affecting factors (gene migration, genetic drift, mutation, recombination and natural selection); Species concepts and modes of speciation (allopatric, sympatric, parapatric)

LEARNING RESOURCES

1. Acquaah, G. (2007). Principles of Plant Genetics & Breeding. New Jersey, U.S. Blackwell Publishing
2. Singh, B.D. (2005). Plant Breeding: Principles and Methods, 7th edition. New Delhi, Delhi: Kalyani Publishers.
3. Chaudhari, H.K. (1984). Elementary Principles of Plant Breeding, 2nd edition. New Delhi, Delhi: Oxford —IBH.
4. Gardner, E.J., Simmons, M.J., Snustad, D.P. (1991). Principles of Genetics, 8th edition. New Delhi, Delhi: John Wiley & Sons
5. Griffiths, A.J.F., Wessler, S.R., Carroll, S.B., Doebley, J. (2010). Introduction to Genetic Analysis, 10th edition. New York, NY: W.H. Freeman and Co.
6. Klug, W.S., Cummings, M.R., Spencer, C.A. (2012). Concepts of Genetics, 10th edition. San Francisco, California: Benjamin Cummings.
7. Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Co.
8. Welsh, J.R. (1981). Fundamentals of Plant Genetics and Breeding. John Wiley and Sons, New York.
9. Poehlman, J.M. (1957). Breeding Field Crops, 3rd Ed. AVI Publishing Co. Inc., Westport, Connecticut
10. Karp, G. (2010). Cell Biology, 6th edition. New Jersey, U.S.A.: John Wiley & Sons.
11. DeRobertis, E.D.P. and DeRobertis, R.E. 2009. Cell and Molecular Biology, 8th edition. Lippincott, Williams and Wilkins, Philadelphia.
12. Becker W.M., Kleinsmith L.J. and Bertoni G.P. 2009. The World of the Cell. 7th edition. Pearson, Benjamin Cummings Publishing, San Francisco.
13. Raven, F.H., Evert, R.F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company
14. Alberts, B., Bray, D., Hopkin, K., Johnson, A.D., Lewis, J., Raff, M., Roberts, K., & Walter, P. (2013). Essential cell biology (4th ed.). Garland Publishing.
15. Verma, P.S. (2004). Cell Biology, Genetics, Molecular Biology: Evolution and Ecology. India: S. Chand Limited.
16. Stewart C N Jr. (2008) Plant Biotechnology and Genetics Principles techniques and applications John Wiley and Sons inc. U.S.A.

Theory Question Paper Scheme
VI Semester - Paper VII
GENETICS, GENETIC ENGINEERING, PLANT BIOTECHNOLOGY &
EVOLUTION

Code: GBO601

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE the following

2 X 5 = 10

3 from Unit I

2 from Unit II

2 from Unit III

II. Answer any SIX of the following

5 X 6 = 30

2 from Unit I

3 from Unit II

3 from Unit III

III. Answer any FOUR of the following

10X4 = 40

2 from Unit I

2 from Unit II

2 from Unit III

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 2 = 20	36
II	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39
III	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39

Assessment method

Assessment		Marks
C ₁	Test	10
C ₂	Test	10
C ₃	Semester end exam	80

Theory Model Question Paper
VI Semester - Paper VII
GENETICS, GENETIC ENGINEERING, PLANT BIOTECHNOLOGY &
EVOLUTION

Code: GBO601

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any SIX of the following

5 X 6 = 30

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

III. Answer any FOUR of the following

10X4 = 40

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.

VI Semester- Practical-VI
Practical Syllabus
GENETICS, GENETIC ENGINEERING, PLANT BIOTECHNOLOGY &
EVOLUTION

Code: GBO502

Credits: 2

64 Hrs.

(1 practical of 4 Hrs / week)

Practicals

1. Solving the Genetic Problems: Monohybrid Cross

- i. In tomatoes Red fruit colour (R) is dominant over yellow (r). A pure Red fruited plant crossed to a yellow fruited one. What will be the appearance of F₁? The F₁ were interbred and produce 320 offspring's in the F₂. How many of them will be red and how many yellow? What will be the genotypes of F₂ and in what numbers?
- ii. In pea plant, Tallness (T) is dominant over dwarfness (t). A tall pea crossed with dwarf produces offspring's of which 50% are tall and 50% are dwarf. What are the genotypes of the parents?

2. Problems on Dihybrid Cross

- i. In garden pea, Yellow seed colour (Y) is dominant over green (y) and Round seed shape (R) is dominant over wrinkled (r). The characters segregate independently. A pure yellow wrinkled variety is crossed to pure green round. Give the phenotypes and genotypes of F₁ and phenotypic ratio of F₂ generation.
- ii. In garden pea, Tall (T) is dominant over dwarf (t) and Red flower colour (R) is dominant over white (r). A Tall Red when crossed with dwarf red produces a dwarf white. Give the genotypes of the parents.

