UNIVERSITY OF JAMMU

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

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(24/Feb./Adp., 105)

In partial modification of this office Notification n vide no. F.Acd/II/22/5382-5425 dated 18.09.2022 and F.Acd/II/23/3541-3551 dated 26.05.2023, 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 amendments in the **note for distribution of marks** in the **Practical Examination** of the syllabi and Courses of studies in the subject of **Botany** in the semester **Ist** to **IVth** for the **Four Year Undergraduate Programme (FYUGP)** under the **Choice Based Credit system** as **per NEP-2020.** The modified copies of the syllabi are placed in **(as given in the annexure)** as per the details given below:-

Semester	Course	Existing	As it would read after modification
I to IV	Major Minor Skill Enhancement Course	Internal Assessment(Total marks) Attendance- 2marks Practical test- 5marks Daily Performance based on practical workdone-3marks Ext. Assessment External Practical examination - 10marks Viva –Voce-5marks	Internal Assesment-10 marks External Assessment- 15 marks

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/24/ 14243-281
Dated: 16/2/24

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

Sumitadhaun 16/2/24
Deputy Registrar (Academic)
16/2/24
16/02/24

UNIVERSITY OF JAMMU

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

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION
(22/Sept./Adp/31)

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 Study in the subject of **Botany** of Semesters **Ist and IInd** for **Four Year Under Graduate Programme** 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 examination to be held in the years
Botany	Semester-I Semester-II	December 2022, 2023 and 2024 May 2023, 2024 and 2025

The Syllabi of the courses is available on the University website: www.jammuuniversity.ac.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/22/5382-5425
Dated: 18-9-2022

Copy for information and necessary action to:

1. Special Secretary to the Vice-Chancellor, University of Jammu for information of Hon'ble Vice-Chancellor
2. Dean, Faculty of Life Science
3. HOD/Convener, Board of Studies in **Botany**
4. Sr. P.A.to the Controller of Examinations
5. All members of the Board of Studies
6. Confidential Assistant to the Controller of Examinations
7. I/C Director, Computer Centre, University of Jammu
8. Deputy Registrar/Asst. Registrar (Conf. /Exams. UG/ Exam Eval Non-Prof/CDC)
9. Incharge, University Website for Uploading of the notification.

Sumitra Kaur 16/9/22
Deputy Registrar (Academic)

15/9/22

UNIVERSITY OF JAMMU

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

Academic Section
Email: academicsectionju14@gmail.com

NOTIFICATION

(23/May/Adp./40)

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 Study in the subject of **Botany** of Semesters **IIIrd** and **IVth** for **Four Year Under Graduate Programme** 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 examination to be held in the years
Botany	Semester-III	December 2023, 2024 and 2025
	Semester-IV	May 2024, 2025 and 2026

The Syllabi of the courses is available on the University website: www.jammuuniversity.ac.in

Sd/-
DEAN ACADEMIC AFFAIRS

No. F. Acd/II/23/3541-3551
Dated: 26-5-2023.

Copy for information and necessary action to:

1. Dean, Faculty of Science
2. Convener, Board of Studies in 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. I/C Director, Computer Centre, University of Jammu
7. Deputy Registrar/Asst. Registrar (Conf. /Exams. UG/Eval Non-Prof)
8. Incharge, University Website for Uploading of the notification.

Sumitra Devi 25/5
Deputy Registrar (Academic)

25/5/23 25/5 24/5/23

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 2022–23

Approved By:

Board of Studies in Botany

DEPARTMENT OF BOTANY, UNIVERSITY OF JAMMU, JAMMU

Following courses of study are prescribed for

1st to 4th 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)
FIRST	MAJOR	INTRODUCTION TO THE PLANT MICROBES AND PLANT KINGDOM	UMJBOT101	4 (3T + 1P)
	MINOR	PLANT AND MICROBIAL WORLD	UMIBOT102	4 (3T + 1P)
	MULTIDISCIPLINARY	PLANTS-IMPORTANCE AND PROPAGATION	UMDBOT103	3 (T)
	SKILL ENHANCEMENT	NURSERY AND GARDENING	USEBOT104	2 (1T + 1P)
SECOND	MAJOR	ECONOMIC BOTANY AND PLANT CONSERVATION	UMJBOT201	4 (3T + 1P)
	MINOR	UTILIZATION AND CONSERVATION OF PLANTS	UMIBOT202	4 (3T + 1P)
	MULTIDISCIPLINARY*	ENTERPRENEURSHIP IN BOTANY*	UMDBOT203*	3 (T)*
	MULTIDISCIPLINARY	PLANTS-IMPORTANCE AND PROPAGATION	UMDBOT205	3 (T)
	SKILL ENHANCEMENT	BIO-FERTILIZERS	USEBOT204	2 (1T + 1P)
THIRD	MAJOR	DIVERSITY OF MICROBES, ALGAE, BRYOPHYTES AND PTERIDOPHYTES	UMJBOT301	4 (3T + 1P)
	MAJOR	CELL AND MOLECULAR BIOLOGY	UMJBOT302	4 (3T + 1P)
	MINOR	CELL BIOLOGY	UMIBOT303	4 (3T + 1P)
	MULTIDISCIPLINARY	PLANTS-IMPORTANCE AND PROPAGATION	UMDBOT304	3 (T)
	SKILL ENHANCEMENT	MUSHROOM CULTIVATION AND TECHNOLOGY	USEBOT305	2 (1T + 1P)
FOURTH	MAJOR	CHARACTERISTICS AND SYSTEMATICS OF SEED PLANTS	UMJBOT401	4 (3T + 1P)
	MAJOR	MYCOLOGY AND PLANT PATHOLOGY	UMJBOT402	4 (3T + 1P)
	MAJOR	PLANT ANATOMY	UMJBOT403	4 (3T + 1P)
	MAJOR	ECOLOGY AND CONSERVATION BIOLOGY	UMJBOT404	4 (3T + 1P)
	MINOR	ENVIRONMENTAL BIOLOGY	UMIBOT405	4 (3T + 1P)

*Course No. UMDBOT205 will run in place of Course No. UMDBOT203

UNIVERSITY OF JAMMU
Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–I
(For the examinations to be held in December 2022, 2023, 2024)

INTRODUCTION TO MICROBES AND PLANT KINGDOM
(MAJOR COURSE)

Course No. UMJBOT101 **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 paper will give an overview of the plant and microbial world to the students and help them understand the interrelationships and evolutionary pathways among them.

Course Learning outcomes:

The course will acquaint the students with the diversity of microbial and plant kingdom. General life cycle, reproduction and economic importance of most of the groups will be covered. The knowledge will help the students appreciate and tap the economic significance of the major microbial and plant groups.

Unit I: Microbial Diversity

1.1 Microbes-Introduction and significance; hierarchical organization of microbes in living world.

1.2 Microbes-Whittaker's Five Kingdom concept; distribution in soil, air, water and food; economic importance.

1.3 Viruses-Discovery, structure, general account of plant and animal viruses and bacteriophages, concept of lytic and lysogenic cycles.

1.4 Bacteria-Discovery, general characteristics, cell structure and modes of reproduction.

Unit-II: Algal, Fungal and Lichen Diversity

2.1 Algae-Distribution, habitat, thallus organization, cell structure, pigments and reserve food, general reproduction, life cycle and economic importance (in brief).

2.2 Fungi- Occurrence, general characteristics, cell structure, reproduction, life cycle and economic importance (in brief).

UNIVERSITY OF JAMMU
Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–I
(For the examinations to be held in December 2022, 2023, 2024)

INTRODUCTION TO MICROBES AND PLANT KINGDOM
(MAJOR COURSE)

Course No. UMJBOT101 **Max. Marks: 100 (Theory-75, Practical-25)**

2.3 Lichen-Morphology, types and reproduction; economic importance.
2.4 Mycorrhiza-General account, types and significance.

Unit-III: Cryptogam Diversity

3.1 Bryophytes- Origin, occurrence, thallus structure and general features.
3.2 Bryophytes-Alternation of generations; reproduction and life cycle; ecological and economic importance (in brief).
3.3 Pteridophytes-General features, affinity with bryophytes, occurrence and alternation of generations.
3.4 Pteridophytes-Reproduction, life cycle and economic importance.

Unit-IV: Phanerogam Diversity

4.1 Gymnosperms-Distribution, general characters, reproduction and life cycle.
4.2 Gymnosperms-Affinities and evolutionary significance; economic importance.
4.3 Angiosperms-Occurrence and general features; reproduction and life cycle.
4.4 Angiosperms-Categorization into monocots and dicots; economic and evolutionary significance (in brief).

Unit-V: Practicals

5.1 Study of diversity in thallus forms of algae: Cyanophyceae, Chlorophyceae, Xanthophyceae, Phaeophyceae and Rhodophyceae through temporary mounts, specimens or permanent slides.
5.2 Study of various types of fungi and lichens through temporary mounts or locally available specimens.
5.3 Study of various types of Bryophytes and Pteridophytes using live/ preserved specimens.
5.4 Study of various types of Gymnosperms and monocots and dicots with the help of specimens collected from local areas during field trips.
5.5 Electron micrographs/Models of viruses.
5.6 Gram staining in bacteria.

INTRODUCTION TO MICROBES AND PLANT KINGDOM
(MAJOR COURSE)

Course No. UMJBOT101 **Max. Marks: 100 (Theory-75, Practical-25)**

5.7 Types of Bacteria from temporary/permanent slides/photographs and by Gram staining technique; electron micrographs of bacterial reproduction, Binary Fission and Conjugation.

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)**	
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

UNIVERSITY OF JAMMU
Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–I
(For the examinations to be held in December 2022, 2023, 2024)

INTRODUCTION TO MICROBES AND PLANT KINGDOM
(MAJOR COURSE)

Course No. UMJBOT101 **Max. Marks: 100 (Theory-75, Practical-25)**

Suggested Readings

1. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
2. 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.
3. Coulter, J.M. (1851). Morphology of Angiosperms (Morphology of Spermatophytes. Part-II). Nebu press, pp 376.
4. Khan, A.S. (2017). Flowering Plants: Structure and Industrial Products. Wiley; 1st edition, United Kingdom, pp 344.
5. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
6. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
7. Pelczar, M.J. (2001). Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
8. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6th 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–I
(For the examinations to be held in December 2022, 2023, 2024)

PLANT AND MICROBIAL WORLD
(MINOR COURSE)

Course No. UMIBOT102 **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 paper will give an overview of the plant and microbial world to the students and help them understand the interrelationships and evolutionary pathways among them.

