

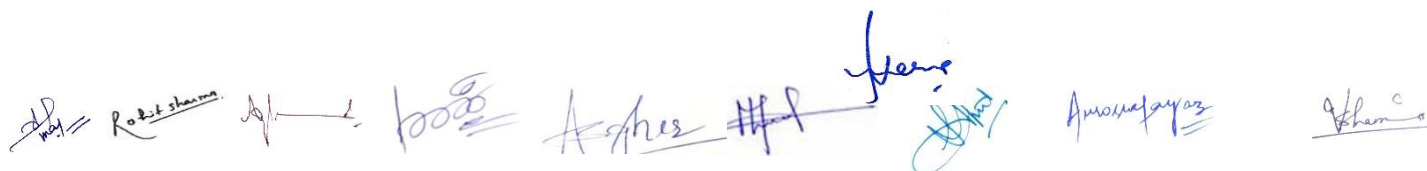
Syllabus of B.Sc. Honours (FYUGP) in Botany
Implementation: from 2026-27, 2027-28 and 2028-29

Semester –I

S. No	Course Type	Course Code	Course Title	Credits	Marks				Total Marks
					Theory		Practical		
					Mid Sem	End Exam	Assessment	Exam	
1	MAJOR (Theory)	UMJBOTH-101	Introduction to Microbes and Plant Kingdom	4	20	80	-	-	100
2	MAJOR (Practical)	UMJBOPR-111	Introduction to Microbes and Plant Kingdom	2	-	-	25	25	50
3	Minor (Theory)	UMIBOTH-121	Microbes and Plant Kingdom	4	20	80	-	-	100
4	Minor (Practical)	UMIBOPR-131	Microbes and Plant Kingdom	2	-	-	25	25	50
5	MD	UMDBOTH-141	Economic Botany-I	3	15	60			75

Semester –II

S. No	Course Type	Course Code	Course Title	Credits	Marks				Total Marks
					Theory		Practical		
					Mid Sem	End Exam	Assessment	Exam	
1	MAJOR (Theory)	UMJBOTH-201	Economic Botany and Plant Conservation	4	20	80	-	-	100
2	MAJOR (Practical)	UMJBOPR-211	Economic Botany and Plant Conservation	2	-	-	25	25	50
3	Minor (Theory)	UMIBOTH-221	Economic Botany and Plant Conservation	4	20	80	-	-	100
4	Minor (Practical)	UMIBOPR-231	Economic Botany and Plant Conservation	2	-	-	25	25	50
5	MD	UMDBOTH-241	Economic Botany-II	3	15	60			75



Syllabus of B.Sc. Honours (FYUGP) in Botany

Department of Botany

FIRST SEMESTER

**Course Title: Introduction to Microbes and
Plant Kingdom**

Course Type: MAJOR

Course Code: UMJBOTH-101

Course Credits: (04)

Internal Assessment: 20 Marks (1.5 hours)

End Semester Examination: 80 Marks (3 hours)

Total Marks: 100

Course Objectives

1. To familiarize students with the fundamental concepts of microorganisms, their diversity and their significant roles in nature.
2. To develop an understanding of the classification and structural organization of microbes and plants.
3. To study the life cycles, reproduction and economic importance of various plant groups.
4. To build a foundation for advanced studies in microbiology and plant science.

Learning Outcomes

1. Understanding the basic characteristics, classification and ecological roles of major groups of microorganisms.
2. Describe the Diversity, structure, reproduction and life cycles of different groups in the plant kingdom. Sheets.

UNIT - I: Microbes

1. Introduction to Microbes and their Economic Importance. Three Kingdom System of Classification and Whittaker's Five kingdom Classification.
2. Viruses - Concept of Viruses, Discovery and Structure of Plant Viruses with Special reference to TMV And Bacteriophage. Concept of Lytic and Lysogenic Cycle.
3. Concept of Viroid, Discovery and Structure with special; reference to Potato Spindle Tuber Viroid (PSTVD); Prions.
4. Bacteria – Discovery, General Characteristics, Cell ultra structure, asexual Reproduction and Horizontal Gene Transfer (conjugation, transformation and transduction) and Economic Importance.

Handwritten signatures and marks at the bottom of the page:
Rohit Sharma, Agnes, Anurag, and others.

Syllabus of B.Sc. Honours (FYUGP) in Botany

UNIT - II: Algae, Fungi and Lichens Diversity

1. Algae - General Characteristics of Algae, Criteria for Classification (outline classification, Fritsch 1935), Range of Thallus, Reproduction, Types of Life cycles and Economic importance.
2. Fungi – General Characteristics of Fungi, Criteria for Classification (outline classification, Ainsworth 1966), Cell Structure, Mode of Reproduction, Life Cycle and Economic Importance (In Brief).
3. Lichen – Morphology, Associated members of lichens, types and reproduction; economic importance.
4. Mycorrhiza – General account, types and significance.

(15 Hours)

UNIT - III: Bryophytes and Pteridophytes

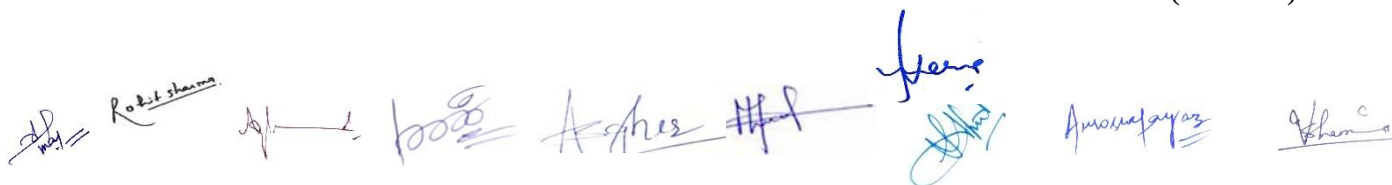
1. Bryophytes- General Characteristics, Criteria for Classification (outline classification, Proskauer's 1957), Thallus Structure.
2. Bryophytes – Alternation of Generation, Mode of Reproduction, Life Cycle, Economic Importance and affinity with Algae.
3. Pteridophytes – General Characteristics, Criteria for Classification (Outline classification Sporne 1965), affinity with bryophytes and alternation of generation.
4. Pteridophytes – Reproduction, life cycle and economic importance.

(15 Hours)

UNIT - IV: Phanerogam Diversity

1. Gymnosperms- General Characteristics diversity and geographical distribution, Outline Classification (Christenhusz et al. 2011), reproduction and life cycle.
2. Gymnosperms – Evolutionary trends in gymnosperms and affinities with pteridophytes and economic Importance.
3. Angiosperms – General Characteristics, Reproduction and life cycle.
4. Angiosperms – Concept of Natural, Artificial and phylogenetic system of classification (Outline) and affinities with gymnosperms.

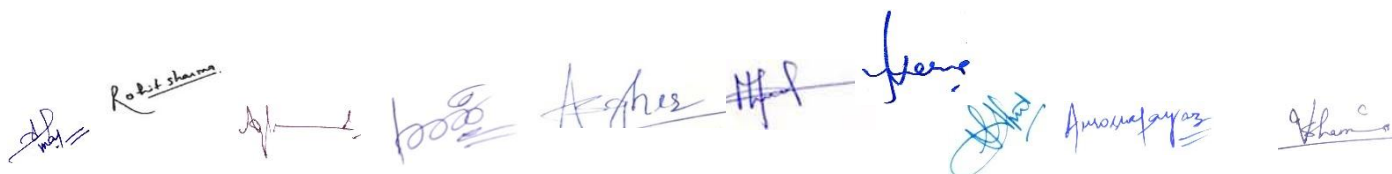
(15 Hours)



Syllabus of B.Sc. Honours (FYUGP) in Botany

References Book

1. Campbell, N. A., and Reece, J. B. (2008.) Biology, 8th edition, Pearson Benjamin Cummings, San Francisco.
2. Evert, RF., and Eichhorn, S.E. (2012). Raven Biology of Plants, 8th edition, W. H. Freeman and Company. New York, NY:
3. Bhatnagar, S.P., and Moitra, A. (1996). Gymnosperms. New Delhi, Delhi: New Age International (P) 3 Ltd Publishers.
4. Kumar, H.D. (1999). Introductory Phycology, 2nd edition. Delhi, Delhi: Affiliated East-West. Press Pvt. Ltd.
5. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi: Tata McGraw-Hill Co.
6. Puri, P. (1985). Bryophytes. New Delhi, Delhi, AtmaRam and Sons.
7. Sethi, K. and Walia, S.K. (2018). Textbook of Fungi and Their Allies. (2nd Edition), Medtech Publishers, Delhi.
8. Vashishta, P.C., Sinha, A.K., and Kumar, A. (2010). Pteridophyta. New Delhi, Delhi: S. Chand & Co Ltd.
9. Singh, G. (2019) Plant Systematics. Integrated Approach. 4th edition. CRC Press, Taylor and Francis Group.
10. Blackmore, S., and Crane, P. (2019) How Plants Work Form, Diversity, Survival, Princeton University Press; Illustrated edition
11. Ingrouille, M., and Eddie, B. (2006) Plants: Evolution and Diversity. Cambridge University Press.
12. Sharma, O.P. (2016). Gymnosperms: Pragati Prakashan Meerut.



