

JSS MAHAVIDYAPEETA



JSS COLLEGE FOR WOMEN (Autonomous)

Saraswathipuram, Mysuru - 9

(Autonomous College under University of Mysore: Reaccredited by NAAC with A Grade)

FOR UNDER GRADUATE PROGRAM

BOTANY

SYLLABUS AND SCHEME OF EXAMINATION

2024-25

ALLOCATION OF CREDITS (2024-25 onwards)

Sem	Course code	Practical/ Theory	TITLE OF THE COURSE DISCIPLINE CORE COURSE (COMPULSORY)	Hrs/ Week L:T:P	Credits	Max marks
I	DSCB* - 1.1	Theory	Diversity of Microbes, Algae, Fungi & Phytopathology	3 Hrs.	3	80+20
		Practical	”	4 Hrs.	2	40+10
II	DSCB* - 1.2	Theory	Bryophytes, Pteridophytes, Gymnosperms, Palaeobotany & Anatomy of Angiosperms	3 Hrs.	3	80+20
		Practical	”	4 Hrs.	2	40+10
III	DSCB* – 1.3	Theory	Reproductive Biology, Plant Ecology, Biodiversity & Conservation	3 Hrs.	3	80+20
		Practical	”	4 Hrs.	2	40+10
	DSEB1.1	Elective	Nursery, Gardening & Floriculture	2 Hrs.	2	40+10
IV	DSCB* – 1.4	Theory	Plant Physiology & Metabolism, Cell Biology & Molecular Biology	3 Hrs.	3	80+20
		Practical	”	4 Hrs.	2	40+10
	DCB**- 1.1	Compulsory	Mushroom culture technology	2 Hrs.	2	40+10
	DSEB - 1.2	Elective	Medicinal plants	2 Hrs.	2	40+10
V	DSEB - 1.2	Theory	Morphology of Angiosperms, Taxonomy, Economic Botany & Ethnobotany	3 Hrs.	3	80+20
		Practical	”	4 Hrs.	2	40+10
	DCB**- 1.2	Theory	Floriculture	2 Hrs.	2	40+10
VI	DSEB - 1.3	Theory	Genetics, Genetic Engineering, Plant Biotechnology & Evolution	3 Hrs.	3	80+20
		Practical	”	4 Hrs.	2	40+10
	DCB** - 1.4	Theory	Botanical products	2 Hrs.	2	40+10

Botany – First semester
DSCB 1.1: Diversity of Microbes, Algae, Fungi and Phytopathology

Code: HMA250

- 48 Hrs (3 Hrs of instruction/ week: 3 Credits)

Course outcome

1. Students will be in position to understand the general characters, classification and economic importance of Mollicutes, Viruses, Bacteria, Cyanobacteria, Algae, Fungi and Lichens
2. They know the structure and reproduction of various forms included in the syllabus
3. They will acquire the basic knowledge of various plant diseases mentioned in the syllabus and their management

Unit I: Microbial diversity

- 16 Hrs.

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: Algae and Lichens

- 16 Hrs.

Cyanobacteria: General characters and economic importance of Cyanobacteria.

Type study: *Spirulina* and *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: Fungi and Phytopathology

- 16Hrs

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 (Neem, *Bacillus subtilis*, *Trichoderma*, NPV).

Suggested readings

1. Alexopolous, J. and Charles, W. M. 1988. Introduction to Mycology. Wiley Eastern, New Delhi.
2. Chopra, G. L. 1973. Text Book of Algae. S. Nagin and Co. Jalandhar.
3. Dube, H. C. 1983. An Introduction of 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. and Datta C. 1935. College Botany. (Vol. II). New Central Book Agency (P) Ltd.
6. Mehrotra, R. S. and Aneja, K. R. 1990. An Introduction of 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 Mc Graw-Hill Co, New Delhi.
10. Presscott, L., Harley, J. and Klein, D. 2005. Microbiology. 6th edition, Tata McGraw- Hill Co. New Delhi.
11. Sambamurthy, A. V. S. S. 2006. A text book 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 Text Book of Thallophyta. McGraw Hill Publishing. Co. New Delhi.
14. Singh, R. S. 1984. Introduction to Principles of Plant Pathology. Oxford and IBH Publication Co. Pvt. Ltd, New Delhi.
15. Singh, V., Pande, P. C. and 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, Jalandar.
18. Srivastava, H. N. 1993. Fungi. Pradeep Publications, Allahabad.
19. Sundarajan, S. 1998. College Microbiology. Vol 1. Vardhana Publications, Bangalore.
20. Sundararajan, S. 1993. College Botany. Vol I and II. Himalaya Publishing Company, Bangalore.
21. Vashishta, B. R., Sinha A. K. and Singh, V. P. 2008. Botany for Degree Students: Algae. S. Chand and Company Ltd, New Delhi.

**Scheme of question paper
(Theory)**

**B.Sc., Degree I Semester Examination
Diversity of Microbes, Algae, Fungi and Phytopathology**

Code: HMA250

Time: 3 Hrs

Max Marks: 80

I. Define/ Explain any EIGHT the following **8 X 1 = 08**

5 from Unit I

3 from Unit II

2 from Unit III

II. Write short notes on any FIVE of the following **5 X 3 = 15**

2 from Unit I

3 from Unit II

2 from Unit III

III. Answer any FIVE of the following **5 X 5 = 25**

2 from Unit I

2 from Unit II

3 from Unit III

IV. Describe any FOUR of the following in detail **4 X 8 = 32**

2 from Unit I

2 from Unit II

2 from Unit III

Unit	1 Mark	3 Marks	5 Marks	8 Marks	Total
I	1 X 5 = 5	3 X 2 = 6	5 X 2 = 10	8 X 2 = 16	37
II	1 X 3 = 3	3 X 3 = 9	5 X 2 = 10	8 X 2 = 16	38
III	1 X 2 = 2	3 X 2 = 6	5 X 3 = 15	8 X 2 = 16	39

Assessment method

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

Practical Syllabus
I Semester - Paper I

(DSCB 1.1) Diversity of Microbes, Algae, Fungi and Phytopathology

Code: HMA250P

- 64 Hrs (1 Practical of 4 Hrs / week: 2 Credits)

Equipments used in Microbiology lab: Inoculation loop & needle, Hot air oven, Incubator, Autoclave, Pressure cooker, Laminar air flow chamber, Hemocytometer, Colony counter.

Photographs /Charts of Microbiologists and their contribution

Staining of bacteria: Simple (positive and negative) and Gram staining.

Structure and reproduction of *Spirulina*, *Nostoc* and *Chlorella*

Structure and reproduction of *Oedogonium*

Structure and reproduction of *Caulerpa* and *Sargassum*

Structure and reproduction of *Polysiphonia* and Pennate Diatom

Structure and reproduction of *Rhizopus*, *Albugo*

Structure and reproduction of *Penicillium* and *Puccinia*,

Structure and reproduction of *Fusarium* and Lichens

Host, causal organism, symptoms and management of Sandal spike, TMV, Citrus canker, Algal rust (Avocado)

Tikka disease of Groundnut, Late blight of Potato and Coffee rust

Biopesticides (Neem, *Trichoderma*, *Bacillus subtilis*, NPV)

Assessment method

Assessment		Marks
C ₁	Continuous assessment (CA)	05
C ₂	Submission	05
C ₃	Semester end exam	40

Practical Question Paper Scheme
I Semester - Practical I
(DSCB 1.1) Diversity of Microbes, Algae, Fungi, and Phytopathology

Code: HMA250P

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 - 10**
- III. Write critical comment on the materials D, E & F - 12**
- IV. Identify the slides G, H & I with reason -06**
- V. Record - 05**

Practical Question Paper Scheme
I Semester - Practical I
(DSCB 1.1) Diversity of Microbes, Algae, Fungi, and Phytopathology

Code:

Time: 3 Hrs

Max. Marks: 40

- I. Perform the experiment A and leave for evaluation - 07**
 [Simple staining (positive and negative) / differential staining]
 (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 - 10**
 (1 from Cyanobacteria/ Algae, 1 from Fungi)
 (Identification- 1; Preparation- 2; Reasons with labeled diagram- 2)
- III. Write critical comment on the materials D, E & F - 12**
 (1 each from Fungi, Virus / Bacteria/ Mycoplasma disease and Algae/Lichen)
 (Identification- 1, Causal organism- 1, Symptoms and Management- 2)
- IV. Identify the slides G, H & I with reason -06**
 (1 each from Algae/ Cyanobacteria, Fungi and Lichen)
 (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.

Theory Syllabus
II Semester - Paper II

(DSCB 1.2) Bryophytes, Pteridophytes, Gymnosperms, Paleobotany and Anatomy of Angiosperms

Code: HMB250

- 48 Hrs (3 Hrs of instruction/ week: 3 Credits)

Course outcome

1. Students will be able to understand the salient features, classification and economic importance of Bryophytes, Pteridophytes and Gymnosperms
2. They will know the Morphology, Anatomy and Reproduction of Bryophytes, Pteridophytes, Gymnosperms and fossil plants included in the syllabus
3. They will acquire the knowledge of geological time scale, fossils and fossilization
4. Students are able to understand various types of tissues and their functions
5. They will understand the anatomical structures of root, stem and leaf of dicots and monocots

Unit I

- 15 Hrs

Bryophytes: General characters, classification and economic importance of Bryophytes

Type Study - *Riccia*, *Marchantia*, *Anthoceros* and *Funaria* (Developmental details not required).

Paleobotany: Geological time scale, fossils and fossilization; Types of fossils.

Type study: *Rhynia* and *Cycadeoidea*

Unit II

- 15 Hrs

Pteridophytes: General characters classification and economic importance.

Stelar Evolution.

Type study: *Psilotum*, *Selaginella*, *Equisetum*, *Pteris* and *Marsilea* (Developmental details not required); Heterospory and seed habit (Brief account).

Unit III

- 15 Hrs

Gymnosperms: General characters, classification and economic importance of Gymnosperms.

Type study: Morphology, Anatomy and Reproduction: *Cycas*, *Pinus* and *Gnetum*.