Course Learning outcomes:

The course will acquaint the students with the diversity of microbial and plant kingdom. General life cycle, reproduction and economic importance of most of the groups will be covered. The knowledge will help the students appreciate and tap the economic significance of the major microbial and plant groups.

Unit I: Microbial Diversity

1.1 Microbes-Introduction and significance; hierarchical organization of microbes in living world.

1.2 Microbes-Whittaker's Five Kingdom concept; distribution in soil, air, water and food; economic importance.

1.3 Viruses-Discovery, structure, general account of plant and animal viruses and bacteriophages, concept of lytic and lysogenic cycles.

1.4 Bacteria-Discovery, general characteristics, cell structure and modes of reproduction.

Unit-II: Algal, Fungal and Lichen Diversity

2.1 Algae-Distribution, habitat, thallus organization, cell structure, pigments and reserve food, general reproduction, life cycle and economic importance (in brief).

2.2 Fungi- Occurrence, general characteristics, cell structure, reproduction, life cycle and economic importance (in brief).

UNIVERSITY OF JAMMU
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PLANT AND MICROBIAL WORLD
(MINOR COURSE)

Course No. UMIBOT102 **Max. Marks: 100 (Theory-75, Practical-25)**

2.3 Lichen-Morphology, types and reproduction; economic importance.
2.4 Mycorrhiza-General account, types and significance.

Unit-III: Cryptogam Diversity

3.1 Bryophytes- Origin, occurrence, thallus structure and general features.
3.2 Bryophytes-Alternation of generations; reproduction and life cycle; ecological and economic importance (in brief).
3.3 Pteridophytes-General features, affinity with bryophytes, occurrence and alternation of generations.
3.4 Pteridophytes-Reproduction, life cycle and economic importance.

Unit-IV: Phanerogam Diversity

4.1 Gymnosperms-Distribution, general characters, reproduction and life cycle.
4.2 Gymnosperms-Affinities and evolutionary significance; economic importance.
4.3 Angiosperms-Occurrence and general features; reproduction and life cycle.
4.4 Angiosperms-Categorization into monocots and dicots; economic and evolutionary significance (in brief).

Unit-V: Practicals

5.1 Study of diversity in thallus forms of algae: Cyanophyceae, Chlorophyceae, Xanthophyceae, Phaeophyceae and Rhodophyceae through temporary mounts, specimens or permanent slides.
5.2 Study of various types of fungi and lichens through temporary mounts or locally available specimens.
5.3 Study of various types of Bryophytes and Pteridophytes using live/ preserved specimens.
5.4 Study of various types of Gymnosperms and monocots and dicots with the help of specimens collected from local areas during field trips.
5.5 Electron micrographs/Models of viruses.
5.6 Gram staining in bacteria.

UNIVERSITY OF JAMMU
Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–I
(For the examinations to be held in December 2022, 2023, 2024)

PLANT AND MICROBIAL WORLD
(MINOR COURSE)

Course No. UMIBOT102 **Max. Marks: 100 (Theory-75, Practical-25)**

5.7 Types of Bacteria from temporary/permanent slides/photographs and by Gram staining technique; electron micrographs of bacterial reproduction, Binary Fission and Conjugation.

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)**	
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

UNIVERSITY OF JAMMU
Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–I
(For the examinations to be held in December 2022, 2023, 2024)

PLANT AND MICROBIAL WORLD
(MINOR COURSE)

Course No. UMIBOT102 **Max. Marks: 100 (Theory-75, Practical-25)**

Suggested Readings

1. Bhatnagar, S.P. and Moitra, A. (1996). Gymnosperms. New Age International (P) Ltd Publishers, New Delhi, India.
2. 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.
3. Coulter, J.M. (1851). Morphology of Angiosperms (Morphology of Spermatophytes. Part-II). Nebu press, pp 376.
4. Khan, A.S. (2017). Flowering Plants: Structure and Industrial Products. Wiley; 1st edition, United Kingdom, pp 344.
5. Kumar, H.D. (1999). Introductory Phycology. Affiliated East-West Press, Delhi.
6. Lee, R.E. (2008). Phycology, Cambridge University Press, Cambridge. 4th edition.
7. Pelczar, M.J. (2001). Microbiology, 5th edition, Tata McGraw-Hill Co, New Delhi.
8. Prescott, L.M., Harley J.P., Klein D. A. (2005). Microbiology, McGraw Hill, India. 6th 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–I
(For the examinations to be held in December 2022, 2023, 2024)

PLANTS–IMPORTANCE AND PROPAGATION
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT103 **Max. Marks: 75**

	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

Objectives:

The course has been framed to familiarize students with the importance of plants for sustenance of our planet in general and mankind in particular. It also aims to educate them about different modes of plant reproduction.

Course Learning outcomes:

The course will teach the students importance of plants and the diversity of their methods of propagation. Insights gained therein will help them to bring the economically important taxa under effective cultivation.

Unit–I: Plants–An Overview

1.1 Diversity in habit (herb, shrub and tree) and habitat (terrestrial and aquatic) with respect to altitude (temperate, tropical, sub-tropical and alpine).
1.2 Diversity in forms and body organisation.
1.3 Diversity of plant adaptation.
1.4 Concept of evolution and speciation.

Unit–II: Importance of Plants

2.1 Plants and their role in climate stability (soil fertility, prevention of soil erosion, availability of Oxygen, Carbon sequestration, pollution control).
2.2 Plants as source of food (Wheat, Maize, Rice, Mango, Jamun, Rajmah, Apple. Bottlegourd and Fenugreek) – general description, botanical names and parts used.

UNIVERSITY OF JAMMU
Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–I
(For the examinations to be held in December 2022, 2023, 2024)

PLANTS–IMPORTANCE AND PROPAGATION
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT103 **Max. Marks: 75**

2.3 Plants as source of fodder (Clover, Oak, Bhimal) and timber (Pine, Deodar, Shisham and Teak) – general description, botanical names and parts used.

2.4 Plants as source of medicine (Quinine, Belladona, Sarpgandha and Foxglove), essential oils (Lemon-grass and Lavender) and beverages (Tea and Coffee) – general description, botanical names and parts used.

Unit–III: Modes of Vegetative Propagation

3.1 General account of asexual means of reproduction; Concept of Apomixis and its main types.

3.2 Natural and artificial means of vegetative propagation; advantages and limitations.

3.3 Propagation by bulbs, corms, tubers, rhizomes, runners, stolons and suckers – general account.

3.4 Propagation by cutting, layering, grafting and budding – basic concepts.

Unit –IV: Modes of Sexual Reproduction

4.1 General account of sexual means of reproduction.

4.2 Structure of flower and its various forms; types of pollination (self-versus cross) mechanisms.

4.3 Fertilization, basic concept of seed and fruit development.

4.4 Seed germination and dormancy; types and methods to break dormancy.

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–I
(For the examinations to be held in December 2022, 2023, 2024)

PLANTS–IMPORTANCE AND PROPAGATION
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT103

Max. Marks: 75

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.

Suggested readings

1. Bhojwani, S.S., Bhatnagar, S.P. and Dantu, P.K. (2018). The embryology of angiosperms. (6th edition). Vikas Publishing House, Noida.
2. Coulter, J.M. (1851). Morphology of Angiosperms (Morphology of Spermatophytes. Part-II). Nebu press, pp 376.
3. Johri, B.M. and Srivastava, P.S. (2013). Reproductive Biology of Plants. Springer Science and Business Media, pp 320.
4. Khan. A.S. (2017). Flowering Plants: Structure and Industrial Products. Wiley; 1st edition, United Kingdom, pp 344.
5. Kochhar, S.L. (2016). Economic Botany. Cambridge University Press, pp 680.
6. Nanda, K.K. and Kochar V.K. (1985). Vegetative Propagation of Plants. Kalyani Publishers, New Delhi.
7. Ramawat, K.G. et al. (2014). Reproductive Biology of Plants. CRC Press, Boca Raton.
8. Sadhu, M.K. (1999). Plant Propagation. New Age International (P) Limited Publishers, New Delhi.

UNIVERSITY OF JAMMU
Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–I
(For the examinations to be held in December 2022, 2023, 2024)

NURSERY AND GARDENING
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT104 **Max. Marks: 50 (Theory-25, 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	½	2½	05	20
Practical	01	30	V	D.P., A	2½	10	15

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

Objectives:

The course aims to make students understand the theoretical and practical details of nursery and gardening. Knowledge so gained will provide them with the means for their self-employment and also of others.

Course Learning outcomes:

The students will be able to distinguish and choose the plant species amenable for nursery and gardening. They can develop their own nursery for livelihood and marketing purposes. The course will also equip the students with the basic skill needed to design and lay gardens.

Unit-I: Introduction to Nursery and Gardening

1.1 Definition and types of nurseries; physical resources for nurseries.
1.2 Selection of nursery site, ecological conditions, important nursery operations.
1.3 Definition and components of gardens, types of gardening (landscape and home gardening).
1.4 Scope and objective of gardening; garden landscaping with specific reference to Kew Botanical garden, AJC Bose Indian Botanic Garden, Kolkata and Lal Bagh Botanical Garden, Bangalore.

Unit-II: Plant Propagation Methods

2.1 Seed dormancy – causes and methods of breaking it; seed germination, types and factors affecting i
2.2 Vegetative propagation, artificial and natural methods; Concept of soilless cultivation with special reference to aeroponics and hydroponics.

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Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–I
(For the examinations to be held in December 2022, 2023, 2024)

NURSERY AND GARDENING
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT104 **Max. Marks: 50 (Theory-25, Practical-25)**

2.3 Concept of micro-propagation, hardening, packaging, transport and marketing of nursery plants; Scope and importance of plant propagation in nurseries.

2.4 Propagation structures: Mist chambers, green houses, glass houses, polyhouses and shade houses.

Unit-III: Practicals

3.1 Equipments and implements used in nurseries and gardening.
3.2 Gardening operations – Soil structure, bed preparation, fertigation and irrigation.
3.3 Weed management, water management, drainage, trimming, pruning and thinning.
3.4 Sowing/ raising of seeds and seedlings; transplanting of seedlings.
3.5 Potting, repotting, depotting and mulching.
3.6 Demonstration of techniques of vegetative means of propagation.
3.7 Preparation of material for hydroponics and aeroponics.
3.8 Field trip to Botanical Garden of University of Jammu and important locally available nurseries.
3.9 Demonstration of formation of vertical gardens.

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.