Syllabus of B.Sc. Honours (FYUGP) in Botany

Testing and Evaluation:

Examination Pattern shall be as under:

1. **20 marks shall be earmarked for Internal Assessment** (05 Marks for Attendance and 15 Marks for Assessment Test).

2. Scheme for award of marks for attendance:

A.	Attendance of 75-80 %	01 Marks
B.	Attendance of 81-85 %	02 Marks
C.	Attendance of 86-90 %	03 Marks
D.	Attendance of 91-95 %	04 Marks
E.	Attendance of 96-100 %	05 Marks

3. Pattern of Internal Assessment Test of 15 marks:

- a. The test shall comprise of two sections:

i. SECTION-A (Short Answer Type questions)

1. Attempt any five Questions of 02 Marks each out of eight Questions. **(5x2=10 Marks)**

ii. SECTION-B (Long Answer Type questions)

1. Attempt any one Question of 05 Marks out of two Questions. **(1x5=5 Marks)**

4. Pattern of External End-Semester Examination of 80 marks:

- a. The Paper shall comprise of three Sections:

i. SECTION-A (Very short Answer Type Questions)

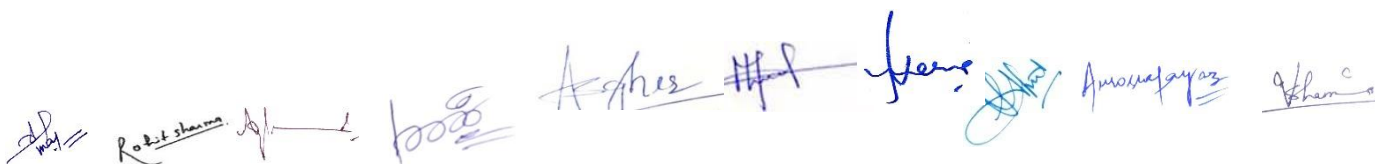
1. 06 questions of 01 mark each. **6x1=6 marks**
2. 05 questions of 02 mark each. **5x2=10 marks**

ii. SECTION-B (Short Answer Type Questions)

1. Total 08 questions (02 Questions from each unit) of 04 marks each.
2. Attempt any one Question from each Unit. **4x4=16 marks**

iii. SECTION-C (Long Answer Type Questions)

1. Total 08 questions (02 Questions from each unit) of 12 marks each.
2. Attempt any one Question from each Unit. **4x12=48 marks**



4D may = Robot Sharma Ap — 2 1000 Aghes 11/1 June 11/1 Amrithapuram Aghes

(30 Hours)

Syllabus of B.Sc. Honours (FYUGP) in Botany

Examination Pattern shall be as under:

1. 25 marks shall be earmarked for Internal Practical Examination

- 05 Marks for Attendance.
- 10 Marks for Practical Test.
- 05 Marks for Project Report.
- 05 Marks for Viva/ Presentation.

2. 25 marks shall be earmarked for External Practical Examination

- 10 Marks for Practical Test.
- 05 Marks for Project Report.
- 05 Marks for Implementation.
- 05 Marks for Viva/ Presentation.

(External Examiner shall be appointed by the Principal of the College).

3. Scheme for award of marks for attendance:

A.	Attendance of 75-80 %	01 Marks
B.	Attendance of 81-85 %	02 Marks
C.	Attendance of 86-90 %	03 Marks
D.	Attendance of 91-95 %	04 Marks
E.	Attendance of 96-100 %	05 Marks

A series of handwritten signatures in blue ink, likely representing the faculty members who approved the syllabus. The signatures are written in a cursive style and are arranged horizontally across the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

Department of Botany

FIRST SEMESTER

Course Title: Microbes and Plant Kingdom

Course Type: MINOR

Course Code: UMIBOTH-121

Course Credits: (04)

Internal Assessment: 20 Marks (1.5 hours)

End Semester Examination: 80 Marks (3 hours)

Total Marks: 100

Course Objectives

1. To familiarize students with the fundamental concepts of microorganisms, their diversity and their significant roles in nature.
2. To develop an understanding of the classification and structural organization of microbes and plants.
3. To study the life cycles, reproduction and economic importance of various plant groups.
4. To build a foundation for advanced studies in microbiology and plant science

Learning Outcomes

1. Understanding the basic characteristics, classification and ecological roles of major groups of microorganisms.
2. Describe the Diversity, structure, reproduction and life cycles of different groups in the plant kingdom. Sheets.

UNIT - I: Microbes

1. Introduction to Microbes and their Economic Importance. Three Kingdom System of Classification and Whittaker's Five kingdom Classification.
2. Viruses - Concept of Viruses, Discovery and Structure of Plants Viruses with Special reference to TMV And Bacteriophage. Concept of Lytic and Lysogenic Cycle.
3. Concept of Viroid, Discovery and Structure with reference to Potato Spindle Tuber Viroid (PSTVD); Prions.
4. Bacteria – Discovery, General Characteristics, Cell ultra structure, asexual Reproduction and Horizontal Gene Transfer (conjugation, transformation and transduction) and Economic Importance.

A series of handwritten signatures in blue ink, likely representing the faculty members involved in the syllabus preparation. The signatures are written in a cursive style and are arranged horizontally across the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

UNIT - II: Algae, Fungi and Lichens Diversity

1. Algae - General Characteristics, Criteria for classification (outline classification, Fritsch 1935), Range of thallus, Reproduction, Types of life cycles and Economic importance.
2. Fungi – General Characteristics, Criteria for Classification (outline classification, Ainsworth 1966), Cell Structure, Mode of reproduction, Life cycle and Economic importance (In Brief).
3. Lichen – Morphology, Associated members of lichens, types and reproduction; Economic importance.
4. Mycorrhiza – General account, types and significance.

(16 Hours)

UNIT - III: Bryophytes and Pteridophytes

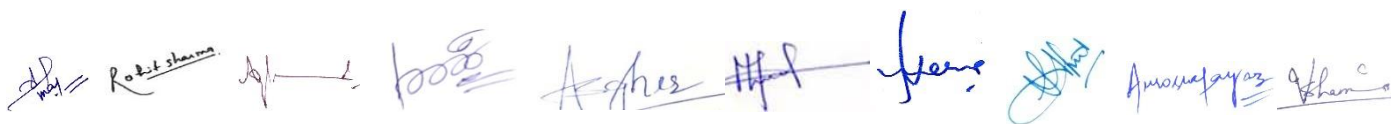
1. Bryophytes- General Characteristics, Criteria for classification (outline classification, Proskauer's 1957), Thallus structure.
2. Bryophytes – Alternation of Generation, Mode of reproduction, Life cycle and Economic importance.
3. Pteridophytes – General Characteristic, Criteria for Classification (Outline classification Sporne 1965), affinity with bryophytes and alternation of generation.
4. Pteridophytes – Reproduction, Life cycle and Economic importance.

