Khandesh Education Society's

Pratap College, Amalner (Autonomous)

Affiliated to

Kavayitri Bahinabai Chaudhari North Maharashtra University, Jalgaon

Department of Botany

SYLLABUS FOR UNDER GRADUATE PROGRAMME IN BOTANY

AS PER

NATIONAL EDUCATION POLICY- 2020

NEP SYLLABUS FOR II YEAR UG BOTANY

(Sem-III and Sem-IV)

WITH EFFECT FROM THE ACADEMIC YEAR

June 2025 – 2026

MEMBERS ON BOARD OF STUDIES IN BOTANY (2023-2026)

Mr. Jayesh T Salve (Chairman)
Head, Department of Botany, K.E.S.,
Pratap College, Amalner (Autonomous)

Dr. Suchandra D Dutta (Vice Chancellor Nominee)
Head, Department of Botany,
R.D. and S.H. National College, Bandra West, Mumbai

Dr. Ashok R Tuwar (Academic Council Nominee)
Head, Department of Botany, MES,
Art, Commerce and Science College, Sonai

Dr. Dnyaneshwar K Sherkar (Academic Council Nominee)
Assistant Professor, Department of Botany,
Art and Commerce College, Warvat (Bakal)

Dr. Sarala C Tadavi (Department Alumni)
Assistant Professor, Department of Botany,
Dhanaji Nana Mahavidyalay, Faizpur

Mr. Ketan R Caudhari (Industrial Representive)
Owner, Shree Venkatesh Mushroom Farm, Shirsoli Road, Jalgaon

Dr. Digambar D Ahire (Expert for Special Courses)
Head, Department of Botany, AJMVPSA,
New Art, Commerce and Science College, Ahmednagar

Mrs. Jyoti P Padul (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Miss. Harshali S Chaudhari (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Miss. Harshada P Shinde (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Mrs. Bhaghyashri B Patil (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Miss. Pragati D Patil (Staff BOS Member)
Assistant Professor, Department of Botany,
Pratap College, Amalner (Autonomous)

Khandesh Education Society's

PRATAP COLLEGE, AMALNER (AUTONOMOUS)

DEPARTMENT OF BOTANY

The Meetings of Board of Studies in Botany was held virtual/hybrid mode through Google Meet (Link:- : https://meet.google.com/rzg-pdri-ynr) on 22nd March 2025 at 02.00 PM in the Department of Botany to discuss on various agendas of the meeting.

MEETING ATTENDANCE

SR. NO.	NAME OF THE MEMBER	DESIGNATION	SIGNATURE
1.	Prof. Jayesh T Salve (Chairman)	Assistant Professor & HOD Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
2.	Dr. Suchandra D Dutta (VC Nominee)	HOD Department of Botany, R. D. & S. H. National College, Bandra West, Mumbai, Dist.- Mumbai 400050	Member Absent
3.	Dr. Ashok R Tuwar (Academic Council Nominee)	Associate Professor, HOD, Administrative Officer Department of Botany, Mula Education Society's, Arts, Commerce & Science College, Sonai, Tal- Newasa, Dist.- Ahmednagar 414105 (Savitribai Phule Pune University, Pune)	The Member Attended Meeting Virtually
4.	Dr. Dnyaneshwar K Sherkar (Academic Council Nominee)	Assistant Professor Department of Botany, Arts & Commerce College, Warvat (Bakal), Tal- Sangrampur, Dist- Buldhana 444202 (Sant Gadge Baba Amravati University, Amravati)	The Member Attended Meeting Virtually
5.	Dr. Sarala C Tadavi (Alumni)	Assistant Professor Department of Botany, Dhanaji Nana Mahavidyalaya, Faizpur, Tal- Yawal, Dist.- Jalgaon 425503	The Member Attended Meeting Virtually
6.	Dr. Digambar D Ahire (Expert)	Associate Professor & HOD Department of Botany, New Arts, Commerce & Science College, Ahmednagar, Dist.- Ahmednagar 414001 (Savitribai Phule Pune University, Pune)	The Member Attended Meeting Virtually
7.	Prof. J. P. Padul (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
8.	Prof. B. B. Patil (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
9.	Prof. H. S. Chaudhari (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
10	Prof. P. D. Patil (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	
11	Prof. H. P. Shinde (Staff Member)	Assistant Professor Department of Botany, Pratap College, Amalner, Dist.- Jalgaon 425401	

Pratap College, Amalner (Autonomous) Depart. of Botany

Department of Botany

Illustrative Credit Distribution Structure for Three/Four Year Honours/ With Honours Research Degree Programme

Credit distribution structure for FYUG as per NEP 2020, with Selection of Major at Second Year
For Faculty of Science & Technology, B. Sc (Honors/Research) – First Year

Year (Level)	Sem.	Faculty	Subject-I (M-1)	Subject-II (M-2)	Subject-III (M-3)	Open Elective (OE)	VC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Min. Credits for the Year (Sem)	Degree.
1 (4.5)	Sem-I	Science	DSC-1 (2T) DSC-2 (2P)	DSC-1 (2T) DSC-2 (2P)	DSC-1 (2T) DSC-2 (2P)	OE-1(2T)	----	AEC-1 (2) (Eng) VEC-1 (2) (ES) IKS (2)	CC-1 (2)	44 (22+22)	UG Certificate In Faculty
	Sem-II	Science	DSC-3 (2T) DSC-4 (2P)	DSC-3 (2T) DSC-4 (2P)	DSC-3 (2T) DSC-4 (2P)	OE-2(4T)	----	AEC-2 (2) (Eng) VEC-2 (2) (CI)	CC-2 (2)		
	Credit: 1st Year		08	08	08	06	---	10	4	44	

B. Sc (Honors/Research) – Second Year

Year (Level)	Sem.	Faculty	Subject-I (M-1) Major		Subject-II (M-2) Minor	Subject-III (M-3)	Open Elective (OE)	VC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Min. Credits for the Year (Sem)	Degree.
			Mandatory DSC	Elective DSE	MIN							
2 (5.0)	Sem-III	Science	DSC-5 (2T) DSC -6 (2T) (IKS) DSC -7 (2P)	---	MIN-1 (2T) MIN-2 (2T) MIN-3 (2P)	---	OE-3 (2T)	SEC-1 (2T) SEC-2 (2P)	AEC-3 (2) (MIL)	CC-3 (2)	44 (22+22)	UG Diploma In Faculty
	Sem-IV	Science	DSC -8 (2T) DSC -9 (2P)	---	MIN-4 (2T) MIN-5 (2P)	---	OE-4 (2T)	VC-1 (2T) VC-2 (2P)	AEC-4 (2) (MIL)	CC-4 (2) & *OJT / Int/CEP (4)		
	Credit: 2nd Year		10	---	10	---	04	08	4	08	44	

* OJT/Internship/CEP should be completed in the summer vacation after 4th semester.

Note:

- **T:** Theory Course. **P**: Practical course. The courses which do not have practical, **'P'** will be treated as **'T'.**
- **Number in bracket indicate credit allotted.**
- **If student select subject other than faculty in the subjects M-1, M-2, & M-3, then that subject will be treated as Minor subject, and cannot be selected as Major at Second year.**
- **Student must choose one subject as a Major subject out of M-1, M-2, M-3, that, He / She has chosen at First Year.**
- **Student must choose one subject as a Minor subject out of M-1, M-2, M-3 that He / She has chosen at First Year. Minor must be other than Major.**
- **The remaining third subject shall stand discontinued.**

Credit distribution structure for FYUG as per NEP 2020, with Selection of Major at Second Year
For Faculty of Science & Technology, B. Sc (Honors/Research) – Third Year

Year (Level)	Sem.	Faculty	Subject-I (M-1) Major		Subject-II (M-2) Minor	Subject-III (M-3)	Open Elective (OE)	VC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Min. Credits for the Year (Sem)	Degree.
			Mandatory DSC	Elective DSE								
3 (5.5)	Sem-V	Science	DSC -10 (2T) DSC -11 (2T) DSC -12 (2T) DSC -13 (2T) DSC -14 (2T) DSC -15 (2P) DSC -16 (2P)	DSE-1 (2T) DSE-2 (2P)	----	---	---	SEC-3 (2T)	----	FP-1 (2)	44 (22+22)	UG Degree
	Sem-VI	Science	DSC -17 (2T) DSC -18 (2T) DSC -19 (2T) DSC -20 (2T) DSC -21 (2P) DSC -22 (2P)	DSE-3 (2T) DSE-4 (2P)	----	---	----	VC-3 (2T) VC-4 (2P)	----	FP-2 (2)		
	Credit: 3rd Year		26	08	00	00	00	06	00	04	44	
	Cum. Cr. 3- Years (1st + 2nd + 3rd Year)		44	08	18	08	10	14	14	16	132	

B.Sc (Honors/Research) – Fourth Year (Honor)

Year (Level)	Sem.	Faculty	Subject-I (M-1) Major Subject		Subject-II (M-2) Minor Subject (MIN)	Subject -III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/ Sem	Degree
			Mandatory (DSC)	Elective (DSE)								
4 (6.0)	Sem-VII	Science	DSC-25 (4T) DSC-26 (2T) DSC-27 (4T) DSC-28 (2P) DSC-29 (2P)	DSE-5 (4T)	RM (4T)	---	---	---	---	---	22	UG Honours Degree
	Sem-VIII	Science	DSC-30 (4T) DSC-31 (2T) DSC-32 (4T) DSC-33 (2P) DSC-34 (2P)	DSE-6 (4T)	---	---	---	---	---	OJT/Int (4)	22	
	Credit: 4th Year		28	08	04	---	---	----	---	04	44	
	Cum. Cr. 4-Years (1st + 2nd + 3rd +4th yr.)		72	16	22	08	10	14	14	20	176	

B.Sc (Honors/Research) – Fourth Year (Research)

Year (Level)	Sem.	Faculty	Subject-I (M-1) Major Subject		Subject-II (M-2) Minor Subject (MIN)	Subject -III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int, RP	Cumulative Credits/Sem	Degree
			Mandatory (DSC)	Elective (DSE)								
4 (6.0)	Sem-VII	Science	DSC-25 (4T) DSC-26 (2T) DSC-28 (2P) DSC-29 (2P)	DSE-5 (4T)	RM (4T)	---	---	---	---	RP (4)	22	UG Honours with Research Degree
	Sem-VIII	Science	DSC-30 (4T) DSC-31 (2T) DSC-33 (2P) DSC-34 (2P)	DSE-6 (4T)	---	---	---	---	---	RP (8)	22	
	Credit: 4th Year		20	08	04	---	---	---	---	12	44	
	Cum. Cr. 4-Years (1st + 2nd + 3rd +4th yr.)		64	16	22	08	10	14	14	28	176	

Preamble

Pratap College, Amalner (Autonomous), Amalner Dist. Jalgaon believes in implementing several measures to bring equity, efficiency and excellence in higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching-learning process, examination and evaluation techniques and ensuring the all-round development of students. S.Y.B. Sc. Botany has been designed to have a progressive and innovative curriculum in order to equip our students to face the future challenges in the field of higher education. The well-organized curricula including basic as well as advanced concepts in the plant sciences from first year to the third year shall inspire the students to pursue higher studies in Botany and become an entrepreneur and also enable students to get employed in the Botany subject-based industries. This course will help students to build on the basic information regarding classification of plant kingdom groups like algae, fungi, bryophytes, pteridophytes, gymnosperms & angiosperms. This course will also help students To be able to understand the physiology of plants & its importance & implications to human life National Education Policy (NEP – 2020) provides opportunities for internships with local industry, businesses, artists, crafts persons, etc., as well as research internships with faculty and researchers at their own or other HEIs/research institutions, so that students may inquiry engage with the practical side of their learning and, as a by- product, further improve their employability. It also recognizing, identifying, and fostering the unique capabilities of each student to promote her/his holistic development objectives. The curriculum for the S. Y. B. Sc. Programme in Botany has been designed with an aim of encouraging the broad instructional goals and to support the growing demands and challenging trends in the educational scenario. It targets at providing an environment that encourages, promotes and stimulates the intellectual, professional and personal development of the student. The curriculum caters to the all-round development of the student, rolling out globally ready individuals into the fast-pacing world.