Anatomy of Angiosperms: Epidermal tissue system (Epidermis, trichomes, stomata and hydathodes) and Secretory tissue (Laticiferous tissues). **- 1 Hrs**

Vascular bundles, types of vascular bundles. **– 1 Hrs**

Anatomy of monocot and dicot root, stem and leaf.

Secondary growth in dicot stem and Anomalous secondary growth in *Dracaena* stem – **1 Hrs**

Suggested readings

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. Easu, K. 1979. Anatomy of seed plants. Wiley Eastern Ltd. New Delhi
11. Fahn, A. 1969. Plant Anatomy. 2nd Edition, Wiley, New York.
12. Frank, C. 1990. The inter-relationships of the Bryophytes. New Phytologist. Today and Tomorrow's Printers and Publishers.
13. Gangulee, H. C., Kar and Kumar, A. 1982. College Botany- Vol. II. Central Book Agency, Calcutta.
14. Pandey, S. N. and Chadha, A. 2009. Plant Anatomy and Embryology. Vikas Publishing House Pvt Limited.
15. Pandey, S. N., Mishra, S. P. and Trivedi, P. S. 2007. A Textbook of Botany- Vol. II. Rastogi Publications, Meerut.
16. Rashid, A. 1999. An Introduction to Pteridophyta. MKM Publisher Pvt Ltd.
17. Shripad, N. A. 1995. Paleobotany. Oxford and I.B.H. New Delhi.
18. Singh, V., Pande, P. C. and Jain, D. K. 2005. Diversity and Systematics of Seed plants. Rastogi Publications, Meerut.
19. Singh, V., Pande, P. C. and Jain, D. K. 2006. A Textbook of Botany. Rastogi Publications, Meerut.
20. Sporne, K. R. 1971. The Morphology of Gymnosperms: The Structure and Evolution of Primitive seed Plants. Hutchinson University Library, London.
21. Sporne, K. R. 1974. Morphology of Pteridophytes. Hutchinson and Co., London.
22. Tayal M. S. 2004. Plant Anatomy. Rastogi Publications.
23. Vashishta, P. C. 1982. Peridophyta. S. Chand and Co. Ltd., New Delhi.

Theory Question Paper Scheme
II Semester - Paper II

(DSCB 1.2) Bryophytes, Pteridophytes, Gymnosperms, Palaeobotany and Anatomy of Angiosperms

Code: HMB250

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/ Explain any EIGHT of the following **8 X 1 = 08**

- 2 from Unit I
- 3 from Unit II
- 2 from Unit III
- 3 from Anatomy

II. Write short notes on any FIVE of the following **5 X 3 = 15**

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

III. Answer any FIVE of the following **5 X 5 = 25**

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

IV. Describe any FOUR of the following in detail **4 X 8 = 32**

- 2 from Unit I
- 2 from Unit II
- 2 from Unit III

Unit	1 Mark	3 Marks	5 Marks	8 Marks	Total
I	1 X 5 = 5	3 X 2 = 6	5 X 2 = 10	8 X 2 = 16	37
II	1 X 3 = 3	3 X 3 = 9	5 X 2 = 10	8 X 2 = 16	38
III	1 X 2 = 2	3 X 2 = 6	5 X 3 = 15	8 X 2 = 16	39

Assessment method

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

Practical Syllabus
II Semester - Practical II
(DSCB 1.2) Pteridophytes, Gymnosperms, Paleobotany and Anatomy of Angiosperms

Code: HMB250P

- 64 Hrs. (1 practical of 4 Hrs / week: 2 Credits)

Meristems, simple and complex tissues
 Anatomy of monocot and dicot root
 Anatomy of monocot and dicot stem
 Anatomy of monocot and dicot leaf
 Morphology, anatomy and reproduction of *Marchantia*
 Morphology, anatomy and reproduction of *Anthoceros* and *Funaria*
 Morphology, anatomy and reproduction of *Psilotum* and *Rhynia*
 Morphology, anatomy and reproduction of *Selaginella* and *Equisetum*
 Morphology, anatomy and reproduction of *Pteris* and *Marsilea*
 Morphology, anatomy and reproduction of *Cycas* and *Cycadeoidea*
 Morphology, anatomy and reproduction of *Pinus*
 Morphology, anatomy and reproduction of *Gnetum*
 Visit to Geology Museum / Fernarium

Assesment method

Assesment		Marks
C ₁	Continuous assessment (CA)	05
C ₂	Submission / Assignment	05
C ₃	Semester end exam	40

Practical Question Paper
II Semester - Practical II
(DSCB 1.2) Pteridophytes, Gymnosperms, Paleobotany, Anatomy of Angiosperms

Code: HMB250P

Time: 3 Hrs

Max. Marks: 40

- | | |
|---|-------------|
| I. Identify the specimens A, B and C with reasons | -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 | -09 |
| IV. Identify the slides / Chart H, I, J and K with reasons | - 12 |
| VI. Record | - 05 |

Practical Question Paper Scheme (2024-25 onwards)
II Semester - Practical II (DSCB 1.2)

Pteridophytes, Gymnosperms, Palaeobotany and Anatomy of Angiosperms

Code: HMB250P

Time: 3 Hrs

Max. Marks: 40

- | | |
|--|-------------|
| I. Identify the specimens A, B and C with reasons
(1 each from Bryophytes, Pteridophytes and Gymnosperms)
(Identification -1; Reasons with labeled diagram- 2) | - 09 |
| II. Prepare a temporary stained slide of the material D sketch, label and identify with reasons. Leave the preparation for evaluation.
(from Anatomy)
(Mounting- 3; Identification- 1; Reasons with labeled diagram- 1) | - 05 |
| III. Comment on the materials E, F and G
(1 each from Bryophytes, Pteridophytes and Gymnosperms/Paleobotany)
(Identification- 1; Reasons with labeled diagram- 2) | - 09 |
| IV. Identify the slides / Chart H, I, J and K with reasons
(1 each from Bryophytes, Pteridophytes, Gymnosperms and Anatomy of Angiosperms)
(Identification- 1; Reasons with labeled diagram- 2) | - 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.

JSS MAHAVIDYAPEETA



JSS COLLEGE FOR WOMEN (Autonomous)

Saraswathipuram, Mysuru-9

(Autonomous College under University of Mysore: Reaccredited by NAAC with A Grade)

II B.Sc – III AND IV SEMESTER

BOTANY

SYLLABUS AND SCHEME OF EXAMINATION

2025-26

BOTANY–III SEMESTER

DSCB 1.3: Reproductive Biology, Plant Ecology, Biodiversity & Conservation

Code: HMC250

64Hrs (4Hrs of instruction/week: 3 Credits)

Course outcome:

1. To study the development and structure of Male and Female Gametophyte, Embryo, Endosperms in Angiosperms
2. To acquire the knowledge of Experimental Embryology
3. To acquire the basic knowledge of Plant community and their adaptations
4. To study the environmental factors and their impact on Plant community
5. To acquire the knowledge of various Ecosystem and energy flow
6. Understanding the fundamental concepts in Ecology, Environmental science and Phytogeography.
7. Concept development in conservation, global ecological crisis, sustainable development and pros and cons of human intervention.
8. Enable the student to appreciate biodiversity and the importance of various conservation strategies, laws and regulatory authorities and global issues related to climate change and sustainable development.

Unit-I: Reproductive Biology (Embryology)

12hrs.

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

Microsporangium and Microsporogenesis:

Development and structure of mature anther, anther wall layers, sporogenous tissue. Tapetum – Types, structure and functions, Development and structure of male gametophyte, Pollen embryo sac (Nemec phenomenon), Pollinia.

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

Megasporangium and Megaspороgenesis: Structure of pistil, placentation, ovule and types; Development of female gametophyte (*Polygonum* type), structure of mature embryo sac and types of embryo sac.

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 embryo (*Triticum*)

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

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

Unit II: Plant ecology

12 Hrs.

Introduction to Ecology, Scope and importance

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

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

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

Unit III: Plant ecology and Environmental issues

12 Hrs.

Bio-geochemical cycles: Carbon, Nitrogen and Phosphorous

Pollution: Water pollution; Causes, effect, types; water quality indicators, water quality standards in India, Control of water pollution (waste water treatment), Water pollution disasters; National mission on clean ganga, Minamata, Pacific gyre garbage patch, Exxon valdez oil spill

Air Pollution: causes, effects, air quality standards, acid rain, control

Soil pollution: causes, effects, solid waste management and control measures

Ecological succession:

Definition, types- primary and secondary; General stages of succession. Hydrosere and Xerosere.

Ecological groups of plants and their adaptations

Morphological and anatomical adaptations of hydrophytes, xerophytes, epiphytes, halophytes and parasites

Unit IV: Biodiversity and conservation

12 Hrs.

Introduction and concept of biodiversity

Values of biodiversity

Ecological, Economic and Social value

Types of biodiversity: Species and genetic diversity

Endemism: Endemism and types of endemism (Neo endemism and paleo endemism); Biodiversity hot spots and hotspots of India, Brief account of Agro biodiversity, Vavilov centers of cultivated crops

Threats to biodiversity: Deforestation, Mining, Land fragmentation, Industrialization, Environmental pollution, Invasive alien species, IUCN threat categories and RED data book.