(15 Hours)

UNIT - IV: Phanerogam Diversity

1. Gymnosperms- General Characteristics and distribution of Gymnosperms with special reference to Jammu and Kashmir, Outline Classification (Christenhusz et al. 2011), Reproduction and Life cycle.
2. Gymnosperms – Evolutionary trends in gymnosperms and affinities with pteridophytes and Economic Importance.
3. Angiosperms – General Characteristics, Reproduction and Life cycle.
4. Angiosperms – Concept of natural, Artificial and phylogenetic system of classification and affinities with gymnosperms.

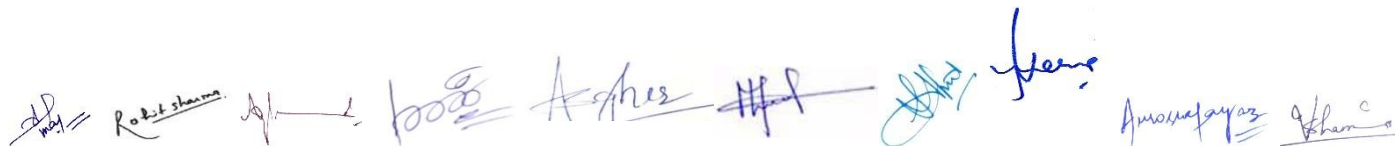
(15 Hours)

A series of handwritten signatures in blue ink, likely representing the faculty members who approved the syllabus. The signatures are written in a cursive style and are arranged horizontally across the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

References Book

1. Campbell, N. A. and Reece, J. B. (2021.) Biology, 12th edition, Pearson Benjamin Cummings, San Francisco.
2. Evert, R.F. and Eichhorn, S.E. (2013). Raven Biology of Plants, 8th edition, W. H. Freeman and Company. New York, NY:
3. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Delhi, Delhi: New Age International (P) 3 Ltd Publishers.
4. Kumar, H.D. (1999). Introductory Phycology, 2nd edition. Delhi, Delhi: Affiliated East-West. Press Pvt. Ltd.
5. Pelczar, M.J. (2001). Microbiology, 5th edition. New Delhi, Delhi: Tata McGraw-Hill Co.
6. Puri, P. (1985). Bryophytes. New Delhi, Delhi, AtmaRam and Sons.
7. Sethi, K. and Walia, S.K. (2018). Textbook of Fungi and Their Allies. (2nd Edition), Medtech Publishers, Delhi.
8. Vashishta, P.C. and Sinha, A.K., Kumar, A. (2010). Pteridophyta. New Delhi, Delhi: S. Chand & Co Ltd.
9. Singh, G. (2019) Plant Systematics. Integrated Approach. 4th edition. CRC Press, Taylor and Francis Group.
10. Blackmore, S. and Crane, P. (2019). How Plants Work Form, Diversity, Survival, Princeton University Press; Illustrated edition
11. Ingrouille, M. and Eddie, B. (2006). Plants: Evolution and Diversity. Cambridge University Press.
12. Sharma, O.P. (2016). Gymnosperms: Pragati Prakashan Meerut.

A row of handwritten signatures in blue ink, likely belonging to faculty members or students involved in the syllabus preparation. The signatures are written in a cursive style and are arranged horizontally across the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

Testing and Evaluation:

Examination Pattern shall be as under:

1. **20 marks shall be earmarked for Internal Assessment** (05 Marks for Attendance and 15 Marks for Assessment Test).

2. Scheme for award of marks for attendance:

A.	Attendance of 75-80 %	01 Marks
B.	Attendance of 81-85 %	02 Marks
C.	Attendance of 86-90 %	03 Marks
D.	Attendance of 91-95 %	04 Marks
E.	Attendance of 96-100 %	05 Marks

3. Pattern of Internal Assessment Test of 15 marks:

- b. The test shall comprise of two sections:

i. SECTION-A (Short Answer Type questions)

1. Attempt any five Questions of 02 Marks each out of eight Questions. **(5x2=10 Marks)**

ii. SECTION-B (Long Answer Type questions)

1. Attempt any one Question of 05 Marks out of two Questions. **(1x5=5 Marks)**

4. Pattern of External End-Semester Examination of 80 marks:

- c. The Paper shall comprise of three Sections:

i. SECTION-A (Very short Answer Type Questions)

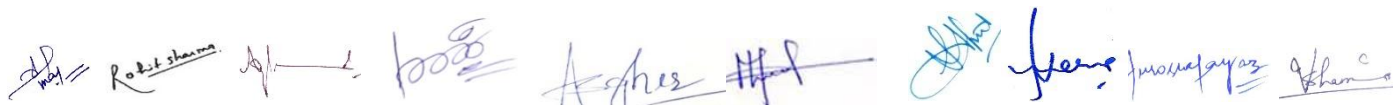
1. 06 questions of 01 mark each. **6x1=6 marks**
2. 05 questions of 02 mark each. **5x2=10 marks**

ii. SECTION-B (Short Answer Type Questions)

1. Total 08 questions (02 Questions from each unit) of 04 marks each.
2. Attempt any one Question from each Unit. **4x4=16 marks**

iii. SECTION-C (Long Answer Type Questions)

1. Total 08 questions (02 Questions from each unit) of 12 marks each.
2. Attempt any one Question from each Unit. **4x12=48 marks**



Syllabus of B.Sc. Honours (FYUGP) in Botany

DEPARTMENT OF BOTANY

FIRST SEMESTER

Course Title: Microbes and Plant

Kingdom Course Type: MINOR

Course Code: UMIBOPR-131

Course Credits: (02)

Internal Practical Examination: 25 Marks

External Practical Examination: 25 Marks

Total Marks: 50

Course Objectives

1. To develop skills in observing and identifying the structure and morphology of microorganisms, algae, fungi, bryophytes, pteridophytes, and gymnosperms through slides, specimens, and models.
2. To understand the diversity and distinguishing features of major plant groups by studying representative genera and their life forms.
3. To gain hands-on experience in preparing temporary mounts and interpreting microscopic structures.
4. To examine reproductive structures such as spores, cones, inflorescences, and fruits across different plant groups.
5. To recognize variations in plant morphology, including leaf venation and adaptations, through direct specimen study.

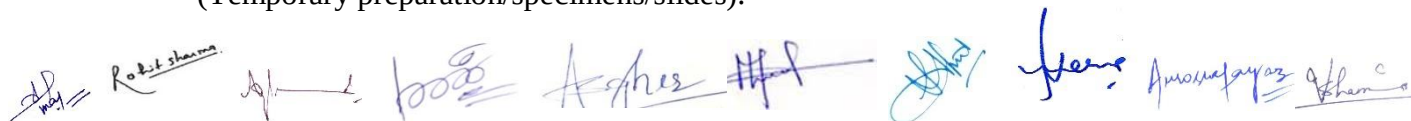
Learning Outcomes

1. Identify and describe the structural features of viruses, algae, fungi, bryophytes, pteridophytes, and gymnosperms using specimens, slides, and models.
2. Prepare and observe temporary mounts, and interpret microscopic details of selected plant materials.
3. Differentiate between major plant groups based on morphology, reproduction, and life cycle characteristics.
4. Recognize and classify variations in leaf venation, inflorescences, and fruits in angiosperms.

UNIT - I

(30 Hours)

1. To study structure of TMV and Bacteriophage (electron micrographs/models).
2. To study morphology of *Volvox*, *Oedogonium*, *Chara*, *Fucus* and *Polysiphonia* (Temporary preparation/specimens/slides).

A series of handwritten signatures in blue ink, likely belonging to the faculty members involved in the syllabus preparation. The signatures are written in a cursive style and are located at the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

3. To study *Rhizopus*, *Penicillium* (Temporary preparations), symptoms of rust of wheat, white rust of crucifer (specimen).
4. To study *Marchantia* (morphology, WM of rhizoids and scales), *Anthoceros* (morphology), *Sphagnum* (morphology, WM of leaf), *Funaria* (morphology WM of rhizoid and leaf).
5. To study *Selaginella* (morphology, WM of strobilus and spores), *Equisetum* (morphology, WM of spores), *Pteris* (morphology of sporangia and spores).