3. Problems on interaction of factors

- i. A tall red when crossed with dwarf red produces a dwarf white. Give the genotypes of the parents. Two white flowered strains of the sweet pea (*Lathyrus odoratus*) were crossed, producing an F₁ with only purple flowers. Random crossing among the F₁ produced 96 progeny plants, 53 exhibiting purple flowers and 43 with white flowers.
 - a. What phenotypic ratio is approximated by the F₂?
 - b. What type of interaction involved?
 - c. What were the probable genotype of the parental strains?

4. Construction of linkage maps - two point and three point test cross

- i. In tomato, red fruit (R) is dominant over yellow fruit (r) and yellow flowers (Y) are dominant over white flower (y). A cross is made between true breeding plants with red fruit and yellow flowers and plants with yellow fruit and white flowers. The F₁ generation plants are then test crossed to plants with yellow fruits and white flowers. The following results are obtained.
 - 333 red fruits / yellow flowers.
 - 64 red fruits / white flowers.
 - 58 yellow fruits / yellow flowers.
 - 350 yellow fruits / white flowers.

Calculate the map distance between the two genes.

- ii. Two different traits affecting pod characteristics in garden pea plants are governed by genes found on chromosomes 5. Narrow pod is recessive to normal pod. Yellow pod is recessive to green pod. A true breeding plant with narrow, green pods was crossed to a true breeding plant with normal yellow pods. The F1 were then test crossed to plants with narrow, yellow pods. The following results were obtained.
- 144 narrow green pods.
 - 150 normal yellow pods.
 - 11 narrow yellow pods.
 - 9 normal green pods.
- How far apart are these two genes?

5. Synthetic seed preparation

6. Isolation of DNA

7. Preparation of MS Media

8. Preparation and inoculation of explant

9. Protoplast isolation

10. Construction of Phylogenetic tree

11. Study of Photographs in Genetic Engineering

12. Study of Photographs of plant tissue culture – callus, multiple shoots, tissue culture equipments

13. Photographs of Evolution and origin of life

14. Industrial visit.

Practical Question Paper
VI Semester - Practical VI
GENETICS, GENETIC ENGINEERING, PLANT BIOTECHNOLOGY &
EVOLUTION

Code: GBO602

Time: 3 Hrs.

Max. Marks: 40

I. Preparation of synthetic seed A	-4
II. Solve the genetic problems B and C	5x2=10
III. Preparation and inoculation of explants D	-8
IV. Isolation of plant DNA- E	-6
V. Comment on F, G, H and I	3x4=12

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

Scheme of Practical Question Paper
VI Semester - Practical VI
GENETICS, GENETIC ENGINEERING, PLANT BIOTECHNOLOGY &
EVOLUTION

Code: GBO602

Time: 3 Hrs.

Max. Marks: 40

I. Preparation of synthetic seed A (Preparation- 2; Procedure- 2)	-4
II. Solve the genetic problems B and C B- Monohybrid/ Dihybrid cross; C- Interaction/two or three point test cross	5x2=10
III. Preparation and inoculation of explants D (Preparation- 2; Inoculation- 2; Procedure- 4)	-8
IV. Isolation of plant DNA- E (Preparation- 2; Procedure- 4)	-6
V. Comment on F, G, H and I F & G-Genetic Engineering; H-plant tissue culture; I-Evolution	3x4=12

Note: Each student should bring the valued practical record to the practical examination without which he or she shall not be allowed to appear for the examination.

BOTANY
VI Semester
Theory Syllabus

PHYTOCHEMISTRY AND HERBAL TECHNOLOGY

Course code: GBO603

48 Hrs.

Credits: 3

(3 Hrs. of instruction per week)

Course Code:

After completing this course, students will be able to:

- 1:** Explain phytochemistry and standardization of medicinal plants.
- 2:** Describe extraction and isolation of phytochemicals.
- 3:** Apply chromatographic and spectroscopic techniques for phytochemical analysis
- 4:** Analyze phytochemicals for qualitative and quantitative evaluation.

Unit I:

16 hours

Phytochemistry: Scope of phytochemistry, plants as source of chemical compounds, primary and secondary metabolites and its applications; Definition, source of herbal raw materials, identification, authentication, standardization of medicinal plants as per WHO guidelines and different herbal pharmacopoeias, natural pigments, natural products as markers for new drug discovery.