Objectives

2.1. The objective of the Bachelor's program in Botany is to equip the students to gain conceptual and analytical skills about morphological, anatomical, physiological, biochemical and cellular aspects of lower and higher plants.

2.2. The program emphasizes to apply knowledge acquired about different taxa of plants for their manipulations, biomolecules and conservation.

2.3. The imparting of laboratory training for bioassay protocols of biological materials, their manipulative treatments, emerging tissue culture and genetic recombinant techniques.

The curriculum for the S. Y. B. Sc. Programme in Botany has been designed with an aim of encouraging the broad instructional goals and to support the growing demands and challenging trends in the educational scenario. It targets at providing an environment that encourages, promotes and stimulates the intellectual, professional and personal development of the student. The curriculum caters to the all-round development of the student, rolling out globally ready individuals into the fast-pacing world.

1. Know the importance and scope of the discipline.
2. Inculcate interest in and love of nature with its myriad living forms.
3. Impart knowledge of science as the basic objective of Education.
4. Create a scientific attitude to make students open minded, critical and curious.
5. Develop the ability to work hard and make students fit for society.
6. Expose students to the diversity amongst life forms.
7. Develop skill in practical work, experiments, equipment's and laboratory use along with collection and interpretation of biological materials and data.
8. Make them aware of natural resources and environment and the importance of conserving it.
9. Develop the ability for the application of acquired knowledge in various field of life so as to make our country self-sufficient.
10. Appreciate and apply ethical principles t biological science research and studies.

Semester-wise Code structure For S. Y. B. Sc. Botany

Programme as per NEP 2020, w.e.f – June 2025

Abbreviations:

- **T:** Theory Course
- **DSC:** Discipline Specific Core Course
- **DSE:** Discipline Specific Elective Course
- **MIN:** Minor subject
- **VSC:** Vocational Skill Courses
- **GE/OE:** Generic/open elective
- **IKS:** Indian Knowledge System
- **CEP:** Community engagement and service
- **RP:**R esearch Project methodology
- **MIL:** Modern Indian language
- **VSEC:** Vocational skill and Skill enhancement courses
- **OJT**: On Job Training: Internship/Apprenticeship
- **Co-curricular Course (CC)**
- **P:** Practical course
- **RM:** Research
- **ENG:** English
- **ES:** Environment studies
- **SEC:** Skill Enhancement courses
- **CI:** Constitution of India

Department of Botany, Pratap College, Amalner (Autonomous)

B.Sc. Botany Program Outcomes and Course Outcomes

Program Outcomes (POs)

- **PO1: Botanical Knowledge and Understanding** Students will demonstrate comprehensive understanding of fundamental botanical concepts including plant diversity, morphology, anatomy, physiology, taxonomy, and ecology, enabling them to analyze and interpret various aspects of plant life and their interactions with the environment.
- **PO2: Scientific Research and Investigation Skills** Students will develop proficiency in scientific methodology, research design, data collection, analysis, and interpretation, enabling them to conduct independent botanical research and contribute to scientific knowledge in plant sciences.
- **PO3: Practical and Laboratory Competence** Students will acquire hands-on expertise in botanical laboratory techniques, field studies, specimen collection, identification methods, and use of modern instruments and technologies relevant to botanical research and applications.
- **PO4: Critical Thinking and Problem-Solving** Students will develop analytical and critical thinking skills to identify, formulate, and solve complex botanical problems using appropriate scientific approaches, tools, and technologies in various plant-related contexts.
- **PO5: Communication and Professional Skills** Students will demonstrate effective communication skills through scientific writing, presentation, and documentation, while developing professional ethics, teamwork abilities, and leadership qualities essential for botanical careers and research.
- Program Specific Outcomes (PSOs)
- **PSO1: Plant Taxonomy and Identification Expertise** Students will master systematic classification, identification, and nomenclature of plants, particularly angiosperms, using modern taxonomic approaches and traditional knowledge systems, enabling them to work effectively in herbaria, botanical surveys, and biodiversity conservation programs.
- **PSO2: Applied Botanical Knowledge Integration** Students will integrate traditional knowledge systems (like Ayurvedic botany) with modern botanical science to understand medicinal plants, ethnobotanical practices, and develop sustainable solutions for agricultural, pharmaceutical, and industrial applications.
- **PSO3: Biotechnological and Agricultural Innovation** Students will acquire specialized skills in modern cultivation techniques including vertical farming, hydroponics, mushroom culture, and biofertilizer production, enabling them to contribute to sustainable agriculture and biotechnological enterprises.
- **PSO4: Economic and Industrial Botany Applications** Students will understand the commercial and industrial applications of plants, including economic botany, industrial processes, and herbal health remedies, preparing them for careers in plant-based industries and entrepreneurship.
- **PSO5: Community Engagement and Environmental Stewardship** Students will develop abilities to engage with communities on botanical and environmental issues, promote plant conservation, and apply botanical knowledge for societal benefit through community service and environmental education programs.

Course Outcomes (COs)

- Semester III Courses
- **CO1: BOT-MJ-231 Angiosperm Taxonomy** Students will demonstrate proficiency in systematic classification, morphological characterization, and identification of angiospermic plants using modern taxonomic principles, phylogenetic relationships, and nomenclatural rules, enabling accurate plant identification and taxonomic research.
- **CO2: BOT-MJ-IKS-232 Ayurvedic Botany** Students will integrate traditional Ayurvedic knowledge with botanical science to understand medicinal plant properties, therapeutic applications, and preparation methods, developing appreciation for indigenous knowledge systems and their relevance in modern healthcare.
- **CO3: BOT-SEC-234 Vertical Farming and Hydroponics** Students will acquire practical skills in soilless cultivation techniques, controlled environment agriculture, and innovative farming methods, enabling them

to design and implement modern agricultural systems for sustainable food production in urban and resource-limited environments.

- **CO4: BOT-MN-236A Ethnobotany & BOT-MN-236B Biofertilizers** Students will understand the cultural significance of plants in human societies and master the production and application of biological fertilizers, combining anthropological botanical knowledge with sustainable agricultural practices for environmentally friendly farming solutions.
- **CO5: BOT-OE-237 Herbal Health Remedies** Students will develop expertise in identifying, preparing, and understanding the therapeutic applications of medicinal plants, enabling them to contribute to natural healthcare systems and herbal medicine development while ensuring safe and effective usage practices.
- Semester IV Courses
- **CO6: BOT-MJ-241 Plant Anatomy** Students will demonstrate comprehensive understanding of internal plant structure, tissue organization, and anatomical adaptations across different plant groups, enabling them to correlate structure with function and apply anatomical knowledge in plant identification and research.
- **CO7: BOT-CEP-243 Community Engagement Services** Students will develop skills to effectively communicate botanical knowledge to diverse communities, participate in environmental conservation projects, and apply their expertise in real-world settings to address societal needs and promote environmental awareness.
- **CO8: BOT-VC-244 Mushroom Culture** Students will master the techniques of mushroom cultivation, including spawn production, substrate preparation, environmental control, and harvesting methods, enabling them to establish mushroom farming enterprises and contribute to alternative protein production systems.
- **CO9: BOT-MN-246A Economic Botany** Students will understand the economic importance of plants in various industries, including agriculture, pharmaceuticals, textiles, and food processing, enabling them to identify commercial opportunities and contribute to plant-based economic development and sustainable resource utilization.
- **CO10: BOT-OE-247 Industrial Botany** Students will comprehend the industrial applications of plants and plant products, including processing techniques, quality control, and value addition methods, preparing them for careers in plant-based industries and enabling innovation in botanical product development and manufacturing processes.

Department of Botany
Pratap College, Amalner (Autonomous)

SYLLABUS FOR THREE/FOUR YEAR UNDER GRADUATE PROGRAMME IN BOTANY
AS PER

NATIONAL EDUCATION POLICY- 2020

B.Sc. (S.Y.U.G.) Botany

(Level 5.0) SEMESTER- III

Discipline Specific Core Courses (Major)

BOT-MJ-231 Angiosperm Taxonomy

BOT-MJ-IKS-232 Ayurvedic Botany

BOT-MJP-233 Practical Based on BOT-MJ-231 & BOT-MJ-IKS-232

SEC (Skill Enhancement Course)

BOT-SEC-234 Vertical Farming and Hydroponics

BOT-SECP -235 Practical Based on BOT-SEC-234

Minor Courses

BOT-MN-236 A Ethnobotany

BOT-MN-236 B Biofertilizers

BOT-MNP-236 C Practical Based on BOT-MN-236 A & BOT-MN-236 B

General Elective/Open Elective Course

BOT-OE-237 Herbal Health Remedies

Department of Botany
Pratap College, Amalner (Autonomous)

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B.Sc. (S.Y.U.G.) Botany

(Level 5.0) SEMESTER- IV

Discipline Specific Core Courses (Major)

BOT-MJ-241 Plant Anatomy

BOT-MJP-242 Practical Based on BOT-MJ-241

CEP (Community Engagement Programme)

BOT-CEP-243 Community Engagement Services

VC (Vocational Course)

BOT-VC-244 Mushroom Culture

BOT-VCP -245 Practical Based on BOT-VC-244

Minor Courses

BOT-MN-246 A Economic Botany

BOT-MNP-246 B Practical Based on BOT-MN-246 A

General Elective/Open Elective Course

BOT-OE-247 Industrial Botany

Department of Botany
Pratap College, Amalner (Autonomous)

B.Sc. (S.Y.U.G.) Botany

(Level 5.0) SEMESTER- III

Year	Sem.	Paper	Title of Course	Marks		Credits
				Int.(CA)	Ext.(UA)	
II	III	**Major**				
		I	BOT-MJ-231 Angiosperm Taxonomy	20	30	2
		II	BOT-MJ-IKS-232 Ayurvedic Botany	20	30	2
		III	BOT-MJP-233 Practical Based On BOT-MJ-231 & BOT-MJ-IKS 232	20	30	2
		SEC				
		IV	BOT-SEC-234 Verical Farming and Hydroponics	20	30	2
		V	BOT-SECP-235 Practical Based on BOT-SEC-234	20	30	2
		Minor				
		VI	BOT-MN-236 A Ethnobotany	20	30	2
		VII	BOT-MN-236 B Biofertilizers	20	30	2
		VIII	BOT-MNP-236 C Practical Based on BOT-MN-236 A & BOT-MN-236 B	20	30	2
		Generic/Open Elective course Group				
		IX	BOT-OE-237 Herbal Health Remedies	20	30	2

Department of Botany
Pratap College, Amalner (Autonomous)

B.Sc. (S.Y.U.G.) Botany

(Level 5.0) SEMESTER- IV

Year	Sem.	Paper	Title of Course	Marks		Credits
				Int.(CA)	Ext.(UA)	
II	IV	**Major**				
		I	BOT-MJ-241 Plant Anatomy	20	30	2
		II	BOT-MJP-243 Practical Based on BOT-MJ-241	20	30	2
		CEP				
		III	BOT-CEP- 242 Community Engagement Services	20	30	2
		VC				
		IV	BOT-VC-244 Mushroom Cultivation	20	30	2
		V	BOT-VCP-245 Practical Based on BOT-SEC-234	20	30	2
		Minor				
		VI	BOT-MN-246 A Economic Botany	20	30	2
		VII	BOT-MNP-246 B Practical Based on BOT-MN-246 A	20	30	2
		Generic/Open Elective course Group				
		VIII	BOT-OE-247 Industrial Botany	20	30	2

Department of Botany

S.Y.B.Sc.