Principles of conservation: *In-situ* and *Ex-situ* conservation

In-situ methods: Biosphere reserves, National Parks, Sanctuaries, sacred grooves

Ex-situ methods: Botanical gardens, Seed banks, Gene bank, Pollen bank, Culture collections and Cryopreservation

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

Suggested readings

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. I., 1984. Embryology of Angiosperms, Springer-Verlag, Netherlands.
4. Pandey S. N. 1997, Plant Anatomy and Embryology
5. 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, Rinehart & 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
16. Krishnamurthy K. V. Text Book of Biodiversity, Science Publishers, United States

**Scheme of Question paper
(Theory)
B.Sc Degree III Semester Examination
Reproductive Biology, Plant Ecology, Biodiversity & Conservation**

Code: HMC250

Time: 3Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any EIGHT of the following

2 X 8 = 16

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

II. Answer any FOUR of the following

6 X 4 = 24

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

III. Answer any FOUR of the following

10 X 4 = 40

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

Unit	2Marks	6Marks	10Marks	Total
I	2 X 3 = 6	6 X 2 = 12	10 X 1 = 10	28
II	2 X 2 = 4	6 X 1 = 6	10 X 2 = 20	30
III	2 X 2 = 4	6 X 1 = 6	10 X 2 = 20	30
IV	2 X 3 = 6	6 X 2 = 12	10 X 1 = 10	28

Assessment method

Assessment		Marks
C1	Assignment/Seminar	10
C2	Test	10
C3	Semester end exam	80

Practical Syllabus

III Semester – Practical Paper III

(DSCB 1.3) Reproductive Biology, Plant Ecology, Biodiversity & Conservation

Code: HMC250P

- 64 Hrs (1 Practical of 4Hrs / Week: 2 Credits)

1. Study of T.S. of anther. Mounting of pollen grains of *Hibiscus*, *Vinca rosea*, *Canna indica*, honey sample and pollinia of *Calotropis*
2. Pollen germination by hanging drop method
3. 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)
4. Mounting of endosperm (*Cucumis*) and embryo (*Crotalaria*)
5. Study of ecological instruments–Anemometer, Hygrometer, Soil thermometer, Barometer, Altimeter and Rain gauge
6. Determination of pH of different types of Soils
Water holding capacity of Soil samples, Conductivity of soil
Determination of soil texture of different soil samples
7. Morphological characters of Hydrophytes – *Hydrilla*, *Eichhornia*, *Pistia*, Anatomical characters of *Hydrilla* stem
8. Morphological characters of Xerophytes – *Opuntia*, *Asparagus*, *Euphorbia tirucalli*, *Aloe vera*, Anatomical characters of *Casuarina* stem
9. Morphological and anatomical characters of Epiphytes–*Vanda*; Parasites –*Cuscuta* & *Viscum*; Halophytes–Pneumatophores, Vivipary (*Avicennia* & *Rhizophora*)
10. Study of pond/forest ecosystem to record different biotic and abiotic components
11. Determination of Density and frequency of different types of vegetation samplings by quadrat methods
12. Marking of Biodiversity Bioreserves, Hot spots of India, National parks & Sanctuaries of India and Karnataka; Vavilov's centres of cultivated crop plants
13. Application of remote sensing in vegetation analysis using satellite imageries
14. Determination of Biological Oxygen Demand (BOD)
Field visit to study different types of vegetation and the report to be submitted.

Assessment method

Assessment		Marks
C1	Test	05
C2	Submission /Continuous Assessment	05
C3	Semester end exam	40

Practical Question Paper Scheme

III Semester – Practical III

(DSCB 1.3) Reproductive Biology, Plant Ecology, Biodiversity & Conservation

Code: HMC250P

Time: 3 Hrs

Max. Marks: 40

- | | |
|---|-----------------|
| I. Perform the experiment A and 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 | 03 Marks |
| IV. Comment on E & F | 08 Marks |
| V. Mapping of given area of G | 05 Marks |
| VI. Identify H | 04 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 (2025-26 onwards)

III Semester – Practical III

(DSCB 1.3) Reproductive Biology, Plant Ecology, Biodiversity & Conservation

Code:HMC250P

Time: 3 Hrs

Max. Marks: 40

I. Perform the experiment A & B

10 Marks

A- Pollen germination by Hanging drop method

B - Soil pH/Water holding capacity of soil/Soil texture

II. Prepare a temporary stained slide, identify and comment on material C
(Hydrophyte/Xerophyte)

05 Marks

III. Mount the material D. Identify with reasons & leave the preparation for evaluation **03 Marks**
(Endosperm/Embryo/Pollen grain & Pollinia)

IV. Comment on E & F

08 Marks

(1 each from Ecological adaptation, Ecological instruments)

V. Mapping of given area of G

05 Marks

(Biodiversity hotspots/ National parks / Sanctuaries/ Vavilov centres)

VI. Identify H

04 Marks

(Slide/Chart from Reproductive biology)

VII. Record

05 Marks

BOTANY–III SEMESTER

DSEB 1.1

Elective Paper: Theory

HORTICULTURE AND FLORICULTURE

Course code:

48 Hrs.

Credits: 3 (3hrs. 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 Hrs.

Introduction, scope and importance, Soil and types of soil (black, red and sandy), Nursery-introduction, objectives, infrastructure (polyhouse, green house, mist chamber, shade house, glass house, net house), nursery beds- types (flat, raised and sunken), their merits and demerits, Media (sand, peat soil, sphagnum mass, 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: HORTICULTURE CROPS:

12 Hrs.

Leafy vegetables (Amaranthus, Spinach, fenugreek, coriander and Dil); perennial vegetables (Drumstick, Flax, Chow-chow), Leguminous vegetables (french beans, cluster bean, lima bean, country bean, pigeon pea, cow pea and green pea); Gourds (cucumber, ridge gourd, snake gourd, bitter gourd, small gourd, pumpkin, ash gourd), Cole crops (cabbage, cauliflower, knoll khol. Tuber crops (taro, elephant foot yam and yam). Root crops (sweet potato, tapioca, carrot, radish, turnip and beet root).

Unit III: HORTICULTURE CROPS:

12 Hrs.

Aromatic plants (patchouli, davana, lemon grass, rosemary, geranium, chamapaka, lavancha). Medicinal plants (amla, ashwagandha, coleus, sarpagandha, hippali, madhunashini, brahmi, tulsi, amruthaballi, sogadeberu, lola sara, and stevia), Spices and condiments (garlic, coriander, turmeric, fennel, vanilla, clove, nutmeg, ginger, black pepper, cinnamon, tamarind, cardamom, onion, allspice), Plantation crops (coconut, areca nut, betel leaves). Fertilizers and manures (chemical fertilizers, compost, vermi composting, biofertilizer (Azolla) and jeevaamrutha/panchagavya), Organic farming.

Unit IV: FLORICULTURE & POMOLOGY

12 Hrs.

Floriculture & Pomology : introduction, cultivation practices and varieties of mango, banana, pomegranate, papaya, guava, citrus, grape, water melon and musk melon, Cut flowers - rose, carnation, gerbera, anthurium, orchids, tube rose, gladiolus and chrysanthemum, Bonsai and

terrarium, Flower arrangement: floral greetings, bouquet, vegetable carvings and dry flowers and ikabana, flower arrangement in functions, Olericulture: introduction, cultivation practices of Solanaceous vegetables (tomato, chilli, brinjal, capsicum and potato).

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

**Scheme of Question paper
(Theory) – Elective paper I
B.Sc Degree III Semester Examination
(DSEB 1.1) Horticulture and Floriculture**

Code:

Time: 3Hrs

Max Marks: 40

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any EIGHT of the following

2 X 8 = 16

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

II. Answer any FOUR of the following

6 X 4 = 24

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

III. Answer any FOUR of the following

10 X 4 = 40

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

Unit	2Marks	6Marks	10Marks	Total
I	2 X 3 = 6	6 X 2 = 12	10 X 1 = 10	28
II	2 X 2 = 4	6 X 1 = 6	10 X 2 = 20	30
III	2 X 2 = 4	6 X 1 = 6	10 X 2 = 20	30
IV	2 X 3 = 6	6 X 2 = 12	10 X 1 = 10	28

Assessment method

Assessment		Marks
C1	Assignment/Seminar	10
C2	Test	10
C3	Semester end exam	80

**Botany – Third Semester
Elective Paper**

DSEB 1.2: MUSHROOM CULTIVATION TECHNOLOGY & BIOFERTILIZER PRODUCTION

Course code: 48 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 CULTIVATION TECHNOLOGY 12 Hrs

Introduction and scope of mushroom cultivation.

Edible and poisonous mushrooms

Common edible mushrooms - Button mushroom (*Agaricus bisporus*), Milky mushroom (*Calocybe indica*), Oyster mushroom (*Pleurotus sajor caju*) and paddy straw mushroom (*Volvariella volvcea*).

Mushroom cultivation: Structure and construction of mushroom house. Sterilization of substrates

Unit II: 12 Hrs

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.

Processing of mushrooms- Short term storage, Long term storage, quality assurance and entrepreneurship.

Nutritional and medicinal values of mushrooms. Mushroom recipes

Post harvest technology: freezing, dry freezing, drying, canning, Packing and marketing
Value added products of mushrooms. Mushroom research stations

Unit III: BIOFERTILIZER 12 Hrs.

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.

Unit IV:**12 Hrs.**

Mycorrhiza- Occurrence and distribution, types of Mycorrhizal association, phosphorus nutrition, growth and yield- colonization of VAM- isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.

Organic farming- Green manuring and organic fertilizers, recycling of biodegradable municipal, agricultural and industrial wastes. Bio-composting and Vermicomposting (methods and field Application).

Suggested readings

1. Bhal, N. 2000. Handbook on Mushrooms. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi
2. Dubey, R. C. 2005. A Text Book of Biotechnology. S. Chand & Co, New Delhi
3. Kumaresan, V. 2005. Biotechnology. Saras Publications, New Delhi.
4. Krishnamoorthy, A. S. Sivaprakasam, K. and Jayarajan. R. 1991. Oyster Mushrooms, Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.
5. Marimuthu, T. 1991. Oyster Mushroom, Department of Plant Pathology Tamilnadu Agricultural University, Coimbatore
6. Pandey, R. K. and Ghosh, S. K. 1996. A Hand Book on Mushroom Cultivation. Emkey Publications.
7. Pathak, V. N, Yadav, N. and Gaur, M. 2000. Mushroom Production and Processing Technology. Vedams Ebooks Pvt Ltd., New Delhi.
8. Prakash, J. J. E. 2004. Outlines of Plant Biotechnology. Emkay Publication, New Delhi.
9. Rao, S.N.S. 2000. Soil Microbiology. Oxford & IBH Publishers, New Delhi.
10. Sathe, T.V. 2004. Vermiculture and Organic Farming. Dayapublishers.
11. Swaminathan, M. 1990. Food and Nutrition. The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore.
12. Tewari, Kapoor, P.S.C. 1988. Mushroom cultivation, Mittal Publications, Delhi.
13. Tripathi, D.P. 2005. Mushroom Cultivation, Oxford & IBH Publishing Co., New Delhi.
14. Vayas, S.C, Vayas, S. and Modi, H. A. 1998. Bio- fertilizers and organic Farming. Akta Prakashan, Nadiad.

