# UNIVERSITY OF JAMMU

(NAAC ACCREDITED 'A' GRADE' UNIVERSITY)
(Baba Sahib Ambedkar Road, Jammu-180006 (J&K)

*Academic Section*
*Email: academicsectionju14@gmail.com*


## NOTIFICATION

**(24/January/Adp./101)**

It is hereby notified for the information of all concerned that the Vice-Chancellor, in anticipation of the approval of the Academic Council, is pleased to authorize the adoption of the Syllabi and Courses of Studies in the subject of **Botany** of Semester **Vth, VIth,VIIth and VIIIth for Four Year Under Graduate Programme (FYUGP)** under the **Choice Based Credit System** as per **NEP-2020 (as given in the annexure)** for the examinations to be held in the years as per the details given below:

| **Subject** | **Semester** | **For the examinations to be held in the year** |
|---|---|---|
| **Botany** | Semester-V | December 2024, 2025 and 2026 |
| | Semester-VI | May 2025, 2026 and 2027 |
| | Semester-VII | December 2025, 2026 and 2027 |
| | Semester-VIII | May 2026, 2027 and 2028 |

**The Syllabi of the courses are also available on the University website: www.jammuuniversity.ac.in.**

**Sd/-**
**DEAN ACADEMIC AFFAIRS**

**No. F. Acd/II/24/13698-13739**
**Dated:** 1/2/2024

**Copy for information and necessary action to:**

1. Dean Faculty of Life-Science
2. HOD/Convener, Board of Studies **Botany**
3. Sr. P.A.to the Controller of Examinations
4. All members of the Board of Studies
5. Confidential Assistant to the Controller of Examinations
6. Director, Computer Centre, University of Jammu
7. Deputy Registrar/Asstt. Registrar (Conf. /Exams. UG )
8. Incharge University Website for necessary action please

Sumita Sharma 1/2/24

**Deputy Registrar (Academic)**

31/1/24 Today 31/01/24

# DEPARTMENT OF BOTANY

## UNIVERSITY OF JAMMU

**CURRICULUM FRAMEWORK FOR**

**FOUR-YEAR UNDER GRADUATE (FYUG) PROGRAM IN BOTANY**

UNDER **CBCS**

AS PER

**National Education Policy–2020**

**WITH EFFECT FROM THE ACADEMIC YEAR 2024–25**

Approved By:

Board of Studies in Botany

## DEPARTMENT OF BOTANY, UNIVERSITY OF JAMMU, JAMMU

Following courses of study are prescribed for

**5th to 8th semesters**

**FYUG** program in the subject of **BOTANY**

under **CBCS** as per **NEP-2020**

| SEMESTER | TYPE OF THE COURSE | TITLE OF THE COURSE | COURSE NO. | CREDITS (T-Teaching P-Practical) |
|---|---|---|---|---|
| FIFTH | MAJOR | PLANT PHYSIOLOGY | UMJBOT501 | 4 (3T+1P) |
| | MAJOR | PLANT BIOCHEMISTRY AND METABOLISM | UMJBOT502 | 4 (3T+1P) |
| | MAJOR | REPRODUCTION IN FLOWERING PLANTS | UMJBOT503 | 4 (3T+1P) |
| | MAJOR | BIOSTATISTICS | UMJBOT504 | 2 (1T+1P) |
| | MINOR | PLANT REPRODUCTION | UMIBOT505 | 4 (3T+1P) |
| | SKILL ENHANCEMENT | SUMMER INTERNSHIP | USEBOT506 | 2 (P) |
| SIXTH | MAJOR | GENETICS AND CYTOGENETICS | UMJBOT601 | 4 (3T+1P) |
| | MAJOR | PLANT BREEDING | UMJBOT602 | 4 (3T+1P) |
| | MAJOR | SYSTEMATICS AND EVOLUTIONARY BIOLOGY | UMJBOT603 | 4 (3T+1P) |
| | MAJOR | PLANT BIOTECHNOLOGY AND TISSUE CILTURE | UMJBOT604 | 4 (3T+1P) |
| | MINOR | CYTOGENETICS | UMIBOT605 | 4 (3T+1P) |
| SEVENTH | MAJOR | RESEARCH METHODOLOGY AND RESEARCH ETHICS | UMJBOT701 | 4 (3T+1P) |
| | MAJOR | APPLIED MICROBIOLOGY AND PLANT PHYSIOLOGY | UMJBOT702 | 4 (3T+1P) |
| | MAJOR | APPLED BOTANY | UMJBOT703 | 4 (3T+1P) |
| | MAJOR | ETHNOBOTANY AND TRADITIONAL KNOWLEDGE | UMJBOT704 | 4 (3T+1P) |
| | MINOR | ETHNOBOTANY | UMIBOT705 | 4 (3T+1P) |
| EIGHTH (4YR UG HONOURS) | MAJOR | BIOLOGICAL TECHNIQUES AND INSTRUMENTATION | UMJBOT801 | 4 (3T+1P) |
| | MAJOR | LATEST DEVELOPMENTS IN PLANT AND MICROBIAL SCIENCES | UMJBOT802 | 4 (3T+1P) |
| | MAJOR | BIOINFORMATICS | UMJBOT803 | 4 (3T+1P) |
| | MAJOR | CONSERVATION AND SUSTAINABILITY | UMJBOT804 | 4 (3T+1P) |
| | MINOR | SUSTAINABLE CONSERVATION | UMIBOT805 | 4 (3T+1P) |
| EIGHTH (4YR UG HONOURS WITH RESEARCH) | MAJOR | CONSERVATION FOR SUSTAINABILITY | UMJBOT806 | 4 (3T+1P) |
| | MINOR | SUSTAINABLE CONSERVATION OF NATURE | UMIBOT807 | 4 (3T+1P) |
| | SKILL ENHANCEMENT | RESEARCH PROJECT/ DISSERTATION | USEBOT808 | 12 (P) |

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

# PLANT PHYSIOLOGY
(MAJOR COURSE)

**Course No. UMJBOT501** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration | (hours) | Weightage | (Marks) |
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P. A- Daily Performance and Attendance**

*Objectives*:

*This course is designed to educate students about the concepts and the mechanisms underlying the uptake and translocation of water, minerals and nutrients to different plant parts. Additionally, the course will focus on physiological roles of various hormones and light responsive pigments in plant morphogenesis.*

*Course Learning Outcomes:*

*On completion of the course, the students will be able to understand and learn the principles and mechanisms behind the various physiological processes operative in the plants. They will be able to analyze the roles played by different plant hormones, signaling compounds and stress responses in plants to achieve desired morphological and physiological effects.*

**Unit-I: Water relations in plants**

1.1 Diffusion of water, osmosis, water potential, plasmolysis, imbibition.

1.2 Absorption and transport of water through xylem, water absorption by roots, pathways of water movement, symplast, apoplast, guttation.

1.3 Ascent of sap: root pressure and cohesion-tension theory .

1.4 Types and mechanism of transpiration; mechanism of opening and closing of stomata, anti- transpirants.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

## PLANT PHYSIOLOGY
(MAJOR COURSE)

**Course No. UMJBOT501** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Mineral nutrition and phloem translocation**

2.1 Concept of macro-and micro-elements and mineral uptake; Importance of Ca, N, P, K, Mg to the plants and their deficiency symptoms.

2.2 Transport of ions across cell membrane, active and passive transport, carriers, channels and pumps.

2.3 Translocation in phloem; composition of phloem sap; girdling experiment, pressure flow model, phloem loading and unloading.

2.4 Source-Sink relationship, factors affecting phloem translocation.

**Unit-III: Physiology of growth**

3.1 Plant growth and development - phases and kinetics of growth.

3.2 Seed dormancy and germination - general account, factors affecting seed dormancy and germination, methods of breaking seed dormancy.

3.3 Plant growth regulators (PGRs) - auxins, gibberellins, cytokinins, abscissic acid and ethylene, their role and mode of action.

3.4 General account of brassinosteroids and polyamines.

**Unit-IV: Photomorphogenesis**

4.1 Physiology of flowering – concept of photoperiodism; classification of plants according to photoperiodic response

4.2 Perception of photoperiodic stimulus, critical day length, concept of scotobiology.

4.3 Phytochromes - their discovery, physiological role and mechanism of action.

4.4 Vernalisation- role of low temperature in flowering; concept of biological clock and biorhythm.

**Unit-V: Practicals**

5.1 Comparison of the rate of respiration in germinating seeds.

5.2 Determination of the osmotic potential of vacuolar sap by plasmolytic method.

5.3 Determination of water potential and osmosis in potato tubers by weight method.

5.4 Demonstration of rate of transpiration by cobalt chloride method.

5.5 Demonstration of stomatal movements.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

## PLANT PHYSIOLOGY
(MAJOR COURSE)

**Course No. UMJBOT501** **Max. Marks: 100 (Theory-75, Practical-25)**

5.6 Demonstration of plasmolysis and deplasmolysis.

5.7 Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of mesophytes and xerophytes.

5.8 Study of the effect of wind velocity and light on the rate of transpiration in excised twig/leaf.

5.9 Study the phenomenon of seed germination (effect of light).

5.10 Study the effect of different concentrations of IAA on *Avena* coleoptile elongation (IAA Bioassay).

5.11 Measurement of cuticular resistance to transpiration.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (one from each unit i.e.. Units I to IV). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment Test (Total Marks: 15; syllabus to be covered: up to 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group in addition to theory classes.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

## PLANT PHYSIOLOGY
(MAJOR COURSE)

**Course No. UMJBOT501** **Max. Marks: 100 (Theory-75, Practical-25)**

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** | |
| | Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested Readings**


1. Sahoo, A. C. (2018). Outlines of Plant Physiology Kalyani Publishers, New Delhi.
2. Srivastava, N. K. (2017). Plant Physiology, Rastogi Publications, Meerut.
3. Sinha. R. K. (2015). Modern Plant Physiology, Narosa Publishing House, New Delhi.
4. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
5. Pandey and Sinha (2011). Plant Physiology, Vikash Publishing House, New Delhi
6. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U. S.A. 4th edition.
7. Bajracharya D. (1999). Experiments in Plant Physiology-A Laboratory Manual. Narosa Publishing House, New Delhi.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)
## PLANT BIOCHEMISTRY AND METABOLISM
(MAJOR COURSE)

**Course No. UMJBOT502** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration | (hours) | Weightage | (Marks) |
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P. A- Daily Performance and Attendance**

*Objectives:*

*This course is designed to educate students about the classification and structure of enzymes and regulation of their activity. It also covers the classification and functions of biomolecules such as carbohydrates, amino acids, proteins, and lipids, the photochemical and biochemical mechanisms for photosynthetic carbon fixation, the mechanism of carbon oxidation and ATP synthesis. Additionally, it delves into the physiological and biochemical mechanisms of nitrogen assimilation.*

*Course Learning Outcomes:*

*The students will be able to understand and learn the importance of biochemical pathways and their regulatory mechanisms. They will develop a comprehensive understanding of various carbon fixation and nitrogen assimilation pathways.*

**Unit-I: Enzymes and their role**

1.1 Discovery and nomenclature of enzymes. Classification of enzymes.

1.2 Structure of enzymes: holoenzyme, apoenzyme, cofactors, coenzymes and prosthetic group.

1.3 Regulation of enzyme activity; mechanism of enzyme action: activation energy, lock and key hypothesis, induced - fit theory

1.4 Michaelis – Menten equation, enzyme inhibition and factors affecting enzyme activity

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)
## PLANT BIOCHEMISTRY AND METABOLISM
(MAJOR COURSE)

**Course No. UMJBOT502** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Biomolecules**

2.1 Carbohydrates: Definition, functions and classification; Components and functions of oligosaccharides and polysaccharides

2.2 Structure, composition and functions of proteins: amino acids, peptide bond.

2.3 Physical properties of proteins, organization of proteins into primary, secondary, tertiary and quaternary structures.

2.4 Lipids: Introduction, classification, properties of Fatty acids, Saturated and unsaturated fatty acids, brief account of simple and mixed Triacylglycerol

**Unit-III: Photosynthesis and Respiration**

3.1 Photosynthesis – a general account of photosynthetic pigments, red drop and enhancement effect; concept of photosystems, PSI and PSII; cyclic and non- cyclic photophosphorylation.

3.2 Carbon fixation- Calvin cycle, C4, crassulacean acid metabolism and photorespiratory pathways and their significance.