UNIT - II

(30 Hours)

1. To study *Cycas* (morphology, leaf, leaflet anatomy, coralloid root, bulbils, megasporophyll and microsporophyll).
2. *Pinus* (morphology of dwarf shoot, needle anatomy, male and female cones, WM pollen grains).
3. To study variation in leaf venations in dicots and monocots (at least two specimens each).
4. To study the types of inflorescences in angiosperms (through specimens).
5. To study the types of fruits in angiosperms (through specimens).

Examination Pattern shall be as under:

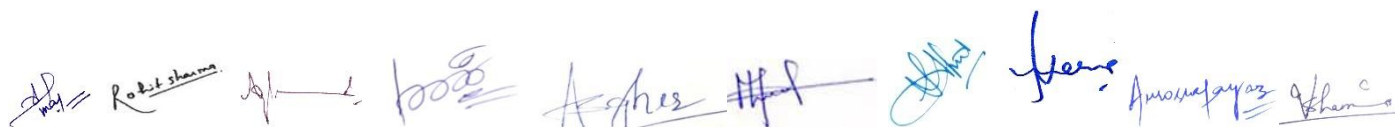
1. 25 marks shall be earmarked for Internal Practical Examination

- a. 05 Marks for Attendance.
- b. 10 Marks for Practical Test.
- c. 05 Marks for Project Report.
- d. 05 Marks for Viva/ Presentation.

2. 25 marks shall be earmarked for External Practical Examination

- a. 10 Marks for Practical Test.
- b. 05 Marks for Project Report.
- c. 05 Marks for Implementation.
- d. 05 Marks for Viva/ Presentation.

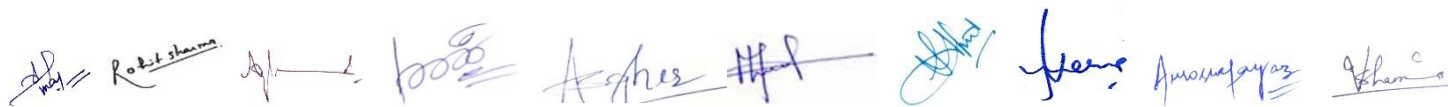
(External Examiner shall be appointed by the principal of the College).



Syllabus of B.Sc. Honours (FYUGP) in Botany

3. Scheme for award of marks for attendance:

A.	Attendance of 75-80 %	01 Marks
B.	Attendance of 81-85 %	02 Marks
C.	Attendance of 86-90 %	03 Marks
D.	Attendance of 91-95 %	04 Marks
E.	Attendance of 96-100 %	05 Marks

A series of handwritten signatures in blue ink, likely representing the faculty members responsible for the syllabus or attendance scheme. The signatures are written in a cursive style and are arranged horizontally.

Syllabus of B.Sc. Honours (FYUGP) in Botany

DEPARTMENT OF BOTANY

FIRST SEMESTER

Course Title: ECONOMIC BOTANY -I

Course Type: MULTIDISCIPLINARY

Course Code: UMDBOTH-141

Course Credits: (03)

Internal Assessment: 15 Marks (1.5 hours)

End Semester Examination: 60 Marks ($2\frac{1}{2}$ hours)

Total Marks: 75

Course Objective: To introduce students to the economic importance of plants, their uses in daily life, and their role in industries, agriculture, and sustainability.

Course outcome: The course will familiarize students to understand the economic importance and diverse uses of plants in daily life, agriculture and industry. The students will gain knowledge of major crop plants, medicinal plants and plant-based resources with their applications.

Unit I: Introduction to Economic Botany

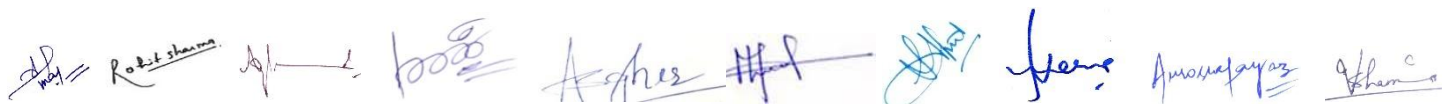
1. Definition, scope and importance of Economic Botany.
2. Relationship between plants and human civilization.
3. Centers of origin of cultivated plants (concept by Nikolai Vavilov).
4. Domestication of crop plants (general account).
5. Forest Resources-Sustainable utilization and development.

Unit II: Important Food Plants

1. Major food crops-Botany and utility of Rice, Wheat and Maize.
2. Pulses (Rajma, Green gram and red lentil)- cultivated in India and food value.
3. Fruits and vegetables- Botany and utility of Apple, Mango, Walnut, Lady finger, Bitter gourd and Turnip.
4. Spices and condiments- Botany and utility of Asafetida, Fennel, Coriander, Cloves, Cardamom, Ginger and Turmeric).
5. Beverages-Botany and utility of tea and coffee.

Unit III: Utilization of Plants

1. Fiber plants-Botany and utility of cotton, jute and flax.
2. Timber and non-wood forest products (general account).
3. Distribution, botany and utility of bamboos and rattans.
4. Oil-yielding plants-Botany and utility of Soybean and mustard.
5. Source and utility of Rubber, gums, resins, and dyes.



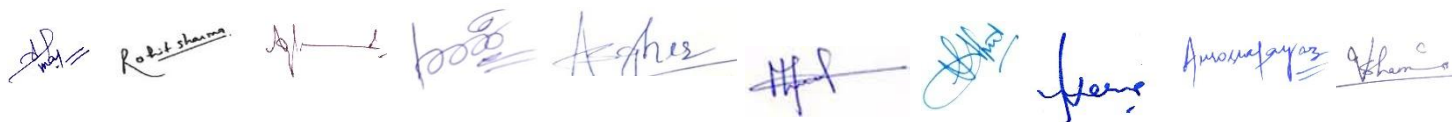
Syllabus of B.Sc. Honours (FYUGP) in Botany

Unit IV: Medicinal and aromatic plants

1. Definition, scope, and importance of medicinal and aromatic plants.
2. Traditional systems of medicine.
3. Concept of natural and synthetic drugs.
4. Root and seeds as sources of drugs.
5. Native important medicinal plants-their distribution and utility.

Suggested Readings:

1. Akeroyd, J. and Jackson, P.W. (1995). *A Handbook of Botanic Garden and Reintroduction of Plants to the Wild*. Botanic Garden Conservation Union, U.K.
2. Chowdhery, H.J. and Murty, S.K. (2000). *Plant Diversity and Conservation in India – An Overview*. Bishen Singh Mahendra Pal Singh, Dehradun.
3. *Directory of Indian Wetlands* (1993). W.W.F. India, New Delhi and AWB, Kuala Lumpur.
4. Gadgil, M. and Guha, R. (1996). *Ecology and Equality: Use and Abuse of Nature in Contemporary India*. Penguin, New Delhi.
5. Heywood, V. (1995). *Global Biodiversity Assessment*. United Nations Environment Programme. Cambridge University Press, Cambridge, U.K.
6. Haunter, M.L. and Gibbs, J. (2007). *Fundamentals of Conservation Biology* (3rd ed.). Blackwell Publishing, U.K.
7. Kochhar, S.L. (2016). *Economic Botany*. Cambridge University Press, p. 680.
8. Kothari, A. (1997). *Understanding Biodiversity: Life Sustainability and Equity*. Orient Longman.

A series of handwritten signatures in blue ink, likely belonging to faculty members, arranged horizontally at the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

DEPARTMENT OF BOTANY

SECOND SEMESTER

**Course Title: Economic Botany and Plant
Conservation**

Course Type: MAJOR

Course Code: UMJBOTH-201

Course Credits: (04)

Internal Assessment: 20 Marks (1.5 hours)

End Semester Examination: 80 Marks (3 hours)

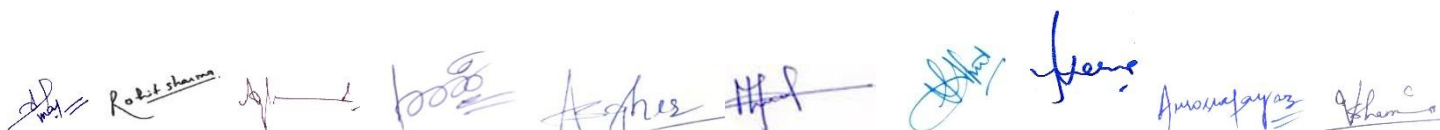
Total Marks: 100

Course Objectives

1. To understand the scope and significance of Economic Botany in relation to human needs and sustainable development.
2. To study the diversity, origin, and economic importance of plants used for food, medicine, fibre, and other resources.
3. To develop knowledge of medicinal and traditional uses of plants, including systems like Ayurveda.
4. To understand biodiversity, threats to plant resources, and the need for conservation.
5. To examine methods of plant conservation and the role of organizations such as International Union for Conservation of Nature (IUCN) in protecting plant diversity.