**Scheme of Question paper
(Theory) – Elective paper II
B.Sc Degree IV Semester Examination
(DSEB 1.2) Mushroom Cultivation Technology & Biofertilizer**

Code:

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any EIGHT of the following

2 X 8 = 16

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

II. Answer any FOUR of the following

6 X 4 = 24

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

III. Answer any FOUR of the following

10 X 4 = 40

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

Unit	2 Marks	6 Marks	10 Marks	Total
I	2 X 3 = 6	6 X 2 = 12	10 X 1 = 10	28
II	2 X 2 = 4	6 X 1 = 6	10 X 2 = 20	30
III	2 X 2 = 4	6 X 1 = 6	10 X 2 = 20	30
IV	2 X 3 = 6	6 X 2 = 12	10 X 1 = 10	28

Assessment method

Assessment		Marks
C1	Assignment/Seminar	10
C2	Test	10
C3	Semester end exam	80

Theory Syllabus

IV SEMESTER – Paper IV

DSCB 1.4 Plant Physiology & Metabolism, Cell biology & Molecular Biology

Course code:

64 Hrs - Credits: 3 (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 ultrastructure of cell organelles
5. To acquire the knowledge of underlying principles of different microscopes
6. To learn chromosomal aberrations and their significance
7. To understand Mendel's principles, deviations from Mendelism, Mutation and its significance
8. To acquire the knowledge on chemistry, structure, types of genetic material and protein synthesis
9. To learn the concepts of gene and mechanism of gene regulation
10. To acquire the knowledge on chemistry, structure, types of genetic material and protein synthesis
11. To learn the concepts of gene and mechanism of gene regulation

Unit I: Plant water relations:

12hrs

Water – A universal solvent, Imbibitions, 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: Vital theory -Pulsatory theory, Root pressure theory, TCT theory. Absorption of mineral salts – carrier concept

Phloem transport – Transport of organic solutes. Path of transport, vein loading and unloading. Transcellular hypothesis, mass flow hypothesis/ Munch's hypothesis

Transpiration

Definition, types, structure of stomata, mechanism of stomatal movement (K^+ transport), anti-transpirants, significance of transpiration and Guttation

Mineral nutrition

Essential elements, macro (N, P, K, Ca, Mg) and micro (Zn, Mo, B, Fe, Mn) nutrients, role of essential elements. A brief account on hydroponics

Phytohormones Application of auxins, gibberellins, cytokinin, ABA, ethylene.

Tropic movements

Phototropism, thigmotropism, geotropism, Chemotropism and hydrotropism.

Photoperiodism

Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis;

Vernalization

Unit II: Plant Metabolism

12 Hrs.

Enzymes

Structure and properties, Mode of action – Lock and Key theory, Induced fit theory

Photosynthesis

Photosynthetic apparatus and pigments, Mechanism of light and dark reactions- C₃, C₄ and CAM pathways and C₂ 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: Cell Biology

12 Hrs.

Cell structure and function Prokaryotic and Eukaryotic cell; Principles, uses of compound and Electron microscopes

Cell organelles

Cell wall, 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- Super numerary chromosomes and their evolutionary significance

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: Molecular biology

12Hrs.

Introduction, nucleic acids as genetic material – Avery et al experiment, Franklin conrat's experiment

Chemistry, structure, types and functions of DNA and RNA,

DNA Replication

Mechanism of DNA replication Prokaryotic (Rolling circle model) Eukaryotic (Semi-conservative method)

Central Dogma

Central Dogma of molecular biology

Gene concept, Genetic code, Fine structure of Gene, Wobble hypothesis

Protein synthesis

Protein synthesis – in prokaryotes & eukaryotes; **Cell Division:** Cell cycle, Mitosis, Meiosis and their significance.

Suggested readings

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. 7thedition. 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,
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. 8thedition. 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 Fratiante. 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. Mc Graw Hill Book Co
12. Salisbury, F.B and Ross, C. W. 1999. Plant Physiology. CBS Publishers and Printers, NewDelhi.
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 Black well publishers
16. Brown, T. A. 1990. Gene Cloning. Chapman and Hall.
17. De Robertis, E.D.P.and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
18. Rashid, A. 2009. Molecular physiology and Biotechnology of Flowering plants. Narosa Publishing House Pvt. Ltd., New Delhi.
19. Singh, S. K.2007. Cytology, Genetics and Molecular Biology. Common wealth Publishers.
20. Sinha,U.and Sinha, S.1998. Cytogenetics. Plant Breeding and Evolution,Vikas Publications.
21. Verma, P.S. and Agarwal, P. K. 1998. Cell Biology, Genetics, Molecular Biology, Evolution and Ecology. S. Chand and Company Ltd.

**Scheme of Question paper
(Theory)**

B.Sc Degree IV Semester Examination

DSCB 1.4 Plant Physiology & Metabolism, Cell biology & Molecular Biology

Code:HMC250

Time: 3Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any EIGHT of the following

2 X 8 = 16

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

II. Answer any FOUR of the following

6 X 4 = 24

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

III. Answer any FOUR of the following

10 X 4 = 40

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

Unit	2Marks	6Marks	10Marks	Total
I	2 X 3 = 6	6 X 2 = 12	10 X 1 =10	28
II	2 X 2 = 4	6 X 1 = 6	10 X 2 =20	30
III	2 X 2 = 4	6 X 1 = 6	10 X 2 =20	30
IV	2 X 3 = 6	6 X 2 = 12	10 X 1 =10	28

Assessment method

Assessment		Marks
C1	Assignment/Seminar	10
C2	Test	10
C3	Semester end exam	80

Practical Syllabus
Plant Physiology & Metabolism, Cell Biology & Molecular Biology

Code:

64 Hrs.

Credits:

(1 practical of 4Hrs / week)

Practicals

Major experiments

1. Determination of osmotic potential of plant cell sap by plasmolytic method.
2. Experiment to demonstrate effect of temperature and solvent on cell membrane permeability using beet cylinders.
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
4. Experiment on the relation between transpiration and absorption
5. To study the effect of light intensity on O₂ evolution in photosynthesis
6. Comparison of the rate of respiration in any two plant parts
7. Separation of chlorophyll pigments by paper chromatography

Minor experiments

8. 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, Thalassemia
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, Antirrhinum, Maize
14. Biochemical tests: Protein, Carbohydrates, Lipids

Assessment method

Assessment		Marks
C1	Test	05
C2	Submission/Continuous Assessment	05
C3	Semester end exam	40

Practical Question Paper
IV SEMESTER – Paper IV

DSCB 1.4 Plant Physiology & Metabolism, Cell biology & Molecular Biology

Code:

Time: 3Hrs

Max. Marks = 40

- | | |
|--|-----------------|
| 1. Perform the Experiment A | 07 |
| Marks | |
| 2. Perform the Experiment B and C | 08 Marks |
| 3. Comment on C , D and E | 12 Marks |
| 4. Prepare a temporary squash of the material F | 08 Marks |
| 5. 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 Examination

IV Semester-Practical IV

(DSCB 1.4) Plant Physiology & Metabolism, Cell biology & Molecular Biology

Code:

Time: 3Hrs

Max. Marks: 40

- | | |
|--|-----------------|
| 1.Perform the Experiment A
(Physiology major experiment) | 07 Marks |
| 2.Perform the Experiment B and C
(Physiology minor experiment) | 08 Marks |
| 3.Comment on C, D and E
(1 each from Demo Experiment, Instrument/growth hormone/Mineral nutrition and Permanent slide or chart from Cell Biology and Molecular Biology) | 12 Marks |
| 4.Prepare a temporary squash of the material F
(Mitosis/Meiosis) | 08 Marks |
| 5. 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.

IV SEMESTER
Elective paper Theory Syllabus
DSCB 1.4 Medicinal Plants and Herbal Technology

Course code: 48 Hrs.
Credits: (3 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: HERBAL MEDICINES 12 Hrs.

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: PHARMACOGNOSY: 12 Hrs.

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

Unit III: PHYTOCHEMISTRY 12Hrs.

Active principles and methods of their testing, identification and utilization of the medicinal herbs; *Catharanthus roseus* (cardiotonic), *Withania somnifera* (drugs acting on nervous system), *Clerodendron phlomoides* (anti-rheumatic) and *Centella asiatica* (memory booster).

UNIT IV: ANALYTICAL PHARMACOGNOSY: 12Hrs.

Drug adulteration- types, methods of drug evaluation, Biological testing of herbal drugs
Phytochemical screening for secondary metabolites (alkaloids, flavonoids, steroids, triterpenoids, phenolic compounds).

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. Mangaldeep 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. Thomson's, London.
7. Kokate, C. K., Purohit, A. P. and Gokhale, S. B. 1999. Pharmacognosy. Nirali Prakashan.

**Scheme of Question paper
(Theory) – Elective paper
B.Sc Degree IV Semester Examination
(DSEB 1.4) Medicinal Plants and Herbal Technology**

Code:

Time: 3Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any EIGHT of the following

2 X 8 = 16

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

II. Answer any FOUR of the following

6 X 4 = 24

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

III. Answer any FOUR of the following

10 X 4 = 40

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

Unit	2Marks	6Marks	10Marks	Total
I	2 X 3 = 6	6 X 2 = 12	10 X 1 =10	28
II	2 X 2 = 4	6 X 1 = 6	10 X 2 =20	30
III	2 X 2 = 4	6 X 1 = 6	10 X 2 =20	30
IV	2 X 3 = 6	6 X 2 = 12	10 X 1 =10	28

Assessment method

Assessment		Marks
C1	Assignment/Seminar	10
C2	Test	10
C3	Semesterend exam	80

BOTANY–IV SEMESTER
Compulsory Elective Practical Paper Syllabus
DCB1.1 NURSERY GARDENING AND LANDSCAPING

Course code:

64 Hrs.

Credits: 2

(4Hrs. 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. Methods of preparation of nursery beds and sowing of seeds. Media for propagation of plants in Nursery Beds, Pots and Mist chamber 02 Weeks
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 gardens). 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 and horticulture garden | 01Week |

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., Little page, 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

(DCB1.1) NURSERY GARDENING AND LANDSCAPING

- | | |
|---|-----------------|
| 1. Perform the experiment A | 07 Marks |
| 2. Perform the experiment B and C | 08 Marks |
| 3. Comment on C , D and E | 12 Marks |
| 4. Prepare a temporary Terrarium/miniature landscape F | 08 Marks |
| 5. 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
IV Semester – Compulsory Elective Practical
(DCB1.1) NURSERY GARDENING AND LANDSCAPING

Code:

Time: 3Hrs.