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UG SEMESTER–I
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NURSERY AND GARDENING
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT104 **Max. Marks: 50 (Theory-25, 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) Acquaah, G. (2009). Horticulture, Principles and Practices (4th edition). Pearson Publisher, PrenticeHall.
2) Bose, T.K and Mukerjee, D. (1977). Gardening in India. New Delhi Oxford & IBH Pub. Co. Pvt. Ltd.
3) Bose, T.K., Singh, L.J., Sandhu, M.K. and Maity, T.K. (2015). Ornamental plants and Garden design in Tropics and Subtropics (Vol 1 & 2). Daya Publishing House; A division of Astral International Pvt. Ltd.
4) Brukell, C. (2007). Encyclopedia of Gardening. Dorling Kindersley Ltd.
5) Hartman, H.T. (1959). Plant Propagation–Principles and Practices by Prentice. Hall International: London.
6) Kumar, N. (2010). Introduction to Horticulture (7th edition). Oxford & IBH Publishing Company Pvt.Ltd.
7) Rao, M.B. (2005). Textbook of Horticulture (2nd edition). Macmillan India Ltd.

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Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP-2020)
UG SEMESTER–II
(For the examinations to be held in May 2023, 2024, 2025)

ECONOMIC BOTANY AND PLANT CONSERVATION
(MAJOR COURSE)

Course No. UMJBOT201 **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 has been framed for enhancing the knowledge of students about the important plant resources and their sustainable utilization. Understanding the origin and domestication of plants will help the students appreciate the need to conserve.

Course Learning outcome:

The course will familiarize students with origin and utilization of plants. The students will be able to understand and appreciate the value of plants as sources of food, fodder, spices and drugs. The students will become aware of the need to conserve, build confidence among them towards sustainable use of plants and enable them to design strategies for their effective conservation.

Unit-I: Plants and civilization

1.1 Origin of agriculture-time and places of origin.
1.2 Centre of origin and domestication of cultivated plants; Vavilov's and de Candolle's concept.
1.3 Forest Resources – sustainable utilization and development.
1.4 Ethnobotany-role of plants in migratory and settled tribes.

Unit- II: Utilization of plants-I

2.1 Food and fibre plants-Botany and utility of Wheat, Maize, Rice, Cotton and Jute.
2.2 Pulses (Black mung, Rajmash and Kulth) – distribution and cultivation in India and food value.

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UG SEMESTER–II
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ECONOMIC BOTANY AND PLANT CONSERVATION
(MAJOR COURSE)

Course No. UMJBOT201 **Max. Marks: 100 (Theory-75, Practical-25)**

2.3 Spices and condiments – Botany and utility of Cumin, Asafoetida, Fennel, Coriander, Cloves, Cinnamon, Ginger, Turmeric and Cardamom.

2.4 Vegetables and fruits-Botany and utility of Turnip, Bitter gourd, Lady Finger, Apple Mango and Walnut.

Unit-III: Utilization of plants-II

3.1 Vegetable oils-Botany and utility of Sunflower and Mustard.

3.2 Source and utility of resins, tannins, gums, rubber and natural dyes.

3.3 Non-wood forest products: distribution and utility of bamboos and rattans, raw materials for paper making and the processing procedure involved.

3.4 Medicinal plants-General account; concept of natural and synthetic drugs; roots and seeds as sources of drugs; psychoactive drugs from Hemp and poppy and their mode of action (in brief).

Unit –IV: Extinction and plant conservation

4.1 IUCN categories of plants, land races of crops, methods of categorization.

4.2 Plant extinction: causes and preventive measures.

4.3 Principles of conservation, *in-situ* and *ex-situ* conservation strategies, CBD, international agreement to protect species and habitat.

4.4 Habitat protection, sacred groves and indigenous knowledge (IK) for the conservation of the plant species.

Unit–V: Practicals

5.1 Determination of the percentage of conservation value of soil and water for herbaceous community.

5.2 Determination of seed viability of medicinal plants by tetrazolium chloride test and its correlation with threat status.

5.3 Comparison of the germplasm diversity in economic traits of locally available vegetables.

5.4 Determination of the percentage of species association using Jaccard's index.

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UG SEMESTER–II
(For the examinations to be held in May 2023, 2024, 2025)

ECONOMIC BOTANY AND PLANT CONSERVATION
(MAJOR COURSE)

Course No. UMJBOT201 **Max. Marks: 100 (Theory-75, Practical-25)**

5.5 Pharmacognostic details (morphology, anatomy and organoleptic characters) of the locally available crude drugs of Indian system of medicine.

5.6 Determination of the presence of tannins and flavonoids in tea samples locally available in the market.

5.7 Comparison of the percentage of protein bodies in the locally available pulses.

5.8 Preparation of temporary mount using iodine solution as stain and compare type, shape, structure, and size of starch granules in the locally available plant material.

5.9 Determination of the presence of phlobatannins, flavonoids, steroids and glycosides in the locally available drug samples.

5.10 Preparation of soap from vegetable oil.

5.11 Extraction and characterization of the plant fibres from provided plant material.

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.

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ECONOMIC BOTANY AND PLANT CONSERVATION
(MAJOR COURSE)

Course No. UMJBOT201 **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. Akeroyd, J. and Jackson, P.W. (1995). A Handbook of Botanic Garden and Reintroduction of Plants to the Wild. Botanic garden conservation Union, UK.
2. Chowdhery, H.J. and Murty, S.K. (2000). Plant Diversity and Conservation in India – an overview. Bishen Singh Mahendra Pal Singh, Dehradun.
3. Directory of Indian Wetlands (1993). W.W.F. India, New Delhi and AWB, Kuala Lumpur.
4. Gadgil, M. and Guha, R. (1996). Ecology and Equality: Use and Abuse of Nature in Contemporary India. Penguin, New Delhi.
5. Heywood, V. (1995). Global Biodiversity Assessment. United National Environment Programme. Cambridge University Press, Cambridge, U.K.
6. Haunter, M.L. and Gibbs, J. (2007). Fundamentals of Conservation Biology. 3rd Edn. Blackwell Publishing, U.K.
7. Kochhar, S.L. (2016). Economic Botany. Cambridge University Press, pp 680.
8. Kothari, A. (1997). Understanding Biodiversity: Life Sustainability and Equity. Orient Longman.

ECONOMIC BOTANY AND PLANT CONSERVATION
(MAJOR COURSE)

Course No. UMJBOT201 **Max. Marks: 100 (Theory-75, Practical-25)**

9. Meffe, G.K. and Ronald, C.R. (1994). Principles of Conservation Biology. Sinauer Associates. INC Publishers, USA.
10. Primack, R.E. (2006). Essentials of Conservation Biology. 4th Edn. Sinauer Associates, U.S.A.
11. Rodgers, N.A. and Panwar, H.S. (1988). Planning a Wildlife Protected Area Network in India. Vol. I. The Report Wildlife Institute of India, Dehradun.
12. Swaminathan, M.S. and Kocchar, S.L. (1989). Plants and Society. MacMillan Publication Ltd., London.
13. Vardhana, R. (2009). Economic Botany. Sarup Book Publishers Pvt. Ltd., New Delhi.
14. Walter, K.S. and Gillett, H.J. (1998). 1997 IUCN Red List of Threatened Plants. IUCN, the World Conservation Union, IUCN, Gland. Switzerland and Cambridge, U.K.

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UG SEMESTER–II
(For the examinations to be held in May 2023, 2024, 2025)

UTILIZATION AND CONSERVATION OF PLANTS
(MINOR COURSE)

Course No. UMIBOT202 **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 has been framed for enhancing the knowledge of students about the important plant resources and their sustainable utilization. Understanding the origin and domestication of plants will help the students appreciate the need to conserve.

Course Learning outcome:

The course will familiarize students with origin and utilization of plants. The students will be able to understand and appreciate the value of plants as sources of food, fodder, spices and drugs. The students will become aware of the need to conserve, build confidence among them towards sustainable use of plants and enable them to design strategies for their effective conservation.

Unit-I: Plants and civilization

1.1 Origin of agriculture-time and places of origin.
1.2 Centre of origin and domestication of cultivated plants; Vavilov's and de Candolle's concept.
1.3 Forest Resources – sustainable utilization and development.
1.4 Ethnobotany-role of plants in migratory and settled tribes.

Unit- II: Utilization of plants-I

2.1 Food and fibre plants-Botany and utility of Wheat, Maize, Rice, Cotton and Jute.
2.2 Pulses (Black mung, Rajmash and Kulth) – distribution and cultivation in India and food value.

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UTILIZATION AND CONSERVATION OF PLANTS
(MINOR COURSE)

Course No. UMIBOT202 **Max. Marks: 100 (Theory-75, Practical-25)**

2.3 Spices and condiments – Botany and utility of Cumin, Asafoetida, Fennel, Coriander, Cloves, Cinnamon, Ginger, Turmeric and Cardamom.

2.4 Vegetables and fruits-Botany and utility of Turnip, Bitter gourd, Lady Finger, Apple Mango and Walnut.

Unit-III: Utilization of plants-II

3.1 Vegetable oils-Botany and utility of Sunflower and Mustard.

3.2 Source and utility of resins, tannins, gums, rubber and natural dyes.

3.3 Non-wood forest products: distribution and utility of bamboos and rattans, raw materials for paper making and the processing procedure involved.

3.4 Medicinal plants-General account; concept of natural and synthetic drugs; roots and seeds as sources of drugs; psychoactive drugs from Hemp and poppy and their mode of action (in brief).

Unit –IV: Extinction and plant conservation

4.1 IUCN categories of plants, land races of crops, methods of categorization.

4.2 Plant extinction: causes and preventive measures.

4.3 Principles of conservation, *in-situ* and *ex-situ* conservation strategies, CBD, international agreement to protect species and habitat.

4.4 Habitat protection, sacred groves and indigenous knowledge (IK) for the conservation of the plant species.

Unit–V: Practicals

5.1 Determination of the percentage of conservation value of soil and water for herbaceous community.

5.2 Determination of seed viability of medicinal plants by tetrazolium chloride test and its correlation with threat status.

5.3 Comparison of the germplasm diversity in economic traits of locally available vegetables.

5.4 Determination of the percentage of species association using Jaccard's index.

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UG SEMESTER–II
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UTILIZATION AND CONSERVATION OF PLANTS
(MINOR COURSE)

Course No. UMIBOT202 **Max. Marks: 100 (Theory-75, Practical-25)**

5.5 Pharmacognostic details (morphology, anatomy and organoleptic characters) of the provided crude drugs of Indian system of medicine.
5.6 Determination of the presence of tannins and flavonoids in the provided tea samples.
5.7 Comparison of the percentage of protein bodies in the provided pulses.
5.8 Preparation of temporary mount using iodine solution as stain and compare type, shape, structure, and size of starch granules in the provided plant material.
5.9 Determination of the presence of phlobatannins, flavonoids, steroids and glycosides in the provided drug samples.
5.10 Preparation of soap from vegetable oil.
5.11 Extraction and characterization of the plant fibres from provided plant material.