Unit II:

16 hours

Extraction, isolation and purification of phytochemicals: Selection of plant samples, processing and storage of samples for extraction; Factors influencing the choice of extraction, principles of extraction methods, infusion, decoction, digestion, maceration, percolation, solvent extraction, ultrasound, microwave assisted extraction, advantage and disadvantage involved in each method; Isolation of selected primary and secondary metabolites – carbohydrate and proteins; Phenolics, flavonoids, alkaloids, lipids, oils, terpenes and saponins.

Unit III:

16 hours

Characterisation of Phytochemicals: Preliminary, qualitative and quantitative techniques – paper chromatography, thin layer chromatography, column chromatography- HPLC, GC (qualitative and quantitative), colour reactions for amino acids, sugars, phenolics, flavonoids, alkaloids, terpenes, saponins, oils, lipids; Spectroscopic estimations/gravimetric determination of total sugars, proteins, lipids, oils, phenolics, flavonoids, terpenes, saponins, alkaloids and amino acids.

LEARNING RESOURCES

1. Braithwaite, A. and Smith, F.J. 1996. Chromatographic Methods. 5th edn., Blackie Academic & Professional, London.
2. Bourne, U.K. Kokate, Purohit, C.K. and Gokhale S.B. 1983. Pharmacognosy. Nivali Prakashan Publication.
3. Braithwaite, A. and Smith, F. J. 1996. Chromatographic Methods. 5th edn. Blackie Academic & Professional, London.
4. Sadasivam. S. and A. Manickam, 0000. Bio Chemical methods 2nd edn. New Age International Pvt Ltd. New Delhi.
5. Harborne, J.B. 1984. Phytochemical Methods, 2nd edn. Chapman and Hall, London.
6. Harborne J.B., 1973. Phytochemical methods a guide to modern techniques of plants analysis. Chapman and Hall Ltd. London.

Theory Question Paper
VI Semester - Paper VIII
PHYTOCHEMISTRY AND HERBAL TECHNOLOGY

Code: GBO603

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE the following

2 X 5 = 10

3 from Unit I

2 from Unit II

2 from Unit III

II. Answer any SIX of the following

5 X 6 = 30

2 from Unit I

3 from Unit II

3 from Unit III

III. Answer any FOUR of the following

10X 4 = 40

2 from Unit I

2 from Unit II

2 from Unit III

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 2 = 20	36
II	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39
III	2 X 2 = 4	5 X 3 = 15	10 X 2 = 20	39

Assessment method

Assessment		Marks
C ₁	Test	10
C ₂	Test	10
C ₃	Semester end exam	80

Theory Question Paper Scheme

VI Semester - Paper VIII

PHYTOCHEMISTRY AND HERBAL TECHNOLOGY

Code: GBO603

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any SIX of the following

5 X 6 = 30

- 8.
- 9.
- 10.
- 11.
- 12.
- 13.
- 14.
- 15.

III. Answer any FOUR of the following

10X4 = 40

- 16.
- 17.
- 18.
- 19.
- 20.
- 21.

**VI Semester
Elective Paper
Theory Syllabus
BOTANICAL PRODUCTS**

Course code: GBO612
Credits: 2

24 Hrs.
(2 Hrs. of instruction per week)

Course Code:

After completing this course, students will be able to:

- 1:** Explain types and uses of botanical products
- 2:** Describe key bioactive constituents of plants.
- 3:** Apply botanicals in foods, beverages, and cosmetics
- 4:** Analyze botanicals' role in nutrition and functional foods

Course Content:

Unit I:

16 hours

Botanical products: Definition, Types and Components, Botanical Dietary Supplements: Products intended to enhance the diet, often containing herbal extracts. Botanical Drugs: Complex mixtures derived from plant materials, meant for diagnosing, curing, or treating diseases. Cosmeceuticals: Plant extracts (leaves, roots, fruits, flowers) used in skincare, hair care, and cosmetics to provide antioxidant and protective effects. Main Constituents: - polyphenols, alkaloids, polysaccharides, essential oils, and fatty acids.

Unit II:

16 hours

Botanical Applications: Bakery Products, Baking & Cereals Sweet Biscuits, Cookies & Snacks: Confectionery- Confectionery Resources, Plant-Based, Dairy Products -Dairy & Plant-Based Pantry Solutions, Beverages -Alcoholic Beverages and Non-Alcoholic Beverages; Specialized Nutrition-Probiotics, Plants Supporting Enhanced Amino Acid Absorption with Probiotics and Plant-Based Proteins.

LEARNING RESOURCES

1. Kochhar, S. L. 2016. Economic botany: A comprehensive study. New Delhi : Cambridge University Press,
2. Wickens, G.E., 2012. Economic botany: principles and practices. Springer Science & Business Media.
3. Albert Frederick Hill. 1952. Economic Botany: A Textbook of Useful Plants and Plant Products, McGraw-Hill
4. Kapoor, L.D., 2017. *Handbook of Ayurvedic medicinal plants: Herbal reference library.* Routledge.