SEM: III

Discipline Specific Core Courses (Major)

BOT-MJ-231 Angiosperm Taxonomy

BOT-MJ-IKS-232 Ayurvedic Botany

BOT-MJPP-233 Practical Based on BOT-MJ-231 & BOT-MJ-IKS-232

SEC (Skill Enhancement Course)

BOT-SEC-234 Vertical Farming and Hydroponics

BOT-SECP -235 Practical Based on BOT-SEC-234

Minor Courses

BOT-MN-236 A Ethnobotany

BOT-MN-236 B Biofertilizers

BOT-MNP-236 C Practical Based on BOT-MN-236 A & BOT-MN-236 B

General Elective/Open Elective Course

BOT-OE-237 Herbal Health Remedies

B. Sc. (Honors/Research) Second Year Semester - III, Level- 5.0
DSC-5, Course Code: BOT-MJ-231
Course Title: Angiosperm Taxonomy

Course Code: BOT-MJ-231	**Course Category: Core Course (DSC-5)**
Course Title: Angiosperm Taxonomy	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To study the diversity of Angiosperm, taxonomy and naming system.
2. To create awareness in classification of plants and its arrangements.
3. To study of comparative account among the families of Angiosperms.
4. To study distinguishing characters, floral formula, floral diagram and economic importance of Angiosperm families.
5. To study the botanical gardens and herbarium techniques.

Course Outcomes:

1. Students will learn taxonomy of Angiosperms and naming system.
2. Students will develop knowledge of Bentham and Hooker`s system of classification.
3. Understand the comparative account among the families of angiosperms.
4. Students will upgrade their knowledge of distinguishing features and economic importance of the angiosperm plants.
5. Realize the concepts of botanical gardens and herbarium techniques.

Course Content:

Unit1: Introduction (6 Marks/ 6 L)

1.1 Definition of Angiosperm Taxonomy
- i) Scope and importance of taxonomy
- ii) Angiosperms: Highly evolved group of plants

1.2 Distinguishing characteristics of Angiosperms.

1.3 Alternations of generations.

1.4 Functions of Taxonomy: Identification, Classification and Nomenclature.

1.5 Binomial Nomenclature.

Unit 2: Classification (6 Marks/ 6 L)

2.1 Types of classification
- i) Artificial System
- ii) Natural System
- iii) Phylogenetic System

2.2 Outline of Bentham and Hooker's system of classification up to series.

2.3 Merits and Demerits.

Unit 3: Study of plants families with respect to systematic position, Morphological characters, distinguishing characters, floral formula, floral diagram, and economic importance of the following. (6 Marks/ 6 L)

i) Malvaceae
ii) Fabaceae
iii) Rubiaceae
iv) Solanaceae
v) Euphorbiaceae
vi) Cannaceae

Unit 4: Botanical Gardens (6 Marks/ 6 L)

4.1 Definition and Functions of Botanical Garden.
4.2 Special feature of following Botanical Garden.
i) Indian Botanical Garden, Kolkata
ii) National Botanical Garden, Lucknow
iii) Royal Botanical Garden, Kew, England.

Unit 5: Herbarium (6 Marks/ 6L)

5.1 Definition, functions of herbarium
5.2 Techniques of herbarium:
i) Collection
ii) Pressing and Drying
iii) Poisoning
iv) Mounting
v) Labeling
vi) Deposition
5.3 Digital herbarium
5.4 Importance of herbaria

Suggested Readings:

1. Balfour Austin (2016). Plant Taxonomy. Syrawood Publishing House, New York, USA.
2. Chopra G.L. (1984). Angiosperms: Systematics and Life-Cycle., Pradeep Publications, Jaipur.
3. Datta S.C. (1988). Systematic Botany. New Age Publ. New Delhi.
4. Davis P.H and V.H Heywood (1963). Principles of Angiosperm Taxonomy. Oliver and Boyd, London.
5. Davis P.H and V.H Heywood (2011). Principles of Angiosperm Taxonomy. Scientific Publishers, New Delhi.
6. Heywood V.H. (1967). Plant Taxonomy, Hodder & Stoughton Educational, London.
7. Lawrence G.H.M. (1955). An Introduction to Plant Taxonomy. McMillan, New York.
8. Lawrence G.H.M. (1951). Taxonomy of Vascular Plants. McMillan, New York.
9. MondolA.K. (2016) Advanced Plant Taxonomy, New Central Book Agency (NCBA), Howrah.
10. Nordemstam B, El.Gazaly, G and Kassas, M.(2000). Plant Systematics for 21st Centuary. Portland Press Ltd., London.

11. Naik V.N. (1988) Taxonomy of Angiosperms. Oxford and IBH Pub., New Delhi.
12. Pandey B.P. (1997). Taxonomy of Angiosperms. S. Chand. Publishing, New Delhi.
13. Pandey B.P. (2001) A Textbook of Botany: Angiosperms. S. Chand. Publishing, New Delhi.
14. Pandey S.N. and S.P.Mishra (2008) Taxonomy of Angiosperms. Anne Books Pvt. Ltd. New Delhi.
15. Pullaiah T. and S. Karuppusamy (2018) Taxonomy of Angiosperms. Astral International (P) Ltd. New Delhi.
16. Radford A.E. 1986. Fundamentals of Plant Systematics, Harper and Row, New York.
17. Sambamurthy A.V.S.S. (2013) Taxonomy of Angiosperms. I.K. International Pvt.Ltd., New Delhi.
18. Sharma O.P. (2011), Plant Taxonomy, Tata McGraw Hill, Bangalore.
19. Shivrajan V.V. and N.K.P. Robson (1991). Introduction to Principles of Plant Taxonomy. Cambridge Univ. Press.
20. Shukla Priti and Shital Mishra (1982). An introduction to Taxonomy of angiosperms. Vikas Publishing House, New Delhi.
21. Singh Gurucharan (2005). Systematics: Theory and Practice. Oxford IBH.Publishing Company, Delhi.
22. Singh N.P. (2001) Flora of Maharashtra Volume-II BSI, Kolkatta.
23. Singh N.P. (2003) Flora of Maharashtra Volume-III BSI, Kolkatta.
24. Singh N.P., S. Karthikeyan (1996) Flora of Maharashtra Volume-I, BSI, Kolkatta.
25. Singh V. and D.K. Jain, (1981). Taxonomy of Angiosperms. Rastogi Publication, Meerut.
26. Singh, Gurcharan. (2012). Plant Systematics: Theory and Practice. Completely revised and enlarged 3rd edition. Oxford & IBH, New Delhi.
27. Sinha S. K.(2013) Taxonomy of Angiosperms. Arts and Science Academic Publication, Delhi.
28. Solanke N.S. (2019) Introduction to Taxonomy of Angiosperms. Oxford Book Company, Noida/ Kolkata.
29. Stuessy Tod F. (2009). Plant Taxonomy: The Systematic Evaluation of Comparative Data, second edition. Columbia University Press.
30. Varma B.K. (2010) Introduction to Taxonomy of Angiosperms. PHI Learning Pvt. Ltd. Delhi.

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B. Sc. (Honors/Research) Second Year Semester - III, Level- 5.0
DSC-IKS-6, Course Code: BOT-MJ-IKS-232
Course Title: Ayurvedic Botany

Course Code: BOT-MJ-IKS-232	**Course Category: Core Course (DSC-6) IKS**
Course Title: Ayurvedic Botany	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To understand the fundamental principles of plant morphology, anatomy, and taxonomy as applied to Ayurvedic medicinal plants
2. To develop skills in identification, collection, and authentication of medicinal plants mentioned in classical Ayurvedic texts
3. To analyse the phytochemical composition and pharmacological properties of important Ayurvedic herbs
4. To evaluate sustainable cultivation practices and conservation strategies for endangered medicinal plant species
5. To integrate traditional Ayurvedic plant knowledge with modern botanical research methodologies

Course Outcomes: After studying this course, the students will be able to:

1. Identify and classify medicinal plants based on their morphological characteristics and taxonomic position according to Ayurvedic and botanical classifications
2. Demonstrate proficiency in proper collection, processing, and storage techniques for medicinal plant materials following traditional and modern standards
3. Analyse and correlate the relationship between phytochemical constituents and therapeutic activities of Ayurvedic herbs
4. Design sustainable cultivation and conservation programs for medicinal plants considering ecological and economic factors
5. Evaluate research literature critically and apply evidence-based approaches to validate traditional uses of medicinal plants

Course Content:

Unit 1: Fundamentals of Ayurvedic Botany **(6 Marks/ 6 L)**

1.1 Introduction to Ayurvedic Botany and its scope
1.2 Historical development of plant medicine in Ayurveda
1.3 Classical Ayurvedic texts and their botanical references
1.4 Principles of plant classification in Ayurveda vs. modern taxonomy
1.5 Concept of Panchamahabhuta in plant kingdom

Unit 2: Plant Morphology and Identification **(6 Marks/ 6 L)**

2.1 Morphological characteristics of medicinal plants
2.2 Plant anatomy relevant to drug identification
2.3 Diagnostic features for field identification
2.4 Microscopic evaluation techniques
2.5 Modern tools for plant authentication (DNA barcoding, chromatography)

Unit 3: Classification and Properties of Medicinal Plants **(6 Marks/ 6 L)**

3.1 Ayurvedic classification systems (Rasa, Guna, Virya, Prabhava)
3.2 Taxonomic classification of important medicinal plant families
3.3 Habitat and distribution patterns of Ayurvedic herbs
3.4 Plant parts used in medicine (root, stem, leaf, flower, fruit, seed)
3.5 Seasonal variations and collection timing

Unit 4: Phytochemistry And Pharmacology **(6 Marks/ 6 L)**

4.1 Primary and secondary metabolites in medicinal plants
4.2 Major phytochemical groups (alkaloids, glycosides, terpenoids, phenolics)
4.3 Extraction methods and standardization techniques
4.4 Correlation between traditional uses and pharmacological activities
4.5 Quality control parameters for herbal drugs

Unit 5: Cultivation, Conservation and Sustainable Utilization **(6 Marks/ 6 L)**

5.1 Principles of medicinal plant cultivation
5.2 Agro-techniques for major Ayurvedic herbs
5.3 Post-harvest processing and value addition
5.4 Conservation strategies for endangered medicinal plants
5.5 Economic botany and medicinal plant trade
5.6 Intellectual property rights and bio-piracy issues

REFERENCES

1. Chopra, R.N. et al. (1986). *Glossary of Indian Medicinal Plants*. CSIR Publications.
2. Evans, W.C. (2009). *Trease and Evans' Pharmacognosy*. Saunders Elsevier.
3. Khare, C.P. (2007). *Indian Medicinal Plants: An Illustrated Dictionary*. Springer.
4. Kirtikar, K.R. & Basu, B.D. (1999). *Indian Medicinal Plants*. International Book Distributors.
5. Kokate, C.K. et al. (2010). *Pharmacognosy*. Nirali Prakashan.
6. Warrier, P.K. et al. (1996). *Indian Medicinal Plants: A Compendium of 500 Species*. Orient Longma .
7. WHO Monographs on Selected Medicinal Plants (Volumes 1-4)

B. Sc. (Honors/Research) Second Year Semester - III, Level- 5.0
DSC-7, Course Code: BOT-MJP-233
Course Title: Practical based on BOT-MJ-231 & BOT-IKS-232

Course Code: BO-MJP-233	**Course Category: Core Course (DSC-7)**
Course Title: Practical based on BOT-MJ-231 & BOT-IKS-232	**Type: Practical**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To make a student familiar with the method of description of Angiospermic plants.
2. To make students aware about the practical of angiosperm taxonomy.
3. To provide the herbarium techniques of plant.
4. They get the practical knowledge of physiological processes like osmosis, imbibition.
5. To compare the environmental factors affecting transpiration and photosynthesis.