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.

UNIVERSITY OF JAMMU
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UTILIZATION AND CONSERVATION OF PLANTS
(MINOR COURSE)

Course No. UMIBOT202 **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)**	
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. Akeroyd, J. and Jackson, P.W. (1995). A Handbook of Botanic Garden and Reintroduction of Plants to the Wild. Botanic garden conservation Union, UK.
2. Chowdhery, H.J. and Murty, S.K. (2000). Plant Diversity and Conservation in India – an overview. Bishen Singh Mahendra Pal Singh, Dehradun.
3. Directory of Indian Wetlands (1993). W.W.F. India, New Delhi and AWB, Kuala Lumpur.
4. Gadgil, M. and Guha, R. (1996). Ecology and Equality: Use and Abuse of Nature in Contemporary India. Penguin, New Delhi.
5. Heywood, V. (1995). Global Biodiversity Assessment. United National Environment Programme. Cambridge University Press, Cambridge, U.K.
6. Haunter, M.L. and Gibbs, J. (2007). Fundamentals of Conservation Biology. 3rd Edn. Blackwell Publishing, U.K.
7. Kothari, A. (1997). Understanding Biodiversity: Life Sustainability and Equity. Orient Longman.
8. Meffe, G.K. and Ronald, C.R. (1994). Principles of Conservation Biology. Sinauer Associates. INC Publishers, USA.
9. Primack, R.E. (2006). Essentials of Conservation Biology. 4th Edn. Sinauer Associates, U.S.A.
10. Rodgers, N.A. and Panwar, H.S. (1988). Planning a Wildlife Protected Area Network in India. Vol. I. The Report Wildlife Institute of India, Dehradun.
11. Swaminathan, M.S. and Kocchar, S.L. (1989). Plants and Society. MacMillan Publication Ltd., London.
12. Walter, K.S. and Gillett, H.J. (1998). 1997 IUCN Red List of Threatened Plants. IUCN, the World Conservation Union, IUCN, Gland. Switzerland and Cambridge, U.K.

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ENTREPRENEURSHIP IN BOTANY
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT203 **Max. Marks: 75**

	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

Objectives:

The course has been designed to make students of different disciplines understand, appreciate and value the significance plant resources hold in our lives and welfare. It will also motivate them to process, propagate and value-add plant products and establish them into small scale industrial units.

Course Learning outcome:

This course exposes students to the practices used for growing, multiplying, value adding and maintaining economically important plant species. Knowledge acquired thereof will help them in setting up their own small business enterprises.

Unit–I: Food and fodder

1.1 Essential components of human nutrition; concept of human disorders due to nutritional deficiencies, concept of rabi (Wheat) and kharif (Rice) crops.

1.2 Cereals- Rice and Wheat, nutritional value, agro-technology, products and long term storage.

1.3 Legumes- Pea and Soybean, nutritional value, agro-technology, products and long term storage.

1.4 Fodder crops- types (conserved forage, compound feed, crop residues, freshly cut forage) and their storage.

Unit–II: Horticulture, floriculture and MAP industry

2.1 Fruits- types, nutritional value, preservation and storage; Agro-technology and market trends of Mango and Amla.

2.2 Flowers - economic importance (decorative, medicinal, aromatic, food); Agro-technology and market trends of Gladiolus, Lavender and Marigold.

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ENTREPRENEURSHIP IN BOTANY
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT203 **Max. Marks: 75**

2.3 Medicinal and Aromatic Plants (MAPs)-general account; agro-technology, market trends and economics of Ashwagandha and Safed muesli.

2.4 Cultivation, agro-technology and economics of essential oils (Lemon grass and Rose).

Unit–III: Vegetable oil and sugar industry

3.1 Composition and uses of vegetable oils (edible and medicinal).

3.2 Sunflower and mustard- agro-technology, storage and uses.

3.3 Extraction and refining of vegetable oils (oil expeller, degumming, bleaching and hydrogenation).

3.4 Sugarcane and Sugarbeet- agro-technology, extraction and economic importance of sugar.

Unit–IV: Plant fibres, natural dyes and paper industry

5.1 Plant fibres-types; agro-technology (Cotton and *Agave*) and extraction of fibres.

5.2 Natural dyes- types, agro-technology (Henna and Safflower) and extraction of dye.

5.3 Dyeing with natural dyes (process, colour combinations), dye recipes- flower, leaves, bark, and roots.

5.4 Paper industry - sources and processes (mechanical and chemical).

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.

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ENTREPRENEURSHIP IN BOTANY
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT203 **Max. Marks: 75**

Suggested readings:

1. Bedi, Y.S., Dutt, H.C. and Kaur, H. (2011). Plants of Indian System of Medicine (Vol. I &II). Lambert Academic Publishing, Germany.
2. Bose, T.K. and Som, M.G.V. (1986). Vegetable crops in India. Naya Prokash, Calcutta
3. Bose, T.K. (1985). Fruits of India tropical and subtropical. Naya Prokash, Calcutta.
4. Chandel, K.P.S., Shukla, G. and Sharma, N. (1996). Biodiversity in Medicinal and Aromatic Plants in India- Conservation and Utilization. National Bureau of Plant Genetic Resources, New Delhi.
5. Furry, S.M. and Viemont, V.M. (1935). Home Dyeing with Natural Dyes. Thresh Publications. California.
6. Hanson, H., Borlaug, N.E. and Anderson, R.G. (1982). Wheat in the Third World. Westbiew Press, Colorado.
7. Jadhav, D. (2009). Medicinal Plants of India. Vol. 1-3. Scientific Publishers, India.
8. NIIR Board (2004).Cultivation of Fruits, Vegetables and Floriculture. NIIR.
9. JindalKent, N.L. (1983). Technology of Cereals (3rd Edn). Pergamon Press, Oxford.
10. Kochar, S.L. (2009). Economic Botany in the Tropics. 3rd Edn. MacMillan Publishers Ltd.
11. Maiti, R.K. and Singh R.K. (2006). An Introduction to Modern Economic Botany. Agrobios (India).
12. Metcalfse, D.S. and Elkins, D.M. (1980). Crop Production: Principles and Practices (IV ed.). Macmillan Publishing Co. Inc. New York.
13. Pradhan, S. (1995). Economic Botany. Har Anand Publication, New Delhi
14. Radhakrishnan, T., Anandaraja, N., Ramasubramanian, M., Nirmala, L. and Israel, M.T. (2009). Traditional Agricultural Practices: Applications and Technical Implementations. New India Publishing Agency, India.
15. Sharma. O.P. (1996). Hill's Economic Botany. Tata McGraw Hill's, Noida.
16. Singh, R. (1969). Fruits. National Book Trust, India.
17. Vardhana, R. (2009). Economic Botany. Sarup Book Publishers Pvt. Ltd., New Delhi.
18. Verma, V. (2009). Textbook of Economic Botany. Ane Books Pvt. Ltd, India.
19. West, R.B. (1999). Practical Gardening in India. Discovery publishing House, New Delhi.

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UG SEMESTER–II
(For the examinations to be held in May 2023, 2024, 2025)

BIO FERTILIZERS
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT204 **Max. Marks: 50 (Theory-25, 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	½	2½	05	20
Practical	01	30	V	D.P., A	2½	10	15

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

Objectives:

The course introduces the students to the world of bio fertilizers which is quite relevant in the face of chemical fertilizers ruining the fertility of our agricultural fields. Bio fertilizers are harmless, replenish the soils and maintain their fertility over long periods of time. Therefore, a course on their types, preparation, and importance is the need of the hour.

Course Learning outcome:

The students will learn about different microbial sources of bio fertilizers. They will understand the role of nitrogen fixing organisms in soil fertility and will be practically trained to make Bio fertilizers. This in turn will enable them to start their own enterprise of a bio fertilizer brand.

Unit–I: Introduction to bio fertilizers

1.1 Bio fertilizers: definition, different sources, importance and comparison with conventional fertilizers.
1.2 Biological nitrogen fixation, symbiotic and asymbiotic.
1.3 General account of the microbes commonly used as bio fertilizers.
1.4 *Rhizobium*- infection and nodulation, isolation and mass multiplication.

Unit–II: Common bio fertilizers and nitrogen fixers

2.1 *Azospirillum* and *Azotobacter*: isolation, important characteristics and mass multiplication.
2.2 Manures: definition, types and their importance with special reference to green manure.
2.3 Cyanobacteria: cell structure, forms and characteristic features.
2.4 Heterocyst as a site of nitrogen fixation and importance of Nitrogenase; role of Cyanobacteria and *Azolla* in rice cultivation.

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Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP-2020)
UG SEMESTER–II
(For the examinations to be held in May 2023, 2024, 2025)

BIO FERTILIZERS
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT204 **Max. Marks: 50 (Theory-25, Practical-25)**

Unit–III: Practicals

3.1 Study the root system of leguminous plants.
3.2 Isolation of *Rhizobium* from root nodules of legumes.
3.3 Collection of Cyanobacteria and *Azolla* from rice fields.
3.4 Study of cell structure of Cyanobacteria.
3.5 Study the morphology of *Azolla*.
3.6 Isolation of *Anabaena* from coralloid roots of *Cycas*.
3.7 Study of heterocyst from *Anabaena* and *Nostoc*.
3.8 Demonstration of bio fertilizer preparation.
3.9 Preparation of farmyard manure (FMY).
3.10 Vermi compost preparation.

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.

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BIO FERTILIZERS
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT204 **Max. Marks: 50 (Theory-25, Practical-25)**

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. Bartha, A. (1998). Microbial Ecology: Fundamentals and applications. Benjamin/ Cummings, (4th edition).
2. Bhojiya, A. A., Jain, D. and Joshi, A. (2019). Manual on Bio fertilizer Research (Laboratory to Commercial Production) Apex Publishing House.
3. Das, D.K. (2002). Introduction to Soil Science. Kalyani Publisher 3rd edition.
4. Diaz, L.F., Bertoldi, M. and de Bidlingmaier, W. (2007). Compost Science and Technology, Elsevier, New York.
5. Gaur, A.C. (1990). Phosphate Solubilities, Micro-organizms and Bio fertilizers.. Oxfordand IBH Publishing Co. New Delhi.
6. Kolay, A. K. (2007). Handbook of Manures and Fertilizers. Atlantic Publisher.
7. Mukerjee, N. and Ghosh, T.K. (1998). Agricultural Microbiology, Kalyani Publisher, NewDelhi.
8. Mukerjee, S.K. (2006). An Introduction to Soil Science. Tata Mc graw Hills ICAR.
9. NIIR Board (2012). The Complete Technology Book on Bio fertilizer and Organic Farming (2nd Revised Edition). NIIR Project Consultancy Services.
10. Russel, E. (2010). Soil Conditions and Plant Growth, Nabu Press Publisher.
11. Sathe, T.V. (2004). Vermiculture and organic Farming. Daya Publishers.
12. Subbha Rao, W.S. (1982). Bio fertilizers in Agriculture and Forestry. Oxford and IBH Publishing Co., New Delhi.
13. Subha Rao, N.S. (2000). Soil Microbiology, Oxford & IBH Publishers, New Delhi.
14. Tandon, H.L.S. (1992). Fertilizers, Organic Manures, Recyclable Wastes and Biofertilizers. Fertilizer Development and Consultation Organization, New Delhi.