3.3 Respiration- glycolytic pathway, Kreb's cycle, pentose phosphate pathway.

3.4 Electron transport mechanism and oxidative phosphorylation, mechanism of synthesis of ATP (Chemi-osmotic theory).

**Unit-IV: Nitrogen fixation, secondary metabolism and abiotic stress**

4.1 Biological nitrogen fixation-symbiotic and asymbiotic nitrogen fixation; nitrate and ammonium assimilation.

4.2 Biosynthesis and functions of phospholipids; β-oxidation pathway.

4.3 Secondary metabolism, concept and role; phenylpropanoid pathway, shikimic acid pathway.

4.4 Abiotic stress – types of and physiological responses to stresses (drought, heavy metal, pH and salinity); reactive oxygen species (production and management).

**Unit-V: Practicals**

5.1 To prepare the standard curve of protein and determine the protein content in unknown samples by Lowry's method.

5.2 To study the enzyme activity of catalase and peroxidase as influenced by pH and

## PLANT BIOCHEMISTRY AND METABOLISM

(MAJOR COURSE)

Course No. UMJBOT502 Max. Marks: 100 (Theory-75, Practical-25)

temperature.

5.3 To study the effect of temperature on permeability of plasma membrane.

5.4 To study the permeability of plasma membrane using different concentrations of organic solvents

5.5 Separation of chloroplast pigments by solvent partitioning/paper chromatography/TLC methods.

5.6 Separation of amino acids in a mixture by paper chromatography and their identification by comparison with standards.

5.7 Qualitative tests for carbohydrates, amino acids and lipids.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (one from each unit i.e., Units I to IV). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment Test (Total Marks: 15; syllabus to be covered: up to 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group in addition to theory classes.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)
## PLANT BIOCHEMISTRY AND METABOLISM
(MAJOR COURSE)

**Course No. UMJBOT502** **Max. Marks: 100 (Theory-75, Practical-25)**

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** | |
| | Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested Readings**


1. Sahoo, A. C. (2018). Outlines of Plant Metabolism, Kalyani Publishers, New Delhi.
2. Taiz, L., Zeiger, E., MØller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.
3. Hopkins, W.G. and Huner, A. (2008). Introduction to Plant Physiology. John Wiley and Sons. U.S.A. 4th edition.
4. Buchanan, B.B., Gruissen, W. and James, R.L. 2000. Biochemistry and MolecularBiology of Plants. I.K. International Pvt. Ltd. New Delhi.
5. Galston, A.W. 1989. Life Process in Plants. Scientific American Library,Springer-Verlag ,New York, USA.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

# REPRODUCTION IN FLOWERING PLANTS
(MAJOR COURSE)

**Course No. UMJBOT503** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination Duration (hours) | | Weightage (Marks) | |
|---|---|---|---|---|---|---|---|
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P. A- Daily Performance and Attendance**

*Objectives:*

*The course has been framed to acquaint the students with various structures associated with the reproductive system of plant body. This will help them to correlate important functions performed by different floral organs and their importance for mankind.*

*Course Learning Outcomes:*

*Proper knowledge regarding plant reproduction, mechanisms of multiplication and their underlying genetic basis will enable students to understand natural diversity in better way. This course will also create awareness among students about proper utilization of important floral parts and to manipulate these for better human utility.*

**Unit-I: Reproductive modes and flower development**

1.1 Types of reproduction in flowering plants; natural and artificial means of vegetative propagation.

1.2 Flower as unit of sexual reproduction; a general account of sex expression (monoecy, dioecy and hermaphroditism).

1.3 Structure of anther, microsporogenesis and male gametophyte.

1.4 Structure of pistil, types of ovules, megasporogenesis and female gametophyte-monosporic, bisporic and tetrasporic.

**Unit-II: Pollination and fertilization**

2.1 Pollination: Types and agents; biotic and abiotic.

2.2 Pollen-pistil interaction; general concept and role of pollen kit substances and stigmatic exudates.

2.3 Details of double fertilization; brief concept of in-vitro fertilization.

2.4 Self-incompatibility: types, mechanism and genetic control.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

## REPRODUCTION IN FLOWERING PLANTS
(MAJOR COURSE)

**Course No. UMJBOT503** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-III: Post fertilization events**

3.1 Embryo: Types and functions; structure and development of monocot and dicot embryos; embryo structure in family Poaceae.
3.2 Suspensor: Structure, development, functions and types; suspensor haustoria.
3.3 Endosperm: Types, development and functions.
3.4 Apomixis and Polyembryony: Definition and types.

**Unit- IV: Fruits and Seeds**

4.1 Fruit: Types and formation; ripening; brief account of biochemical changes.
4.2 Seed formation: Structure of dicot and monocot seeds; classification according to storage tissue, major storage biochemicals.
4.3 Seed dispersal: Agents, adaptations and mechanisms.
4.4 Seed germination: Types and mechanism, mobilization of food products during germination.

**UNIT- V: Practicals**

5.1 Examination of wide range of flowers available in the locality and methods of their pollination.
5.2 Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts).
5.3 Pollen viability using in vitro pollen germination.
5.4 Study of pollen and stigma types
5.5 Ovule types and structure.
5.7 Study of heteromorphic self-incompatibility.
5.8 Study endosperm and embryo development in monocots and dicots (using slides and dissections).
5.9 Field visits to Botanical Garden, Natural habitat and Industries.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

## REPRODUCTION IN FLOWERING PLANTS
(MAJOR COURSE)

**Course No. UMJBOT503** **Max. Marks: 100 (Theory-75, Practical-25)**

questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** | |
| | Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested Readings**


1. Bhojwani, S. S., Bhatnagar, S. P. and Dantu, P. K. (2018). The embryology of angiosperms. 6th ed. Vikas Publishing House, Noida.
2. Ramawat, K. G. et al. (2014). Reproductive biology of plants. CRC Press, Boca Raton.
3. Bradford, K. J. and Nonogaki, W eds. (2007). Seed development, dormancy and germination. Blackwell Publications, Oxford.
4. Raghvan, V. (2006). Double fertilization. Springer Verlag, Berlin-Heidelberg.
5. Bhojwani, S. S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. 4th Edn. Vikas Publishing House, Delhi.
6. Raghavan, V. (1999). Developmental Biology of Flowering Plants. Springer- Verlag, New York
7. Bewley, J.D. and Black, M. (1994). Seeds-Physiology of Development and Germination. Plenum Press, New York.
8. Raghavan, V. (1997). Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridg.
9. Proctor, M. and Yeo, P. (1973). The Pollination of Flowers. William Collins Sons, London.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

# BIOSTATISTICS
## (MAJOR COURSE)

**Course No. UMJBOT504** **Max. Marks: 50 (Theory-40, Practical-10)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration | (hours) | Weightage | (Marks) |
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 02 | 20 | I to II | 1 | 02 | 10 | 30 |
| Practical | 01 | 10 | III | D.P.A | 1 | 5 | 5 |

**D.P. A- Daily Performance and Attendance**

*Objectives:*

*The course is designed to educate the students about the sampling methods, collection and interpretation of data related to biological problems. They will also learn to represent the data graphically. An introduction to probability distribution and correlation will help them to understand their importance in predictive analysis and the relationship of one variable with the other respectively.*

*Course Learning Outcomes:*

*Students will be able to understand and design biological experiments, analyze and interpret the data.*

### Unit-I: Basics of Biostatistics and Descriptive statistics

1.1 Conceptual understanding of statistics, statistical methods and basic principles.
1.2 Variables -measurements, functions, limitations and uses of statistics.
1.3 Measures of central tendency: mean, median and mode, merits and demerits.
1.4 Measures of dispersion: range, quartile deviation, mean deviation, standard deviation, standard error and coefficient of variation.

### Unit-II: Relational Statistics

2.1 Introduction to probability distributions; concept of normal distribution.
2.2 Tests of significance: methods of computation and applications of chi square and t-tests.
2.3 Correlation: concept, types and methods.
2.4 Regression: application, similarities and dissimilarities with correlation.

### Unit-III: Practicals

3.1 Tabulation of secondary data, and construction of histograms and frequency polygons
3.2 Calculation of mean, mode, median, standard deviation and coefficient of variation.
3.3 Applications of t-test and chi square test.
3.4 Correlation and regression analysis.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

## BIOSTATISTICS
(MAJOR COURSE)

**Course No. UMJBOT504** **Max. Marks: 50 (Theory-40, Practical-10)**

**Note for paper setters**

**End Semester University Examination (Total Marks: 30; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having two questions of 3 marks each and spread over the entire theory syllabus (i.e. Units I & II; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have four long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid semester Assessment (Total Marks: 10; syllabus to be covered upto: 50%)**

Ten (10) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 6 marks and two short answer type questions of 2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit III)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 5)** | |
| | Daily performance based on practical work done and attendance | 5 |
| II. | **External Assessment (Total Marks: 5)** | |
| | External practical examination and Viva-voce | 5 |

**Suggested readings:**


1. Khan and Khanum. (2018). Fundamentals of Biostatistics. 5th rev ed. Ukaaz Publications, Hyderabad.
2. Norman, G. R. and Streiner, D. L. (2008) Biostatistics-the Bare Essentials. B C Decker Inc., Hamilton, Canada.
3. Sokal, R. R. and Rohlf, F. J. (2001) Biometry-The Principles and Practice of Statistics in Biological Research. W. H. Freeman and Company, New York.
4. Senedecor, G. and Cochran, W. (1980) Statistical Methods. 7th Edn. Iowa State University Press.
5. Sokal, R. R. and Rohlf, F. J. (1973). An Introduction to Biostatistics. W. H. Freeman and Company, New York. 19.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

# PLANT REPRODUCTION
(MINOR COURSE)

Course No. UMIBOT505 Max. Marks: 100 (Theory-75, Practical-25)

| | Credits | Contact Hours | Units | Examination Duration (hours) | | Examination Weightage (Marks) | |
|---|---|---|---|---|---|---|---|
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

D.P., A- Daily Performance and Attendance

*Objectives:*

*The course has been framed to acquaint the students with various structures associated with the reproductive system of plant body. This will help them to correlate important functions performed by different floral organs and their importance for mankind.*

*Course Learning Outcomes:*

*Proper knowledge regarding plant reproduction, mechanisms of multiplication and their underlying genetic basis will enable students to understand natural diversity in better way. This course will also create awareness among students about proper utilization of important floral parts and to manipulate these for better human utility.*

**Unit-I: Reproductive modes and flower development**

1.1 Types of reproduction in flowering plants; natural and artificial means of vegetative propagation.

1.2 Flower as unit of sexual reproduction; a general account of sex expression (monoecy, dioecy and hermaphroditism).

1.3 Structure of anther, microsporogenesis and male gametophyte.

1.4 Structure of pistil, types of ovules, megasporogenesis and female gametophyte-monosporic, bisporic and tetrasporic.

**Unit-II: Pollination and fertilization**

2.1 Pollination: Types and agents; biotic and abiotic.

2.2 Pollen-pistil interaction; general concept and role of pollen kit substances and stigmatic exudates.

2.3 Details of double fertilization; brief concept of in-vitro fertilization.

2.4 Self-incompatibility: types, mechanism and genetic control.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

## PLANT REPRODUCTION
(MINOR COURSE)

**Course No. UMIBOT505** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-III: Post fertilization events**

3.1 Embryo: Types and functions; structure and development of monocot and dicot embryos; embryo structure in family Poaceae.
3.2 Suspensor: Structure, development, functions and types; suspensor haustoria.
3.3 Endosperm: Types, development and functions.
3.4 Apomixis and Polyembryony: Definition and types.

**Unit- IV: Fruits and Seeds**

4.1 Fruit: Types and formation; ripening; brief account of biochemical changes.
4.2 Seed formation: Structure of dicot and monocot seeds; classification according to storage tissue, major storage biochemicals.
4.3 Seed dispersal: Agents, adaptations and mechanisms.
4.4 Seed germination: Types and mechanism, mobilization of food products during germination.

**UNIT- V: Practicals**

5.1 Examination of wide range of flowers available in the locality and methods of their pollination.
5.2 Structure of anther, microsporogenesis (using slides) and pollen grains (using whole mounts).
5.3 Pollen viability using in vitro pollen germination.
5.4 Study of pollen and stigma types
5.5 Ovule structure and types.
5.7 Study of heteromorphic self-incompatibility.
5.8 Endosperm and embryo development in monocots and dicots (using slides and dissections).
5.9 Field visits to Botanical Garden, Natural habitat and Industries.