Max.Marks: 40

- | | |
|--|-----------------|
| 1. Perform the experiment A
(Media for Propagation of plants) | 07 Marks |
| 2. Perform the experiment B and C
(Propagation methods viz., cutting, layering, division, grafting and budding) | 08 Marks |
| 3. Comment on C, D and E
(Identification of key horticultural plants and implements) | 12 Marks |
| 4. Prepare a temporary Terrarium/miniature landscape F | 08 Marks |
| 5. 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.

Assessment method

Assessment		Marks
C1	Assignment	05
C2	Test	05
C3	Semester end practical exam	40

JSS MAHAVIDYAPEETA

JSS COLLEGE FOR WOMEN (Autonomous)

Saraswathipuram, Mysuru-9

(Autonomous College under University of Mysore: Reaccredited by NAAC with A Grade)



FOR UNDER GRADUATE PROGRAM

DEPARTMENT OF BOTANY

REVISED NEP SYLLABUS V and VI Semester

2026-27

PROGRAM DETAILS

Program Name: Bachelor of Science (B. Sc)

Nature of the Program: Under graduate Degree Program (Choice Based Credit System – CBCS)

Duration of the Program: Three academic years, consisting of six semesters, or as prescribed by the University from time to time.

Eligibility for Admission: Candidates who have successfully completed their Pre-University course in accordance with the norms prescribed by the University.

Medium of Instruction: English

Program Structure:

The Program comprises a structured combination discipline core course Botany (DSCB), discipline elective Botany (DSEB), discipline compulsory course Botany (DCB), Practical Courses, and other components as prescribed by the

University of Mysore distributed across semesters in accordance with the Choice Based Credit System (CBCS) and University regulations in force from time to time.

Credits: Credits are assigned to each course based on instructional hours, learning activities, and expected learner effort, in conformity with the Choice-Based Credit System (CBCS) norms prescribed by the University.

ACADEMIC REGULATIONS

The academic regulations of B.Sc Program shall be governed by the rules and ordinances of the University of Mysore and shall conform to the Choice Based Credit System (CBCS) and UGC-LOCF framework in force from time to time.

Attendance Requirements:

Students shall be required to maintain a minimum percentage of attendance as prescribed by the University of Mysore to become eligible to appear for the end- of-semester examination in each course. Condonation, of the shortage of attendance, if any, shall be governed by the rules and procedures notified by the University from time to time.

Assessment and Evaluation Scheme:

Evaluation of student performance shall be based on a combination of Continuous Internal Assessment (CIA) and Semester END Examination (SEE), as prescribed under the CBCS framework of the University of Mysore.

The components of assessment may include:

- Internal tests
- Assignments
- Seminars/presentations
- Practical/laboratory work
- Hands- on exercises
- Fieldwork/field visit reports
- Project work

The distribution of marks between Continuous Internal Assessment and End of Semester Examination shall be as per University regulations.

Passing Criteria:

A student shall be declared to have passed a course if he/she secures:

- The minimum prescribed marks in the Continuous Internal Assessment.
- The minimum prescribed marks in the End-Semester Examination, and
- The aggregate minimum marks as stipulated by the University.

Grading System:

The grading of students shall be carried out using the grading system adopted by the University of Mysore under CBCS, with letter grades and grade points assigned based on performance in each course. The computation of Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA) shall be done in accordance with university regulations.

A. Theory Courses

Component	Nature of Assessment	Marks
Continuous Internal Assessment (CIA) C1(10)+C2(10)	Tests/Assignment/ Seminars/Presentations	20
End-Semester Examination (ESE)	Examination	80
Total		100

B. Practical Courses

Component	Nature of Assessment	Marks
Continuous Internal Assessment (CIA) C1(5)+C2(5)	Practical work / Records	10
Semester End Examination (SEE)	Practical Examination	40
Total		50

PROGRAMME OUTCOMES

On successful completion of B.Sc. Botany program, graduates will be able to:

PO1: Scientific Knowledge and Critical Thinking-Apply Scientific principles and analytical thinking to understand, Investigate and solve problems in relevant areas of science.

PO2: Effective Communication- Communicate Scientific concepts, Experimental findings and technical information effectively through oral, written and digital media in English and any Indian language.

PO3: Use of Modern Tools and techniques- utilize modern laboratory instruments, computational tools, digital technologies and science software/platforms effectively for experimentation, data analysis and research.

PO4: Impact of Science on Society- To prepare competent human resource and to develop scientific attitude at local and global levels for social benefits.

PO5: Responsible Citizenship- Apply Scientific Knowledge for Societal development with awareness of constitution, fundamental rights and duties of citizens, public health and safety, Sustainable usage of natural resources, environmental protection and national priorities.

PO6: Ethics and Professional Responsibility- Demonstrate ethical conduct, biosafety practices, integrity and respect for diversity while working individually and collaboratively.

PO7: Communication and Leadership- Communicate scientific concepts effectively through oral, written and digital media, demonstrate leadership quality and work effectively in multidisciplinary teams.

PO8: Lifelong Learning, Innovation and Employability- Engage in lifelong learning, entrepreneurship and professional development to pursue higher education, research and careers in science and technology while contributing to national and global development.

PROGRAM SPECIFIC OUTCOMES (PSOS)

After successful completion of the Bachelor of Science in Biochemistry, Botany and Microbiology (BBM):

PSO 1: Understand fundamental concepts in plant science in the areas of reproductive biology, taxonomy, anatomy, physiology and genetics.

PSO 2: Develop ecological awareness; understand diverse plant groups ranging from microbes to highly evolved plant groups, Angiosperms.

PSO 3: Understand plant life processes and evolutionary principles.

PSO 4: Execute experiments measuring plant growth regulators and physiological stress responses.

PSO 5: Study of bioorganic, biophysical, human physiology, nutrition, enzymology, metabolism and basis of immunology, biostatistics and bioinformatics.

PSO 6: Study the structure and functions of chemical component of the cell involved in biological process.

PSO 7: Provide an excellent for higher studies and research in the field of biochemistry, molecular science and profession in the area leading to health science.

PSO 8: Biochemistry knowledge can be used to develop products and monitor the production in pharmaceutical, food processing and beverage industries.

PSO 9: Knowledge and understanding of concepts of microbiology and its application in pharma, food, agriculture, beverages, nutraceutical industries.

PSO 10: Understand the distribution, morphology and physiology of microorganism and demonstrate the skills in aseptic handling of microbes including isolation, identification and maintenance.

PSO 11: Competent to apply the knowledge gained for conserving the environment and revolving the environment related issues.

PSO 12: Exploring the microbial world and analyzing the specific benefits and challenges.

PROGRAM SPECIFIC OUTCOMES (PSOS)

After successful completion of the Bachelor of Science in Botany, Chemistry and Biotechnology (BCBt)

PSO 1: Understand fundamental concepts in plant science in the areas of reproductive biology, Taxonomy, anatomy, physiology and genetics.

PSO 2: Develop ecological awareness; understand diverse plant groups ranging from microbes to highly evolved plant groups, Angiosperms.

PSO 3: Understand plant life processes and evolutionary principles.

PSO 4: Execute experiments measuring plant growth regulators and physiological stress responses.

PSO 5: To provide students with broad and balanced knowledge and Understanding of key concepts in chemistry.

PSO 6: To develop in students the ability to apply standard methodology to the solution of problems in chemistry.

PSO 7: To develop in students the ability to plan and carryout experiments independently and assess the significance of outcomes and to cater to the demands of chemical industries of well trained graduates.

PSO 8: To instill critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees in chemical sciences and to develop an independent and responsible work ethics.

PSO 9: Apply biological knowledge: Demonstrate a sound understanding of molecular biology, genetics, microbiology, cell biology, plant and animal biotechnology.

PSO 10: Develop laboratory skills: Perform laboratory techniques such as aseptic handling, microbial culture, molecular biology experiments, tissue culture and biochemical analysis while following laboratory safety practices.

PSO 11: Apply biotechnology in industries: Utilize biotechnology principles to address challenges in healthcare, agriculture, food technology, environmental management and industrial biotechnology.

PSO 12: Enhance employability and lifelong learning: Develop communication, team work, entrepreneurship and professional skills to pursue higher education, research or careers in biotechnology and allied life science industries.

PROGRAM SPECIFIC OUTCOMES (PSOS)

After successful completion of the Bachelor of Science in Botany, Chemistry and Biotechnology (CBZ)

PSO 1: To provide students with broad and balanced knowledge and Understanding of key concepts in chemistry.

PSO 2: To develop in students the ability to apply standard methodology to the solution of problems in chemistry.

PSO 3: To develop in students the ability to plan and carryout experiments independently and assess the significance of outcomes and to cater to the demands of chemical industries of well trained graduates.

PSO 4: To instill critical awareness of advances at the forefront of chemical sciences, to prepare students effectively for professional employment or research degrees in chemical sciences and to develop an independent and responsible work ethics.

PSO 5: Understand fundamental concepts in plant science in the areas of reproductive biology, taxonomy, anatomy, physiology and genetics.

PSO 6: Develop ecological awareness; understand diverse plant groups ranging from microbes to highly evolved plant groups, Angiosperms.

PSO 7: Understand plant life processes and evolutionary principles.

PSO 8: Execute experiments measuring plant growth regulators and physiological stress responses.

PSO 9: Develop proficiency in laboratory techniques, microscopy, specimen collection and identification, dissection, biological experimentation and data analysis for zoological studies.

PSO 10: Conduct scientific investigations, interpret biological data, prepare research reports and communicate scientific findings effectively through oral and written presentations.