15. Tandon, H.L.S. (2011). Bio fertilizers and Organic Fertilizers. Fertilizer Development and Consultation Organization, New Delhi.
16. Tate, R.L. (2012). Soil Microbiology (Second edition). Wiley India Pvt Ltd; pp 532.
17. Vayas,S.C, Vayas, S. and Modi, H.A. (1998). Bio-fertilizers and organic Farming Akta Prakashan, Nadiad
18. Yadav, A.N. (2021). Production Technology for Bio agents and Bio fertilizers-A Laboratory Manual. Eternal University, Himachal Pradesh.
19. Rai M.K. (2005). Handbook of Microbial Bio fertilizers. The Haworth Press Inc., New York.

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Syllabus for FYUG Program in
BOTANY (under CBCS as per NEP–2020)
UG SEMESTER–III
(For the examinations to be held in December 2023, 2024, 2025)

DIVERSITY OF MICROBES, ALGAE, BRYOPHYTES AND PTERIDOPHYTES
(MAJOR COURSE)

Course No. UMJBOT301 **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 familiarize the students with microbes and cryptogams. These plant groups are of great use in agriculture, horticulture, medical and biotechnology based industries. Therefore, students need to know about their structural diversity, biology and utilization.

Course learning outcomes:

Students will be able to identify and document different microbes and cryptogams using laboratory and field skills. They will also learn about their economic importance and enable them to utilize the knowledge so gained for their livelihood generation.

Unit-I: Microbes and Microbiology

1.1 General account of plant viruses (TMV), transmission and control; general characteristics of viroids and prions; structure of Potato Spindle Tuber Viroid (PSTVd).

1.2 Bacteria-Ultrastructure, nutrition and reproduction, general account of Mycoplasma, Phytoplasma, Actinomycetes and Cyanobacteria.

1.3 Genetic recombination in bacteria (transformation, transduction and conjugation).

1.4 Economic importance of bacteria and plant viruses.

Unit-II: Algae

2.1 General characteristics and classification of algae (Parker, 1982) up to class level.

2.2 Important features of Chlorophyceae and Xanthophyceae; life histories of *Volvox*, *Oedogonium*, *Chara* and *Vaucheria*.

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DIVERSITY OF MICROBES, ALGAE, BRYOPHYTES AND PTERIDOPHYTES
(MAJOR COURSE)

Course No. UMJBOT301 **Max. Marks: 100 (Theory-75, Practical-25)**

2.3 Important features of Phaeophyceae and Rhodophyceae; Life histories of *Ectocarpus* and *Polysiphonia*.

2.4 Economic importance of algae (as food and feed; algal blooms and toxins).

Unit-III: Bryophytes

3.1 Bryophytes as the earliest land dwellers; general characteristics, classification (Smith, 1955) and alternation of generations.

3.2 Structure and reproduction in Hepaticeae with reference to *Marchantia*.

3.3 Structure and reproduction in Anthocerotae and Musci with reference to *Anthoceros* and *Funaria*.

3.4 Evolution of sporophyte in bryophytes; importance of bryophytes in, preventing soil erosion, monitoring and controlling pollution, geobotanical prospecting, horticulture and as source of antibiotics.

Unit-IV: Pteridophytes

4.1 General characteristics, classification (Sporne, 1975) and origin of pteridophytes (the first vascular plants); stelar system and alternation of generations.

4.2 Important characteristics of Psilopsida and Lycopsida; Structure and reproduction in *Psilotum*, *Lycopodium* and *Selaginella* (excluding development).

4.3 Important characteristics of Sphenopsida; structure and reproduction in *Equisetum* (excluding development).

4.4 Important characteristics of Pteropsida; structure and reproduction in *Pteris* and *Marsilea* (excluding development).

Unit-V: Practicals

5.1 Study of the genera included under algae and fungi.

5.2 Study of morphology, reproductive structures and anatomy of the examples cited in theory under Bryophyta and Pteridophyta.

5.3 Observation of disease symptoms in hosts infected by fungi, viruses and mycoplasma.

5.4 Section cutting of diseased materials and identification of the pathogens as per the theory syllabus.

5.5 Gram staining of bacteria.

5.6 Study of crustose, foliose and fruticose types of lichen thalli.

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DIVERSITY OF MICROBES, ALGAE, BRYOPHYTES AND PTERIDOPHYTES
(MAJOR COURSE)

Course No. UMJBOT301 **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 (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.

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. Bilgrami, K.S. and Saha L.C. (1992). A Textbook of Algae. CBS Publishers and Distributors, Delhi
2. Dube, H.C. (1990). An Introduction to Fungi. Vikas Publishing House Pvt. Ltd., Delhi.
3. Parihar, N. S. (1996). The Biology and Morphology of Pteridophytes. Central Book Distributors, Allahabad.
4. Puri, P. (1980). Bryophyta: Broad prospectives. Atma Ram & Sons, Delhi.

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DIVERSITY OF MICROBES, ALGAE, BRYOPHYTES AND PTERIDOPHYTES

(MAJOR COURSE)

Course No. UMJBOT301 **Max. Marks: 100 (Theory-75, Practical-25)**

5. Rashid A. (1976). An Introduction to Pteridophytes- Diversity and Differentiation. VikasPublishing House.
6. Smith, G.M. (1971). Cryptogamic Botany. Vol-I: Algae & Fungi. Tata McGraw Hill Publishing Co., New Delhi.
7. Smith, G.M. (1971). Cryptogamic Botany. Vol. II; Bryophytes & Pteridophytes. Tata McGraw Hill Publishing Co., New Delhi.
8. Sporne, K. R. (1970). The Morphology of Pteridophytes. Hutchinson Univ. Library, London.
9. Sumbali, G. and Mehrotra, R. S. (2009). Principles of Microbiology. The McGraw Hill Education Pvt. Ltd. New Delhi.
10. Sumbali G. (2010). The Fungi. 2nd Edn. Narosa Publishing House, New Delhi.

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UG SEMESTER–III
(For the examinations to be held in December 2023, 2024, 2025)

CELL AND MOLECULAR BIOLOGY
(MAJOR COURSE)

Course No. UMJBOT302 **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 the structural and functional aspects of cellular, sub-cellular and molecular components of a cell. It will also help them to understand the interactions and interrelationships among these components.

Course learning outcomes:

The course will make the students understand the cellular regulatory mechanisms and enable them to suggest remedial approaches in case of abnormal cellular behavior.

Unit-I: Cell Structure.

1.1 Cell wall; Primary cell wall, its structure, formation and function.

1.2 Plasma membrane; the lipid bilayer structure, fluid mosaic model; functions of plasma membrane.

1.3 Cell organelles; structure and functions of endoplasmic reticulum, golgi bodies, chloroplasts, mitochondria and ribosomes.

1.4 Ultrastructure of nuclear membrane, organization and function of nucleolus.

Unit-II: Chromosome Structure and Multiplication.

2.1 Physical and chemical structure of chromosome; structure and importance of centromere and telomere; concept of sex chromosomes.

2.2 Reductional and equational divisions: Various stages; detailed structure of pairing and crossing over.

2.3 DNA: structure and replication; satellite and repetitive DNA.

2.4 Extranuclear genome: structure and function of mitochondrial and plastid DNA;Plasmids.

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CELL AND MOLECULAR BIOLOGY
(MAJOR COURSE)

Course No. UMJBOT302 **Max. Marks: 100 (Theory-75, Practical-25)**

Unit-III: Genome Organization and Function/Gene to Protein.

3.1 Organization of DNA in prokaryotic and eukaryotic genomes, role of proteins; nucleosome model.

3.2 Concept of gene; genetic code; structure and functions of mRNA, rRNA and tRNA.

3.3 Transcription: Mechanism and machinery.

3.4 Translation: Mechanism and machinery.

Unit-IV: Product and Regulation of Gene Expression.

4.1 Proteins: structure (primary, secondary and tertiary) and functions.

4.2 Gene expression and its regulation in prokaryotes.

4.3 Gene expression and its regulation in eukaryotes.

4.4 Concept and importance of regulatory RNAs.

Unit-V: Practicals

5.1 To study cell structure from onion leaf peels and demonstrate staining and mounting methods.

5.2 Comparative study of cell structure in onion cells, *Hydrilla* and *Spirogyra*.

5.3 Study of cyclosis in *Tradescantia* petal cells.

5.4 Study of plastids to examine pigment distribution in plants (e.g. *Cassia*, Tomato and *Capsicum*).

5.5 Examination of electron micrographs of eukaryotic cells with special reference to organelles.

5.6 Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.

5.7 Study of electron micrographs and X-ray crystallographs of DNA structure and replication (both prokaryotes and eukaryotes).

5.8 Preparation of 1% agarose gel and demonstration of gel loading.

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CELL AND MOLECULAR BIOLOGY
(MAJOR COURSE)

Course No. UMJBOT302 **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 (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.

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

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CELL AND MOLECULAR BIOLOGY

(MAJOR COURSE)

Course No. UMJBOT302 **Max. Marks: 100 (Theory-75, Practical-25)**

Suggested Readings:

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

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CELL BIOLOGY
(MINOR COURSE)

Course No. UMIBOT303 **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 the structural and functional aspects of cellular, sub-cellular and molecular components of a cell. It will also help them understand the interactions and interrelationships among these components.

Course learning outcomes:

The course will make the students understand the cellular regulatory mechanisms and enable them to suggest remedial approaches in case of abnormal cellular behavior.

Unit-I: Cell Structure.

1.1 Cell wall; Primary cell wall, its structure, formation and function.

1.2 Plasma membrane; the lipid bilayer structure, fluid mosaic model; functions of plasma membrane.

1.3 Cell organelles; structure and functions of endoplasmic reticulum, golgi bodies, chloroplasts, mitochondria and ribosomes.