Learning Outcomes

1. Students will be able to unravel the scope and importance of Economic Botany and its role in human welfare and sustainable development.
2. Students will be able to identify and describe economically important plants and their uses in food, medicine, fibre and industry.
3. Students will be able to analyse traditional plant-based knowledge systems, including Ayurveda and their relevance in modern society to care ailments.
4. Students will be able to evaluate the causes of biodiversity loss and assess strategies for plant conservation towards zero carbon emission.
5. Students will be able to apply knowledge of conservation techniques and understand the role of organizations such as International Union for Conservation of Nature in preserving plant diversity.

A series of handwritten signatures in blue ink, likely belonging to the faculty members involved in the syllabus development or approval.

Syllabus of B.Sc. Honours (FYUGP) in Botany

UNIT - I: Plants and Civilization

1. Origin of agriculture – time and places of origin.
2. Centre of origin and domestication of Cultivated plants; Vavilov's and de Candolle's concept.
3. Forest Resources – Sustainable Utilization and Development.
4. Ethnobotany – role of plants in migratory and settled tribes

(15 Hours)

UNIT - II: Utilization of Plants-I

1. Food Crops: Botany and utility of Wheat, Rice, Maize and Sugarcane.
2. Pulses: Black mung and Rajmash- Distribution, Botany, Cultivation and economic importance.
3. Fiber Crops: Cotton and Jute: Botany, Cultivation, utility and processing.
4. Spices and condiments – Botany and utility of Cumin, Asafetida, Fennel, Coriander, Cloves, Cinnamon, Ginger and Cardamom.

15 Hours)

UNIT - III: Utilization of Plants-II

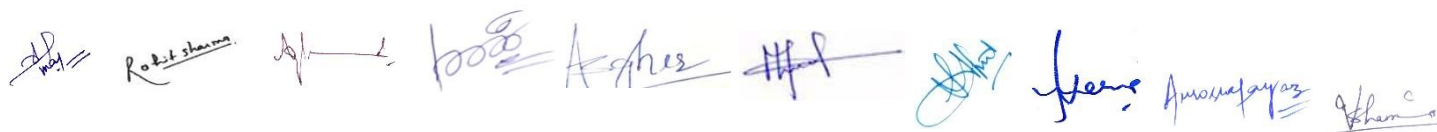
1. Vegetables and Fruits: Botany and utility of Turnip, Bitter guard, Ladyfinger, Apple, Mango, Walnut and Almond.
2. Vegetable oils: Botany and utility of Sunflower and Mustard.
3. Beverages: Distribution, Cultivation and Utility of Tea and Coffee.
4. Medicinal Plants: General account, Major plants derived drugs and their utility; psychoactive drugs from Hemp and poppy and their mode of action in brief.

(15 Hours)

UNIT - IV - Extinction and plant conservation

1. IUCN categories of plants, land races of crops, method of categorization.
2. Plants extinction: Causes and preventive measures.
3. Principles of conservation: in-situ and ex-situ conservation strategies, CBD, international agreement to protect species and habitat.
4. Habitat protection, sacred groves, and indigenous knowledge (IK) for the conservation of plant species.
5. Medicinal plants of J&K.

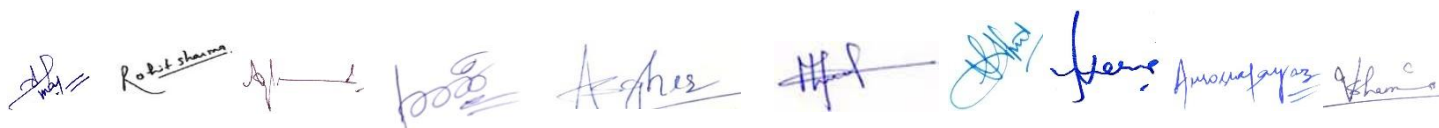
(15 Hours)

A series of handwritten signatures in blue ink, likely representing the faculty members who approved the syllabus. The signatures are written in a cursive style and are arranged horizontally across the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

Suggested readings:

1. Akeroyd, J. and Jackson, P.W. (1995). A Handbook of Botanical Garden and Reintroduction of Plants to the wild. Botanical Garden Conservation Union, UK.
2. Chowdhary, H.J. and Murty, S.K. (2000). Plant Diversity and Conservation in India-an overview. Bishen Singh and Mahendra Pal Singh, Dehradun.
3. Directory of Indian Wetlands (1993). W.W.F. India, New Delhi and AWB, Kuala Lumpur.
4. Gadgil, M. and Guha, R. (1996). Ecology and Equality. Use and Abuse of Nature in Contemporary India, Penguin, New Delhi.
5. Heywood, V. (1995). Global Biodiversity Assessment. United National Environment Programme. Cambridge University Press, Cambridge, U.K.
6. Hunter, M.L and Gibbs, J. (2007). Fundamentals of conservation Biology. 3rd Edn. Blackwell Publishing, U.K.
7. Kochhar, S.L. (2016). Economic Botany, Cambridge University Press, pp 680.
8. Kothari, A. (1997). Understanding Biodiversity: Life Sustainability and Equity. Orient Longman.
9. Meffe, G.K. and Ronald, C.R. (1994). Principal of Conservation Biology. Sinauer Associates. INS publisher, USA.
10. Primack, R.E. (2006). Essentials of Conservation Biology. 4th Edn. Sinauer Associates. INS publisher, USA.
11. Rodgers, N.A. and Panwar, H.S. (1988). Planning of Wildlife Protected Area Network in India. Vol. I. The Report Wildlife Institute of India, Dehradun.
12. Swaminathan, M.S. and Kocchar, S.L. (1989). Plants and Society. MacMillan Publication Ltd., London.
13. Vardhana, R. (2009). Economic Botany. Sarup Book Publishers Pvt, Ltd., New Delhi.
14. Walter, K.S. and Gillet, H.J. (1998). 1997 IUCN Red List of Threatened Plants. IUCN, The World Conservation Union, IUCN Gland. Switzerland and Cambridge, U.K.



Syllabus of B.Sc. Honours (FYUGP) in Botany

Testing and Evaluation:

Examination Pattern shall be as under:

1. 20 marks shall be earmarked for Internal Assessment (05 Marks for Attendance and 15 Marks for Assessment Test).

2. Scheme for award of marks for attendance:

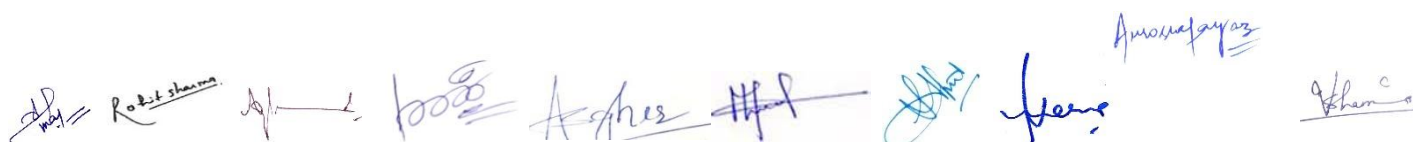
A.	Attendance of 75-80 %	01 Marks
B.	Attendance of 81-85 %	02 Marks
C.	Attendance of 86-90 %	03 Marks
D.	Attendance of 91-95 %	04 Marks
E.	Attendance of 96-100 %	05 Marks

3. Pattern of Internal Assessment Test of 15 marks:

- a. The test shall comprise of two sections:
 - i. **SECTION-A (Short Answer Type questions)**
 1. Attempt any five Questions of 02 Marks each out of eight Questions. **(5x2=10 Marks)**
 - ii. **SECTION-B (Long Answer Type questions)**
 1. Attempt any one Question of 05 Marks out of two Questions. **(1x5=5 Marks)**

4. Pattern of External End-Semester Examination of 80 marks:

- a. The Paper shall comprise of three Sections:
 - i. **SECTION-A (Very short Answer Type Questions)**
 1. 06 questions of 01 mark each. **6x1=6 marks**
 2. 05 questions of 02 mark each. **5x2=10 marks**
 - ii. **SECTION-B (Short Answer Type Questions)**
 1. Total 08 questions (02 Questions from each unit) of 04 marks each.
 2. Attempt any one Question from each Unit. **4x4=16 marks**
 - iii. **SECTION-C (Long Answer Type Questions)**
 1. Total 08 questions (02 Questions from each unit) of 12 marks each.
 2. Attempt any one Question from each Unit. **4x12=48 marks**

A series of handwritten signatures in blue ink at the bottom of the page, likely representing the faculty members involved in the syllabus preparation.