PSO 11: Acquire skills necessary for employment and entrepreneurship in biotechnology, environmental management, wildlife conservation, fisheries, sericulture, apiculture and related life science sectors.

PSO 12: Analyze biological problems using scientific reasoning and apply appropriate methods to develop solutions related to animal biology, health and environmental issues.

SCHEME OF INSTRUCTION AND EXAMINATION FOR B.Sc PROGRAM IN BOTANY

Semester	Course Code	Title	Theory /Practical	Credit L: T: P	Hours/Week	Maximum Marks			Total Marks	Exam Duration in Hours
						CIA		SEE		
						C1	C2	C3		
V	HME250	Morphology of angiosperms, Taxonomy, Economic Botany and Ethnobotany	Theory	3:0:0	3	10	10	80	100	3
	HME250P	Morphology of angiosperms, Taxonomy, Economic Botany and Ethnobotany	Practical	0:0:2	4	5	5	40	50	3
	HME252	Plant Breeding and Phytogeography	Theory	3:0:0	3	10	10	80	100	3
	HME 256	Nursery, Gardening and Landscaping	Practical	0:0:2	4	5	5	40	50	3

Total Credits (Theory and Practical): 6+2+2 = 10

SCHEME OF INSTRUCTION AND EXAMINATION FOR B.Sc PROGRAM IN BOTANY

Semester	Course Code	Title	Theory /Practical	Credit L: T: P	Hours/Week	Maximum Marks			Total Marks	Exam Duration in Hours
						CIA		SEE		
						C1	C2	C3		
VI	HMF 250	Genetics, Genetic Engineering, Biotechnology and Plant Evolution	Theory	3:0:0	3	10	10	80	100	3
	HMF 250 P	Genetics, Genetic Engineering, Biotechnology and Plant Evolution	Practical	0:0:2	4	5	5	40	50	3
	HMF 252	Phytochemistry and Herbal Technology	Theory	2:0:0	2	5	5	40	50	2
	HMF 256	Nursery, Gardening and Landscaping	Practical	0:0:2	4	5	5	40	50	3

Total Credits (Theory and Practical): 5+2+2 = 9

Semester: V

Program Name: B.Sc	Semester: V
Course Title: Morphology of angiosperms, Taxonomy, Economic Botany and Ethnobotany	
Course Code: HME250	No. of Credits: 03 (3:0:0)
Contact Hours: 48	Duration of SEE/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assessment Marks: 80

Course outcomes (COs): After completion of this course, students will be able to:	
CO1	Analyze morphological diversity and diagnostic characteristics of angiosperms and apply taxonomic principles to identify and interpret plant diversity
CO2	Apply botanical nomenclature, identification methods and classification systems to analyze and establish taxonomic relationships among angiosperms using scientific evidence
CO3	Conduct systematic investigations using herbarium techniques, taxonomic keys, digital resources and appropriate scientific tools to identify, classify and document angiosperms
CO4	Evaluate the economic, medicinal and ethnobotanical importance and promote ethical, sustainable utilization, biodiversity conservation and societal well-being.

Course articulation matrix mapping of POs VS COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	3	3	3	2	3	3
CO2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	3	3
CO4	3	3	3	3	3	3	3	3

High (Substantial) correlate – 3, Moderate correlate – 2, Low Correlate - 1

Course Content:

Unit I: Morphology of Angiosperms: Root system: Tap, Fibrous and Adventitious root system, **Root modification:** Fusiform, napiform, conical, fasciculated, tuberous, prop, stilt, climbing, respiratory, parasitic and epiphytic, **Stem modification:** Rhizome, tuber, corm, bulb, runner, stolon, offset, sucker, phylloclade (*Opuntia*, *Euphorbia*), cladode (*Ruscus*, *Asparagus*), **Leaf:** phyllotaxy, simple and compound leaves, **Leaf modification:** tendril, spine, phyllode, insectivorous plant, **Inflorescence:** Racemose, Cymose and Special types (cyathium, thyrus, verticillaster, hypanthodium), **Fruits:** classification- simple, fleshy fruits (dry dehiscent, dry indehiscent, Schizocarpic); aggregate and composite; Structure of dicot seed and monocot seed.

Plant Taxonomy: Contributions of Van Rheed: *Hortus Malabaricus*, 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: Artificial – Linnaeus, Natural - Bentham and Hooker, Phylogenetic - Engler and Prantl's System with merits and demerits. A brief account of APG IV system of classification

Important Botanical Gardens of India and World, Botanical Survey of India, Herbarium Techniques - important herbaria.

16 hrs

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

16 hrs

Unit III: Economic Botany: Cereals: Rice, Wheat and Maize, **Millets:** Finger millet, foxtail millet and pearl millet, **Pulses:** Red gram, Green gram, Horse gram, Black gram and Bengal gram, **Oil yielding Plants:** Groundnut, Sunflower, Safflower, Coconut, **Fiber yielding plants:** Cotton, Jute and Coir, **Spices:** Cardamom, Clove, Cinnamon, Pepper, Asafoetida and Coriander, **Beverages:** Tea, Coffee and Cocoa, **Perfumes:** Jasmine, Patchouli, Polianthes and Sandal, **Dyes:** Indigo, Bixa and Lawsonia, **Narcotic Plants:** Opium, Cannabis and Tobacco, **Insecticides:** Neem, Pyrethrin and Nicotine, Timber: Rosewood, Teakwood, Indian Kino (Honne) and Neem.

Brief account of Medicinal Plants and their uses: *Annona Muricata*, *Catharanthus roseus*, *Justicia Adhatoda*, *Tinospora cordifolia*, and *Vitex negundo*

Ethnobotany: Introduction to Ethnobotany Contributions of Ethnobotanist: Richard Evans Schultes, Issabella Abbot, Janaki Ammal, and S K Jain, **Ethnobotanical significance of following Plants:** *Phyllanthus emblica* 2. *Hemidesmus indicus* 3. *Strychnos nux-vomica* 4. *Withania Somnifera* 5. *Terminalia chebula*. 6. *T. bellirica*, 7. *T. arjuna*, 8. *Rauwolfia serpentina* 9. *Aconitum heterophyllum*, 10. *Cinchona officinalis*, 11. *Atropa belladonna*, 12. *Digitalis purpurea* 13. *Tylophora asthamatica* and 14. *Vetiveria zizanioides*

16 hrs

Learning resources

1. Cotton, C.M. 1996. Ethnobotany - Principles and Applications. Wiley and Sons.
2. Datta S C, Systematic Botany, 4th Ed, Wiley Eastern Ltd., New Delhi, 1988.
3. Eames A.J. Morphology of Angiosperms, McGraw Hill, NewYork.
4. Gurucharan Singh. Plant Systematics, 3rd Ed, Science Publishers, NH, USA
4. Hall, B.G. (2011). Phylogenetic Trees Made Easy: A How-to Manual. Sinauer Associates, Inc. USA
5. Heywood, V.H. 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. New Delhi.
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. Taxonomy and Plant Conservation. C.B.S. Publishers & Distributors. New Delhi.
12. Pulliah. T. 1998. Taxonomy. Regency Publication, Delhi
13. Sharma O P – Plant Taxonomy. McGraw Hill Publications,
14. Singh V. & Jain- Taxonomy of Angiosperm. Rastogi Publications, Meerut.
15. Sivarajan V.V Introduction of Principles of Taxonomy. Oxford & IBH New Delhi.
16. Any local/ state/regional flora published by BSI or any other agency.

Pedogogy: Chalk and Board, ICT

Assessment Method:

Assessment		Marks
C1	Assignment/Seminar	10
C2	Test	10
C3	Semester End Exam	80

BOTANY – V SEMESTER (2026-27 onwards)

PRACTICAL – V DSCB 5.1

Practical Syllabus

Morphology of Angiosperms, Taxonomy, Economic Botany and Ethnobotany

Code: HME250P

64 Hrs (1 practicals of 4Hrs/week)

Practicals

1. Root, stem and leaf Modifications
2. Inflorescence: Racemose, Cymose and Special types
3. Fruits: Simple aggregate and composite type
4. Construction of floral diagrams with floral formulae
5. Study of the plants belonging to the families: Brassicaceae and Malvaceae
6. Rutaceae and Fabaceae (with sub families),
7. Myrtaceae and Apiaceae
8. Asteraceae and Rubiaceae
9. Apocynaceae, Solanaceae, and Euphorbiaceae
10. Monocot families; Liliaceae and Arecaceae
11. Poaceae, Musaceae and Orchidaceae
12. Economic Botany as per theory syllabus
13. Ethno botany as per the theory syllabus
14. As a part of curriculum, compulsory field trip to study the local flora

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 shall be submitted during the practical examination for assessment.

Assessment Method:

Assessment		Marks
C1	Continuous Assessment	05
C2	Test	05
C3	Semester End Exam	40

PRACTICAL -V (MODEL QUESTION PAPER)

Morphology of Angiosperms, Taxonomy, Economic Botany and Ethnobotany

Code: HME250P

Time: 3 hrs

Max. Marks 40

- | | |
|---|----------|
| 1. Assign the plants A, B and C to their respective families giving reasons | 9 marks |
| 2. Describe the plant D with botanical terms | 04 marks |
| 3. Draw a floral diagram with floral formula of E | 04 marks |
| 4. Plant Modification F and G | 06 marks |
| 5. Comment on H, I and J (Economic Botany) | 06 marks |
| 6. Comment on K and L (Ethno botany) | 06 marks |
| 7. Class Record and Herbarium | 05 Marks |
| 8. Report | 03 Marks |

SCHEME OF PRACTICAL EXAMINATION

Morphology of Angiosperms, Taxonomy, Economic Botany and Ethnobotany

Code: HME250P

Time: 3 hrs

Max. Marks 40

- | | |
|---|----------|
| 1. Assign the plants A, B and C to their respective families, giving reasons
(One from Polypetalae/One from Gamopetalae/One from Monochlamydae/Monocot)
Family Name and Characters – 3 Marks each | 9 marks |
| 2. Describe the plant D with botanical terms
Characters – 4 marks | 04 marks |
| 3. Draw a floral diagram with floral formula of E
(Floral diagram – 2 marks, Floral formula – 1 mark) | 03 marks |
| 4. Identify the plant modification F and G
(Identification – 1mark, Reason – 1 Mark) | 04 marks |
| 5. Comment on H, I and J (Economic Botany)
Botanical name – ½ Mark, Family – ½ Mark, Part used and uses – 1 Mark | 06 marks |
| 6. Comment on K and L (Ethno botany)
Botanical name – ½ Mark, Family – ½ Mark, Part used and medicinal uses – 2 Marks | 06 marks |
| 7. Class Record and Herbarium | 05 Marks |
| 8. Report | 03 Marks |