1.4 Ultrastructure of nuclear membrane, organization and function of nucleolus.

Unit-II: Chromosome Structure and Multiplication.

2.1 Physical and chemical structure of chromosome; structure and importance of centromere and telomere; concept of sex chromosomes.

2.2 Reductional and equational divisions: Various stages; detailed structure of pairing and crossing over.

2.3 DNA: structure and replication; satellite and repetitive DNA.

2.4 Extranuclear genome: structure and function of mitochondrial and plastid DNA;Plasmids.

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CELL BIOLOGY
(MINOR COURSE)

Course No. UMIBOT303 **Max. Marks: 100 (Theory-75, Practical-25)**

Unit-III: Genome Organization and Function/Gene to Protein.

3.1 Organization of DNA in prokaryotic and eukaryotic genomes, role of proteins; nucleosome model.

3.2 Concept of gene; genetic code; structure and functions of mRNA, rRNA and tRNA.

3.3 Transcription: Mechanism and machinery.

3.4 Translation: Mechanism and machinery.

Unit-IV: Product and Regulation of Gene Expression.

4.1 Proteins: structure (primary, secondary and tertiary) and functions.

4.2 Gene expression and its regulation in prokaryotes.

4.3 Gene expression and its regulation in eukaryotes.

4.5 Concept and importance of regulatory RNAs.

Unit-V: Practicalss

5.1 To study cell structure from onion leaf peels and demonstrate staining and mounting methods.

5.2 Comparative study of cell structure in onion cells, *Hydrilla* and *Spirogyra*.

5.3 Study of cyclosis in *Tradescantia* petal cells.

5.4 Study of plastids to examine pigment distribution in plants (e.g. *Cassia*, Tomato and *Capsicum*).

5.5 Examination of electron micrographs of eukaryotic cells with special reference to organelles.

5.6 Study of electron micrographs of viruses, bacteria, cyanobacteria and eukaryotic cells for comparative cellular organization.

5.7 Study of electron micrographs and X-ray crystallographs of DNA structure and replication (both prokaryotes and eukaryotes).

5.8 Preparation of 1% agarose gel and demonstration of gel loading.

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CELL BIOLOGY
(MINOR COURSE)

Course No. UMIBOT303 **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 (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.

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, K and Watson J.D. (2004). MolecularBiology of Cell. 3rd Edn. Garland Science. New York, USA.
2. Atherly, A.G., Girton, J.R. and Mc.Donald, J.F. (1999). The Science of Genetics.Diane Publishing. Co. Fort Worth, USA.
3. Gupta, PK. (1999). A Text Book of Cell and Molecular Biology. Rastogi Publications, Meerut, India.
4. Kleinsmith, L J. And Kish, V. M. (1995). Principles of Cell and Molecular

CELL BIOLOGY
(MINOR COURSE)

Course No. UMIBOT303 **Max. Marks: 100 (Theory-75, Practical-25)**

5. Biology.2nd Edn. Harper Collins College Publishers, New York, USA.
6. 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.
7. Russell, P J. (1998). Genetics. The Benjamin Cummings Publishing Co. Inc., USA.
8. Snustad, D.P. and Simmons, M.J. (2000). Principles of Genetics. John Wiley &sons, Inc. USA.
9. Wolfe, S.L. (1993). Molecular and Cell biology. Wadsworth Publishing Co. California, USA.

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UG SEMESTER–III
(For the examinations to be held in December 2023, 2024, 2025)

PLANT USES AND PROPAGATION
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT304 **Max. Marks: 75**

	Credits	Contact Hours	Units	Examination Duration (hours) Mid semester	End semester	Weightage (Marks) Mid semester	End semester
Theory	03	45	I to IV	1½	03	15	60

Objectives:

The course has been framed to familiarize students with the importance of plants for sustenance of our planet in general and mankind in particular. It also aims to educate them about different modes of plant reproduction.

Course learning outcomes:

The students will learn the importance of plants and various methods of their propagation. Insights gained therein will help them to bring the economically important taxa under effective commercial production and utilization.

Unit–I: Plants–An Overview

1.1 Diversity in habit (herb, shrub and tree) and habitat (terrestrial and aquatic) with respect to altitude (temperate, tropical, sub tropical and alpine).

1.2 Diversity in forms and body organisation.

1.3 Diversity of plant adaptation.

1.4 Concept of evolution and speciation.

Unit–II: Importance of Plants

2.1 Plants and their role in climate stability (soil fertility, prevention of soil erosion, availability of Oxygen, Carbon sequestration, pollution control).

2.2 Plants as source of food (wheat, maize, rice, mango, jamun, rajmah, apple, bottlegourd and fenugreek) – general description, botanical names and parts used.

2.3 Plants as source of fodder (clover, oak, *Grewia optiva*) and timber (*Pinus*, *Cedrus*, *Dalbergia* and Teak) – general description, botanical names and parts used.

2.4 Plants as source of medicine (quinine, belladona, *Rauwolfia* and *Digitalis*), essential oils (lemon-grass and lavender) and beverages (tea and coffee) – general description, botanical names and parts used.

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UG SEMESTER–III
(For the examinations to be held in December 2023, 2024, 2025)

PLANT USES AND PROPAGATION
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT304 **Max. Marks: 75**

Unit–III: Modes of Vegetative Propagation

3.1 General account of asexual means of reproduction.

3.2 Natural and artificial means of vegetative propagation; advantages and limitations.

3.3 Propagation by bulbs, corms, tubers, rhizomes, runners, stolons and suckers – general account.

3.4 Propagation by cutting, layering, grafting and budding – basic concepts.

Unit –IV: Modes of Sexual Reproduction

4.1 General account of sexual means of reproduction.

4.2 Structure of flower and its various forms; types of pollination (self versus cross) mechanisms.

4.3 Fertilization, basic concept of seed and fruit development.

4.4 Seed germination and dormancy; types and methods to break dormancy.

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.

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UG SEMESTER–III
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PLANT USES AND PROPAGATION
(MULTIDISCIPLINARY COURSE)

Course No. UMDBOT304 **Max. Marks: 75**

Suggested readings

1. Bhojwani, S.S., Bhatnagar, S.P. and Dantu, P.K. (2018). The embryology of angiosperms. (6th edition). Vikas Publishing House, Noida.
2. Coulter, J.M. (1851). Morphology of Angiosperms (Morphology of Spermatophytes.Part-II). Nebu press, pp 376.
3. Johri, B.M. and Srivastava, P.S. (2013). Reproductive Biology of Plants. Springer Science and Business Media, pp 320.
4. Khan, A.S. (2017). Flowering Plants: Structure and Industrial Products. Wiley; 1st edition, United Kingdom, pp 344.
5. Kochhar, S.L. (2016). Economic Botany. Cambridge University Press, pp 680.
6. Nanda, K.K. and Kochar V.K. (1985). Vegetative Propagation of Plants. Kalyani Publishers, New Delhi.
7. Ramawat, K.G. et al. (2014). Reproductive Biology of Plants. CRC Press, Boca Raton.
8. Sadhu, M.K. (1999). Plant Propagation. New Age International (P) Limited Publishers,New Delhi.

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UG SEMESTER–III
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MUSHROOM CULTIVATION TECHNOLOGY
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT305 **Max. Marks: 50 (Theory-25, Practical-25)**

	Credits	Contact Hours	Units	Examination			
				Duration	(hours)	Weightage	(Marks)
				Mid-semester	End-semester	Mid-semester	End-semester
Theory	01	15	I to II	½	2½	5	20
Practical	01	30	III	D.P.A	2½	10	15

D.P. A- Daily Performance and Attendance

Objectives:

The course aims to make students understand the theoretical and practical details of mushrooms and their cultivation. The course is also focused upon the practical and safe utility of mushrooms for human consumption and economy generation.

Course Learning outcomes:

The students will be able to distinguish the various mushroom species for their nutritional, medicinal and other economic values. They can develop their own start ups for mushroom cultivation and can do value addition of both edible and medicinally important taxa.

Unit-I: Introduction, Types and Cultivation of Mushrooms

1.1 Characteristics of mushrooms. Types of edible mushrooms available in India- *Volvariella volvacea*, *Pleurotus citrinopileatus*, *Calocybe indica*, *Agaricus bisporus* and their cultivation.

1.2 Structure and life cycle of mushrooms with special reference to *Agaricus* and *Morchella*.

1.3 Nutritional, Pharmaceutical values and other economic importance of mushrooms.

1.4 Poisonous mushrooms: characteristics and effects.

Unit-II: Storage, Diseases and Value addition.

2.1 Shelf life of mushrooms, Short-term storage (Refrigeration – upto 24 hours), Long termstorage (canning, pickles, papads), drying, storage in salt solutions. Low cost storage techniques. Types of foods prepared from mushrooms.

2.2 Diseases, infections and pests of mushrooms (Pre and Post harvest).

2.3 Scope of mushroom cultivation for rural upliftment as self help groups (SHGs) or co-operatives; different funding schemes available in J&K UT.

2.4 X matrix for business development in mushroom cultivation that includes Product value addition, Domestic and Export opportunities.

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MUSHROOM CULTIVATION TECHNOLOGY
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT305 **Max. Marks: 50 (Theory-25, Practical-25)**

Unit-III: Practicals

3.1 Demonstration of the infrastructure required for cultivation of mushrooms [Substrates (locally available) Polythene bags, vessels, low cost stove, sieves, culture rack].

3.2 Spawn Production Technology: Mushroom Unit (Thatched house), water sprayer, tray, small polythene bags.

3.3 Preparation and maintenance of Pure culture:

i) Sterilization of glassware and media.
ii) Inoculation and preparation of spawn, casing and harvesting

3.4 Mushroom bed preparation using locally available agro-wastes.

3.5 Composting technology in mushroom production (A low cost technology).

3.6 Cultivation of *Pleurotus citrinopileatus*/ *Agaricus bisporus*.

Note for paper setters

End Semester University Examination (Total Marks: 40; syllabus to be covered: 100%)

The question paper will have 2 components of 20 marks each.
Component 1 based on Units I & II will have 2 sections. Section 'I' will be compulsory having four questions of 2½ marks each and spread over the entire theory syllabus (two from each unit i.e., Units I and II). The questions will be short answer type having answers not exceeding 30 to 60 words. Section 'II' will have four long answer type questions, two from each unit. Each question will be of 5 marks. The candidates will be required to answer one question from each unit.
Component 2 based on Unit III will be external practical examination of 15 marks and viva voce of 5 marks.