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

## PLANT REPRODUCTION
(MINOR COURSE)

**Course No. UMIBOT505** **Max. Marks: 100 (Theory-75, Practical-25)**

Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each

**Note for paper setters**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** | **Marks** |
| | Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested Readings**


1. Bhojwani, S. S., Bhatnagar, S. P. and Dantu, P. K. (2018). The embryology of angiosperms. 6th ed. Vikas Publishing House, Noida.
2. Ramawat, K. G. et al. (2014). Reproductive biology of plants. CRC Press, Boca Raton.
3. Bradford, K. J. and Nonogaki, W eds. (2007). Seed development, dormancy and germination. Blackwell Publications, Oxford.
4. Raghvan, V. (2006). Double fertilization. Springer Verlag, Berlin-Heidelberg.
5. Bhojwani, S. S and Bhatnagar, S.P. 2000. The Embryology of Angiosperms. 4th Edn. Vikas Publishing House, Delhi.
6. Raghavan, V. (1999). Developmental Biology of Flowering Plants. Springer- Verlag, New York
7. Bewley, J.D. and Black, M. (1994). Seeds-Physiology of Development and Germination. Plenum Press, New York.
8. Raghavan, V. (1997). Molecular Embryology of Flowering Plants. Cambridge University Press, Cambridg.
9. Proctor, M. and Yeo, P. (1973). The Pollination of Flowers. William Collins Sons, London.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–V
## (For the examinations to be held in December 2024, 2025, 2026)

### SUMMER INTERNSHIP

**Course No. USEBOT506** **Max. Marks: 50**

*Objectives:*

*The summer internship has been introduced to expose students to understand, identify and handle research problems. They will learn to propose hypothesis, design and execute the experiments and finally, be able to manage and interpret the data and draw inferences.*

*Course Learning Outcomes:*

*The students will get to know the subject outside the boundaries of their classrooms. This will help them to learn field work, new methods and techniques and to coordinate with other fellow students. This will broaden their horizons with respect to different aspects of plant sciences.*

**Guidelines: Refer to Statute 22.vii of the statutes governing FYUG as per NEP 2020. notified vide No. F.Acd/I/23/7769-7828 Dated: 03-08-2023**

**Scheme of Examination**

**Note: Minimum passing criteria for summer internship is 40%.**

**Guidelines for**

**A) Report compilation and submission:**

The interns will compile their work and submit it to the supervisor. The compilation should include the brief introduction and review, materials used for research, methodology employed for the same, observations recorded or results obtained, discussion and conclusions, all supported by relevant references. The chapter headings can be

1. Introduction
2. Materials and methods
3. Results/Observations
4. Discussion
5. Conclusion
6. References

The summer internship will enable the students to plan, work and execute independently on a project wherein they will get hands on training in various research techniques. The students will apply the knowledge gained thereof on the successful completion of the project assigned to them.

**B) Monitoring and evaluation:** The Internal supervisor designated to the students will monitor the progress and evaluate student's internship course at the end of semester on the basis of internship report/seminar presentation/viva-voce. The evaluation of the internship course shall be internal.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

## GENETICS AND CYTOGENETICS
## (MAJOR COURSE)

**Course No. UMJBOT601** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration | (hours) | Weightage | (Marks) |
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P. A- Daily Performance and Attendance**

*Objectives:*

*The course has been devised to acquaint the students with the structural and functional aspects of chromosomes and genes and alterations generally found in these.*

*Course Learning Outcomes:*

*The students will be able to prepare slides of mitotic and meiotic divisions in different species and differentiate between all their respective stages. By understanding the concepts of transcription, translation and mutation, the students can design their experiments of molecular biology for a better understanding of plant life.*

**Unit-I: Mendelian and non-Mendelian inheritance**

1.1 Mendelism, laws of segregation and independent assortment; allelic and non-allelic interactions.

1.2 Linkage and recombination, role of linkage in mapping of genes.

1.3 Cytological techniques: classical (karyotypic and meiotic studies based on general staining) and modern (banding and in-situ hybridization).

1.4 Chromosomal theory of inheritance: details and evidence.

**Unit-II: Specialized chromosomes**

2.1 Lampbrush and Polytene chromosomes: Structure peculiarities and function.

2.2 B-chromosomes and Sex chromosomes: Structure and function.

2.3 Balanced theory of Sex-determination; Sex-linked inheritance.

2.4 Cytoplasmic inheritance; male sterility, Kappa particles.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

## GENETICS AND CYTOGENETICS
(MAJOR COURSE)

Course No. UMJBOT601 **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-IV: Alterations in the basic unit of inheritance**

4.1 Mutations-types, sources (spontaneous and induced), uses and mechanisms of induction.

4.2 DNA damage and repair mechanisms: Types and brief account of excision repair and recombination repair systems.

4.3 Concept and salient features of transposable elements in prokaryotes (IS and Tn).

4.4 Concept and salient features of transposable elements in eukaryotes (Ac-Ds).

**UNIT-V: Practicals**

5.1 Examination of various stages of mitosis and meiosis using appropriate plant material (e.g. onion root tips, onion flower buds).

5.2 Preparation of karyotypes from dividing root tip cells and pollen grains.

5.3 Cytological examination of special types of chromosomes; lampbrush and polytene chromosomes.

5.4 Working out the laws of inheritance (monohybrid, dihybrid, gene interactions) using seed mixtures.

5.5 Working out the mode of inheritance of linked genes from test cross and/ or $F_2$ data.

5.6 Construction of chromosome maps using three - point test cross data.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

## GENETICS AND CYTOGENETICS
(MAJOR COURSE)

**Course No. UMJBOT601** **Max. Marks: 100 (Theory-75, Practical-25)**

**Mid semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate group of 15-20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** | |
| | Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested Readings:**


1. Albert B., Bray, D., Raff, M., Roberts, Kand Watson J. D. 2004. Molecular Biology of Cell. 3rd Edn. Garland Science. New York, USA.
2. Snustad, D. P. and Simmons, M. J. 2000. Principles of Genetics. John Wiley & sons, Inc. USA
3. Lodish, H., Berk, A., Zipursky, S.L., Matsudaria P., Baltimore, D and Darnell, J. 2000. Molecular Cell Biology. 5th Edn. W.H. Freeman & Co. New York, USA.
4. Atherly, A.G., Girton, J.R. and Mc. Donald, J.F. 1999. The Science of Genetics. Diane Publishing. Co. Fort Worth, USA.
5. Gupta, P K. 1999. A Text Book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.
6. Russell, P J.1998. Genetics. The Benjamin Cummings Publishing Co. Inc., USA.
7. Kleinsmith, L J. AndKish, V. M. 1995. Principles of Cell and Molecular Biology. 2nd Edn. Harper Collins College Publishers, New York, USA.
8. Wolfe, S. L. 1993. Molecular and Cell biology. Wadsworth Publishing Co. California, USA.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

# PLANT BREEDING
(MAJOR COURSE)

**Course No. UMJBOT602** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration | (hours) | Weightage | (Marks) |
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P. A- Daily Performance and Attendance**

*Objectives*

*The students will gain knowledge on commercially important plants, their breeding systems and strategies employed for crop improvement.*

*Course Learning Outcomes*

*The students would be able to understand the experimental steps and methods involved in generating new varieties using classical and contemporary breeding practices.*

**Unit- I: Basics of Plant Breeding**

1.1 Introduction, objectives,need and scope of breeding
1.2 Historical perspective: green revolution and its impact.
1.3 Modes of reproduction in crop plants: vegetative, sexual and apomictic.
1.4 Centre of origin of plants, Vavilov's concept.

**Unit –II: Genetic basis of plant breeding**

2.1 Pure line theory of Johanssen: Concept of homozygous balance.
2.2 Concept of heterosis and inbreeding depression.
2.3 Hardy-Weinberg principle and its applications in plant breeding.
2.4 Male sterility: Types, genetic basis and applications.

**Unit- III: Breeding methods for self pollinated crops**

3.1 Selection: mass and pure line selection; methods and achievements.
3.2 Selection after hybridization; bulk population method and its modifications.
3.3 Pedigree method and its modifications, pedigree records
3.4 Back cross methods for dominant and recessive traits.

**Unit- IV: Breeding methods for cross-pollinated crops**

4.1 Population improvement: mass selection and its applications.
4.2 Recurrent selection: methods and applications.
4.3 Hybrid varieties: methods of production.
4.4 Concept of synthetic and composite varieties.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

## PLANT BREEDING
(MAJOR COURSE)

**Course No. UMJBOT602** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit- V: Practicals**

5.1 Introduction to field/controlled pollinations in field and laboratory.
5.2 Temporal details of anthesis, anther dehiscence, stigma receptivity and pollen viability.
5.3 Demonstration of emasculation and bagging.
5.4 Analysis of the breeding system of chosen crop species by calculating Pollen:Ovule Ratio
5.5 Study of Quantitative and qualitative characters in select crops.
5.6 Introduction to vegetative and asexual modes of reproduction.
5.7 Field visits to Agricultural University or any nearby research institute.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate group of 15-20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** | |
| | Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

## PLANT BREEDING

(MAJOR COURSE)

**Course No. UMJBOT602** **Max. Marks: 100 (Theory-75, Practical-25)**

**Suggested Readings**

1. Acquaah, G. (2020). Principles of Plant Genetics and Breeding, Wiley-Blackwell, USA.
2. Allard, R. W. (2018). Principles of plant breeding. 2nd ed. Wiley, New Delhi.
3. Khan, A.S. (2017). Flowering Plants: Structure and Industrial Products. Wiley; 1st edition, United Kingdom, pp 344.
4. Campbell, N.A., Reece J.B., Urry, L.A., Cain, M.L., Wasserman, S.A. Minorsky, P.V. and Jackson, R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.
5. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
6. Atwell, B. J., Kriedemann, P. E. and Turnbull, C. G. N. (1999). Plants in action: adaptation in nature, performance in cultivation. McMillan Education, Australia.
7. Coulter, J.M. (1851). Morphology of Angiosperms (Morphology of Spermatophytes. Part-II ). Nebu press, pp 376.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
### (For the examinations to be held in May 2025, 2026, 2027)

## PLANT BIOTECHNOLOGY AND TISSUE CULTURE
(MAJOR COURSE)

**Course No. UMJBOT603** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration | (hours) | Weightage | (Marks) |
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P. A- Daily Performance and Attendance**

*Objectives:*

*An attempt is being made to impart students the training of using tissue culture tools and biotechnological techniques in the utilization as well as improvement of crops.*

*Course Learning Outcomes:*

*The students will understand the concepts and role of plant biotechnology and tissue culture in the improvement of economically important crops. They will be able to apply these techniques for genetically engineering the crops.*

**Unit-I: Plant Biotechnology**

1.1 Concept of biotechnology and recombinant DNA technology.

1.2 Enzymes in genetic engineering: exo- and endonucleases, restriction enzymes, DNA polymerases.

1.3 Agarose gel electrophoresis, concepts of Southern, Northern and Western blotting, construction of genomic and cDNA libraries

1.4 Polymerase chain reaction; mechanism and applications; DNA fingerprinting

**Unit- II: Applications in genetic engineering**

2.1 Salient features of cloning vectors – plasmids (pBR322, pUC), bacteriophages (λ phage) and cosmids

2.2 Biology of *Agrobacterium* vectors for gene delivery in plants.

2.3 Physical methods of gene delivery in plants and their advantages

2.4 Applications of Genetic engineering in production of nutritionally rich plants (Golden Rice) and those with resistance against insects (BtCotton and Bt Brinjal).

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

## PLANT BIOTECHNOLOGY AND TISSUE CULTURE
(MAJOR COURSE)

**Course No. UMJBOT603** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit- III: Plant Tissue Culture**

3.1 Basic concepts of plant tissue culture: requirements, composition and preparation of culture media

3.2 Cellular totipotency, differentiation and morphogenesis,

3.3 Anther culture and production of haploid plants, role of tissue culture in plant improvement.

3.4 Protoplast fusion: Technique and Application, Somatic Hybrids and Cybrids

**Unit- IV: Techniques and applications**

4.1 Micropropagation, stages, advantages and applications.

4.2 Somatic embryos: production and applications.

4.3 Somaclonal variations and factors underlying their generation; advantages of somaclonal variants.

4.4 Production of secondary metabolites through callus cultures

**Unit- V: Practicals**

5.1 Demonstration of horizontal agarose gel electrophoresis.

5.2 Demonstration of blotting techniques

5.3 Demonstration of DNA loading, running and scoring of bands in the gel.

5.4 Demonstrate media preparation for culturing plant tissues.

5.5 Demonstration of the technique of micropropagation by using different explants e.g. axillary buds, shoot meristems.

5.6 Demonstration of the technique of anther culture.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

## PLANT BIOTECHNOLOGY AND TISSUE CULTURE
(MAJOR COURSE)

**Course No. UMJBOT603** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate group of 15-20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | |
| | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested Readings**


1. Brown,T.A. 2010. Genomes. JohnWileyand Sons (Asia)Pvt.Ltd.
2. Glick, B.R., Pasternak J.J. and Patten, C.L. 2010. Molecular Biotechnology: Principles and Applications of Recombinant DNA. 4th Edn. ASM Press Washington, DC.
3. Das, H.K. 2007. Textbook of Biotechnology. 3rd Edn. Wiley India Pvt. Ltd. U.P., India.
4. Bhojwani,S.S.and Razdan,M.K.2005.Plant Tissue Culture: Theory andPractice. Revised Edn. Elsevier Science Publication, The Netherlands.
5. Razdan, M.K. 2000. An Introduction to Plant Tissue Culture. Oxford and IBH.
6. Kochar, S. L. 1998. Economic Botany in Tropics. 2nd edition. Macmillan India Ltd. New Delhi.
7. Raghvan, V.1997.MolecularBiologyofFloweringPlants.CambridgeUniversity Press, New York, USA.
8. Sharma, O.P. 1996. Hills Economic Botany. (Late Dr. A.F. Hill, Adapted by Dr. O.P.Sharma), Tata McGraw Hill Co. Ltd. New Delhi.
9. Primrose, S. B. 1995. Principles of Genome Analysis. Blackwell Scientific Publishers, Oxford UK Vasil, I.K. and Thorpe, T.A. 1994. Plant Cell and Tissue Culture. Kluwer Academic Publishers. The Netherlands.
10. Salisbury, F.B. and Ross, C.W. 1992. Plant Physiology. Wadsworth Publication Co. California, USA.