Course Outcomes: After studying this course, the students will be able to :

1. The student will be able to describe the Angiospermic plant.
2. The course will help students to be aware of the practical of angiosperms taxonomy.
3. The students will learn the herbarium techniques of plants.
4. Students will be able to understand the physiological knowledge of imbibition and
5. Osmosis.
6. The students will get the knowledge of transpiration and rate of photosynthesis
7. and how it varies according to environmental factors.

Experiments:

Practical No. 1: How to describe vegetative characters of Angiospermic plants.

Practical No. 2: How to describe floral characters of Angiospermic plant.

Practical No. 3: How to write floral formula and draw the floral diagram of Angiospermic plant.

Practical No. 4, 5, 6, 7: Study of any four plant families as per theory with respect to systematic position, morphological characters (vegetative and floral), floral formula and floral diagram (sensu Bentham and Hookers system)

Practical No. 8: Demonstration of Herbarium Technique

a) Pressing and Drying
b) Poisoning
c) Mounting
d) d) Labelling.

Practical No. 9: Study of classical Ayurvedic texts (Charaka Samhita, Sushruta Samhita) and identification of botanical references with comparative analysis of historical vs. modern terminology.

Practical No. 10 and 11: Qualitative phytochemical screening for alkaloids, glycosides, terpenoids, and phenolic compounds with demonstration of extraction methods and quality control testing any three medicinal plants.

Practical No. 12: Morphological study of 15-20 important medicinal plants using diagnostic features and field identification techniques for different plant parts used in medicine.

Suggested Readings:

1. Naik, V. N (1984) Taxonomy of Angiosperms. Tata McGraw – Hil publishing Company Ltd , New Delhi, India.
2. Pandey B.P. (1997) Taxonomy of Angiosperms. S. Chand & Company Ltd., New Delhi, India.
3. Sharma, O.P. (1997) Plants Taxonomy. Tata McGraw – Hill Publishing Co.Ltd. New Delhi, India.
4. Singh V. And Jain, D.K (1992) Taxonomy of Angiosperms. Rastogi publication, Meerut, India.
5. Bendre. Kumar: A Textbook of Practical Botan -2. Rastogi Publication, India.

B. Sc. (Honors/Research) Second Year Semester- III, Level- 5.0
SEC-1, Course Code: BOT-SEC-234
Course Title: Vertical Farming and Hydroponics

Course Code: BOT-SEC-234	**Course Category: SEC-1**
Course Title: Vertical Farming and Hydroponics	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To enable students for pursuing career through self-employment.
2. To train future industry professionals.
3. To impart comprehensive knowledge on high-tech farming.
4. To develop the entrepreneurial skills among the students.
5. To develop theoretical knowledge and practical understanding of the science and techniques of hydroponic crops production.
6. To develop proficiency in selecting specific hydroponic systems for successfully growing leafy greens, culinary herbs and vegetables.

Course Outcomes: After studying this course the students will be able to :

1. Identify the basic elements in a vertical farming.
2. Evaluate environmental control systems.
3. Select plants those are appropriate for vertical farming.
4. Develop plant growing procedure.
5. Design and maintain a simple vertical farm.
6. Understand the advantages and disadvantages of vertical farming.
7. Develop interdisciplinary thinking to solve challenges in vertical farming

Course Content:

Unit 1: Introduction to vertical farming. (6 Marks/ 6 L)

1.1 Concept of vertical farming.
1.2 Definition, Scope and importance of vertical farming.
1.3 Types of vertical farms.
1.4 Advantages and limitations of vertical farming.
1.5 Challenges of vertical farming.

Unit 2: Techniques of vertical farming (6 Marks/ 6 L)

2.1 Techniques of Vertical farming-i) Hydroponics, ii) Aeroponics,
ii) Aquaponics vertical farming.
2.2 Types of vertical farming structures. i) Rack and Tray systems ii) Tower system
ii) Vertical Wall System.
2.3 Important growth parameters in vertical farming. i) Light ii) Temperature
iii) Humidity iv) Electric conductivity and pH v) Water culture system vi) Growing media.
2.4 Plants suitable for vertical farming.

Unit 3: Micro greens farming. (6 Marks/ 6 L)

3.1. Introduction– Definition.
3.1 Types of Micro greens farming.
i) Kitchen Microgreen Farming or Indoor Microgreen Farming.
ii) Hydroponic Microgreen Farming System.
3.3. Techniques of Microgreen Farming.
3.4. Growing methods of microgreens farming.
3.5. Nutritional values and health benefits of microgreens.
3.6. Plants used in growing micro greens.

Unit 4: Vertical gardening (6 Marks/ 6 L)

4.1. Introduction- Definition, importance of vertical gardens.
4.2. Types of vertical gardens-
i) Green walls/ Living walls ii) Green facades iii) Tower garden.
4.3. Important factors of vertical gardening.
4.4. Plants suitable for vertical gardens.
4.5. Advantages and disadvantages of vertical gardening.

Unit 5: Hydroponics techniques (6 Marks/ 6L)

5.1. Introduction, definition, basic concept and design of hydroponics techniques,
5.2. Hydroponic Growing Systems-
i) Nutrient Film Technique (NFT).
ii) Deep Flow technique (DFT).
iii) Solution culture or liquid hydroponics.
iv) Flood and Drain Systems.
5.3. Growing medium and Nutrient solutions in hydroponics.
5.4. Growth parameters.
5.5. Importance of hydroponics.
5.6. Plants suitable for hydroponics.
5.7. Applications of hydroponics techniques-fodder, microgreens, vegetables.

Suggested Readings:

1. Despommier D.and Carter M.(2011).The Vertical Farm: Feeding the World in the 21st Century. UK: Picador.
2. Jain, R. and Janakiram T.(2016).Vertical gardening: a new concept of modern era.In: Commercial Horticulture, New India Publishing Agency, New Delhi, India.
3. Kojai T., Niu G.,Takagaki M.(ed).(2015). Plant factory an indoor vertical farming system for efficien quality food production. Academic Press, pp: 1-432.
4. Eric Franks and Jasmine Richardson (2009). Microgreens: A Guide to Growing Nutrient Packed Greens Gibbs M. Smith Inc publication pp-1-207.
5. Joe C. Grant (2022). Vertical Farming: A Practical Guide to Sustainable Agriculture in the 21st Century pp-1-131.
6. NAAS (2019). Vertical Farming. Policy Paper No. 89, National Academy of Agricultural Sciences, New Delhi: pp 20.
7. https://labassociates.com/types-of-growing-systems-in-vertical-farming
8. Gupta, M. K., & Ganapuram, S. Vertical Farming Using Information and Communication Technologies, Infosys.
9. Sengupta, A., & Banerjee, H. (2012). Soil-less culture in modern agriculture. World J. Sci. Technol, 2(7), 103-108.
10. Ali F. And Srivastava C. (2017). Futuristic Urbanism-An overview of vertical farming and Urban agriculture for future cities in India. *International Journal of Advanced Research In Science, Engineering and Technology*,4 (4), April 2017.
11. Banerjee C. (2014). Up and Away! The Economics of Vertical Farming.*Journal of Agricultural Studies*, 2(1):40-60.
12. Hota S., Stobdon T. and Chaurasia O. P. (2018). Aeroponics and inflatable green house in trans-Himalaya: Challenges and future perspective. *New Age Protected Cultivation*, ISPC, New Delhi: 4(2)18-20.
13. Jankiram T. and Bhaskar S. (2018). Recent advances in protected cultivation in China. *New Age Protected Cultivation*, ISPC, New Delhi: 4(2):25-30.
14. Kheir Al-Kodmany (2018). The Vertical Farm: A Review of Developments and Implications for the Vertical City. *MDPI, February 2018:*1-36 (www.mdpi.com/journal/buildings).
15. Pant T.; Agarwal A.; Bhoj A.S.; Joshi R.P.; Om Prakash and Dwivedi S.K. (2018). Vegetable cultivation under hydroponics in Himalayas- challenges and opportunities. *Defence Life Science J*., 3 (2):111-115.

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B. Sc. (Honors/Research) Second Year Semester- III, Level- 5.0
SEC-2, Course Code: BOT-SECP-235
Course Title: Practical Based on BOT-SEC-234

Course Code: BOT-SECP-235	**Course Category: SEC-2**
Course Title: Practical Based on BOT-SEC-234	**Type: Practical**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To enable students for pursuing career through self-employment.
2. To train future industry professionals.
3. To impart comprehensive knowledge on high-tech farming.
4. To develop the entrepreneurial skills among the students.
5. To develop theoretical knowledge and practical understanding of the science and techniques of hydroponic crops production.
6. To develop proficiency in selecting specific hydroponic systems for successfully growing leafy greens, culinary herbs and vegetables.

Course Outcomes: At the completion of this course, students will be able to:

1. Identify the basic elements in a vertical farming.
2. Evaluate environmental control systems.
3. Select plants that are appropriate for vertical farming.
4. Develop plant growing procedure.
5. Design and maintain a simple vertical farm.
6. Understand the advantages and disadvantages of vertical farming.
7. Develop interdisciplinary thinking to solve challenges in vertical farming.

Experiments:

Practical No. 1: Study of basic concept of Vertical farming/vertical gardening/Hydroponics.

Practical No. 2: Study of techniques of vertical farming.

Practical No. 3: Study of various instruments used in vertical farming.

Practical No. 4: Study of different types of growing media for vertical farming system.

Practical No. 5: Demonstration on important growth parameters in vertical farming.

Practical No. 6 and 7: Study of hydroponic system -

a) Nutrient Film Techniques (NFT) b**)** Deep Flow Techniques (DFT)
c) Floating Technique d) Aeroponics Technique.

Practical No. 8 and 9: Study of basic requirements for hydroponic system in brief Container, Growth Medium, Nutrient Solution, Water Quality, Light, Temperature, Oxygen and pH.

Practical No. 10: Growing a leafy vegetable/Fruity vegetable / medicinal herbs/green fodder plants in Hydroponic /Aeroponic solution.

Practical No. 11: Growing profitable leafy crop in vertical farming e.g. Fenugreek (*TrigonellaFoenum-graecum*-Fabaceae) / Spinach(*Spinaciaoleracea*-Amaranthaceae).

Practical No. 12: Growing profitable fruit crop in vertical farming. e.g. Tomato **(***Solanum lycopersicum*, Syn. *Lycopersicum esculentum* Mill-Solanaceae**)** / Capsicum (*Capsicum annuum* **-** Solanaceae**).**

Practical No. 13: Growing of suitable microgreens Mustard /Coriander.

Practical No. 14: Preparation of outdoor green walls/green facades with locally available materials.

Practical No. 15: Visit to nearby vertical farm /vertical garden/ Hydroponics Unit (Submit Visit Report).

Suggested Readings:

1. Jain, R. and Janakiram T.(2016).Vertical gardening: a new concept of modern era.In: Commercial Horticulture, New India Publishing Agency, New Delhi, India.
2. Joe C. Grant (2022). Vertical Farming: A Practical Guide to Sustainable Agriculture in the Century pp-1-131.
3. Kojai T., Niu G.,Takagaki M.(ed).(2015). Plant factory an indoor vertical farming system for efficient quality food production. Academic Press, pp: 1-432.
4. Pant T.; Agarwal A.; Bhoj A.S.; Joshi R.P.; Om Prakash and Dwivedi S.K. (2018). Vegetable cultivation under hydroponics in Himalayas- challenges and opportunities. *Defence Life Science J*., 3 (2):111-115.
5. Sengupta, A., & Banerjee, H. (2012). Soil-less culture in modern agriculture. World J. Sci. Technol, 2(7), 103-108.
6. Hota S., Stobdon T. and Chaurasia O. P. (2018). Aeroponics and inflatable green house in trans-Himalaya: Challenges and future perspective. *New Age Protected Cultivation*, ISPC, New Delhi: 4(2)18-20.