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MUSHROOM CULTIVATION TECHNOLOGY
(SKILL ENHANCEMENT COURSE)

Course No. USEBOT305 **Max. Marks: 50 (Theory-25, Practical-25)**

Mid Semester Assessment Test (Total Marks: 5; syllabus to be covered: up to 50%)

The question paper will have 2 components of 5 marks each.

Component 1 will consist of theory paper with ten (10) questions distributed as 5 MCQs, 3 fill in the blanks and 2 one word answer type questions. All the questions are compulsory and each question carries ½ mark.

Component 2 will consist of practicals and will comprise of attendance, practical test and daily performance based on practical work done.

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. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. Jayarajan. R (1991) Oyster Mushrooms. Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
2. Swaminathan, M. (1990) Food and nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No.88, Mysore Road, Bangalore- 560018.
3. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation, Mittal Publications, Delhi.
4. Nita Bahl (1984-1988) Hand Book of Mushrooms, II Edition, Vol. I & Vol. Ii
5. Chang, S., & Miles, G. P. (2004). Mushrooms: Cultivation, Nutritional Value, Medicinal Effects and Environmental Impact (p. 436). Boca Raton, FL: CRC Press.
6. Aggarwal, A., Sharma, Y.P. & Jangra, E. (2022). A Textbook on Mushroom Cultivation Theory and Practice, Newrays Publishing House, India, pp 292.
7. Kanwal, H.K., Acharya, K., Ramesh, G. and Reddy M.S. (2011). Molecular characterization of *Morchella* species from the Western Himalayan region of India. Current microbiology. 62(4): 1245-52.

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Syllabus for FYUG Program in BOTANY
(Under CBCS as per NEP–2020)
UG SEMESTER–IV
(Syllabus for the examinations to be held in May 2024, 2025, 2026)

CHARACTERISTICS AND SYSTEMATICS OF SEED PLANTS
(MAJOR COURSE)

Course No. UMJBOT401 **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:

Gymnosperms and angiosperms occupying the two uppermost rungs in the evolutionary ladder of plants exhibit great diversity. The course is designed to study these groups for their morphological aspects and analyze the diversity in a scientific manner for establishing their interrelationships.

Course learning outcomes:

The students will be able to understand the process of fossilization and identify the fossil taxa. The course contents will enable them to identify, characterize and describe gymnosperms and angiosperms using classifications and taxonomic keys. It will also help them analyze the role of anatomy, embryology, cytology and phytochemistry in systematics. The students can pursue and disseminate the traditional and medicinal knowledge of seed plants among the stakeholders.

Unit-I: Seed Plants-Origin, Evolution and Characteristics

1.1 Fossilization –Processes and types, age of fossils and their importance.

1.2 Fossil gymnosperms - a general account; Benettitales (Cycadeoidales)-history and distribution.

1.3 Characteristic features, morphology, anatomy and reproduction in *Williamsonia* and *Cycadeoidea*.

1.4 Fossil angiosperms – a general account.

Unit-II: Classification, Morphology and Reproduction in Gymnosperms

2.1 General characters of gymnosperms: classification of gymnosperms as proposed by Sporne (1965).

2.2 Morphology, anatomy, reproduction and life cycle of Cycas.

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CHARACTERISTICS AND SYSTEMATICS OF SEED PLANTS
(MAJOR COURSE)

Course No. UMJBOT401 **Max. Marks: 100 (Theory-75, Practical-25)**

2.3 Morphology, anatomy, reproduction and life cycle of *Pinus*.
2.4 Morphology, anatomy, reproduction and life cycle of *Ephedra*.

Unit-III: Angiosperms-Origin and Nomenclature

3.1 Origin of angiosperms, characteristics of some primitive angiosperms with specialreference to *Magnolia*.
3.2 History of angiosperm taxonomy - classical and modern; species concept and speciation.
3.3 Taxonomic identification: taxonomic keys and literature (floras, monographs and reviews).
3.4 Botanical nomenclature- principles and rules, taxonomic ranks, type concept and principle of priority.

Unit-IV: Classification and Tools in Angiosperm Taxonomy

4.1 Salient features of the classifications of Bentham & Hooker and Engler & Prantl; merits and demerits.
4.2 Concept and salient features of APG system of classification.
4.3 Contribution of anatomy and embryology to taxonomy.
4.4 Contribution of cytology and phytochemistry to taxonomy.

Unit-V: Practicals

5.1 Morphological diversity of families: Ranunculaceae (*Ranunculus*, *Delphinium*), Brassicaceae (*Brassica*, *Alyssum*, *Iberis*, *Coronopus*), Malvaceae (*Hibiscus*, *Abutilon*) and Asteraceae (*Tagetes*, *Ageratum*).
5.2 Morphological diversity of families: Fabaceae (Faboideae- *Lathyrus*, *Cajanus*, *Melilotus*, *Trigonella*; Caesalpinioideae- *Cassia*, *Caesalpinia*; Mimosoideae- *Prosopis*, *Mimosa*, *Acacia*), Apiaceae (*Coriandrum*, *Foeniculum*, *Anethum*), Acanthaceae (*Adhatoda*, *Peristrophe*), Apocynaceae (*Vinca*, *Thevetia*, *Nerium*).
5.3 Morphological diversity of families: Asclepidiaceae (*Calotropis*), Solanaceae (*Solanum*, *Withania*, *Datura*, *Petunia*), Euphorbiaceae (*Euphorbia*, *Phyllanthus*), Lamiaceae (*Ocimum*, *Salvia*).

CHARACTERISTICS AND SYSTEMATICS OF SEED PLANTS
(MAJOR COURSE)

Course No. UMJBOT401 **Max. Marks: 100 (Theory-75, Practical-25)**

5.4 Morphological diversity of families: Chenopodiaceae (*Chenopodium*, *Beta*), Lilliaceae (*Asphodelus*, *Asparagus*, *Allium*), Poaceae (*Zea mays*, *Triticum aestivum*, *Oryza sativa*).

(Locally available genera/species of following should be included. This list is only indicative. Teachers may select plants available in their locality.)

5.5 Habit, external morphology, anatomy and life cycle of *Cycas*.

5.6 Habit, external morphology, anatomy and life cycle of *Pinus*.

5.7 Habit, external morphology, anatomy and life cycle of *Ephedra*.

(Studies should be made through live specimens, permanent slides, hand sections and dissections.)
In addition to laboratory exercises, study of plant diversity in nature is required, for which a field trip should be organized.

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.

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CHARACTERISTICS AND SYSTEMATICS OF SEED PLANTS
(MAJOR COURSE)

Course No. UMJBOT401 **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. Bhatnagar, S.P. and Moitra, A. 1996. Gymnosperms. New Age International Limited, New Delhi.
2. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver andBoyd, London.
3. Gifford, E.M. and Foster, A.S. 1988. Morphology and Evolution of Vascular Plants. W.H. Freeman and company, New York.
4. Jeffery, C. 1982. An Introduction to Plant Taxonomy. Cambridge University Press, London.
5. Jones, S.B. and Luchsinger, A.E. 1986. Plant Systematics. 2nd Edn. Mc Graw Hill BookCo., New York.
6. Radford, A.E.1986. Fundamentals of Plant Systematics. Harper and Row, New York.
7. Singh, G. 1999. Plant Systematics: Theory and Practice. Oxford and IBH Pvt. Ltd., NewDelhi.
8. Sporne, K.R. 1965. The Morphology of Gymnosperms. Hutchinson and Co. Ltd.,London.
9. Stace, C.A. 1989. Plant Taxonomy and Biosystematics. 2nd Edn., Edward Arnold,London.
10. Stewart, W.M. 1983. Paleobotany and the Evolution of Plants. Cambridge University Press, Cambridge.

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MYCOLOGY AND PLANT PATHOLOGY
(MAJOR COURSE)

Course No. UMJBOT402 **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 impart knowledge and understanding on the structure, diversity, reproduction and life-cycle of fungi and fungi-like organisms. It will also provide insight into their pathogenic relationships with the plants.

Course learning outcomes:

The students will understand the extent of diversity of fungi and fungi-like organisms, and their mechanisms of affecting plant and animal life in one or the other way. It will enable them to identify plant pathogens and their role in causing substantial losses in yield of major crop plants. The students can attempt to devise strategies for their control and management.

Unit-I: Mycology: Origin, growth and scope

1.1 Introduction and history of mycology.
1.2 Concepts of nomenclature and classification, fungal biodiversity.
1.3 Reproduction and life cycles in fungi.
1.4 Importance of mycology in agriculture, dairy and food spoilage.

Unit-II: Organization, classification and reproduction in fungal organisms

2.1 Ultrastructure of a fungal cell; Hyphal types and aggregation; Nutritional types.
2.2 Characteristics of different groups of fungi and fungi like organisms up to generic level (a) Myxomycota and (b) Eumycota- i) Mastigomycotina ii) Zygomycotina, iii) Ascomycotina, iv) Basidiomycotina and v) Deuteromycotina.
2.3 Lichens: types and importance.
2.4 Homothallism and Heterothallism; Parasexuality in fungi.

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MYCOLOGY AND PLANT PATHOLOGY
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Course No. UMJBOT402 **Max. Marks: 100 (Theory-75, Practical-25)**

Unit-III: Plant pathology: History and development

3.1 Concepts of plant diseases.
3.2 History and developments in plant pathology, biotic and abiotic causes of plant diseases.
3.3 Survival and dispersal of important plant pathogens.
3.4 Role of environment and host nutrition on disease development.

Unit- IV: Disease development and defense strategies

4.1 Host parasite interaction, recognition concept and infection, symptomatology.
4.2 Disease development - role of enzymes, toxins and growth regulators.
4.3 Defense strategies- morphological and biochemical (Phytoalexins, PR proteins).
4.4 Disease management strategies-cultural, chemical and biological concepts.

Unit- V: Practicals

5.1 Preparation of various culture media.
5.2 Various sterilization methods used in culturing.
5.3 Preparation of PDA petri-plates and slants; aeromycoflora studies of lab./open air.
5.4 Fungal diseases; symptomatology and causal organisms; host-parasite relationship and diseases caused by fungi and fungal like organisms (Red Rot of sugarcane, Tikka disease of groundnut, Rust of wheat, Smut of maize, White Rust).
5.5 Macrofungi: Indentification and morphological studies of *Agaricus*, *Morchella*, *Geopora*, *Peziza*, *Polyporus*.
5.6 Study and identification of Crustose, Foliose and Fruticose lichens.

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MYCOLOGY AND PLANT PATHOLOGY
(MAJOR COURSE)

Course No. UMJBOT402 **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 (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.