Syllabus of B.Sc. Honours (FYUGP) in Botany

DEPARTMENT OF BOTANY

FIRST SEMESTER

Course Title: Economic Botany and Plant Conservation

Course Type: Major

Course Code: UMJBOPR-211

Course Credits: (02)

Internal Practical Examination: 25 Marks

External Practical Examination: 25 Marks

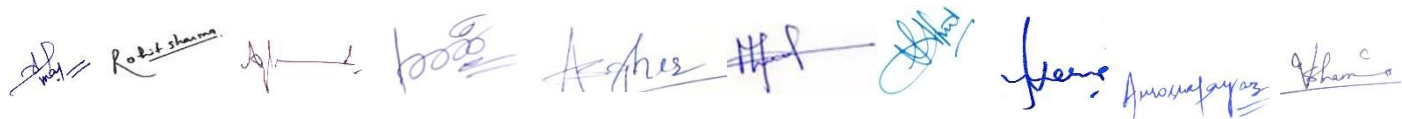
Total Marks: 50

Course Objectives

1. To develop skills in identification of economically important plants based on morphological and diagnostic features.
2. To examine and study plant-derived products such as fibres, oils, spices, and medicinal materials through practical samples.
3. To apply concepts of Economic Botany through hands on experience an extraction from nature.
4. To learn techniques of plant collection and herbarium preparation for proper documentation and preservation.
5. To understand practical aspects of Plant Conservation, including field surveys and basic conservation methods.

Learning Outcomes

1. Identify and classify economically important plants using observable morphological characteristics.
2. Recognize and evaluate plant-based products and explain their economic uses in daily life and industry.
3. Apply knowledge of Economic Botany in analysing plant resources and their utilization.
4. Demonstrate skills in herbarium techniques including collection, preservation, and documentation of plant specimens.
5. Assess basic conservation practices related to Plant Conservation through field observations and practical approaches.



Syllabus of B.Sc. Honours (FYUGP) in Botany

UNIT I

1. Determination of the percentage of conservation value of soil water for herbaceous community.
2. Determination of seed viability of medicinal plants by tetrazolium test and its correlation with threat status.
3. Comparison of the germplasm diversity in economic traits of locally available vegetables.
4. Determination of the percentage of species association using Jaccard's index.
5. Pharmacogenetic details (morphology and utility) of the locally available crude drugs of Indian system of medicine.
6. Determination of the presence of tannins and flavonoids in tea samples locally available in the market.
7. To study the presence of protein bodies in the locally available pulses.

(30 Hours)

UNIT II

1. Preparation of the temporary mount using iodine solution as stain and compare types, shapes, structure and size of starch granules in the locally available plant materials.
2. Determination of the presence of flavonoids, steroids and glycosides in the locally available drugs sample.
3. Preparations of soaps from vegetables oil.
4. Harvesting and processing of fibers from cotton and jute.
5. A field visit to study the role of plants for locally available migratory and settled tribes.
6. A field visit to study medicinal plants focuses on documenting traditional knowledge, identifying species and understanding drugs preparation methods used by indigenous communities.
7. A field visit to study the role of tribal communities in plant conservation (sacred groves, cultural believes, sustainable resources management and ethno-medicinal knowledge).

(30 Hours)



Syllabus of B.Sc. Honours (FYUGP) in Botany
Examination Pattern shall be as under:

1. 25 marks shall be earmarked for Internal Practical Examination

- a. 05 Marks for Attendance.
- b. 10 Marks for Practical Test.
- c. 05 Marks for Project Report.
- d. 05 Marks for Viva/ Presentation.

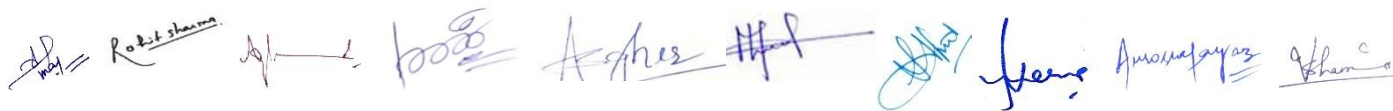
2. 25 marks shall be earmarked for External Practical Examination

- a. 10 Marks for Practical Test.
- b. 05 Marks for Project Report.
- c. 05 Marks for Implementation.
- d. 05 Marks for Viva/ Presentation.

(External Examiner shall be appointed by the principal of the College).

3. Scheme for award of marks for attendance:

A.	Attendance of 75-80 %	01 Marks
B.	Attendance of 81-85 %	02 Marks
C.	Attendance of 86-90 %	03 Marks
D.	Attendance of 91-95 %	04 Marks
E.	Attendance of 96-100 %	05 Marks

A series of handwritten signatures in blue ink, likely representing the faculty members who approved the syllabus. The signatures are written in a cursive style and are arranged horizontally.

Syllabus of B.Sc. Honours (FYUGP) in Botany

DEPARTMENT OF BOTANY

SECOND SEMESTER

**Course Title: Economic Botany and Plant
Conservation**

Course Type: MINOR

Course Code: UMIBOTH-221

Course Credits: (04)

Internal Assessment: 20 Marks (1.5 hours)

End Semester Examination: 80 Marks (3 hours)

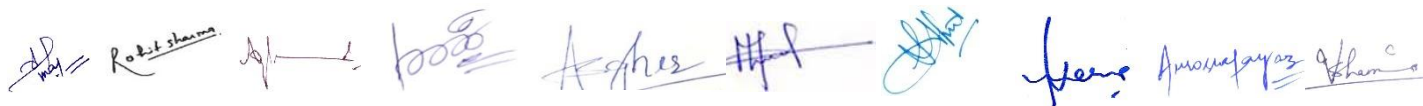
Total Marks: 100

Course Objectives

1. To understand the scope and significance of Economic Botany in relation to human needs and sustainable development.
2. To study the diversity, origin, and economic importance of plants used for food, medicine, fibre, and other resources.
3. To develop knowledge of medicinal and traditional uses of plants, including systems like Ayurveda.
4. To understand biodiversity, threats to plant resources, and the need for conservation.
5. To examine methods of plant conservation and the role of organizations such as International Union for Conservation of Nature in protecting plant diversity.

Learning Outcomes

1. Students will be able to explain the scope and importance of Economic Botany and its role in human welfare and sustainable development.
2. Students will be able to identify and describe economically important plants and their uses in food, medicine, fibre, and industry.
3. Students will be able to analyse traditional plant-based knowledge systems, including Ayurveda, and their relevance in modern society.
4. Students will be able to evaluate the causes of biodiversity loss and assess strategies for plant conservation.
5. Students will be able to apply knowledge of conservation techniques and understand the role of organizations such as International Union for Conservation of Nature in preserving plant diversity.

A series of handwritten signatures in blue ink at the bottom of the page, likely representing the faculty members involved in the syllabus development.