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B. Sc. (Honors/Research) Second Year Semester - III, Level- 5.0
MIN- 1, Course Code: BOT-MN-236 A
Course Title: Ethnobotany

Course Code: BOT-MN-236 A	**Course Category: MIN-1**
Course Title: Ethnobotany	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. Introduce students to the basic concepts of ethnobotany with an emphasis on plant-human interactions.
2. To introduce students to the science of how people use plants in different cultures and societies (ethnobotany).
3. To study sources of ethnobotany.
4. To make the students aware of ethnology of certain tribes in Maharashtra.
5. To study Indian ethnomedicines used against human diseases

Course Outcomes:

1. Students will be able to: Collect and identify plants using standard methods.
2. Practice standard ethnobotanical survey techniques. Field Collection and Identification Methods.
3. Recognize regionally important plant families.
4. Plants utilization for different disease.
5. Explore the general principles of ethnobotany, including its history and importance in traditional and modern culture

Course Content:

Unit 1: Introduction to Ethnobotany (6 Marks/ 6 L)

1.1 Introduction to Ethnobotany, Definition and scope.
1.2 Man, and Plant relationship: Concrete and Abstract.
1.3 Comparison of Ethnobotany and Economic Botany.
1.4 Landmarks of Indian Ethnobotany.
1.5 Sub-disciplines of Ethnobotany.

Unit 2: Ethnobotanical fieldwork (6 Marks/ 6 L)

2.1 Herbaria as an aid to ethnobotanical study.
2.2 Ethnobotanical study with the help of literature.
2.3 Tribes of NorthMaharashtra:1. Pawara 2. Bhil 3. Kokani

Unit 3: Study of Ethnobotany of plants from Indian region (6 Marks/ 6 L)

3.2 Plants used against Human and veterinary Diseases: w.r.t. Botanical Name of plants, family, parts used, mode of preparation and administration of medicine, for following.

Cough, Cold, Bronchial problems. (Human Diseases)
Headache, Toothache. (Human Diseases)
Arthritis and Rheumatism. (Human Diseases)
Fever & Diabetes. (Human Diseases)
Diarrhoea and Dysentery (Veterinary Diseases)
Foot and Mouth disease. (Veterinary Diseases)

Unit 4: Ethnobotany of North Maharashtra: w.r.t. Botanical Sources and administration (6 Marks/ 6 L)

4.1 Ethnobotany of food plants and beverages.
4.2 Plants used as Toothbrush.
4.3 Fodder sources.
4.4 Ethnology of vernacular names.

Unit 5: Cosmetics, Decoration and Adornment used by Tribal (6 Marks/ 6L)

5.1 Introduction.
5.2 Floral Adornment.
5.3 Dyes, Perfume, Haircare, Tattooing.
5.4 Ornaments, wall painting, and Decoration.

Suggested Readings:

1. Jain, S. K. (Ed) (1981). Glimpses of Indian Ethnobotany. Oxford &IBH, New Delhi, India.
2. Jain, S.K.(Ed) (1995). A Manual of Ethnobotany (II nd Ed.) Scientific Publishers, Jodhpur, India.
3. Jain, S.K. and Mudgal (1999). A Hand Book of Ethnobotany. Bishen Singh Mahendra Pal Singh, Dehradun, India.
4. Jain. S. K, (1991). Contributions to Indian Ethnobotany, Scientific Publishers, Jodhpur, India:
5. Jain, S. K. (1989). Methods and Approaches in Ethnobotany. Society of Ethnobotanists, Lucknow, India.
6. Jain S. K. (1996). Ethnobiology in Human Welfare. Deep Publication, New Delhi, India.
7. Jain, S. K., B. K. Sinha and R. C. Gupta (1991). Notable Plants in Ethnomedicine in India, Deep Publication, New Delhi, India
8. Joshi P. (1995). Ethnobotany of Primitive Tribe of Rajasthan Print well, Jaipur, India.
9. Martin, G. J. (1995). Ethnobotany: A Methods Manual, Chapman and Hall, London, U.K.
10. Saklani, A. and S. K. Jain (1994). Cross Cultural Ethnobotany of North East India New Delhi.
11. Singh, V. and R.P. Pandey (1998). Ethnobotany of Rajasthan, Scientific Publishers, Jodhpur.
12. Martin G. J. (1995) Ethnobotany: A Methods Manual, Chapman & Hall, London, U. K.
13. Sinha, Rajiv, Kand S. Sinha (2001). Ethnobiology, Sura Publications, Jaipur, India.
14. Maheshwari, J.K. (1996). Ethnobotany in South Asia. Scientific Publishers, Jodhpur.

15. Patil D.A. (2008). Useful plants, Navyug Publishers and Distributors, New Delhi, India.
16. P.C. Trivedi and Niranjan Sharma (2011). T. B. of Ethnobotany, Pointer publisher, Jaipur.
17. Samba Murthy, A.V. S. S. and Subramanyam, N.S. (1989). A Text of Economic Botany, Wikes Eastern Ltd., New Delhi, India.
18. Swaminathan, MS. and Kocchar, S.L.(Eds.) (1989). Plants Society, MacMillan Publications, Ltd. London, U.K.
19. Ashalata D Rozario and Dipak Mukherji (2004). Ahand Book of Ethnobotany.

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B. Sc. (Honors/Research) Second Year Semester - III, Level- 5.0
MIN-2, Course Code: BOT-MN-236 B
Course Title: Biofertilizers

Course Code: BOT-MN-236 B	**Course Category: MIN-2**
Course Title: Biofertilizers	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To understand the diversity and utilization of microbes as a biofertilizers
2. To demonstrate the low-cost production of biofertilizers.
3. To aware the students about the benefits and significant role of biofertilizers, to protect the agricultural environment.
4. To learn the applications of biofertilizers.

Course Outcomes: After studying this course, the students will be able to :

1. Able to distinguish types of biofertilizers and the methods of application.
2. Acquire skill of isolation and maintenance of biofertilizers
3. Able to understand the importance of biofertilizers in relation to environment
4. Able to understand formulation and large-scale industrial production of biofertilizers.

Course Content:

Unit 1: General Account (6 Marks/ 6 L)

19.1 Introduction, scope and importance of Biofertilizers.
19.2 Manures and Biofertilizers: Types of fertilizers, manures, manure composition, manure for crop productivity.
19.3 Difference between Chemical fertilizers and Biofertilizers.
19.4 General accounts on the microbes used as a Biofertilizers

Unit 2: Bacterial fertilizers (6 Marks/ 6 L)

2.1 *Azospirillum*: isolation and mass multiplication, carrier-based inoculant, applications.
2.2 *Azotobactor*: Classification, characteristics, crop response, to *Azotobactor* inoculum, maintenance, mass multiplication
2.3 *Rhizobium*: isolation and mass multiplication, applications.

Unit 3: Algal Biofertilizers (6 Marks/6 L)

3.1 Types of Algal Biofertilizers: BGA-Cyanobacteria, *Azolla*, isolation and mass multiplication of cyanobacteria and *Azolla*.
3.2 Applications of Algal Biofertilizers
3.3 Biological Nitrogen Fixation.

Unit 4: Fungal Biofertilizers (6 Marks/ 6 L)

4.1 Mycorrhizal Association, types of mycorrhizal association, occurrence and distribution, growth and yield.
4.2 Colonization of VAM (Vesicular Arbuscular Mycorrhiza)
4.3 Application of mycorrhiza in agriculture.

Unit 5: Organic Farming (6 Marks/ 6L)

5.1 Green manuring and organic fertilizers
5.2 Recycling of biodegradable agricultural and industrial waste
5.3 Bio compost making methods: Farm Yard, Green leaf Compost.

Suggested Readings:

1. Aneja, K. R. 1993 Experiments in Microbilogy, Plant Pathology and Tissue Culture Wishwa Prakashan New Delhi.
2. Borkar,S.G. 2015.Beneficial Microbes as Biofertilizers and its Production Technology Woodhead Publisher, India,New Delhi
3. Dubey R.C. 2005. A Text book of Biotechnology. S.Chand & Co. New Delhi.
4. John Jothi Prakash E. 2004. Outlines of Plant Biotechnology. Emkay Publication. New Delhi
5. Kumaresan, V. (2005). Biotechnology. New, Delhi, Delhi: Saras Publication.
6. Sathe T.V. 2004. Vermiculture and Organic Farming. Daya Publishers. New Delhi.
7. Subha Rao, N.S. (2000). Soil Microbiology. New Delhi, Delhi: Oxford & IBH Publishers.
8. Vayas S.C, Vayas S. and Modi H.A. 1998.Bio-fertilizers and organic Farming Akta, Prakashan.

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B. Sc. (Honors/Research) Second Year Semester- III, Level- 5.0
MIN-3, Course Code: BOT-MNP-236 C
Course Title: Practical Based on BOT-MN-236 A & BOT-MN-236 B

Course Code: BOT-MNP-236 C	**Course Category: MIN-3**
Course Title: Practical Based on BOT-MN-236 A & BOT-MN-236 B	**Type: Practical**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To study sources of ethnobotany
2. To aware the students about of ethnobotany of certain tribes in Maharashtra
3. To study the India ethnomedicines used against the huma diseases
4. To understand the diversity and utilization of microbes as a biofertilizers
5. To demonstrate the low-cost production of biofertilizers.
6. To learn the applications of biofertilizers.

Course Outcomes: After studying this course, the students will be able to:

1. Recognize regionally important plant families
2. Plants utilization for different diseases.
3. Explore the general principals of ethnobotany, including its history and importance in traditional and modern culture.
4. Able to distinguish types of biofertilizers and the methods of application.
5. Acquire skill of isolation and maintenance of biofertilizers
6. Able to understand the importance of biofertilizers in relation to environment
7. Able to understand formulation and large-scale industrial production of biofertilizers.

Experiments:

Practical No. 1 & 2: Preparation of Digital Herbarium of some ethnobotanical plants (any five) and its techniques.

Practical No. 3, 4 & 5: Ethnobotany of some plants W.R.T. Botanical name, taxonomic description, distribution, phytochemistry and uses of:

i) *Justicia adhathoda* (Adulsa)
ii) *Aegle marmelos* (Bel)
iii) *Azadirecta indica* (Kadunimb)
iv) *Butea monosperma* (Palas)
v) *Datura metal* (Dhotara)
vi) *Madhuka longifolia var. longifolia* (Mahuva)

Practical No. 6 & 7: Study of following plants with reference to their vernacular names, botanical names, family, plant parts used, uses, mode of preparation and administration from the local area with the help of plants or their parts or specimens.

A) Food plants: Tubers: *Dioscorea bulbifera* (Kadukand)
B) Beverages: Flowers: *Madhuka longifolia* (Mahu)
C) Oil Yielding: Seed: *Ricinus communis* (Erand)
D) Fiber Yielding: Stem: *Helicteris isora* (Murudsheng)
E) Bidi Wrapper: Leaves: *Diospyros melanoxylan* (Tendu)
F) Tooth Brush: Stem: *Pongamia pinnata* (Karanj), *Cassia auriculata* (Avali), *Vachellia nilotica* (Babul), *Azadirecta indica* (Neem)

Practical No. 8: Methods of Sterilization

Practical No. 9 & 10: Nutritional media and their preparation

i) Bacterial- YEMA (Yeast Extract Mannitol Agar)
ii) Algal- Chu's medium
iii) Fungal- PDA (Potato Dextrose Agar)

Practical No. 11: Methods of isolation and purification of microbial cultures

Practical No. 12: Isolation of *Rhizobium* from leguminous root nodule

Practical No. 13: Isolation of BGA from Paddy fields (*Anabaena*/ *Nostoc*/ *Oscillatoria* etc.)