## PLANT BIOTECHNOLOGY AND TISSUE CULTURE

(MAJOR COURSE)

**Course No. UMJBOT603** **Max. Marks: 100 (Theory-75, Practical-25)**

11. Bhojwani,S.S.1990.Plant Tissue Culture: Applications and Limitations.
12. Elsevier Science Publishers, New York, USA.
13. Old, R.W. and Primrose, S.B. 1989. Principles of Gene Manipulation. Blackwell Scientific Publications, Oxford, UK.
14. Sambamurthy, A.V. S.S. and Subramanyam, N.S. 1989. A textbook of Economic Botany.Wiley Eastern Ltd. New Delhi.
15. Simpson, B.B. and Conner Ogorzaly, M. 1986. Economic Botany- Plants in Our World, McGraw Hill, New York.
16. Raghvan, V. 1986. Embryogenesis in Angiosperms:A Developmental and Experimental Study. Cambridge University Press, New York, USA
17. Hartmann,H.T.andKestler,D.E.1976.PlantPropagation:Principlesand Practices. 3rd Edn., Prentice Hall of India Pvt. Ltd. New Delhi.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

## SYSTEMATICS AND EVOLUTIONARY BIOLOGY
(MAJOR COURSE)

**Course No. UMJBOT604** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration | (hours) | Weightage | (Marks) |
| | | | | Mid-semester | End-semester | Mid-semester | End-semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

D.P. A- Daily Performance and Attendance

*Objectives:*

*The course focuses on the role of systematics in grouping plants. Students will be acquainted with the significance of phylogeny in speciation.*

*Course Learning Outcomes*

*The students will be able to understand the concepts of systematics and evolution. This will create awareness among them to analyze and apply various tools in understanding phylogeny, redefining affinities and arranging different plant groups.*

**Unit-I: Approaches to Plant Systematics**

1.1 Introduction, history, basics and difference between Taxonomy and Systematics.

1.2 Concepts of phenetic and phylogenetic systems.

1.3 Introduction to International Code of Nomenclature (ICN), Typification, Legitimate and illegitimate names.

1.4 Taxonomic tools and techniques: botanical keys, botanical literature and herbarium techniques.

**Unit-II: Phylogeny of Angiosperms**

2.1 APG IV system of classification of angiosperms

2.2 Concept of various groups in APG, Basal Angiosperms, Magnollids and Eudicots.

2.3 Characteristics and phylogeny of orders: Amborellales, Nymphaeles,

2.4 Characteristics and phylogeny of orders: Austrobaileyales and Chloranthales

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in**
**BOTANY (under CBCS as per NEP–2020)**
**UG SEMESTER–VI**
**(For the examinations to be held in May 2025, 2026, 2027)**

## SYSTEMATICS AND EVOLUTIONARY BIOLOGY
(MAJOR COURSE)

**Course No. UMJBOT604** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-III: Basics of Evolution**

3.1 Origin of life and concept of Evolution.
3.2 Theories of organic evolution; comparison between Lamarckism, Darwinism and Neo-Darwinism.
3.3 Concepts of morphological (analogy, homology), paleontological, embryological and molecular evidences of evolution.
3.4 Geological time scale and neutral theory of molecular evolution.

**Unit-IV: Basics of species and speciation**

4.1 Concept of species and speciation.
4.2 Genetic drift; concept and consequences.
4.3 Isolating mechanisms: geographic and reproductive
4.4 Origin of Angiosperms: Theories and ancestors possible

**Unit- V: Practicals**

5.1 Description and identification of specimens of live plants as well as herbarium
5.2 Study and documentation of floras available in library.
5.3 Preparation of herbarium of 10 plants by each student
5.4 Comparison of different species of a genus and calculate similarity index.
5.5 Table exercises based on secondary data.
5.6 Meiotic preparations of two or more populations of a species, study and analyze them.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**
The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VI
## (For the examinations to be held in May 2025, 2026, 2027)

## SYSTEMATICS AND EVOLUTIONARY BIOLOGY
(MAJOR COURSE)

**Course No. UMJBOT604** **Max. Marks: 100 (Theory-75, Practical-25)**

**Mid semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** | |
| | Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested readings**


1. The Angiosperm phylogeny Group (2016). An update of the Angiosperm Phylogeny Group classification for the orders and families of flowering plants: APG IV. Botanical Journal of the Linnean Society, 2016, 181, 1–20.
2. The Angiosperm phylogeny Group (2009). The Botanical Classification of Angiospermae. The Botanical System of Plants. Das Botanisches System der Pflanzean. Fredrich A Lohmuller.
3. The Angiosperm Phylogeny Group (2003). An update of the angiosperm phylogeny group classification for the orders
4. Judd WS, Campbell CS, Kellogg EA, Stevens PA and Donoghue MJ (2002). Plant Systematics: A phylogenetic approach. Sinauer associates, INC., Massachusetts.
5. The Angiosperm Phylogeny Group (1998). An ordinal classification for the families of flowering plants. Annals of the Mussorie Botanic Garden 85 (4):531-553.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### RESEARCH METHODOLOGY AND RESEARCH ETHICS

(MAJOR COURSE)

**Course No. UMJBOT701** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The students will be exposed to the basic concepts and techniques used in research and make them understand its fundamentals, importance and practical utility.*

*Course Learning outcomes:*

*They will become research oriented and develop the ability to review literature, identify problems, design experiments, collect data, conduct appropriate tests and draw inferences. Besides, they will become aware of the ethical dimensions associated with the conduct of applied research.*

**Unit-I: Basic concepts of research**

1.1 Research in biological sciences: Concept and need, Identifying, defining and delimiting research problem

1.2 Objectives of research problem; Selection and formulation; Research methods vs Research methodology

1.3 Types of research: descriptive or analytical, applied or basic, quantitative or qualitative, conceptual or empirical

1.4 Review of literature: importance in defining and delimiting a research problem, Various sources of literature- reviews, treatises, monographs, journals; different search engines as a source for literature survey.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### RESEARCH METHODOLOGY AND RESEARCH ETHICS

(MAJOR COURSE)

**Course No. UMJBOT701** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Experimental design, data collection and analysis, and scientific writing**

2.1 Basic principles of research design-Objectives, introduction, rationale of work, designing experiments

2.2 Observations and data acquisition, processing, analysis, interpretation and applications of data

2.3 Scientific writing-I: Format of writing concept, research and policy papers, popular scientific articles for general awareness

2.4 Scientific writing-II: Review and reports-layout, structure, language, illustrations and tables; Methods of citing literature

**Unit-III: Research integrity and Ethics-I**

3.1 Ethics: Definition and importance

3.2 Ethics with respect to science and research; Ethical issues; Ethical committees

3.3 Concepts of publication ethics, their violation and misconduct

3.4 Conflict of interest (Authors, Reviewers and Editors), authorship, contributor ship, ghost authorship and acknowledgements

**Unit-IV: Research integrity and Ethics-II**

4.1 Trade related aspects of intellectual property rights; Copyrights and Designs, TRAFFIC & CITES

4.2 Reproduction of published material; Salami publication, image duplication and overlapping publication

4.3 Research integrity and scientific misconducts: falsification, fabrication and plagiarism

4.4 Selective reporting and misrepresentation of data; Reference citation; Reproducibility and accountability

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### RESEARCH METHODOLOGY AND RESEARCH ETHICS

(MAJOR COURSE)

**Course No. UMJBOT701** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V: Practicals**

5.1 Formulation of a research problem using a hypothetical example based on different biodiversity aspects:

i) Distribution and status (Vulnerable, rare, endemic, least concerned, data deficient, etc).

ii) Morphological traits.

iii) Phenological features at plant and floral levels.

iv) Ecological parameters (Quadrat analysis for herbs/ shrubs, etc).

v) Ethnobotanical perspectives.

5.2 Preparation of questionnaire for collecting information about the utility of some important plant taxa from local inhabitants and/or healers.

5.3 Setting up of hypothesis on the research problem.

5.4 Design of experiment to collect data on S. Nos. 5.1 and 5.2.

5.5 Collection, organisation and presentation of data (Tabulation and graphical representation)

5.6 Critical analysis of data and drawing conclusions.

5.7 Demonstration of software for determining the extent of plagiarism in a manuscript.

5.8 Online exposure of students to distinguish between quality and predatory journals.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### RESEARCH METHODOLOGY AND RESEARCH ETHICS

(MAJOR COURSE)

**Course No. UMJBOT701** **Max. Marks: 100 (Theory-75, Practical-25)**

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group, in addition to theory classes

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** | |
| | Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VII**
**(Syllabus for the examinations to be held in December 2025, 2026, 2027)**

## RESEARCH METHODOLOGY AND RESEARCH ETHICS

(MAJOR COURSE)

**Course No. UMJBOT701** **Max. Marks: 100 (Theory-75, Practical-25)**

**Suggested Readings**


1. Chawla, Deepak & Sondhi, Neena (2011). Research methodology: Concepts and cases, Vikas Publishing House Pvt. Ltd. Delhi.
2. Pawar, B.S. (2009). Theory building for hypothesis specification in organizational studies, Response Books, New Delhi.
3. Kothari, C.R. Research Methodology (Methods and Techniques), New Age Publisher
4. Dawson, C. (2002). Practical research methods. UBS Publishers, New Delhi.
5. Stapleton, P., Yondeowei, A., Mukanyange, J., Houten, H. (1995). Scientific writing for agricultural research scientists – a training reference manual.
6. Neuman, W.L. (2008). Social research methods: Qualitative and quantitative approaches, Pearson Education
7. Best, J.W. and Kahn, J.V. (2006). Research in Education. 10th Edition, Pearson Education Inc., Cape Town.
8. Wilcox R R (2010). Fundamentals of modern statistical methods: Substantially improving power and accuracy (Vol. 249). New York: Springer.
9. Kuehl, R. O. (2000). Design of experiments: statistical principles of research design and analysis.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### APPLIED MICROBIOLOGY AND PLANT PATHOLOGY

(MAJOR COURSE)

**Course No. UMJBOT702** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The students will be able to understand the impact and significance of microbes in maintaining a healthy ecosystem in general and promoting plant growth in particular. Additionally, they will also be able to understand microbial interactions, plant diseases, and diverse pathologies caused by viruses, bacteria, and fungi, emphasizing identification techniques and modern disease control strategies.*

*Course Learning outcomes:*

*The course will enable students to learn methods of detecting plant pathogens and will enable them to be better plant disease managers.*

**Unit-I: Applied microbiology**

1.1 Microbial symbiosis and their significance; Mycorrhizal fungi: types and significance.

1.2 Plant microbe interactions and plant health (PGPR and defence priming)

1.3 Applications of microbes in agriculture (Biofertilizers and biopesticides) and industry (Fermentations, antibiotics and vaccines)

1.4 Microbes in bioremediation; Biological control and IPM

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### APPLIED MICROBIOLOGY AND PLANT PATHOLOGY

(MAJOR COURSE)

**Course No. UMJBOT702** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Introduction to Plant diseases**

2.1 Plant diseases: Brief account and types.

2.2 Brief account of impact of crop diseases on global food security.

2.3 General account of the stages in the development of plant diseases.

2.4 Brief concept and types of Plant immunity

**Unit-III: Viral and Bacterial pathology**

3.1 Isolation and Purification of plant viruses

3.2 Serological and molecular methods for detection and identification of plant viruses and bacteria

3.3 Modern methods of plant virus control (cross protection, transgenic approaches, RNAi and CRISPR-Cas system)

3.4 Viral and Bacterial diseases: Causal organisms, symptomology, disease cycle and Control measures of Mosaic diseases of Tobacco and Cucumber, Yellow vein mosaic of Okra, Tomato leaf curl, Citrus canker, Scab of potato, Bacterial blight of Soyabean

**Unit-IV: Fungal Pathology**

4.1 Major symptoms of fungal diseases; Koch's postulates

4.2 Types and role of toxins in plant diseases, Role of mycotoxins in storage

4.3 Role of enzymes in plant diseases

4.4 Host-parasite relationship of major diseases caused by Fungi and Fungi-like organisms-Damping off of seedlings, Early and Late blight of potato, Wheat rusts and Red rot of sugarcane.