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. Agrios GN. 2005. Plant Pathology. 5th Ed. Academic Press, New York.
2. Mehrotra RS & Aggarwal A. 2003. Plant Pathology. 2nd Ed. Oxford & IBH, New Delhi.
3. Singh RS. 2002. Introduction to Principles of Plant Pathology. Oxford & IBH, New Delhi.
4. Singh DP & Singh A. 2007. Disease and Insect Resistance in Plants. Oxford & IBH, New Delhi.

MYCOLOGY AND PLANT PATHOLOGY
(MAJOR COURSE)

Course No. UMJBOT402 **Max. Marks: 100 (Theory-75, Practical-25)**

5. Upadhyay RK & Mukherjee KG. 1997. Toxins in Plant Disease Development and Evolving Biotechnology. Oxford & IBH, New Delhi. 69
6. Sharma PD, 2006. Plant Pathology. Narosa publishing house pvt. Ltd. 22 Daryaganj, Delhi.
7. Chaube HS, Pundhir VS, 2014. Crop diseases and their management. PHI learning Pvt. Ltd. Delhi – 110092.
8. Ainsworth GC, Sparrow FK & Susman HS. 1973. The Fungi – An Advanced Treatise. Vol. IV (A & B). Academic Press, New York.
9. Alexopoulos CJ, Mims CW¬ & Blackwell M.2000. Introductory Mycology. 5th Ed. John Wiley & Sons, New York.
10. Singh RS. 1982. Plant Pathogens – The Fungi. Oxford & IBH, New Delhi.
11. Webster J. 1980. Introduction to Fungi. 2nd Ed. Cambridge Univ. Press, Cambridge, New York.
12. Dubey H.C. 2005. Introduction of fungi. 3rd edition, vikash publishing house, New Delhi.

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UG SEMESTER–IV
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PLANT ANATOMY
(MAJOR COURSE)

Course No. UMJBOT403 **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:

Seed bearing plants represent the most advanced groups of plant kingdom. Proper knowledge about the internal and external structures will help the students in understanding the architectural designs of cells, tissues and organs of all the parts of these plants.

Course learning outcomes:

The students will be able to analyze the importance and significance of cellular and sub-cellular organizations of the tissues and organs. This will help them to appreciate and tap these natural resources for sustainable use.

UNIT-I: Basics of plant anatomy

1.1 Shoot primary structure, leaf, stem and their modifications.
1.2 Root system, structure, components, diversity and evolutionary significance.
1.3 Epidermal modifications in monocots and dicots (trichomes and stomata), their structural organization and systematic value.
1.4 Leaf : origin, development and vascularisation.

UNIT-II: Plant, Structure and Organization.

2.1 Meristems: concept and types; structure and organization of RAM and SAM
2.2 Anatomy of primary root and primary stem (both monocots and dicots)
2.3 Vascularisation of primary shoot in monocotyledons and dicotyledons, leaf traces and leaf gaps; branch traces and branch gaps.
2.4 Internal structure of monocot and dicot leaf, concept of leaf senescence and abscission.

UNIT-III: Primary and Secondary Structures

3.1 Vascular cambium: structure and derivatives.

PLANT ANATOMY
(MAJOR COURSE)

Course No. UMJBOT403 **Max. Marks: 100 (Theory-75, Practical-25)**

3.2 Cork cambium: structure and derivatives; lenticels.
3.3 Structure of secondary xylem and secondary phloem.
3.4 Secondary growth – a general account; growth rings; heartwood, sapwood.

UNIT-IV: Fundamental tissues

4.1 Concepts of cell polarity and cell differentiation.
4.2 Xylem: classification, components, structure, diversity and function.
4.3 Phloem: classification, components, structure, diversity and function.
4.4 Wood anatomy: growth rings, functional aspects of dendrochronology, methods of wood quality parameters in India.

UNIT-V: Practicals

5.1 To study shoot and root tips with emphasis on cyto-histological zonation.
5.2 Anatomy of primary and secondary growth in monocots and dicots using hand sections and prepared slides.
5.3 Study of structure of secondary phloem and xylem.
5.4 Examination of Growth rings in wood and microscopic study of wood in T.S., T.L.S., and R.L.S.
5.5 Study of diversity in leaf shape, size, thickness, surface properties.
5.6 Study of internal structure of leaf, structure and type of stomata and trichomes (using epidermal peels of leaf).
5.7 Anatomy of the root; primary and secondary structure.

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

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PLANT ANATOMY
(MAJOR COURSE)

Course No. UMJBOT403 **Max. Marks: 100 (Theory-75, Practical-25)**

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. Cutter, E.G. (1969). Plant Anatomy: Experiment and Interpretation. Part-I: Cells and Tissues. Edward Arnold, London
2. Cutter, E.G. (1970). Plant Anatomy: Experiment and Interpretation. Part-II: Organs. Edward Arnold London.
3. Esau, K. (1977). Anatomy of Seed Plants. 2nd Edn. John Wiley and Sons, NewYork.
4. Fahn, A. (1974). Plant Anatomy. 2nd Edn. Pergamon Press.
5. Kind, J. (1997). Reaching for the sun: How Plants work. Cambridge University Press, Cambridge, U.K.
6. Mauseth, J.D. (1988). Plant Anatomy. The Benjamin Cummings Publishing Company, Menio Park, California, USA.
7. Crang, Richard. (2018). Plant Anatomy. Springer, Switzerland.
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UNIVERSITY OF JAMMU
Syllabus for FYUG Program in BOTANY
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UG SEMESTER–IV
(Syllabus for the examinations to be held in May 2024, 2025, 2026)

ECOLOGY AND CONSERVATION BIOLOGY
(MAJOR COURSE)

Course No. UMJBOT404 **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:

Plants are sessile on account of which they have to respond instantaneously to the changing environmental conditions in nature. The course content will make the students understand various mechanisms of their interactions with biotic and abiotic components of the ecosystems. This will make them realize the importance of plants to the ecosystem and hence mankind.

Course Learning Outcomes:

Knowledge gained by the students will enable them to utilize the plants for multifarious purposes in a sustainable manner. The students will also be able to understand the niche requirements of plants and analyze the possible threats to the plant diversity. Outcomes will help the students to think and devise strategies for their effective conservation.

Unit-I: Plants and Environment

1.1 Atmosphere- Stratification and gaseous composition; Carbon and hydrological cycle and their significance, greenhouse gases and climate change.

1.2 Soil structure, soil profiles and development; soil types in India.

1.3 Concept of ecology, ecosystem: structure, abiotic and biotic components, food chain, food web, ecological pyramids and energy flow.

1.4 Community ecology: Community characteristics, frequency, density cover, life forms, biological spectrum.

Unit-II: Population, community and niches

2.1 Population ecology, survivorship curves and life tables; ecotypes and ecads.

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2.2 Ecological succession: Concept, process and its types; climax communities.
2.3 Ecotone and edge effect-concept and types
2.4 Species distribution and ecological niche: concepts and significance.

Unit-III: Introductory concepts of Conservation Biology

3.1 A brief history, concept and scope of conservation biology; ecological footprint.
3.2 Guiding Principles and characteristics of Conservation Biology.
3.3 The species and Conservation; levels of Biodiversity (Genetic, intraspecific, ecosystem and Biome).
3.4 Value of Biodiversity; challenges associated with its conservation; Conservation values and ethics.

Unit-IV: Concerns of Conservation Biology

4.1 Overview of mass extinctions; Hot spots of extinction; patterns of species vulnerability.
4.2 Genetics and conservation; intrapopulation, interpopulation variation, the fitness consequences of variation.
4.3 Loss of genetic variation, management of genetic variation in natural populations, uses of genetic information in conservation.
4.4 Community level conservation, the role of keytone species, mutualisms, species invasions and ecological restoration.

Unit-V: Practicals

5.1 To determine the minimum requisite size of the quadrate for phytosociological studies.
5.2 To determine the frequency, density, abundance, basal area and importance valueindex of herbaceous and tree flora.
5.3 To determine the different life forms of the plant species of the grassland ecosystem and prepare a biological spectrum by comparing with Raunkaier's normal spectrum.
5.4 To study the various soil horizons for drawing the soil profile diagram.
5.5 To determine the bulk density, water holding capacity and porosity of forest and grassland ecosystems.
5.6 To measure pH and dissolved oxygen in different water ecosystems.
5.7 Determination of seed viability of highly threatened medicinal plants by tetrazolium chloride test.

ECOLOGY AND CONSERVATION BIOLOGY
(MAJOR COURSE)

Course No. UMJBOT404 **Max. Marks: 100 (Theory-75, Practical-25)**

5.8 Comparison of the seed morphology and viability of variously temperature treated seeds for seed storage practice.

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.

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. Chapman, J.L. and Reiss, M.J. 2000. Ecology: Principles and Applications. 2nd Edn., Cambridge University Press , U.K.
2. Kebs, C.J. 1989. Ecological Methodology. Harper and Row, New York, USA.
3. Kormondy, E.J. 1996. Concepts of Ecology. Prentice- Hall of India Pvt. Ltd. New

ECOLOGY AND CONSERVATION BIOLOGY

(MAJOR COURSE)

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Delhi.

4. Ludwist. J.A. and Reynolds, J.F. 1988. Statistical Ecology. Wiley, New York.
5. Misra, R. 1988. Ecology Work Book. Oxford and IBH, New Delhi.
6. Moore. P.W. and Chapman, S.B. 1986. Methods in Plant Ecology. Blackwell Scientific Publications.
7. Odum, E.P. 1983. Basic Ecology. Saunders, Philadephia.
8. Sharma, P. D. 2010. Ecology and Environment. 10th Edn. Rastogi Publications, Merut. India
9. Townsend, C.R., Begon, M. and Harper, J.L. 2008. Essentials of Ecology. 3rd Edn. Blackwell publishing. U.K.
10. Underwood, A.J. 1977. Experiments in Ecology: Their logical design and interpretation using analysis of variance. Cambridge University Press.
11. APHA-Standard methods for the examination of water and waste water, American Public Health Association, Washington.
12. Gary K. Meffe and C. Ronald Caroll. 1994. The Principles of Conservation Biology. Sinauer Associates, Inc, Sunderland, Massachusetts.
13. Richard B. Primack. 2014. Essentials of Conservation Biology Hardcover . Oxford University Press.
14. Richard B. Primack. 2016. An Introduction to Conservation Biology. Oxford University Press.

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UG SEMESTER–IV
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ENVIRONMENTAL BIOLOGY
(MINOR COURSE)

Course No. UMIBOT405 **Max. Marks: 100 (Theory-75, Practical-25)**

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