Theory Question Paper Scheme (2026-27 onwards)

V Semester – Paper (DSCB 5.1)

Morphology of Angiosperms, Taxonomy, Economic Botany and Ethnobotany

Code: HME250

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any EIGHT of the following

2 X 8 = 16

- 3 from Unit I
- 4 from Unit II
- 3 from Unit III

II. Write short note on any FOUR of the following

6 X 4 = 24

- 2 from Unit I
- 2 from Unit II
- 2 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 Marks	6 Marks	10 Marks	Total
I	2X3 = 6	6 X2 = 12	10 X 2 = 20	38
II	2X4 = 8	6 X2 = 12	10 X 2 = 20	40
III	2X3 = 6	6 X2 = 12	10 X 2 = 20	38

Assessment Method

Assessment		Marks
C ₁	Assignment	10
C ₂	Test	10
C ₃	Semester End Exam	80

Semester: V

Program Name: B.Sc	Semester: V
Course Title: Plant Breeding and Phytogeography	
Course Code: HME252	No. of Credits: 03 (3:0:0)
Contact Hours: 48	Duration of SEE/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assessment Marks: 80

Course outcomes (COs): After completion of this course, students will be able to:	
CO1	Explain the principles, objectives, methods, genetic resources and acclimatization involved in plant breeding for crop improvement.
CO2	Apply the principles of hybridization, selection, heterosis, mutation breeding, polyploidy and Biotechnology in developing improved crop varieties
CO3	Analyze and evaluate the achievements of plant breeding, crop improvement programmes and the contributions of major plant breeding institutes in India.
CO4	Analyze the principles of phytogeography, centres of origin, patterns of plant distribution and the vegetation types of India and Karnataka and interpret their significance in plant conservation and biodiversity management

Course articulation matrix mapping of POs VS COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	3	2	2	3	3	2	3
CO2	3	3	3	3	3	3	3	3
CO3	3	3	3	3	3	3	2	3
CO4	3	3	3	3	3	3	2	3

High (Substantial) correlate – 3, Moderate correlate – 2, Low Correlate - 1

Course Content:

Unit I: 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 and cross pollinated crops and vegetatively propagated plants. **16 hrs**

Unit II: Hybridization: Self, cross and vegetatively propagated 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, Cotton and Sugarcane. Plant breeding institutes in India, Contributions of N E Borlaug and M S Swaminathan. **16 hrs**

Unit III: Phytogeography: Introduction, principles, biogeography of India with special reference to Karnataka. Polar oscillations and glaciations. Centre of origin of crop plants - Vavilov's concept, types. Phytogeographical regions concept, phytogeographical regions of India and Karnataka, Climatic zones, plate tectonics, continental movement. Brief introduction to plant distribution, Vegetation types in Karnataka, vegetation composition of Western Ghats, Types of Forest: Evergreen, semi-evergreen, deciduous, scrub, mangroves, shola forests and grasslands.

16hrs

Learning Resources

1. Abbottt, A.J. and Atkin, R.K. eds. 1987. Improving vegetatively propagated crops. Academic press, New York.
2. Bose, T.K., Sadhu, M.K., & Das, P., 1986. Propagation of Tropical and Subtropical Horticultural crops, Nowya Prakash, Calcutta.
3. Cain, S.A. 1944. Foundations of plant Geography. Harper and Brothers Publishers, NewYork
4. Chahal, G.S. and Gosal, S.S. 2002. Principles and procedures of Plant Breeding. Narosa Publishing House, New Delhi.
5. Chopra, V.L. 2000. Plant Breeding- theory and practices. Oxford and IBH Publishing Co. Pvt. Ltd., Oxford.
6. Croizat, 1952. Manual of Phytogeography. Dr. W. Junk Publishers, Netherlands
7. Dodson E. O. and Dodson P. 1976. Evolution: Process and Product. 2nd Ed., D. Van Nostrand Company, 450 West 33rd Street, New York, N.Y. 10001
8. Edgar A. 1972. Plants, Man and Life. University of California Press,
9. Futuyma, Douglas J. 2005. Evolution. Sinauer Associates, Inc., 23 Plumtree Road, Sunderland, MA 01375, United States of America
10. Good R.D. 1974. Geography of the flowering plants. Longman Higher education, London.
11. Hartmann, H.T., Kester E.D., Davis, F.T., and Geneve, R.L. 1997. Plant propagation. Principles and practices. Prentice Hall of India Private Limited, New Delhi.
12. James H. B. 1998. Biogeography. Sinauer Associates, Inc., 23 Plumtree Road, Sunderland, MA 01375, United States of America
13. Krishnamurthy. H.M. 1981. Plant Growth substances including application in Agriculture.
14. Polunin, N. 1961. Introduction to plant geography. McGraw Hill Publications, New York.
15. Valentine, D. H. 1972. Taxonomy, Phytogeography & Evolution. Academic Press, London

Pedogogy: Chalk and Board, ICT

Assessment Method:

Assessment		Marks
C1	Assignment/Seminar	10
C2	Test	10
C3	Semester End Exam	80

Theory Question Paper Scheme (2026-27 onwards)

V Semester – Paper (DSCB 5.1)

Plant Breeding and Phytogeography

Code: HME252

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any EIGHT of the following

2 X 8 = 16

- 3 from Unit I
- 4 from Unit II
- 3 from Unit III

II. Write short note on any FOUR of the following

6 X 4 = 24

- 2 from Unit I
- 2 from Unit II
- 2 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 Marks	6 Marks	10 Marks	Total
I	2X3 = 6	6 X2 = 12	10 X 2 = 20	38
II	2X4 = 8	6 X2 = 12	10 X 2 = 20	40
III	2X3 = 6	6 X2 = 12	10 X 2 = 20	38

Assessment Method

Assessment		Marks
C ₁	Assignment	10
C ₂	Test	10
C ₃	Semester End Exam	80

Semester: VI

Program Name: B.Sc	Semester: VI
Course Title: Genetics, Genetic Engineering, Plant Biotechnology & Evolutionary Biology	
Course Code: HMF 250	No. of Credits: 03 (3:0:0)
Contact Hours: 48	Duration of SEE/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 20	Summative Assessment Marks: 80

Course outcomes (COs): After completion of this course, students will be able to:	
CO1	Analyze the principles of mendelian genetics and Non- mendelian inheritance and patterns of inheritance to solve genetic problems and predict outcomes in organisms
CO2	Apply the principles and techniques of genetic engineering and evaluate their applications, benefits, limitations and biosafety and ethical implications in agriculture and biotechnology
CO3	Demonstrate and evaluate plant tissue culture techniques and molecular techniques, analyze experimental outcomes and apply appropriate biotechnological approaches for crop improvement and sustainable agricultural practices
CO4	Analyze and evaluate the theories, evidences, mechanism of evolution and speciation using scientific patterns of biological diversity

Course articulation matrix mapping of POs VS COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	2	2	2	1	3
CO2	3	3	3	3	3	3	2	3
CO3	3	2	3	3	3	3	2	3
CO4	3	2	2	3	3	2	2	3

High (Substantial) correlate – 3, Moderate correlate – 2, Low Correlate - 1

Course Content:

Unit I: 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*. **16 hrs**

Unit II: Genetic Engineering - Scope and importance of Genetic engineering, principles and applications of Genetic engineering in agricultural, medical, industrial and environmental sectors. Enzymes employed in genetic engineering (DNA polymerases, restriction enzymes, ligases, kinases, endonucleases, phosphatase, reverse transcriptase). **Vectors** - Plasmids (pBR322), Cosmids, Shuttle Vector, YAC & BAC. Direct DNA delivery methods (Agrobacterium mediated gene transfer, 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 tissue culture in forestry and agriculture. **16 hrs**

Unit III: 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 evolution); Hardy-Weinberg principle and affecting factors (gene migration, genetic drift, mutation, recombination and natural selection); Species concepts and modes of speciation (allopatric, sympatric, parapatric), significance of speciation. Polymorphism and its significance. **16 hrs**

Learning Resources:

1. Bhojwani, S. S., & Razdan, M. K. (1996). *Plant tissue culture: Theory and practice: A revised edition*. Elsevier.
2. Brooker, R. J. (2021). *Genetics: Analysis and principles* (7th ed.). McGraw Hill.
3. Brown, T. A. (2016). *Gene cloning and DNA analysis: An introduction* (7th ed.). Wiley-Blackwell.
4. Chawla, H. S. (2002). *Introduction to plant biotechnology* (2nd ed.). Oxford & IBH Publishing.
5. Freeman, S., & Herron, J. C. (2007). *Evolutionary analysis* (4th ed.). Pearson.
6. Futuyma, D. J., & Kirkpatrick, M. (2017). *Evolution* (4th ed.). Sinauer Associates.
7. George, E. F., Hall, M. A., & De Klerk, G.-J. (2008). *Plant propagation by tissue culture* (3rd ed.). Springer.
8. Glick, B. R., Pasternak, J. J., & Patten, C. L. (2010). *Molecular biotechnology: Principles and applications of recombinant DNA* (4th ed.). ASM Press.
9. Green, M. R., & Sambrook, J. (2019). *Molecular cloning: A laboratory manual* (4th ed.). Cold Spring Harbor Laboratory Press.
10. Griffiths, A. J. F., Wessler, S. R., Carroll, S. B., & Doebley, J. (2020). *Introduction to genetic analysis* (12th ed.). W. H. Freeman.
11. Hall, B. K., & Hallgrimsson, B. (2014). *Strickberger's evolution* (5th ed.). Jones & Bartlett Learning.