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VII**
**(Syllabus for the examinations to be held in December 2025, 2026, 2027)**

## APPLIED MICROBIOLOGY AND PLANT PATHOLOGY

(MAJOR COURSE)

**Course No. UMJBOT702** **Max. Marks: 100 (Theory-75, Practical-25)**

### Unit-V Practicals

5.1 Study of bacteria using Gram staining techniques.

5.2 Study of symptomology and casual organisms of Mosaic diseases of Tobacco and Cucumber.

5.3 Study of symptomology and casual organisms of Yellow vein mosaic of Okra and Tomato leaf curl.

5.4 Study of symptomology and casual organisms of Citrus canker, Scab of potato and Bacterial blight of Soyabean

5.5 Study of symptomology and casual organisms of Damping off of seedlings and Early and Late blight of potato

5.6 Study of symptomology and casual organisms of Wheat rusts and Red rot of sugarcane.

### Note for paper setters

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### APPLIED MICROBIOLOGY AND PLANT PATHOLOGY

(MAJOR COURSE)

**Course No. UMJBOT702** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group, in addition to theory classes

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | **Marks** |
| | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested Readings**


1. Kodo, C.I. and Agarwal, H.O. 1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
2. Alexopoulos, C.J., Mims, C.W., Blackwell, M. (1996). Introductory Mycology, 4th edition. Singapore, Singapore: John Wiley & Sons.
3. Sethi, I.K. and Walia, S.K. (2011). Text book of Fungi and Their Allies. Noida, U.P.: Macmillan Publishers India Ltd.
4. Reven, F.H., Evert, R. F., Eichhorn, S.E. (1992). Biology of Plants. New York, NY: W.H. Freeman and Company.
5. Sharma, P.D. (2011). Plant Pathology. Meerut, U.P.: Rastogi Publication.
6. Rangaswamy, G. (2009). Disease of Crop Plants in India, Prientice Hall of India, New Delhi.
7. Sharma. P. D. (2012) Microbiology and Plant Pathology, Rastogi Publication Pvt Ltd., Meerut, India.

## APPLIED MICROBIOLOGY AND PLANT PATHOLOGY

(MAJOR COURSE)

**Course No. UMJBOT702** **Max. Marks: 100 (Theory-75, Practical-25)**

8. Singh, R. P. (2007) Microbial Taxonomy and Culture Techniques, Kalyani Publication, New Delhi.
9. Pelzar, 1963. Microbiology, Tata Mc Graw Hill, New Delhi
10. Aneja, K. R. 1993. Experiments in Microbiology, Pathology and Tissue Culture, Vishwa Prakashan, New Delhi.
11. Dubey, R. C. and Maheshwari. D.K. 2012. Practical Microbiology, S. Chand & Company, Pvt. Ltd., New Delhi.
12. Kodo, C.I. and Agarwal, H.O.1972. Principles and techniques in Plant Virology, Van Nostrand, Reinhold Company, New York.
13. MadhaveeLatha, P. 2012, A Textbook of Immunology, S. Chand & Company Pvt. Ltd., New Delhi
14. Agrios, G.N. (1997). Plant Pathology, 4th edition. Cambridge, U.K.: Academic Press.
15. Amos Richmond Ph.D., Prof. Emeritus, Qiang Hu 2013. Handbook of Microalgal Culture: Applied Phycology and Biotechnology, Second Edition Print ISBN:9780470673898.
16. Trigiano Robert N. 2007. Plant Pathology Concepts and Laboratory Exercises. 2nd Edition, CRC
17. Sumbali G and Mehrotra R.S. (2018). Principles of Microbiology-1st Edition. Publisher: Mc Graw Hill Education.
18. Sumbali G (2010). The Fungi- Second edition. Alpha Science International.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### APPLIED BOTANY

(MAJOR COURSE)

**Course No. UMJBOT703** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The course intends to give detailed knowledge on the applied potential of all the groups of living plants. Students will get familiarised with the experimental studies on the lower plant groups.*

*Course Learning outcomes:*

*Acquisition of knowledge on the applied aspects will enable students to explore new vistas in engineering plant-based products.*

**Unit-I Applied Phycology**

1.1 Resource potential and commercial utility of algae: Algae as a source of food, feed, pigments, fine chemicals, fuel and biofertilizers

1.2 Distribution of economically important algae in India; Algal immobilization and its applications

1.3 Methods of preparation and application of liquid sea weed fertilizers

1.4 Biodiesel producing algae: general concept and advantages over other sources; Phyco-remediation and role of algae in nanobiotechnology.

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VII**
**(Syllabus for the examinations to be held in December 2025, 2026, 2027)**

## APPLIED BOTANY

(MAJOR COURSE)

**Course No. UMJBOT703** **Max. Marks: 100 (Theory-75, Practical-25)**

### Unit-II Applied Bryology

2.1 Resource potential and commercial utility of bryophytes: Horticultural uses as material for decoration, bedding, packing, plugging and stuffing; moss garden

2.2 Ecological importance: Seed bed for higher plants; rock and mineral builders; erosion controllers; ecological; palaeoecological mineral deposit, water and air pollution indicators

2.3 Medicinal uses: Anti-microbial and allergenic substances

2.4 Other uses: Sources of stress related genes; production of complex biopharmaceuticals; concept of moss bioreactors; establishment and importance of International Moss Stock Center

### Unit-III Applied Pteridology

3.1 Traditional uses of ferns in pharmaceuticals

3.2 Secondary metabolites of ferns: types, composition and their therapeutic/medicinal role

3.3 Ferns in horticulture: Significance and different practices; role of climate and other factors

3.4 Role of ferns in environmental restoration; ecotoxicology and bioremediation; removal of contaminants by ferns in soil and water

### Unit-IV Applied aspects of Phanerogams

4.1 Phytochemistry of gymnosperms: Secondary metabolites, medicinal value and drugs

4.2 Gymnosperms in horticulture: Significance and different practices; Ecological role of gymnosperms on regional climate, soil and vegetation

4.3 Angiosperms in medicine: General account, Significance and therapeutical potential

4.4 Commercial utility of Angiosperms as Timber, Fibers, Rubber and Dyes

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### APPLIED BOTANY

(MAJOR COURSE)

**Course No. UMJBOT703** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V Practicals**

5.1 Preparation of Bryophytes for decoration and as packing materials.

5.2 Demonstration of using mosses in preparing green walls for smart cities.

5.3 Preparation of Ferns for ornamental purposes.

5.4 Development of protocol for Fern propagation in gardens.

5.5 Demonstration of use of some relevant Gymnosperms for landscaping.

5.6 Extraction and characterization of the plant fibres from the provided material

5.7 Extraction of dyes from different plant parts.

5.8 Qualitative estimation of secondary metabolites (Phenols, Flavonoids and Tannins).

5.9 Study the structure and type of the starch granules in the locally available plant material using iodine solution.

5.10 Study protein bodies in different pulses available in the local market.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### APPLIED BOTANY

(MAJOR COURSE)

**Course No. UMJBOT703** **Max. Marks: 100 (Theory-75, Practical-25)**

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group, in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | **Marks** |
| | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| | External practical examination and Viva-voce | 15 |

**Suggested Readings:**


1. Kocchar, S.L. 1998: Economic Botany in Tropics, 2nd edition, MacMillan India Ltd., New Delhi.
2. Simpson, B.B. and Conner-Ogorzaly, M. 1986: Economic Botany- Plants in our World, McGraw Hill, New York.
3. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
4. Campbell, N.A., Reece J.B., Urry, L.A., Cain, M.L., Wasserman, S.A. Minorsky, P.V. and Jackson, R.B. (2008). Biology, Pearson Benjamin Cummings, USA. 8th edition.

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VII**
**(Syllabus for the examinations to be held in December 2025, 2026, 2027)**

## APPLIED BOTANY

(MAJOR COURSE)

**Course No. UMJBOT703** **Max. Marks: 100 (Theory-75, Practical-25)**


5. Coulter, J.M. (1851). Morphology of Angiosperms (Morphology of Spermatophytes. Part-II). Nebu press, pp 376.
6. Khan, A.S. (2017). Flowering Plants: Structure and Industrial Products. Wiley; 1st edition, United Kingdom, pp 344.
7. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
8. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
9. Rashid, A. (1998). An Introduction to Bryophytes. Vikas publishing House, pp 308.
10. Sahoo, D. (2000). Farming the ocean: seaweeds cultivation and utilization. Aravali International, New Delhi.
11. Vanderpoorten, A. and Goffinet, B. (2009). Introduction to Bryophytes. Cambridge University Press, pp 303.
12. Vashistha, P.C., Sinha, A.K. and Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### ETHNOBOTANY AND TRADITIONAL KNOWLEDGE

(MAJOR COURSE)

**Course No. UMJBOT704** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| **Theory** | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| **Practical** | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The course will provide an overview of the science of plant usage by people belonging to different cultures, tribes and societies. Role of these people in the biodiversity management and conservation of plant genetic resources; in alleviating pain and curing diseases will eventually culminate in the discovery of drugs.*

*Course Learning outcomes:*

*Upon completion, students will possess a comprehensive understanding of plant usage by diverse cultures. They will be able to appreciation the traditional methods in biodiversity conservation, and insights into the medicinal properties of plants fostering thereby an understanding of their potential in healthcare and pharmaceutical research.*

**Unit-I Ethnobotany and related issues**

1.1 Concept, scope and objectives of ethnobotany.

1.2 Ethnobotany as an interdisciplinary Science and its importance.

1.3 Life styles and livelihood options of major ethnic groups/ tribals of India with special reference to Jammu & Kashmir.

1.4 Major issues related to ethnobotany (Ethical, Cultural, Social, etc.).

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### ETHNOBOTANY AND TRADITIONAL KNOWLEDGE

(MAJOR COURSE)

**Course No. UMJBOT704** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II Methodology of Ethnobotanical studies**

2.1 Field work and collection of plant-based data, Herbarium preparation and identification of plants.

2.2 Sources of data and methods of study: Fossils, archaeological resources and ancient literature.

2.3 Validation of ethnobotanical data using various ethnobotanical indices.

2.4 Sacred grooves and ancient monuments as sources of data and plant conservation.

**Unit-III Role of Ethnobotany in modern medicine**

3.1 Ethnobotanical sources of medicinal importance in India: a general account.

3.2 Habitat, morphology and significance of (a) *Azadiracta indica* (b) *Ocimum tenuiflorum* (c) *Vitex negundo* (d) *Gloriosa superba* (e) *Tribulus terrestris* (f) *Pongamia pinnata* in ethnobotanical practices.

3.3 Role of ethnobotany in modern medicine with special reference to *Rauvolfia serpentina*, *Artemisia* and *Withania somnifera*.