Practical No. 14: Mass cultivation of BGA

Practical No. 15: To visit botanical garden/herbal garden/medicinal plant repositories

Suggested Readings:

1. Aneja, K. R. 1993 Experiments in Microbilogy, Plant Pathology and Tissue Culture Wishwa Prakashan New Delhi.
2. Borkar,S.G. 2015.Beneficial Microbes as Biofertilizers and its Production Technology Woodhead Publisher, India,New Delhi.
3. Dubey R.C. 2005. A Text book of Biotechnology. S.Chand & Co. New Delhi.
4. John Jothi Prakash E. 2004. Outlines of Plant Biotechnology. Emkay Publication. New Delhi
5. Kumaresan, V. (2005). Biotechnology. New, Delhi, Delhi: Saras Publication
6. Sathe T.V. 2004. Vermiculture and Organic Farming. Daya Publishers. New Delhi.
7. Subha Rao, N.S. (2000). Soil Microbiology. New Delhi, Delhi: Oxford & IBH Publishers.
8. Vayas S.C, Vayas S. and Modi H.A. 1998.Bio-fertilizers and organic Farming Akta, Prakashan

9. Jain Singh Mahendra Pal Singh, Dehradun, India.
10. Jain. S. K, (1991). Contributions to Indian Ethnobotany, Scientific Publishers, Jodhpur, India:
11. Jain, S. K. (1989). Methods and Approaches in Ethnobotany. Society of Ethnobotanists, Lucknow, India.
12. Jain S. K. (1996). Ethnobiology in Human Welfare. Deep Publication, New Delhi, India.
13. Jain, S. K., B. K. Sinha and R. C. Gupta (1991). Notable Plants in Ethnomedicine in India, Deep Publication, New Delhi, India
14. Jain, S. K. and Mudgal (1999) A Handbook of Ethnobotany, Bishen Singh Mahendra Pal Singh, Dehradun, India.
15. Joshi P. (1995). Ethnobotany of Primitive Tribe of Rajasthan Print well, Jaipur, India.
16. Martin, G. J. (1995). Ethnobotany: A Methods Manual, Chapman and Hall, London, U.K.
17. Saklani, A. and S. K. Jain (1994). Cross Cultural Ethnobotany of North East India New Delhi.
18. Singh, V. and R.P. Pandey (1998). Ethnobotany of Rajasthan, Scientific Publishers, Jodhpur.
19. Martin G. J. (1995) Ethnobotany: A Methods Manual, Chapman & Hall, London, U. K.
20. Sinha, Rajiv, Kand S. Sinha (2001). Ethnobiology, Sura Publications, Jaipur, India.
21. Maheshwari, J.K. (1996). Ethnobotany in South Asia. Scientific.

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B. Sc. (Honors/Research) Second Year Semester- III, Level- 5.0
OE-3, Course Code: BOT-OE-237
Course Title: Herbal Health Remedies

Course Code: BOT-OE-237	**Course Category: OE-3**
Course Title: Herbal Health Remedies	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. This course explores the world of herbal home remedies, delving into traditional knowledge, scientific evidence, and safe practices for self-care.
2. Students will gain a comprehensive understanding of common medicinal plants, their properties, and potential uses for addressing minor ailments and supporting well- being.
3. Emphasis will be placed on responsible and informed utilization of herbal remedies while acknowledging the limitations and importance of conventional healthcare.

Course Outcomes:

1. Identify and describe various medicinal plants and their traditional uses.
2. Understand the basic science behind common herbal remedies. sand their potential therapeutic effects.
3. Critically evaluate the scientific evidence supporting herbal claims and recognize limitations.
4. Learn safe preparation and usage methods for different herbal remedies.
5. Develop responsible self-care practices that integrate traditional and evidence- based approaches.
6. Cultivate respect for cultural diversity and sustainable harvesting practices regarding medicinal plants.

Course Content:

Unit 1: Introduction (6 Marks/ 6 L)

Introduction of Herbal Home Remedies and herbal medicine: History, principles, and ethical considerations

Unit 2: Herbal preparation methods (6 Marks/ 6 L)

Different dosage forms- 1. Powder 2. Infusion 3. Decoctions 4. Tincture 5. Medicated Wines 6. Syrups 7. Herbal capsules 8. Herbal Tablets 9. Herbal ointments 10. Herbal balms 11. Herbal creams 12. Herbal oils 13. Herbal pastes 14. Herbal liniments.

Unit 3: Common House Hold Plants (6 Marks/ 6 L)

Botanical source, Classification, Identification Characters, Plant Parts used, Properties and medicinal uses of common house hold plants-

i. Haldi (*Curcumadomestica*)
ii. Tulsi (*Ocimumtenuiflorum*)
iii. Senna (*Cassiaangustifolia*)
iv. Ginger (*Zingiberofficinale*)
v. Fenugreek (*Trigonellafoenum-graecum*)
vi. Amla (*Emblicaofficinalis*)
vii. Ashoka (*Saracaindica*)

Unit 4: Characteristics of Herbal Plant Parts (6 Marks/ 6 L)

Identification characteristics, vernacular name and Active principle of some important drug containing plants,

a. Clove
b. Black Pepper
c. Coriander
d. Eucalyptus oil

Unit 5: Cosmetic Herbology (6 Marks/ 6L)

Introduction and Definition, Types of herbal cosmetics-

b. Skincare- i) Korphad ii) Sandalwood iii) Turmeric v) Cucumber v) Rose
c. Haircare- i) Henna ii) Hibiscus iii) Amlai v) Shikakai v) Brahmi
d. Dentalcare- i) Neem ii) Babool iii) Khair iv) Bakul v) Miswak
e. Preparation of gel– i) Preparation of Aloe vera gel
ii) Preparation of Jaswand gel

Suggested Readings:

1. Agrawal. S.and M.Paridhavi (2007) Herbal Drug Technology, University Press, Himayat nagar, Hydrabad- 500029
2. Dhale D. A.(2022) Medicinal Herbs for Pharma Industry,D.P.S.Publishing House, 4598-12B, Ansari Road, Darya Ganj, New Delhi- 110002 India.
3. Dhale D. A. and D.A.Patil (2024) Medicinal Plants of Maharashtra, Atharva Publications, Shahu Nagar, Jalgaon – 425001
4. Dhale D. A. (2024) Herbal Techniques, Atharva Publications, Shahu Nagar, Jalgaon – 425001
5. Gokhale S. B. (1979) Text book of Pharmaconosy, Jai Publishing house, Jalgaon
6. Kalianna Girija (1993) All about herbal remedies, Vikas publishing house, New Delhi.
7. Kaushik Purshottam and Dhiman A. K.(2000) Medicinal Plants and herbal drugs of India, Bishen

Singh and Mahendra pal Singh, Dehradun, India

8. Kokate C. K., Porohit A.P. and S.B.Gokhale (2009) Pharmacognosy,Nirali Prakashan, Shivaji Nagar, Pune-411005
9. Patil D.A.(2010) Medicinal Plants: History, Culture and Usage,Mangalam Publishers & Distributors, Delhi, India.
10. Patil D.A.and D.A.Dhale (2012) Spices and Condiments: Origin, History & Applications, Daya Publishing House, Delhi, India.
11. Patil M.V. and D.A. Patil (2013) Herbal Materia Medica of Maharashtra, Daya Publishing Hose, Division of Astral International P. Ltd., New Delhi, India.
12. Prajapati N. D. Purohit S.S., Sharma Arun K. and TarunKumar (2003) A Hand book of Medicinal Plants- A complete source, Agrobias, India.
13. Sathya S.S.,Jaiganesh K.P.and Sudha T. (2022) Current Trends in Herbal Drug Technology, PV Books, Bikrampura, Jalandhar City-144008.
14. Shah Biren N. and A. K. Seth (2010) Textbook of Pharmacognosy and Phytochemistry, Published by Elsevier, a division of Reed Elsevier India Private Limited, Kalkaji, New Delhi-110019.
15. Shinde V. M.and Bodas-Yadv K. S. (2022) A Text book of Herbal Drug Technology, Nirali Prakashan, Shivaji Nagar, Pune-411005.

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Department of Botany

S.Y.B.Sc.

SEM: IV

Discipline Specific Core Courses (Major)

BOT-MJ-241 Plant Anatomy

BOT-MJP-242 Practical Based on BOT-MJ-241

CEP (Community Engagement Programme)

BOT-CEP-243 Community Engagement Services

VC (Vocational Course)

BOT-VC-244 Mushroom Culture

BOT-VCP -245 Practical Based on BOT-VC-244

Minor Courses

BOT-MN-246 A Economic Botany

BOT-MNP-246 B Practical Based on BOT-MN-246 A

General Elective/Open Elective Course

BOT-OE-247 Industrial Botany

B. Sc. (Honors/Research) Second Year Semester - IV, Level- 5.0
DSC-8, Course Code: BOT-MJ-241
Course Title: Plant Anatomy

Course Code: BOT-MJ-241	**Course Category: Core Course (DSC-8)**
Course Title: Plant Anatomy	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

1. To know scope and importance of plant anatomy
2. To study various tissue systems
3. To know primary structure of dicot and monocot plants
4. To study normal secondary growth in plants and their causes
5. To study protective tissue system

Course Outcomes: After completion of the course, student will be able to:

1. Knowledge regarding anatomy equipped the students to identify different types of tissues and make them able to correlate their physiology in a better away.
2. This will also help them to understand how different plant tissue evolve and modify their structure and functions with respect to their environment.

Course Content:

Unit 1: Introduction (2 Lectures/2 Marks)

1.1. Definition

1.2. Scope and Importance

Unit 2: Plant Tissues (8 Lectures/8 Marks)

2.1 Definition

2.2 Meristematic tissues: Classification based on position and origin

2.3 Tissues and it's types:

a) Simple tissues:
   i) Parenchyma: Arenchyma, Chlorenchyma and Palisade
   ii) Collenchyma
   iii) Sclerenchyma: Fiber and Sclereids / Stone cells

b) Complex tissues:

i) Xylem and its elements

ii) Phloem and its elements

Unit 3: Protective Tissue System (8 Lectures/8 Marks)

3.1 Epidermal Tissue System: Definition and Function

3.2 Types of Epidermal Appendages

i. Unicellular, Multicellular (Uniseriate and Multiseriate) Trichomes

ii. Glandular, Non-glandular Trichomes

iii. Stellate, Dendroid Trichomes and Peltate scales

3.3 Types of Stomata

i. Ranunculaceous (Anomocytic)

ii. Cruciferous (Anisocytic)

iii. Rubiaceous (Paracytic)

iv. Caryophyllaceous (Diacytic)

v. Graminaceous

vi. Sunken Stomata

Unit 4: Primary Structure (6 Lectures/6 Marks)

4.1 Dicotyledonous (Sunflower)

i. Root

ii. Stem

iii. Leaf

4.2 Monocotyledonous (Maize)

i. Root

ii. Stem

iii. Leaf

Unit 5: Secondary Growth (6 Lectures/6 Marks)

5.1 Introduction of Vascular cambium- Structure and function, seasonal activity

5.2 Secondary growth in root and stem of Sunflower

5.3 Anomalous Secondary Growth in *Bignonia*

5.4 Wood- Heartwood and sapwood

Suggested reading:

1. Carlquist, S. (1961) Comparative Plant anatomy. Hold, Rinehart and Winson, NewYork, USA.
2. Chandurkar, P.J, (1971) Plant Anatomy (3rd Ed.), Oxford and IBH Publishing Co. NewDelhi and Bombay, India.
3. Choyal Rajaram (2012) Plant Anatomy and Physiology, Sonali Publications, NewDelhi, India.
4. Cutter, E. G. (1971) Plant Anatomy: Experiment and Interpretation Part-II, Organ.Edward Arnold, London, UK.
5. Das Susheela, M. (2017) A Text Book of Plant Anatomy. Dominant Publishers and Distributers Pvt. Ltd., New Delhi, India.
6. Eames, A.J. and L.H. Mc Daniels (1947) An Introduction to Plant Anatomy, (2nd Ed.).McGraw Hill Co. New York, USA.
7. Esau, K. (1977) Anatomy of Seed Plants (2nd Ed.).John Wiley, New York, USA.
8. Fahn, A. (1982) Plant Anatomy (3rd Ed.) Pergman Press, Oxford and New York. USA.
9. Grewal, R.C. (2011) Plant Anatomy. Campus Books International, New Delhi, India.
10. Mauseth, J.D. (1988) Plant Anatomy. The Benjamin/Cummings Publisher, USA.
11. Sharma Rajani (2009) An Introduction to Plant Anatomy. Campus BooksInternational, New Delhi, India.
12. Singh Sanjay Kumar ((2005) Text Book of Plant Anatomy. Campus BooksInternational, New Delhi, India.
13. Singh, S. K., and Seema Srivastava (2011) Anatomy of Angiosperm. Campus Books International, New Delhi, India.
14. Singh, V., P.C. Pande and D.K. Jain (1998) Anatomy of Seed Plants. RastogiPublications, Meerut, India.
15. Singh, V., P. C. Pande and D.K. Jain (2013) A Text Book of Botany Angiosperm. Rastogi Publications, Meerut, India.

B. Sc. (Honors/Research) Second Year Semester- IV, Level- 5.0
DSC-9, Course Code: BOT-MJP-242
Course Title: Practical Based on BOT-MJ-241

Course Code: BOT-MJP-242	**Course Category: Core Course (DSC-9)**
Course Title: Practical Based on BOT-MJ-241	**Type: Practical**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. Provide knowledge of plant tissue organization through microscopic studies.
2. Develop skills in identifying diagnostic anatomical features.
3. Understand relationship between plant structure and function.
4. Correlate theoretical knowledge with practical observations.
5. Foster appreciation for plant diversity and structural adaptations.

Course Outcomes: After completion of the course, students will be able to:

1. Identify and differentiate plant tissues through microscopic examination.
2. Compare anatomical differences between dicot and monocot plants.
3. Analyze primary and secondary growth patterns in plant organs.
4. Evaluate anomalous secondary growth and correlate structure with function.
5. Assess epidermal tissue systems in local plant materials.

Experiments:

Practical No.1-3

i) Study of meristem (Permanent slides/ Photographs).

ii) Study of Simple Tissues:
Parenchyma, Collenchyma and Sclerenchyma (Permanent Slides/Photographs)

iii) Macerated xylem and phloem elements (Permanent slides/ Photographs).

iv) Study of dicot leaf (Sunflower) and monocot leaf (Maize) (permanent slides.)

Practical No: 4 and 5

i) Study of primary structure of dicot stem (Sunflower) and monocot stem (Maize).

Practical No.6 and 7

i) Study of primary structure of dicot root (Sunflower) and monocot root (Maize) (Permanent slides).

Practical No.8 and 9:

i) Study of secondary growth structure in dicot stem (Sunflower) and Anomalous secondary growth in *Bignonia/Dracaena/Bougainvillea*

Practical No. 10:

i) Study of Epidermal Tissue System with the help of locally available plant materials

Suggested Readings:

1. **Pandey, S.N. & Chadha, A.** (2019). *Plant Anatomy and Embryology*. Vikas Publishing House, New Delhi.
2. **Bhojwani, S.S. & Bhatnagar, S.P.** (2018). *The Embryology of Angiosperms* (5th Edition). Vikas Publishing House, New Delhi.
3. **Dickison, W.C.** (2000). *Integrative Plant Anatomy*. Academic Press, San Diego.
4. **Eames, A.J. & MacDaniels, L.H.** (2019). *An Introduction to Plant Anatomy* (Reprint). Tata McGraw-Hill, New Delhi.
5. **Fahn, A.** (1990). *Plant Anatomy* (4th Edition). Pergamon Press, Oxford.
6. **Esau, K.** (1977). *Anatomy of Seed Plants* (2nd Edition). John Wiley & Sons, New York.
7. **Srivastava, L.M.** (2002). *Plant Growth and Development: Hormones and Environment*. Academic Press, London.
8. **Cutler, D.F., Botha, T. & Stevenson, D.W.** (2008). *Plant Anatomy: An Applied Approach*. Blackwell Publishing, Oxford.
9. **Sharma, O.P.** (2017). *Plant Taxonomy* (3rd Edition). Tata McGraw-Hill, New Delhi.
10. **Cutter, E.G.** (1978). *Plant Anatomy: Experiment and Interpretation* (2nd Edition). Addison-Wesley, Reading, Massachusetts.

B. Sc. (Honors/Research) Second Year Semester-IV, Level- 5.0
CEP, Course Code: BOT-CEP-243
Course Title: Community Engagement Services

Course Code: BOT-CEP-243	**Course Category: CEP**
Course Title: Community Engagement Services	**Type: Practical**
Total Contact Hours: (4/week)	**Course Credits: 04**
College Assessment (CA) Marks: 40	**University Assessment (UA): 60**

Course Objectives:

1. To develop an appreciation of rural culture, life-style and wisdom amongst students.
2. To learn about the status of various agricultural and development.
3. To understand causes for distress and poverty faced by vulnerable households and explore solutions for the same.
4. To apply classroom knowledge of courses to field realities and thereby improve quality of learning.

Course Outcomes: After completing this course, student will be able to

1. Gain an understanding of rural life, Indian culture & ethos and social realities.
2. Develop a sense of empathy and bonds of mutuality with local community.
3. Appreciate significant contributions of local communities to Indian society and economy.
4. Learn to value the local knowledge and wisdom of the community.
5. Identify opportunities for contributing to community's socioeconomic improvements

Course Content:

Community Engagement Services

In 2011, a national review was conducted by a Committee of Experts (set up by the then Planning Commission) to analyse the purposes, principles and forms of social responsibilityand community engagement which are relevant to our context. Its recommendations to MHRD about "fostering social responsibility and community engagement of HEIs" in India contain several important elements for the new policy.[1]

The National Education Policy (NEP) announced by the Government of India in 2020 has presented a transformative framework for higher education in the country. It has reinforced many of the recommendations are already included in the new policy, as exemplified through the below lines:

"The purpose of the education system is to develop good human being capable of rational thought and action, possessing compassion and empathy, courage and resilience, scientific temper and creative imagination, with sound ethical moorings and values. It aims at producing engaged, productive, and contributing citizens for building an equitable, inclusive, and plural society as envisaged by our Constitution.

The goals of 'fostering social responsibility and community engagement in HEIs' can comprise of

- Improving the quality of teaching/learning in HEIs, by bridging the gap between theory and practice through community engagement;
- Promoting deeper interactions between higher educational institutions and local communities for identification and solution of real-life problems faced by the communities in a spirit of mutual benefit;
- Facilitating partnerships between local communities and institutions of higher education so that students and teachers can learn from local knowledge and wisdom;
- Engaging higher education institutions with local communities in order to make curriculum, courses and pedagogies more appropriate to achieving the goals of national development;
- Catalysing acquisition of values of public service and active citizenship amongst students and youth alike, which would also encourage, nurture and harness the natural idealism of youth;
- Undertaking research projects in partnership with local community through community-based research method.

**** Recommended field-based practical activities:**

- Interaction with SHG women members, and study of their functions and challenges; planning for their skill building and livelihood activities
- Visit MGNREGS project sites, interact with beneficiaries and interview functionaries at the work site
- Field visit to Swachh Bharat project sites, conduct analysis and initiate problem solving measures
- Conduct Mission Antyodaya surveys to support under Gram Panchayat Development Plan (GPDP).
- Interactive community exercise with local leaders, panchayat functionaries, grass-root officials and local institutions regarding village development plan preparation and resource mobilization.
- Visit Rural Schools/mid-day meal centres, study academic and infrastructural resources and gaps.
- Participate in Gram Sabha meetings, and study community participation.
- Associate with Social audit exercises at the Gram Panchayat level, and interact with programme beneficiaries.
- Visit to local Nagarpalika office and review schemes for urban informal workers and migrants

- Attend Parent Teacher Association meetings, and interview school drop outs
- Visit local Anganwadi Centre and observe the services being provided
- Visit local NGOs, civil society organisations and interact with their staff and beneficiaries,
- Organize awareness programmes, health camps, Disability camps and cleanliness camps
- Conduct soil health test, drinking water analysis, energy use and fuel efficiency surveys
- Raise understanding of people's impacts of climate change, building up community's disaster preparedness
- Organise orientation programmes for farmers regarding organic cultivation, rational use of irrigation and fertilizers and promotion of traditional species of crops and plants
- Formation of committees for common property resource management, village pond maintenance and fishing.

Student Benefits of Community Engagement[12]

Learning Outcomes

- ✓ Positive impact on students' academic learning
- ✓ Improves students' ability to apply what they have learned in "the real world"
- ✓ Positive impact on academic outcomes such as demonstrated complexity of understanding, problem analysis, problem-solving, critical thinking, and cognitive development
- ✓ Improved ability to understand complexity and ambiguity

Personal Outcomes

- ✓ Greater sense of personal efficacy, personal identity, spiritual growth, and moral development
- ✓ Greater interpersonal development, particularly the ability to work well with others, and build leadership and communication skills

Social Outcomes

- ✓ Reduced stereotypes and greater inter-cultural understanding
- ✓ Improved social responsibility and citizenship skills
- ✓ Greater involvement in community service after graduation

Career Development

- ✓ Connections with professionals and community members for learning and career opportunities
- ✓ Greater academic learning, leadership skills, and personal efficacy can lead to greater opportunity

Relationship with the Institution

- ✓ Stronger relationships with faculty
- ✓ Greater satisfaction with college
- ✓ Improved graduation rates

Faculty Benefits of Community Engagement

- ✓ Satisfaction with the quality of student learning
- ✓ New avenues for research and publication via new relationships between faculty and community
- ✓ Providing networking opportunities with engaged faculty in other disciplines or institutions
- ✓ A stronger commitment to one's research

Community Benefits of Community Engagement

- ✓ Satisfaction with student participation
- ✓ Valuable human resources needed to achieve community goals
- ✓ New energy, enthusiasm and perspectives applied to community work
- ✓ Enhanced community-university relations

Some reports give you guideline for involving and teaching for community engagement services for students.[2,3,4,5,6,7,8,9,10 ,11]

Suggested Readings:

1. https://www.pria.org/uploaded_files/article_category/1531475111_Fostering_Social_Responsibility.pdf
2. https://chemonics.com/wp-content/uploads/2019/05/Community_Engagement_in_Biodiversity_Conservation_East_Afric a Report_final.pdf
3. https://cft.vanderbilt.edu/guides-sub-pages/teaching-through-community-engagement/
4. https://www.ugc.gov.in/pdfnews/6202338_Public-Notice-Fostering052019.pdf
5. https://ars.electronica.art/aeblog/en/2024/06/12/fostering-plant-diversity-through-community- participation/
6. https://www.publicgardens.org/resource/value-community-engagement-botanic-gardens- examples-royal-botanic-garden-edinburgh/
7. https://www.racoman.com/blog/basics-of-community-engagement-for-plant-operators-in-the- groundwater-management-industry?srsltid=AfmBOopd8oWwm0T-FwU4UwoOQEXxuHqTELwEaJSuJxb6vJifJhJTXhW1
8. https://simplystakeholders.com/what-is-community-engagement/
9. https://www.instantinput.com/blog/community-engagement-examples
10. https://granicus.com/blog/define-community-engagement/
11. https://www.cargill.co.in/en/community-engagement
12. https://www.utrgv.edu/ceo/_files/documents/service-learning-and-community-engagement.pdf

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B. Sc. (Honors/Research) Second Year Semester- IV, Level- 5.0
VC-1, Course Code: BOT-VC-244
Course Title: Mushroom Cultivation

Course Code: BOT-VC-244	**Course Category: VC-1**
Course Title: Mushroom Cultivation	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To learn the history, scope and importance of mushroom technology.
2. To understand the nutritional and medicinal values of edible mushrooms.
3. To know about the storage, marketing and various food preparations of mushrooms.
4. To understand the diseases, Post-harvesting techniques of Mushrooms.
5. To facilitate self-employment.