Syllabus of B.Sc. Honours (FYUGP) in Botany

UNIT - I: Plants and Civilization:

1. Origin of agriculture – time and places of origin.
2. Centre of origin and domestication of Cultivated plants; Vavilov's and de Candolle's concept.
3. Forest Resources – Sustainable Utilization and Development.
4. Ethnobotany – role of plants in migratory and settled tribes

(15 Hours)

UNIT - II: Utilization of Plants-I

1. Food Crops: Botany and utility of Wheat, Rice, Maize and Sugarcane.
2. Pulses: Black mung and Rajmash- Distribution, Botany, Cultivation and economic importance.
3. Fiber Crops: Cotton and Jute: Botany, Cultivation, utility and processing.
4. Spices and condiments – Botany and utility of Cumin, Asafetida, Fennel, Coriander, Cloves, Cinnamon, Ginger and Cardamom.

15 Hours)

UNIT - III: Utilization of Plants-II

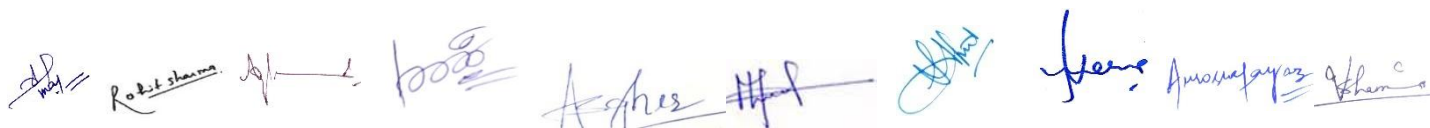
1. Vegetables and Fruits: Botany and utility of Turnip, Bitter guard, Ladyfinger, Apple, Mango and Walnut.
2. Vegetable oils: Botany and utility of Sunflower and Mustard.
3. Beverages: Distribution, Cultivation and Utility of Tea and Coffee.
4. Medicinal Plants: General account, Major plants derived drugs and their utility; psychoactive drugs from Hemp and poppy and their mode of action in brief.

(15 Hours)

UNIT IV - Extinction and plant conservation

1. IUCN categories of plants, land races of crops, method of categorization.
2. Plants extinction: Causes and preventive measures
3. Principles of conservation: in-situ and ex-situ conservation strategies, CBD, international agreement to protect species and habitat.
4. Habitat protection, sacred groves and indigenous knowledge (IK) for the conservation of plant species.

(15 Hours)

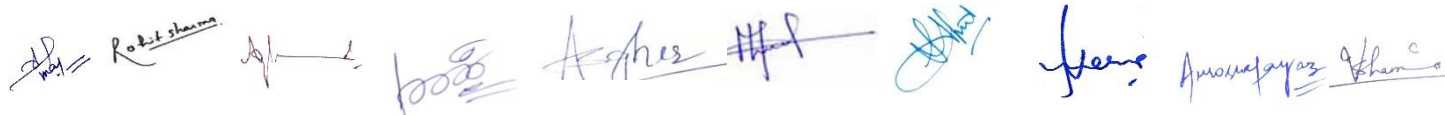


A series of handwritten signatures in blue ink, likely representing the faculty members responsible for the syllabus. The signatures are written in a cursive style and are arranged horizontally across the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

Suggested readings:

1. Akeroyd, J. and Jackson, P.W. (1995). A Handbook of Botanical Garden and Reintroduction of Plants to the wild. Botanical Garden Conservation Union, UK.
2. Chowdhary, H.J and Murty, S.K. (2000). Plant Diversity and Conservation in India-an overview. Bishen Singh and Mahendra Pal Singh, Dehradun.
3. Directory of Indian Wetlands (1993). W.W.F. India, New Delhi and AWB, Kuala Lumpur.
4. Gadgil, M. and Guha, R. (1996). Ecology and Equality. Use and Abuse of Nature in Contemporary India, Penguin, New Delhi.
5. Heywood, V. (1995). Global Biodiversity Assessment. United National Environment Programme. Cambridge University Press, Cambridge, U.K.
6. Hunter, M.L. and Gibbs, J. (2007). Fundamentals of conservation Biology. 3rd Edn. Blackwell Publishing, U.K.
7. Kochhar, S.L. (2016). Economic Botany, Cambridge University Press, pp 680.
8. Kothari, A. (1997). Understanding Biodiversity: Life Sustainability and Equity. Orient Longman.
9. Meffe, G.K. and Ronald, C.R. (1994). Principal of Conservation Biology. Sinauer Associates. INS publisher, USA.
10. Primack, R.E. (2006). Essentials of Conservation Biology. 4th Edn. Sinauer Associates. INS publisher, USA.
11. Rodgers, N.A. and Panwar, H.S. (1988). Planning of Wildlife Protected Area Network in India. Vol. I. The Report Wildlife Institute of India, Dehradun.
12. Swaminathan, M.S. and Kocchar, S.L. (1989). Plants and Society. MacMillan Publication Ltd., London.
13. Vardhana, R. (2009). Economic Botany. Sarup Book Publishers Pvt, Ltd., New Delhi.
14. Walter, K.S. and Gillet, H.J. (1998). 1997 IUCN Red List of Threatened Plants. IUCN, The World Conservation Union, IUCN Gland. Switzerland and Cambridge, U.K.



Syllabus of B.Sc. Honours (FYUGP) in Botany

Testing and Evaluation:

Examination Pattern shall be as under:

1. **20 marks shall be earmarked for Internal Assessment** (05 Marks for Attendance and 15 Marks for Assessment Test).

2. **Scheme for award of marks for attendance:**

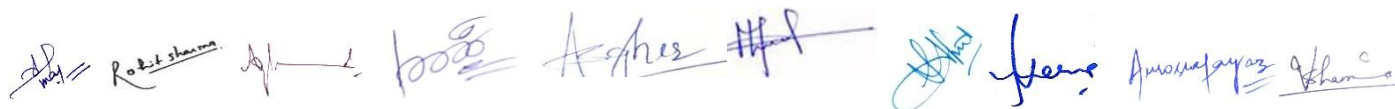
A.	Attendance of 75-80 %	01 Marks
B.	Attendance of 81-85 %	02 Marks
C.	Attendance of 86-90 %	03 Marks
D.	Attendance of 91-95 %	04 Marks
E.	Attendance of 96-100 %	05 Marks

3. **Pattern of Internal Assessment Test of 15 marks:**

- a. The test shall comprise of two sections:
 - i. **SECTION-A (Short Answer Type questions)**
 1. Attempt any five Questions of 02 Marks each out of eight Questions. **(5x2=10 Marks)**
 - ii. **SECTION-B (Long Answer Type questions)**
 1. Attempt any one Question of 05 Marks out of two Questions. **(1x5=5 Marks)**

4. **Pattern of External End-Semester Examination of 80 marks:**

- a. The Paper shall comprise of three Sections:
 - i. **SECTION-A (Very short Answer Type Questions)**
 1. 06 questions of 01 mark each. **6x1=6 marks**
 2. 05 questions of 02 mark each. **5x2=10 marks**
 - ii. **SECTION-B (Short Answer Type Questions)**
 1. Total 08 questions (02 Questions from each unit) of 04 marks each.
 2. Attempt any one Question from each Unit. **4x4=16 marks**
 - iii. **SECTION-C (Long Answer Type Questions)**
 1. Total 08 questions (02 Questions from each unit) of 12 marks each.
 2. Attempt any one Question from each Unit. **4x12=48 marks**



Syllabus of B.Sc. Honours (FYUGP) in Botany

DEPARTMENT OF BOTANY

SECOND SEMESTER

Course Title: Economic Botany and Plant Conservation

Course Type: MINOR

Course Code: UMJBOPR-231

Course Credits: (02)

Internal Practical Examination: 25 Marks

External Practical Examination: 25 Marks

Total Marks: 50

Course Objectives

1. To develop skills in identification of economically important plants based on morphological and diagnostic features.
2. To examine and study plant-derived products such as fibres, oils, spices, and medicinal materials through practical samples.
3. To apply concepts of Economic Botany through hands-on observation and analysis of useful plants.
4. To learn techniques of plant collection and herbarium preparation for proper documentation and preservation.
5. To understand practical aspects of Plant Conservation, including field surveys and basic conservation methods.