3.4 ISM (Indian System of Medicine); Alternative and Complimentary medicine: Concept and scope.

**Unit-IV Legal aspects in Ethnobotany**

4.1 Concept of Rare, Endemic and Threatened (RET) taxa.

4.2 Role of International Union for Conservation of Nature (IUCN) and Botanical Survey of India (BSI) in conservation.

4.3 Biopiracy, Intellectual Property Rights and Traditional Knowledge.

4.4 Biodiversity laws in India; Peoples' Biodiversity Registers.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### ETHNOBOTANY AND TRADITIONAL KNOWLEDGE

(MAJOR COURSE)

**Course No. UMJBOT704** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-IV Practicals**

5.1 Microscopy of plant parts (roots, stem and leaves) used as important drugs.

5.2 Powder analysis of compound drug formulations.

5.3 Preparation of herbarium sheets of succulent and non- succulent plant specimens.

5.4 Field survey of nearby local areas for studying existing plant biodiversity.

5.5 Demonstration for filling the PBR formats.

5.6 Recording of data for PBR (Assignments).

5.7 Documentation of traditional knowledge from local/ indigenous population.

5.8 Validation of Ethnobotanical data using relevant indices

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### ETHNOBOTANY AND TRADITIONAL KNOWLEDGE

(MAJOR COURSE)

**Course No. UMJBOT704** **Max. Marks: 100 (Theory-75, Practical-25)**

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group, in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** External practical examination and Viva-voce | 15 |

**Suggested Readings**


1. S.K. Jain, (1995) Manual of Ethnobotany, Scientific Publishers, Jodhpur.
2. S.K. Jain (ed.) (1981). Glimpses of Indian- Ethnobotany, Oxford and IBH, New Delhi.
3. S.K. Jain and V. Mudgal, (1999). A Handbook of Ethnobotany, BSMPS, Dehradun
4. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists,
5. Lucknow, India.
6. S.K. Jain, 1990. Contributions of Indian- ethnobotany. Scientific publishers, Jodhpur.
7. Cotton C.M. 1997. Ethnobotany- Principles and applications. John Wiley and sons-Chichester.
8. Rama Rao, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Ahdhra Pradesh, India. Botanical Survey of India. Howrah.
9. Rajiv K. Sinha, (1996). Ethnobotany the Renaissance of Traditional Herbal Medicine-INASHREE Publishers, Jaipur-1996.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### ETHNOBOTANY

(MINOR COURSE)

**Course No. UMIBOT705** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| **Theory** | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| **Practical** | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The course will provide an overview of the science of plant usage by people belonging to different cultures, tribes and societies. Role of these people in the biodiversity management and conservation of plant genetic resources; in alleviating pain and curing diseases will eventually culminate in the discovery of drugs.*

*Course Learning outcomes:*

***Upon completion, students will possess a comprehensive understanding of plant usage by diverse cultures. They will be able to appreciation the traditional methods in biodiversity conservation, and insights into the medicinal properties of plants fostering thereby an understanding of their potential in healthcare and pharmaceutical research.***

**Unit-I Ethnobotany and related issues**

1.1 Concept, scope and objectives of ethnobotany.

1.2 Ethnobotany as an interdisciplinary Science and its importance.

1.3 Life styles and livelihood options of major ethnic groups/ tribals of India with special reference to Jammu & Kashmir.

1.4 Major issues related to ethnobotany (Ethical, Cultural, Social, etc.).

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### ETHNOBOTANY

(MINOR COURSE)

**Course No. UMIBOT705** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II Methodology of Ethnobotanical studies**

2.1 Field work and collection of plant-based data, Herbarium preparation and identification of plants.

2.3 Validation of ethnobotanical data using various ethnobotanical indices.

2.4 Sacred grooves and ancient monuments as sources of data and plant conservation.

**Unit-III Role of Ethnobotany in modern medicine**

3.1 Ethnobotanical sources of medicinal importance in India: a general account.

3.2 Habitat, morphology and significance of (a) *Azadiracta indica* (b) *Ocimum tenuiflorum* (c) *Vitex negundo* (d) *Gloriosa superba* (e) *Tribulus terrestris* (f) *Pongamia pinnata* in ethnobotanical practices.

3.3 Role of ethnobotany in modern medicine with special reference to *Rauvolfia serpentina*, *Artemisia* and *Withania somnifera*.

3.4 ISM (Indian System of Medicine); Alternative and Complimentary medicine: Concept and scope.

**Unit-IV Legal aspects in Ethnobotany**

4.1 Concept of Rare, Endemic and Threatened (RET) taxa.

4.2 Role of International Union for Conservation of Nature (IUCN) and Botanical Survey of India (BSI) in conservation.

4.3 Biopiracy, Intellectual Property Rights and Traditional Knowledge.

4.4 Biodiversity laws in India; Peoples' Biodiversity Registers.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### ETHNOBOTANY

(MINOR COURSE)

**Course No. UMIBOT705** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-IV Practicals**

5.1 Microscopy of plant parts (roots, stem and leaves) used as important drugs.

5.2 Powder analysis of compound drug formulations.

5.3 Preparation of herbarium sheets of succulent and non- succulent plant specimen.

5.4 Field survey of nearby local areas for studying existing plant biodiversity.

5.5 Demonstration for filling the PBR formats.

5.6 Recording of data for PBR (Assignments).

5.7 Documentation of traditional knowledge from local/ indigenous population.

5.8 Validation of Ethnobotanical data using relevant indices

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VII
## (Syllabus for the examinations to be held in December 2025, 2026, 2027)

### ETHNOBOTANY

(MINOR COURSE)

**Course No. UMIBOT705** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group, in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| I. | **Internal Assessment (Total Marks: 10)** Daily performance based on practical work done and attendance | 10 |
| II. | **External Assessment (Total Marks: 15)** External practical examination and Viva-voce | 15 |

**Suggested Readings**


1. S.K. Jain, (1995) Manual of Ethnobotany, Scientific Publishers, Jodhpur.
2. S.K. Jain (ed.) (1981). Glimpses of Indian- Ethnobotany, Oxford and IBH, New Delhi.
3. S.K. Jain and V. Mudgal, (1999). A Handbook of Ethnobotany, BSMPS, Dehradun
4. S.K. Jain (ed.) 1989. Methods and approaches in ethnobotany. Society of ethnobotanists.
5. Lucknow, India.
6. S.K. Jain, 1990. Contributions of Indian- ethnobotany. Scientific publishers, Jodhpur.
7. Cotton C.M. 1997. Ethnobotany- Principles and applications. John Wiley and sons-Chichester.
8. Rama Rao, N and A.N. Henry (1996). The Ethnobotany of Eastern Ghats in Ahdhra Pradesh, India. Botanical Survey of India. Howrah.
9. Rajiv K. Sinha, (1996). Ethnobotany the Renaissance of Traditional Herbal Medicine-INASHREE Publishers, Jaipur-1996.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

# BIOLOGICAL TECHNIQUES AND INSTRUMENTATION

(MAJOR COURSE)

**Course No. UMJBOT801** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| **Theory** | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| **Practical** | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The students will be able to utilize various techniques for estimating natural products of plants which can later be used for industrial purposes.*

*Course Learning Outcomes:*

***The students will gain a better understanding of plant cell growth and development through these techniques. They will also be able to detect adulterants in food items, undertake purification of proteins and enzymes, and conduct other metabolomic studies.***

**Unit-I: Analytical Research Techniques-I**

1.1 Microscopy-I: Principles and applications of bright field, phase contrast, fluorescence and confocal microscopy.

1.2 Microscopy-II: Principles and applications of Scanning and Transmission Electron Microscopy.

1.3 Flow cytometry: Instrumentation and applications.

1.4 Microtomy: Methodology and applications

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VIII**
**(Syllabus for the examinations to be held in May 2026, 2027, 2028)**

# BIOLOGICAL TECHNIQUES AND INSTRUMENTATION

(MAJOR COURSE)

**Course No. UMJBOT801** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Analytical Research Techniques-II**

2.1 Chromatography-I: Principles and applications of paper, thin layer, column, gas and liquid chromatography (HPLC and GC).

2.2 Chromatography-II: Principles and applications of gel filtration, ion exchange and affinity chromatography.

2.3 Spectroscopy-I: Principles, basic features and applications of UV-Vis spectrophotometer, NMR and ESR.

2.4 Spectroscopy-II: Principles, working and applications of atomic absorption and plasma emission spectroscopy

**Unit-III: Molecular Techniques**

3.1 Methods of DNA isolation and purification, role of centrifugation and ultracentrifugation therein.

3.2 Principles and applications of electrophoresis- AGE and PAGE; electro focusing.

3.3 Detection of proteins and nucleic acids (Western, Northern and Southern blots; Immuno blots.

3.4 Methods of preparation of cDNA libraries, Sanger's dideoxy genome sequencing.

**Unit-IV: Radiobiology and Remote Sensing**

4.1 Principles and applications of tracer techniques in biology; detection and measurement of radioisotopes.

4.2 Autoradiography: concept and principles of radiation dosimetry.

4.3 Concept and foundation of Remote Sensing and GIS.

4.4 Digital Image Interpretation and Analysis (vector and Raster analysis).

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## BIOLOGICAL TECHNIQUES AND INSTRUMENTATION

(MAJOR COURSE)

**Course No. UMJBOT801** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V: Practicals**

5.1 Demonstration of microscopic techniques.

5.2 Demonstration of spectrophotometry and preparation of standard curves.

5.3 Demonstration of working of centrifuge.

5.4 Demonstration of use of GPS and RS-GIS.

5.5 Image Analysis {False Color Composite (FCC) and True Color Composite (TCC)} .

5.6 Change detection in Land-use and Land- cover pattern using TCC.

5.7 Organization of visit to a highly equipped instrumentation laboratory and Department of Remote Sensing, J&K UT.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words.

Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## BIOLOGICAL TECHNIQUES AND INSTRUMENTATION

(MAJOR COURSE)

**Course No. UMJBOT801** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group, in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | |
| 1. | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| 1. | External practical examination and viva-voce | 15 |

**Suggested Readings**


1. Hewitt E.J. (1966). Sand and water culture methods used in the study of plant nutrition. Commonwealth Agricultural Bureaux, FarnhamRoyl. Bucks, England.
2. Hegyi G., Kardos J., Kovács M., Malnasi-Csizmadia A., Nyitray L., Pal G., Radnai L., Reményi A. and Venekei I. (2013). Introduction to Practical Biochemistry, ELTE Faculty of Natural Sciences, Institute of Biology.
3. Wilson K. and Walker J. (2010). Principles and Techniques of Biochemistry and Molecular Biology, Seventh Edition, Cambridge University Press, NewYork, USA.
4. Phillip S. and Donald E.B. (2006). Cell and Molecular Biology, John Wiley and Sons, Inc. U.K.
5. Boyer R. (2000). Modern Experimental Biochemistry, Pearson Education, Asia
6. Ruzin S.E. (1999). Plant Microtechniques and Microscopy, Oxford University Press, New York
7. Sawhney S.K. and Randhir S. (2000). Introductory Practical Biochemistry, Narosa Publishing House, New Delhi.
8. Simon R. (2001). Protein purification techniques: A practical approach, 2nd edition, Oxford University press.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## LATEST DEVELOPMENTS IN PLANT AND MICROBIAL SCIENCES
(MAJOR COURSE)

**Course No. UMJBOT802** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| **Theory** | 03 | 45 | ItoIV | 1½ | 03 | 15 | 60 |
| **Practical** | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The course is so designed that the students will learn about the latest methods, techniques and procedures developed/available/utilized by researchers across the world to gain an in-depth insight into the life of plants.*

*Course Learning Outcomes:*

*The students will not only learn about the plant responses to various biotic and abiotic factors but utilize the knowledge so gained in the welfare of human kind. They will also understand the applications of nanotechnology in various fields of plant and microbial sciences.*

**Unit-I: IPR &Traditional Knowledge**

1.1 IPR and WTO (TRIPS, WIPO), Patent Act 1970 and its amendments, TIFAC, NRDC, Rights.

1.2 Procedure of filing patents and its implication and Infringement [Case study on IPR Infringement]. Concepts of Copyrights, Trademarks and Geographical Indications.

1.3 Traditional Knowledge Digital Library, Protection of Traditional Knowledge.

1.4 Protection of Plant Varieties and Biotechnological interventions.

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VIII**
**(Syllabus for the examinations to be held in May 2026, 2027, 2028)**

## LATEST DEVELOPMENTS IN PLANT AND MICROBIAL SCIENCES
(MAJOR COURSE)

**Course No. UMJBOT802** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Nanotechnology**

2.1 Nanoparticles: Concept and design for effective management of abiotic stress in plants.

2.2 Applications of silver nanoparticles in agriculture.

2.3 Generation of nanoparticles using plant materials; their structural analysis through XRD (X-Ray crystallography) and FTIR (Fourier transform infrared spectroscopy).

2.4 Methods of testing nanoparticle formulation efficacy in plant and animal systems.

**Unit-III: Stress Physiology**

3.1 Concept of plant responses to drought, salinity, flooding, extreme temperatures (low and high), metal toxicity, ozone and UV-B radiations.

3.2 Oxidative stress generation through reactive oxygen species (ROS) [singlet, superoxide, hydrogen peroxide and hydroxyl radicals] in plants.