Theory Question Paper Scheme

VI Semester Elective Paper BOTANICAL PRODUCTS

Code: GBO612

Time: 2 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following **2 X 5 = 10**

3 from Unit I

4 from Unit II

II. Answer any TWO of the following **5 X 2 = 10**

2 from Unit I

1 from Unit II

III. Answer any TWO of the following **10X2 = 20**

1 from Unit I

2 from Unit II

Unit	2 Mark	5 Marks	10 Marks	Total
I	2 X 3 = 6	5 X 2 = 10	10 X 1 = 10	36
II	2 X 4 = 8	5 X 1 = 05	10 X 2 = 20	33

Assessment method

Assessment		Marks
C ₁	Test	05
C ₂	Test	05
C ₃	Semester end exam	40

**Theory Model Question Paper
VI Semester
Elective Paper
BOTANICAL PRODUCTS**

Code: GBO612

Time: 2 Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any FIVE of the following

2 X 5 = 10

- 1.
- 2.
- 3.
- 4.
- 5.
- 6.
- 7.

II. Answer any TWO of the following

5 X 2 = 10

- 8.
- 9.
- 10.

III. Answer any TWO of the following

10X2 = 20

- 11.
- 12.
- 13.

PROGRAM LEARNING OUTCOMES (PLOs)- COURSE COMPLIANCE MATRIX

Legend: + = primary alignment; – = not a primary focus

Sl.No.	Course Title	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8
1.	Diversity of Microbes, Algae, Fungi & Phytopathology	+	+	+	+	+	+	–	+
2.	Bryophytes, Pteridophytes, Gymnosperms, Palaeobotany & Anatomy of Angiosperms	+	+	–	–	–	+	–	+
3.	Reproductive Biology, Plant Ecology, Biodiversity & Conservation	+	+	+	+	+	+	–	+
4.	Horticulture and Floriculture	+	+	+	–	–	+	+	+
5.	Mushroom culture technology & Biofertilizers	+	+	+	–	–	+	+	+
6.	Plant Physiology & Metabolism, Cell Biology & Molecular Biology	+	+	+	–	–	+	+	+
7.	Nursery, Gardening & Landscaping	+	+	–	+	–	+	+	+
8.	Medicinal Plants & Herbal Technology	+	+	+	–	–	+	+	+
9.	Morphology of Angiosperms, Taxonomy, Economic Botany & Ethnobotany	+	+	+	–	+	+	–	+
10.	Plant Breeding and Phytogeography	+	+	–	–	–	+	+	+
11.	Floriculture	+	+	–	–	–	+	+	+
12.	Genetics, Genetic Engineering, Plant Biotechnology & Evolution	+	+	+	–	–	+	+	+
13.	Phytochemistry and Herbal Technology	+	+	+	–	–	+	+	+
14.	Botanical products	+	+	–	–	–	+	+	+

SUSTAINABLE DEVELOPMENT GOALS (SDGs)- COURSE MAPPING

Legend: + = Direct thematic contribution; - = not a primary focus

Sl. No.	Course Title	SDG2 Zero hunger	SDG3 Good health and wellbeing	SDG4 Quality Education	SDG7 Affordable and Clean energy	SDG9 Industry, Innovation and Infrastructure	SDG13 Climate action	SDG14 Life below water	SDG15 Life on land
1.	Diversity of Microbes, Algae, Fungi & Phytopathology	+	+	+	-	-	-	+	+
2.	Bryophytes, Pteridophytes, Gymnosperms, Palaeobotany & Anatomy of Angiosperms	-	-	+	-	-	-	+	+
3.	Reproductive Biology, Plant Ecology, Biodiversity & Conservation	+	+	+	-	-	+	+	+
4.	Horticulture and Floriculture	+	+	+	-	-	-	-	+
5.	Mushroom culture technology & Biofertilizers	+	+	+	-	+	-	-	+
6.	Plant Physiology & Metabolism, Cell Biology & Molecular Biology	-	-	+	-	-	-	-	-
7.	Nursery, Gardening & Landscaping	+	+	+	-	-	-	-	+
8.	Medicinal Plants & Herbal Technology	+	+	+	-	+	-	-	-
9.	Morphology of Angiosperms, Taxonomy, Economic Botany & Ethnobotany	-	-	+	-	-	-	-	+
10.	Plant Breeding and Phytogeography	+	+	+	-	-	-	-	+
11.	Floriculture	-	-	+	-	-	-	-	+
12.	Genetics, Genetic Engineering, Plant Biotechnology & Evolution	-	+	+	+	-	-	-	-
13.	Phytochemistry and Herbal Technology	-	+	+	-	+	-	-	-
14.	Botanical products	+	+	+	-	-	-	-	-