Learning Outcomes

1. Identify and classify economically important plants using observable morphological characteristics.
2. Recognize and evaluate plant-based products and explain their economic uses in daily life and industry.
3. Apply knowledge of Economic Botany in analyzing plant resources and their utilization.
4. Demonstrate skills in herbarium techniques including collection, preservation, and documentation of plant specimens.
5. Assess basic conservation practices related to Plant Conservation through field observations and practical approaches.

A series of handwritten signatures in blue ink at the bottom of the page. From left to right, the signatures are: a stylized 'SD', 'Rohit Sharma', a signature that appears to be 'A. K. Singh', 'A. K. Singh' (written more fully), a signature that appears to be 'H. P.', 'H. P.' (written more fully), 'Anurag Kumar', and 'Sharma'.

Syllabus of B.Sc. Honours (FYUGP) in Botany

UNIT I

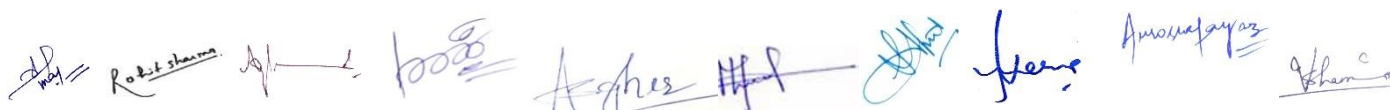
1. Determination of the percentage of conservation value of soil water for herbaceous community.
2. Determination of seed viability of medicinal plants by tetrazolium test and its correlation with threat status.
3. Comparison of the germplasm diversity in economic traits of locally available vegetables.
4. Determination of the percentage of species association using Jaccard's index.
5. Pharmacogenetic details (morphology and utility) of the locally available crude drugs of Indian system of medicine.
6. Determination of the presence of tannins and flavonoids in tea samples locally available in the market.
7. To study the presence of protein bodies in the locally available pulses.

(30 Hours)

UNIT II

1. Preparation of the temporary mount using iodine solution as stain and compare types, shapes, structure and size of starch granules in the locally available plant materials.
2. Determination of the presence of flavonoids, steroids and glycosides in the locally available drugs sample.
3. Preparations of soaps from vegetables oil.
4. Harvesting and processing of fibers from cotton and jute.
5. A field visit to study the role of plants for locally available migratory and settled tribes.
6. A field visit to study medicinal plants focuses on documenting traditional knowledge, identifying species and understanding drugs preparation methods used by indigenous communities.
7. A field visit to study the role of tribal communities in plant conservation (sacred groves, cultural believes, sustainable resources management and ethno-medicinal knowledge).

(30 Hours)

A series of handwritten signatures in blue ink, likely representing the faculty members who approved the syllabus. The signatures are written in a cursive style and are arranged horizontally across the bottom of the page.

Syllabus of B.Sc. Honours (FYUGP) in Botany

Testing and Evaluation:

Examination Pattern shall be as under:

1. 15 marks shall be earmarked for Internal Assessment (05 Marks for Attendance and 10 Marks for Assessment Test).

2. Scheme for award of marks for attendance:

A.	Attendance of 75-80 %	01 Marks
B.	Attendance of 81-85 %	02 Marks
C.	Attendance of 86-90 %	03 Marks
D.	Attendance of 91-95 %	04 Marks
E.	Attendance of 96-100 %	05 Marks

3. Pattern of Internal Assessment Test of 10 marks:

- a. The test shall comprise of two sections:

i. SECTION-A (Short Answer Type questions)

1. Attempt any four Questions of $1\frac{1}{2}$ Marks each out of Six Questions. ($4 \times 1\frac{1}{2} = 06$ Marks)

ii. SECTION-B (Long Answer Type questions)

1. Attempt any one Question of 04 Marks out of two Questions. ($1 \times 4 = 4$ Marks)

4. Pattern of External End-Semester Examination of 60 marks:

- a. The Paper shall comprise of two Sections:

i. SECTION-A (Short Answer Type Questions)

1. 04 questions having one Question from each Unit of 03 marks. $4 \times 3 = 12$ marks

ii. SECTION-B (Long Answer Type Questions)

1. Total 08 questions having 02 Questions from each unit of 12 marks.
2. Attempt any one Question from each Unit. $4 \times 12 = 48$ marks

[Handwritten signatures and marks at the bottom of the page]

Syllabus of B.Sc. Honours (FYUGP) in Botany

DEPARTMENT OF BOTANY

Course Title: ECONOMIC BOTANY

Course Type: MULTIDISCIPLINARY

SECOND SEMESTER

Course Code: UMDBOTH-241

Course Credits: (03)

Internal Assessment: 15 Marks (1 hour)

End Semester Examination: 60 Marks (2: 30 hours)

Total Marks: 75

Course Objective: To deepen students' understanding of plant-based resources, their industrial applications, conservation strategies, and emerging trends like biotechnology and sustainable utilization.

Course outcome: The course will familiarize students to understand the economic importance and diverse uses of plants in daily life, agriculture, and industry. The students will gain knowledge of major crop plants medicinal plants and plant-based resources with their applications. They will develop awareness of sustainable utilization, conservation of plant resources and modern plant-based technologies.

Unit I: Crop production and management

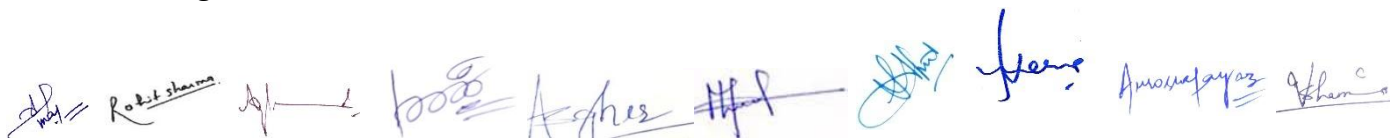
1. Crop improvement: Methods-selection and hybridization.
2. Plant breeding techniques-Traditional and modern approaches (in brief).
3. Major cash crops: Botany and utility of Sugarcane, Cotton, Tea and Coffee.
4. Agricultural practices in India-Cropping patterns, irrigation, fertilizers and sustainable agriculture

Unit II: Industrial and Commercial plant products

1. Industrial uses of plants-Paper, textile and pharmaceutical industries.
2. Essential oils - Sources and uses.
3. Tannins and dyes-Sources and industrial applications.
4. Fermentation products-Alcohol, vinegar and antibiotics (general account)
5. Biofuels -Ethanol and biodiesel (concept and sources)

Unit III: Plant Resources and Conservation

1. Biodiversity its types and importance.
2. In-situ and ex-situ conservation methods.
3. Threatened plants: Causes and protection measures.
4. Role of plants in environmental protection: Carbon sequestration and climate regulation.



Syllabus of B.Sc. Honours (FYUGP) in Botany

Unit IV: Applied Economic Botany

1. Ethnobotany- Study of traditional knowledge and plant use by indigenous people.
2. Genetically Modified crops and applications.
3. Herbal drugs (general account their uses).
4. Post-harvest technology-Storage and preservation.
5. Entrepreneurship in plant-based industries – Small - scale industries: medicinal plants, floriculture and nursery management.

Suggested Readings:

1. Akeroyd, J. and Jackson, P.W. (1995). *A Handbook of Botanic Garden and Reintroduction of Plants to the Wild*. Botanic Garden Conservation Union, U.K.
2. Chowdhary, H.J. and Murty, S.K. (2000). *Plant Diversity and Conservation in India – An Overview*. Bishen Singh Mahendra Pal Singh, Dehradun.
3. *Directory of Indian Wetlands* (1993). W.W.F. India, New Delhi and AWB, Kuala Lumpur.
4. Gadgil, M. and Guha, R. (1996). *Ecology and Equality: Use and Abuse of Nature in Contemporary India*. Penguin, New Delhi.
5. Heywood, V. (1995). *Global Biodiversity Assessment*. United Nations Environment Programme. Cambridge University Press, Cambridge, U.K.
6. Haunter, M.L. and Gibbs, J. (2007). *Fundamentals of Conservation Biology* (3rd ed.). Blackwell Publishing, U.K.
7. Kochhar, S.L. (2016). *Economic Botany*. Cambridge University Press, p. 680.
8. Kothari, A. (1997). *Understanding Biodiversity: Life Sustainability and Equity*. Orient Longman.