12. Klug, W. S., Cummings, M. R., Spencer, C. A., Palladino, M. A., & Killian, D. J. (2019). *Concepts of genetics* (12th ed.). Pearson.
13. Pierce, B. A. (2020). *Genetics: A conceptual approach* (7th ed.). Macmillan Learning.
14. Primrose, S. B., & Twyman, R. M. (2013). *Principles of gene manipulation and genomics* (7th ed.). Wiley-Blackwell.
15. Ridley, M. (2004). *Evolution* (3rd ed.). Blackwell Publishing.
16. Singh, B.D. 2007. Fundamentals of Genetics. Kalyani Publishers, Ludhiana
16. Slater, A., Scott, N. W., & Fowler, M. R. (2008). *Plant biotechnology: The genetic manipulation of plants*. Oxford University Press.
17. Snustad, D. P., & Simmons, M. J. (2016). *Principles of genetics* (7th ed.). Wiley.
18. Stearns, S. C., & Hoekstra, R. F. (2005). *Evolution: An introduction*. Oxford University Press.
19. Watson, J. D., Baker, T. A., Bell, S. P., Gann, A., Levine, M., & Losick, R. (2014). *Molecular biology of the gene* (7th ed.). Pearson.

Pedogogy: Chalk and Board, ICT

Assessment Method:

Assessment		Marks
C1	Assignment/Seminar	10
C2	Test	10
C3	Semester End Exam	80

BOTANY – VI SEMESTER (2026-27 onwards)
PRACTICAL – V DSCB 6.1
Practical Syllabus
Genetics, Genetic Engineering, Plant Biotechnology & Evolutionary Biology

Code: HMF250P

- 64 Hrs (1 practicals of 4Hrs/week)

Practicals

1. Cultivation of *Pisum sativum*, *Mirabilis jalapa*, *Arabidopsis thaliana*, *Antirrhinum majas*, *Zea mays*, *Cucurbita pepo* and observation of different traits.
- 2-4. Solving the genetic problems related to theory portions: Monohybrid Cross, dihybrid Cross, interaction of factors, two – point test cross
5. Preparation of Artificial/Synthetic seeds by Sodium Alginate method
6. Qualitative detection of DNA by Schiff's reagent in Onion/Coconut Endosperm/Banana
7. Preparation of MS Media
8. Preparation of Explant and its inoculation
9. Demonstration of Protoplast isolation
10. Construction of phylogenetic tree
11. Study of Photographs related to Genetic Engineering – Vectors, restriction endonucleases, Gene transfer methods
12. Study of photographs related to plant tissue Culture – Callus, Multiple shoots, Protoplast fusion, Anther culture, Embryo Culture, Endosperm culture, Micropropagation and Somatic embryogenesis.
13. Photographs of Evolutionary Biology and origin of life – Charles Darwin, Jean-Baptiste Lamarck, Hugo de Vries, Alfred Russell Wallace, Hardy Weinberg Law, Modes of speciation
14. Industrial visit

Assessment Method:

Assessment		Marks
C1	Continuous Assessment	05
C2	Test	05
C3	Semester End Exam	40

SCHEME OF PRACTICAL EXAMINATION.
PRACTICAL -VI (MODEL QUESTION PAPER)

Genetics, Genetic Engineering, Plant Biotechnology & Evolutionary Biology

Time: 3 hrs

Max. Marks = 40

- | | |
|--|-------------|
| 1. Solve the genetic problems A and B | 10 marks |
| 2. Detect and confirm the presence of DNA by Schiff's reagent in the sample C | 06 marks |
| 3. Prepare and inoculate explant D | 06 marks |
| 4. Prepare the synthetic seed by sodium alginate method | 04 marks |
| 5. Comment on F, G, H and I | 4X2=8 marks |
| 6. Class records | 04 Marks |

GENETIC PROBLEMS

PROBLEMS ON MONOHYBRID CROSS

1. In Tomatoes Red fruit color (R) is dominant over yellow (r). A pure red fruited plant is crossed to a yellow fruited one. What will be the appearance of F₁? The F₁ are interbred and produce 320 off springs 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?
2. In pea plant, Tallness (T) is dominant over dwarfness (t). A tall plant crossed with dwarf produces offspring's of which 50% are tall and 50% are dwarf. What are the genotypes of the parents?

PROBLEMS ON DIHYBRID CROSS

1. In garden pea, yellow seed color (Y) is dominant over green (y) and round seed shape (R) is dominant over wrinkled (r). The character pair segregates separately. A pure yellow wrinkled variety is crossed to a pure green round. Give the phenotypes and genotypes of F₁ and phenotypic ratio of F₂ generation.
2. A tall red when crossed with dwarf red produces a dwarf white. Give the genotypes of the parents.

PROBLEMS ON INTERACTION OF FACTORS

1. 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 is involved?

What were the probable genotypes of the parental strains?

PROBLEMS ON 2 POINT TEST CROSSES

1. In tomato, red fruit (R) is dominant over yellow fruit (r) and yellow flowers (Y) are dominant over white flowers (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.

2. Two different traits affecting pod characteristics in garden pea plants are enclosed by genes found on chromosome 5. Narrow pod is recessive to normal pod, yellow pod 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 normal green pods

150 narrow yellow pods

11 normal yellow pods

9 narrow green pods

How far apart are these two genes?

SCHEME OF PRACTICAL EXAMINATION.

PRACTICAL -VI

Genetics, Genetic Engineering, Plant Biotechnology & Evolutionary Biology

Time: 3 hrs

Max. Marks= 40

1. Solve the genetic problems **A** and **B** 10 marks
(From Monohybrid, dihybrid, interaction of factors and 2 point test cross – 5 marks each)
2. Detect and confirm the presence of DNA by Schiff's reagent in the sample **C** 06 marks
(Requirements – 1 mark, Preparation – 2 Marks, Procedure – 2 marks, result – 1mark)
3. Prepare and inoculate explant **D** 06 marks
(Preparation – 2 marks, Inoculation – 2 marks, Procedure– 2 marks)
4. Prepare the synthetic seed by sodium alginate method 04 marks
(Preparation – 2 Marks, Procedure – 2 marks)
5. Comment on **F, G, H** and **I** 4X2=8 marks
(Genetic Engineering, plant tissue culture and Evolution)
(Identification – 1/2 Mark – Reasons – 1½ marks)
6. Class records 04 Marks

Theory Question Paper Scheme (2026-27 onwards)

VI Semester – Paper (DSCB 6.1)

Genetics, Genetic Engineering, Plant Biotechnology & Evolutionary Biology

Code: HMF 250

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any EIGHT of the following

2 X 8 = 16

- 3 from Unit I
- 4 from Unit II
- 3 from Unit III

II. Write short note on any FOUR of the following

6 X 4 = 24

- 2 from Unit I
- 2 from Unit II
- 2 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 Marks	6 Marks	10 Marks	Total
I	2X3 = 6	6 X2 = 12	10 X 2 = 20	38
II	2X4 = 8	6 X2 = 12	10 X 2 = 20	40
III	2X3 = 6	6 X2 = 12	10 X 2 = 20	38

Assessment Method

Assessment		Marks
C ₁	Assignment	10
C ₂	Test	10
C ₃	Semester End Exam	80

Semester: VI

Program Name: B.Sc	Semester: VI
Course Title: Phytochemistry and Herbal Technology	
Course Code: HMF 252	No. of Credits: 02 (2:0:0)
Contact Hours: 48	Duration of SEE/Exam: 03 Hours
Hours/Week: 03	
Formative Assessment Marks: 10	Summative Assessment Marks: 40

Course outcomes (COs): After completion of this course, students will be able to:	
CO1	Explain the principles of phytochemistry, primary and secondary metabolites, medicinal plants and their standardization
CO2	Apply appropriate extraction, isolation and purification methods to obtain phytochemicals from plant materials
CO3	Analyze phytochemicals using appropriate chromatographic, spectroscopic and analytical techniques for qualitative and quantitative evaluation.
CO4	Evaluate phytochemical findings and herbal products with respect to medicinal applications, quality, ethical practice and sustainable utilization of plant resources

Course articulation matrix mapping of POs VS COs

CO/PO	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8
CO1	3	2	3	2	3	3	2	3
CO2	3	2	3	2	3	3	2	3
CO3	3	2	3	3	2	3	2	3
CO4	3	3	3	3	3	3	3	3

High (Substantial) correlate – 3, Moderate correlate – 2, Low Correlate - 1

Unit I Phytochemistry: Scope of phytochemistry, plants as source of chemical compounds, primary and secondary metabolites and their applications; Definition, source of herbal materials, identification, authentication, standardization of medicinal plants as per WHO guidelines and different herbal pharmacopeias, natural pigments, natural products as markers for new drug discovery. **Phytochemical Analysis:** 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 **16hrs**

Unit II: Isolation of selected primary and secondary metabolites – carbohydrate and proteins; Phenolics, flavonoids, alkaloids, lipids, oils, terpenes and saponins. **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. **16hrs**

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. Invalid Prakashan Publications.
3. Braithwaite, A. and Smith, F. J. 1996. Chromatographic Methods. 5th edn. Blackie Academic & Professional, London.
4. Sadasivam. S. and A. Manickam. 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.

Pedogogy: Chalk and Board, ICT

Assessment Method:

Assessment		Marks
C1	Assignment/Seminar	5
C2	Test	5
C3	Semester End Exam	40

Theory Question Paper Scheme (2026-27 onwards)

VI Semester – Paper (DSCB 6.1)

Phytochemistry and Herbal Technology

Code: HMF 252

Time: 3 Hrs

Max Marks: 80

Instruction: Draw neat labeled diagrams wherever necessary

I. Define/Explain any THREE of the following

3 X 2 = 06

3 from Unit I

2 from Unit II

II. Write short note on any TWO of the following

2 X 5 = 10

1 from Unit I

3 from Unit II

III. Answer any FOUR of the following

10 X 4 = 40

3 from Unit I

2 from Unit II

Unit	2 Marks	5 Marks	8 Marks	Total
I	2X3= 6	5X1 = 5	8 X 3 = 24	35
II	2X2 = 4	5X3 = 15	8 X 2 = 16	35

Assessment Method

Assessment		Marks
C1	Assignment/Seminar	5
C2	Test	5
C3	Semester End Exam	40