3.3 Biological effect of ROS viz. oxidative damage, oxidation of lipids, proteins and nucleic acids.

3.4 System for oxidative stress management in plants (enzymes and antioxidants).

**Unit-IV: Genome Engineering**

4.1 RNA interference and its role in gene-editing.

4.2 CRISPR/Cas 9 system for cleaving DNA molecules.

4.3 Targeted mutagenesis with CRISPR/Cas 9 system by deleting, substituting and editing genes.

4.4 RNA editing and its therapeutic values.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## LATEST DEVELOPMENTS IN PLANT AND MICROBIAL SCIENCES
(MAJOR COURSE)

**Course No. UMJBOT802** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V: Practicals**

5.1 Preparation of nanoparticles using standard procedure.

5.2 Effect of nanoparticles on catalase enzyme.

5.3 Online demonstration of patent filing in India.

5.4 Online demonstration of trade-mark and logo registration.

5.5 Estimation of Peroxidase and Superoxide desmutase in response to heavy metal stress.Change detection in Land-use and Land- cover pattern using TCC.

5.6 Estimation of membrane damage under abiotic stress using electrical conductivity methods.

5.7 Conduct of a mock exercise on IPR Infringement

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words.

Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (TotalMarks:15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## LATEST DEVELOPMENTS IN PLANT AND MICROBIAL SCIENCES
(MAJOR COURSE)

**Course No. UMJBOT802** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group, in addition to theory classes

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | |
| 1. | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| 1. | External practical examination and viva-voce | 15 |

**Suggested Readings**


1. Hopkins and Hunner. 2011. Introduction to plant physiology. Willey Publication, UK.
2. YubingXie. 2012. The Nanobiotechnology Handbook. CRC Press.
3. Sulabha K. Kulkarni. 2014 Nanotechnology : Principles and Practices. CP publishing, New Delhi
4. B S Murty. P Shankar, Baldev Raj, B B Rath, James Murday. 2012. Textbook of Nanoscience and Nanotechnology. Springer
5. K. K. Chattopadhyay and A. N. Banarjee. 2009. Introduction to Nanoscience and Nanotechnology. PHI Publication
6. David S. Goodshell. 2004. Bionanotechnology-Lessons from nature. John Wiley Publications
7. Ashwani Pareek, S.K. Sopory, Hans J. Bohnert and Govindjee (2010). Abiotic Stress Adaptation in Plants: Physiological, Molecular and Genomic Foundation, Springer Publication.
8. Buchanan, Greessam and Jones .2002. Biochemistry and Molecular Biology of plants. American society of plant biology. USA.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

# BIOINFORMATICS
(MAJOR COURSE)

**Course No. UMJBOT803** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The students will build an understanding about in silico/computational approaches in various aspects of understanding biology and biological research. They will develop analytical skills and integrate the principles of bioinformatics for robust interpretation of biological observations.*

*Course Learning Outcomes:*

*The students will understand the basics of bioinformatics and develop awareness of the interdisciplinary nature of this field. They will also learn about biological databases, sequence retrieval, alignment, and phylogenetic analysis using various tools and understand the basic concept of sampling methods, data classification, presentation and statistical analysis.*

**Unit-I: Introduction to Bioinformatics**

1.1 Bioinformatics: Historical background, basics, aims and scope & Phylogenetic Analysis.

1.2 Bioinformatics: Scope in Genomics and Transcriptomics.

1.3 Bioinformatics: Scope in Proteomics.

1.4 Bioinformatics: Scope in Metabolomics.

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VIII**
**(Syllabus for the examinations to be held in May 2026, 2027, 2028)**

## BIOINFORMATICS
(MAJOR COURSE)

**Course No. UMJBOT803** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Biological Databases**

2.1 Biological databases – introduction and types.

2.2 Applications of databases: NCBI (GenBank, PubChem, EMBL, PubMed).

2.3 Applications of databases: Protein databases (Swiss-Prot, PDB).

2.4 Applications of databases: Metabolic pathway database (KEGG).

**Unit-III: Basic concepts of Sequence Alignment**

3.1 Sequence alignment: basic concepts; similarity, identity and homology.

3.2 Alignment: Concepts of gaps and penalty.

3.3 Pairwise and multiple sequence alignments.

3.4 Methods of alignment (BLAST and FASTA) and analysis.

**Unit-IV: Molecular Phylogeny**

4.1 Molecular Phylogeny: Introduction, need and scope.

4.2 Molecular Phylogeny: a brief idea of various methods used for construction of phylogenetic trees.

4.3 Molecular Phylogeny: Methods [maximum parsimony (MP), maximum likelihood (ML) and distance (Neighbor-joining)].

4.4 Molecular phylogeny- Uniprot phylogeny.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## BIOINFORMATICS
(MAJOR COURSE)

**Course No. UMJBOT803** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V: Practicals**

5.1 Biological databases (NCBI, EMBL, UniProt, PDB)

5.2 Literature retrieval from PubMed.

5.3 Sequence retrieval (protein and gene) from NCBI (formats - FASTA, GenBank and GenPept formats).

5.4 Protein Structure retrieval from PDB (in pdb format) and visualization by viewing tools (Ras Mol/ J mol/Mol*/Swiss 3D Viewer/Pymol).

5.5 Multiple sequence alignment (MEGA/Clustal omega).

5.6 Construction of phylogenetic tree (PHYLIP/ MEGA/ Clustal omega).

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words.

Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## BIOINFORMATICS
## (MAJOR COURSE)

**Course No. UMJBOT803** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15-20 students per group, in addition to theory classes

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | **Marks** |
| 1. | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| 1. | External practical examination and viva-voce | 15 |

**Suggested Readings**


1. Ghosh, Z., Mallick, B. (2008). Bioinformatics – Principles and Applications, 1st edition. New Delhi, Delhi: Oxford University Press.
2. Baxevanis, A.D., Ouellette, B.F., John (2005). Bioinformatics: A Practical Guide to the Analysis of Genes and Proteins, 3rd edition. New Jersey, U.S.: Wiley & Sons, Inc.
3. Roy, D. (2009). Bioinformatics, 1st edition. New Delhi, Delhi: Narosa Publishing House.
4. Andreas, D., Baxevanis, B.F., Francis, Ouellette. (2004). Bioinformatics: A practical guide to the analysis of genes and proteins, 3rd edition. New Jersey, U.S.: John Wiley and Sons.
5. Pevsner, J. (2009). Bioinformatics and Functional Genomics, 2nd edition. New Jersey, U.S.: Wiley Blackwell.
6. Xiong, J. (2006). Essential Bioinformatics, 1st edition. Cambridge, U.K.: Cambridge University Press.
7. Mount, D.W. (2004). Bioinformatics: Sequence and Genome analysis 2nd edition, Cold Spring Harbor Laboratory Press, USA.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## CONSERVATION AND SUSTAINABILITY
(MAJOR COURSE)

**Course No. UMJBOT804** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

D.P.A- Daily Performance and Attendance.

*Objectives:*

*The course is designed to acquaint students with basic principles of conservation of biodiversity and Sustainable Development Goals.*

*Course Learning Outcomes:*

*The students will understand the role of plants in human welfare and ecological restoration through prevention of soil erosion and degradation, and habitat destruction. They will also understand the key green skill development programs helping to achieve Sustainable Development Goals.*

**Unit-I: Conservation of Natural Resources**

1.1 Natural Resource Conservation: Concept and types.

1.2 Need of Conservation in the Biodiversity crisis; causes of biodiversity loss; IUCN categorization of plant species.

1.3 *In-situ* conservation strategies, Biosphere reserves, National parks and wildlife sanctuaries.

1.4 *Ex-situ* conservation, Role of Botanic gardens and gene banks.

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VIII**
**(Syllabus for the examinations to be held in May 2026, 2027, 2028)**

## CONSERVATION AND SUSTAINABILITY
(MAJOR COURSE)

**Course No. UMJBOT804** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Species Restoration and Recovery**

2.1 Ecological restoration: Concept and role of ecological restoration in nature and species conservation.

2.2 Central concerns of restoration ecology, the product, feasibility and authenticity, scale and costs.

2.3 Global case studies on species recovery and habitat restoration, terrestrial as well as aquatic ecosystems.

2.4 Species recovery in India, success stories and way forward.

**Unit-III: Sustainability-I**

3.1 Principles and scope of sustainability, strategies for promoting sustainable development and consumption.

3.2 Current issues and areas of debate in relation to sustainable development, carrying capacity-based planning processes, Environment impact assessment and Environment Management Plan.

3.3 Environmental sustainability, Energy, Water, Food and social security.

3.4 Carbon credit system, Carbon trading and Carbon sequestration.

**Unit-IV: Sustainability-II**

4.1 The UN's Sustainable Development Goals (SDGs) and the biodiversity protocols proposed at COP28.

4.2 Politics and policies of sustainable development in different parts of the world; Challenges of toxic waste management and climate change.

4.3 Economics and sustainability, market-based approaches for achieving sustainability.

4.4 Economic philosophy and causes of biodiversity erosion, step towards creating a sustainable economy vis a vis environment.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## CONSERVATION AND SUSTAINABILITY
(MAJOR COURSE)

**Course No. UMJBOT804** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V: Practicals**

5.1 Categorization of floral elements of an area to different categories on the basis of IUCN criteria.
5.2 Collection of seed material for development of seed repository as an *ex-situ* conservation approach
5.3 In vitro approach for plant propagation as an *ex-situ* conservation strategy.
5.4 Assessment of plant diversity of an area using Importance Value Index.
5.5 Techniques of plant waste management and recycling.
5.6 Assessment of factors contributing to threat to the survival in case of threatened plants.
5.7 Calculation of $CO_2$ sequestration.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## CONSERVATION AND SUSTAINABILITY
(MAJOR COURSE)

**Course No. UMJBOT804** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15 to 20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | |
| 1. | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| 1. | External practical examination and viva-voce | 15 |

**Suggested readings**


1. Anita Varghese, Meera Anna Oommen, Mridula Mary Paul, Snehlata Nath. 2022. Conservation through Sustainable UseLessons from India. Routledge India.
2. Poonam Aggarwal. 2018. Challenges to Biodiversity Conservation And Sustainable Development.Astral International Pvt. Ltd. Darya Ganj, New Delhi.
3. J. S. Singh, S. P. Singh and S. R. Gupta. 2017. Ecology,environmental Science & Conservation. S.Chand (G/L) & Company Ltd, New Delhi.
4. Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll.2005. Principles of Conservation Biology. Oxford University Press.
5. Oliver S. Owen, Daniel D. Chiras, John P. Reganold. 1998. Natural Resource Conservation: Management for a Sustainable Future. Prentice Hall.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## SUSTAINABLE CONSERVATION
(MINOR COURSE)

**Course No. UMIBOT805** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| Theory | 03 | 45 | I to IV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The course is designed to acquaint students with basic principles of conservation of biodiversity and Sustainable Development Goals.*

*Course Learning Outcomes:*

*The students will understand the role of plants in human welfare and ecological restoration through prevention of soil erosion and degradation, and habitat destruction. They will also understand the key green skill development programs helping to achieve Sustainable Development Goals.*

**Unit-I: Conservation of Natural Resources**

1.1 Natural Resource Conservation: Concept and types.

1.2 Need of Conservation in the Biodiversity crisis; causes of biodiversity loss; IUCN categorization of plant species.

1.3 *In-situ* conservation strategies. Biosphere reserves. National parks and wildlife sanctuaries.

1.4 *Ex-situ* conservation, Role of Botanic gardens and gene banks.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## SUSTAINABLE CONSERVATION
(MINOR COURSE)

**Course No. UMIBOT805** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Species Restoration and Recovery**

2.1 Ecological restoration: Concept and role of ecological restoration in nature and species conservation.

2.2 Central concerns of restoration ecology, the product, feasibility and authenticity, scale and costs.

2.3 Global case studies on species recovery and habitat restoration, terrestrial as well as aquatic ecosystems.

2.4 Species recovery in India, success stories and way forward.

**Unit-III: Sustainability-I**

3.1 Principles and scope of sustainability, strategies for promoting sustainable development and consumption.

3.2 Current issues and areas of debate in relation to sustainable development, carrying capacity-based planning processes, Environment impact assessment and Environment Management Plan.

3.3 Environmental sustainability, Energy, Water, Food and social security.

3.4 Carbon credit system, Carbon trading and Carbon sequestration.

**Unit-IV: Sustainability-II**

4.1 The UN's Sustainable Development Goals (SDGs) and the biodiversity protocols proposed at COP28.

4.2 Politics and policies of sustainable development in different parts of the world; Challenges of toxic waste management and climate change.

4.3 Economics and sustainability, market-based approaches for achieving sustainability.

4.4 Economic philosophy and causes of biodiversity erosion, step towards creating a sustainable economy vis a vis environment.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## SUSTAINABLE CONSERVATION
(MINOR COURSE)

**Course No. UMIBOT805** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V: Practicals**

5.1 Categorization of floral elements of an area to different categories on the basis of IUCN criteria.

5.2 Collection of seed material for development of seed repository as an *ex-situ* conservation approach

5.3 In vitro approach for plant propagation as an *ex-situ* conservation strategy.

5.4 Assessment of plant diversity of an area using Importance Value Index.

5.5 Techniques of plant waste management and recycling.

5.6 Assessment of factors contributing to threat to the survival in case of threatened plants.

5.7 Calculation of $CO_2$ sequestration.

**Note for paper setters**

**End Semester University Examination (Total Marks: 60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## SUSTAINABLE CONSERVATION
(MINOR COURSE)

**Course No. UMIBOT805** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15 to 20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | **Marks** |
| 1. | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| 1 | External practical examination and viva-voce | 15 |

**Suggested readings**


1. Anita Varghese, Meera Anna Oommen, Mridula Mary Paul, Snehlata Nath. 2022. Conservation through Sustainable UseLessons from India. Routledge India.
2. Poonam Aggarwal. 2018. Challenges to Biodiversity Conservation and Sustainable Development.Astral International Pvt. Ltd. Darya Ganj, New Delhi.
3. J. S. Singh, S. P. Singh and S. R. Gupta. 2017. Ecology,environmental Science & Conservation. S.Chand (G/L) & Company Ltd. New Delhi.
4. Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll.2005. Principles of Conservation Biology. Oxford University Press.
5. Oliver S. Owen, Daniel D. Chiras, John P. Reganold. 1998. Natural Resource Conservation: Management for a Sustainable Future. Prentice Hall.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## CONSERVATION FOR SUSTAINABILITY
(MAJOR COURSE)

**Course No. UMJBOT806** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| Theory | 03 | 45 | ItoIV | 1½ | 03 | 15 | 60 |
| Practical | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

*The course is designed to acquaint students with basic principles of conservation of biodiversity and Sustainable Development Goals.*

*Course Learning Outcomes:*

*The students will understand the role of plants in human welfare and ecological restoration through prevention of soil erosion and degradation, and habitat destruction. They will also understand the key green skill development programs helping to achieve Sustainable Development Goals.*

**Unit-I: Conservation of Natural Resources**

1.1 Natural Resource Conservation: Concept and types.

1.2 Need of Conservation in the Biodiversity crisis; causes of biodiversity loss; IUCN categorization of plant species.

1.3 *In-situ* conservation strategies, Biosphere reserves, National parks and wildlife sanctuaries.

1.4 *Ex-situ* conservation, Role of Botanic gardens and gene banks.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## CONSERVATION FOR SUSTAINABILITY
(MAJOR COURSE)

**Course No. UMJBOT806** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Species Restoration and Recovery**

2.1 Ecological restoration: Concept and role of ecological restoration in nature and species conservation.

2.2 Central concerns of restoration ecology, the product, feasibility and authenticity, scale and costs.

2.3 Global case studies on species recovery and habitat restoration, terrestrial as well as aquatic ecosystems.

2.4 Species recovery in India, success stories and way forward.

**Unit-III: Sustainability-I**

3.1 Principles and scope of sustainability, strategies for promoting sustainable development and consumption.

3.2 Current issues and areas of debate in relation to sustainable development, carrying capacity-based planning processes, Environment impact assessment and Environment Management Plan.

3.3 Environmental sustainability, Energy, Water, Food and social security.

3.4 Carbon credit system, Carbon trading and Carbon sequestration.

**Unit-IV: Sustainability-II**

4.1 The UN's Sustainable Development Goals (SDGs) and the biodiversity protocols proposed at COP28.

4.2 Politics and policies of sustainable development in different parts of the world; Challenges of toxic waste management and climate change.

4.3 Economics and sustainability, market-based approaches for achieving sustainability.

4.4 Economic philosophy and causes of biodiversity erosion, step towards creating a sustainable economy vis a vis environment.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## CONSERVATION FOR SUSTAINABILITY
(MAJOR COURSE)

**Course No. UMJBOT806** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V: Practicals**

5.1 Categorization of floral elements of an area to different categories on the basis of IUCN criteria.
5.2 Collection of seed material for development of seed repository as an *ex-situ* conservation approach
5.3 In vitro approach for plant propagation as an *ex-situ* conservation strategy.
5.4 Assessment of plant diversity of an area using Importance Value Index.
5.5 Techniques of plant waste management and recycling.
5.6 Assessment of factors contributing to threat to the survival in case of threatened plants.
5.7 Calculation of $CO_2$ sequestration.

**Note for paper setters**

**End Semester University Examination (TotalMarks:60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks:15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## CONSERVATION FOR SUSTAINABILITY
(MAJOR COURSE)

**Course No. UMJBOT806** **Max. Marks: 100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15 to 20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| **I.** | **Internal Assessment (Total Marks: 10)** | |
| 1. | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| 1. | External practical examination and viva-voce | 15 |

**Suggested readings**


1. Anita Varghese, Meera Anna Oommen, Mridula Mary Paul, Snehlata Nath. 2022. Conservation through Sustainable Use Lessons from India. Routledge India.
2. Poonam Aggarwal. 2018. Challenges to Biodiversity Conservation And Sustainable Development. Astral International Pvt. Ltd. Darya Ganj, New Delhi.
3. J. S. Singh, S. P. Singh and S. R. Gupta. 2017. Ecology, environmental Science & Conservation. S. Chand (G/L) & Company Ltd, New Delhi.
4. Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll.2005. Principles of Conservation Biology. Oxford University Press.
5. Oliver S. Owen, Daniel D. Chiras, John P. Reganold. 1998. Natural Resource Conservation: Management for a Sustainable Future. Prentice Hall.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## SUSTAINABLE CONSERVATION OF NATURE
(MINOR COURSE)

**Course No.UMIBOT807** **Max. Marks: 100 (Theory-75, Practical-25)**

| | Credits | Contact Hours | Units | Examination | | | |
|---|---|---|---|---|---|---|---|
| | | | | Duration (hours) | | Weightage (Marks) | |
| | | | | Mid-semester | End semester | Mid-semester | End semester |
| **Theory** | 03 | 45 | ItoIV | 1½ | 03 | 15 | 60 |
| **Practical** | 01 | 30 | V | D.P.A | 3½ | 10 | 15 |

**D.P.A- Daily Performance and Attendance.**

*Objectives:*

***The course is designed to acquaint students with basic principles of conservation of biodiversity and Sustainable Development Goals.***

*CourseLearning Outcomes:*

***The students will understand the role of plants in human welfare and ecological restoration through prevention of soil erosion and degradation, and habitat destruction. They will also understand the key green skill development programs helping to achieve Sustainable Development Goals.***

### Unit-I: Conservation of Natural Resources

1.1 Natural Resource Conservation: Concept and types.

1.2 Need of Conservation in the Biodiversity crisis; causes of biodiversity loss; IUCN categorization of plant species.

1.3 *In-situ* conservation strategies, Biosphere reserves, National parks and wildlife sanctuaries.

1.4 *Ex-situ* conservation, Role of Botanic gardens and gene banks.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## SUSTAINABLE CONSERVATION OF NATURE
(MINOR COURSE)

**Course No. UMIBOT807** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-II: Species Restoration and Recovery**

2.1 Ecological restoration: Concept and role of ecological restoration in nature and species conservation.

2.2 Central concerns of restoration ecology, the product, feasibility and authenticity, scale and costs.

2.3 Global case studies on species recovery and habitat restoration, terrestrial as well as aquatic ecosystems.

2.4 Species recovery in India, success stories and way forward.

**Unit-III: Sustainability-I**

3.1 Principles and scope of sustainability, strategies for promoting sustainable development and consumption.

3.2 Current issues and areas of debate in relation to sustainable development, carrying capacity-based planning processes, Environment impact assessment and Environment Management Plan.

3.3 Environmental sustainability, Energy, Water, Food and social security.

3.4 Carbon credit system, Carbon trading and Carbon sequestration.

**Unit-IV: Sustainability-II**

4.1 The UN's Sustainable Development Goals (SDGs) and the biodiversity protocols proposed at COP28.

4.2 Politics and policies of sustainable development in different parts of the world; Challenges of toxic waste management and climate change.

4.3 Economics and sustainability, market-based approaches for achieving sustainability.

4.4 Economic philosophy and causes of biodiversity erosion, step towards creating a sustainable economy vis a vis environment.

**UNIVERSITY OF JAMMU**
**Syllabus for FYUG Program in BOTANY**
**(Under CBCS as per NEP–2020)**
**UG SEMESTER–VIII**
**(Syllabus for the examinations to be held in May 2026, 2027, 2028)**

## SUSTAINABLE CONSERVATION OF NATURE
(MINOR COURSE)

**Course No. UMIBOT807** **Max. Marks: 100 (Theory-75, Practical-25)**

**Unit-V:Practicals**

5.1 Categorization of floral elements of an area to different categories on the basis of IUCN criteria.

5.2 Collection of seed material for development of seed repository as an *ex-situ* conservation approach

5.3 In vitro approach for plant propagation as an *ex-situ* conservation strategy.

5.4 Assessment of plant diversity of an area using Importance Value Index.

5.5 Techniques of plant waste management and recycling.

5.6 Assessment of factors contributing to threat to the survival in case of threatened plants.

5.7 Calculation of $CO_2$ sequestration.

**Note for paper setters**

**End Semester University Examination (Total Marks:60; syllabus to be covered: 100%)**

The question paper will have 2 sections. Section 'I' will be compulsory having four questions of 3 marks each and spread over the entire theory syllabus (i.e. Unit I to IV; one from each unit). The questions will be short answer type having answers not exceeding 50 to 70 words. Section 'II' will have eight long answer type questions, two from each unit. Each question will be of 12 marks. The candidates will be required to answer one question from each unit.

**Mid Semester Assessment (Total Marks: 15; syllabus to be covered upto: 50%)**

Fifteen (15) marks for theory paper in a subject reserved for internal assessment shall have one long answer type question of 7 marks and four short answer type questions of 2 marks each.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in BOTANY
## (Under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (Syllabus for the examinations to be held in May 2026, 2027, 2028)

## SUSTAINABLE CONSERVATION OF NATURE
(MINOR COURSE)

**Course No. UMIBOT807** **Max. Marks:100 (Theory-75, Practical-25)**

**Practicals (Mandatory)**

Conduct of practicals is mandatory as per UGC guidelines. These can be undertaken in separate groups of 15 to 20 students per group in addition to theory classes.

**Note for distribution of 25 Marks in Practical Examination (based on Unit V)**

| | | Marks |
|---|---|---|
| **I.** | **InternalAssessment (Total Marks: 10)** | |
| 1. | Daily performance based on practical work done and attendance | 10 |
| **II.** | **External Assessment (Total Marks: 15)** | |
| 1. | External practical examination and viva-voce | 15 |

**Suggested readings**


1. Anita Varghese, Meera Anna Oommen, Mridula Mary Paul, Snehlata Nath. 2022. Conservation through Sustainable Use Lessons from India. Routledge India.
2. Poonam Aggarwal. 2018. Challenges to Biodiversity Conservation and Sustainable Development. Astral International Pvt. Ltd. Darya Ganj, New Delhi.
3. J. S. Singh, S. P. Singh and S. R. Gupta. 2017. Ecology, environmental Science & Conservation. S.Chand (G/L) & Company Ltd, New Delhi.
4. Martha J. Groom, Gary K. Meffe, and C. Ronald Carroll.2005. Principles of Conservation Biology. Oxford University Press.
5. Oliver S. Owen, Daniel D. Chiras, John P. Reganold. 1998. Natural Resource Conservation: Management for a Sustainable Future. Prentice Hall.

# UNIVERSITY OF JAMMU
## Syllabus for FYUG Program in
## BOTANY (under CBCS as per NEP–2020)
## UG SEMESTER–VIII
## (For the examinations to be held in May 2026, 2027, 2028)

### RESEARCH PROJECT/DISSERTATION
(MAJOR COURSE)

**Course No. USEBOT808** **Max. Marks: 300**

**Credits: 12 [Dissertation =08; Viva-voce/Presentation =04]**

**Marks: 300 [Dissertation =200; Viva-voce/Presentation =100]**

*Objectives:*

*The research project/dissertation has been introduced to inculcate scientific acumen in students and expose them to diverse aspects in the field of research. The students will not only develop an insight into the day to day problems of the society at large and will try to find appropriate solutions too.*

*Course Learning Outcomes:*

*The students will apply the knowledge gained in exploring/solving/analyzing real life situations or problems.*

Guidelines: Refer to Statute 22.viii of the statutes governing FYUG as per NEP 2020. notified vide No. F.Acd/I/23/7769-7828 Dated: 03-08-2023.