Course Outcomes: After completing this course, students will be able to

1. Understanding mushrooms, types (edible & poisonous) and mushroom production.
2. Learning cultivation of different edible mushrooms.
3. Knowledge about climatic requirements of mushroom cultivation.
4. Knowing the harvesting and post-harvesting processes of mushrooms.
5. Learning value-added products preparation from mushrooms.

Course Content:

Unit-1: Introduction (6 Marks/ 6 L)

1.1 Introduction and history of mushrooms, scope and importance of mushroom technology, and distribution of mushrooms.

1.2 Structure of mushrooms with special reference to Agaricus, Types of mushrooms: edible mushrooms or Non-Edible/ Poisonous mushrooms.

1.3 General account of mushrooms,Morphology and distinguishing characteristics of following mushrooms:i. Button mushrooms (*Agaricus bisporus)* ii. Oyster mushrooms ((Pleurotus ostreatus) iii. Paddy straw mushrooms (Volvariella volvacea)

1.4 Medicinal value and nutritional value of edible mushrooms

Unit-2: Cultivation System & Farm design (6 Marks/ 6 L)

2.1 Fundamentals of cultivation system- small village unit & larger commercial unit.

2.2 Principles of mushroom farm layout- location of building plot, Design of farm, Bulk chamber, Composting platform, Equipment's & facilities, Pasteurization room & growing rooms.

Unit-3: Compost & Composting (6 Marks/ 6 L)

3.1 Substrates for Mushroom Production.
3.2 Principles of composting Sterilization of substrates.
3.3 Materials for compost preparation.
3.4 Methods of Composting- Long method of composting (LMC), Short method of composting (SMC)
3.5 Mushroom bed preparation

Unit- 4 Spawn & Spawning: (6 Marks/ 6 L)

4.1 Facilities required for spawn preparation,
4.2 Preparation of pure culture from spore.
4.3 Media used in raising pure culture.
4.4 Spawn preparation (Mushroom seeds).
4.5 Spawn maintenance and storage.

Unit-5: Preservation techniques, Marketing and Food preparation (6 Marks/6 L)

5.1 Marketing mushrooms.
5.2 Preservation techniques include canning, drying, and freezing.
5.3 Types of foods prepared from mushroom: Soup, Cutlet, Omelets, Samosa, Pickles, Curry.

Suggested Readings:

1. Mushroom Production and Processing Technology, Pathak Yadav Gour (2010). Published by Agrobios (India).
2. Pandey R.K, S. K Ghosh (1996). A Hand Book on Mushroom Cultivation. Emkey Publications.
3. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
4. V.N. Pathak, Nagendra Yadav and Maneesha Gaur(2000). Mushroom Production and Processing Technology/ Vedams Ebooks Pvt Ltd., New Delhi.
5. Shu Fing Chang, Philip G. Miles and Chang, S.T. 2004. Mushrooms Cultivation, nutritionalvalue, Medicinal Effect and environmental impact. 2nd ed., CRC press.
6. Swarninathan, M. (1990). Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.
7. S.C.Tewari. Pankaj Kapoor, (1988). Mushroom Cultivation, Mittal Publications. Delhi.
8. Nita Bahl (1984-1988). Hand book of Mushrooms, II Edition. Vol.I and Vol. II.
9. Vijaya Khader, (1993). Mushrooms for Livelihood. Kalyani Publishers. Pp170.
10. D. P. Tripathi, (2005). Mushroom cultivation. Oxford IBH Publishing Co. Pvt. Ltd.Pp354.
11. A hand book of edible mushroom, S.Kannaiyan& K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi.
12. P.K. Khanna and S. Kappor, (2007).Mannual of mushroom production. Dept. of Microbiology. College of Basic Sciences and Humanities, Punjab Agriculture University, Ludhiana. pp.86-90.
13. Paul Stamets, J.S. and Chilton, J.S. (2004). Mushroom cultivation A practical guide to growing mushrooms at home, Agarikon Press.
14. Marimuthu, T. Krishnamoorthi, A.S. Sivaprakasam, K. and Jayarajan. R (1991). Oyster Mushrooms. Department of Plant Pathology. TamilNadu Agricultural University, Coimbatore.

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B. Sc. (Honors/Research) Second Year, Semester-IV, Level- 5.0

VC-2, Course Code: BOT-VCP-245

Course Title: Practical based on BOT-VC-244

Course Code: BOT-VCP-245	**Course Category: VC-2**
Course Title: Practical Based on BOT-VC-244	**Type: Practical**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To provide students with a comprehensive understanding of mushroom cultivation.
2. To develop students' skills in mushroom cultivation including identification, isolation, cultivation and post-harvest handling.
3. To enable students to start their own mushroom cultivation business.

Course Outcomes: After completing this course, students will be able to:

1. Identify different types of edible mushrooms.
2. Isolate and cultivate pure cultures of mushrooms.
3. Prepare compost and spawn for mushroom cultivation.
4. Harvest, process and store mushrooms.
5. Start their own mushroom cultivation business.

Experiments:

Practicals No. 1, 2 & 3: To study the morphology of the following mushrooms.

a. Button (*Agaricus bisporus*)
b. Oyster (*Pleurotus ostreatus*)
c. Paddy straw (*Volvariella volvacea*)

Practical No. 4: To study edible mushrooms and non-edible mushrooms (Chart/Specimens)

Practical No. 5: To study the different types of compost required for mushroom cultivation.

Practical No. 6 & 7: To study sterilization of glasswares, equipments and culture media used in mushroom cultivation.

Practical No. 8: Demonstration of spawn preparation.

Practicals No. 09, 10 & 11: Cultivation of Button (*Agaricus bisporus*)/ Oyster (*Pleurotus ostreatus*)/ Paddy straw (*Volvariella volvacea*) mushroom.

Practicals No. 12 &13: Preparation of mushrooms dish as per theory (Any two)

Practical No. 14: Demonstration of preservation methods of Mushrooms

Practical No. 15: Visit to a mushroom cultivation unit. (Submission of study tour visit report at the time of examination)

Suggested Readings:

2. Rai, R. D., & Arumuganathan, T. (2008). "Postharvest Technology of Mushrooms." *ICAR Research Publication*
3. Singh, M., Vijay, B., & Kamal, S. (2011). "Commercial Cultivation of Mushrooms." *Directorate of Mushroom Research, Solan*
4. Paul Stamets, J.S. and Chilton, J.S. (2004). Mushroom cultivation A practical guide to growing mushrooms at home, Agarikon Press.
5. P.K. Khanna and S. Kappor, (2007).Mannual of mushroom production. Dept. of Microbiology. College of Basic Sciences and Humanities, Punjab Agriculture University, Ludhiana. pp.86-90.
6. A hand book of edible mushroom, S.Kannaiyan& K.Ramasamy (1980). Today & Tomorrows printers & publishers, New Delhi.
7. Stamets, P., & Chilton, J. S. (1983). *The mushroom cultivator: A practical guide to growing mushrooms at home*. Agarikon Press.
8. Singh, M., Vijay, B., & Kamal, S. (2011). *Commercial cultivation of mushrooms*. Directorate of Mushroom Research, ICAR.
9. Chang, S. T., & Wasser, S. P. (2017). The cultivation and environmental impact of mushrooms. *International Journal of Medicinal Mushrooms, 19*(2), 93-108.
10. Tripathi, D. P. (2005). *Modern mushroom cultivation*. Oxford & IBH Publishing.
11. Rai, R. D., Sharma, S. R., & Doshi, A. (2005). *Diseases and pests of mushrooms and their management*. ICAR.
12. Tewari, R. P., & Kapoor, J. N. (1988). *Mushroom cultivation*. Mittal Publications.
13. FAO. (1995). *Mushroom production: A technical guide*. Food and Agriculture Organization.
14. Directorate of Mushroom Research. (2019). *Mushroom cultivation for beginners*. Indian Council of Agricultural Research.
15. USDA Agricultural Research Service. (2022). *Mushroom growing and processing techniques*. https://www.ars.usda.gov
16. ICAR-Directorate of Mushroom Research (ICAR-DMR). (2023). *Training and research on mushroom cultivation*. https://www.dmrsolan.icar.gov.in

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B. Sc. (Honors/Research) Second Year Semester- IV, Level- 5.0
MIN-4, Course Code: BOT-MN-246 A
Course Title: Economic Botany

Course Code: BOT-MN-246 A	**Course Category: MIN-4**
Course Title: Economic Botany	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. Identifying and documenting useful plant species: Economic botanists aim to catalog and study plants that have economic significance, such as those used for food, medicine, fiber, fuel, or construction materials.
2. Understanding plant-human interactions: includes studying traditional knowledge of plant use and how it can be applied in modern contexts.
3. Improving crop production and management: Economic botany contributes to agricultural research by studying crop plants and their wild relatives to develop new cultivars with improved traits such as yield, disease resistance, and nutritional value.
4. Exploring medicinal plants: Economic botanists study the medicinal properties of plants, identifying bioactive compounds and their potential applications in pharmaceuticals and natural remedies.
5. Conservation and sustainability: Economic botanists work to conserve plant biodiversity and promote sustainable use of plant resources to ensure their availability for future generations.

Course Outcomes:

1. Knowledge of economically important plant species.
2. Students should develop an understanding of the historical, cultural, and socio-economic aspects of human-plant interactions.
3. Identification and classification skills: Students should acquire the ability to identify economically important plant species using taxonomic keys and other identification methods.
4. Students should gain insight into agricultural practices, including crop cultivation, breeding and management techniques aimed at improving yield, quality.
5. Understanding of medicinal plants and natural products: including the bio active compounds they contain and their potential applications in pharmaceuticals, Herbal medicine and other health-related industries.

Course Content:

Unit-1: Introduction and Origin of Cultivated Plants (6 Marks/ 6 L)

1.1 Scope and Importance
1.2 Green revolution in Indian context
1.3 Concept of Centers of Origin, their importance with reference to Vavilov's Work.
1.4 Examples of major plant introductions
1.5 Crop domestication and loss of genetic diversity
1.6 Evolution of new crops/varieties,
1.7 Importance of germ plasm diversity

Unit-2: Study of Cereals, Legumes and Millets (6 Marks/ 6 L)

2.1 **Wheat, Maize** -Origin, morphology, Botanical name, family, part used, chemical content, uses and byproducts.
2.2 **Pigeon Pea (Tur), Green gram (Moong bean),** Origin, morphology, Botanical name, family, part used, chemical content, uses and byproducts.
2.3 **Jowar, Band Nachani**- Origin, morphology, Botanical name, family, part used, chemical content, uses and byproducts.
2.4 Importance of Cereals, Legumes and Millets in the human diet.

Unit-3: Spices, Beverages and Oils (6 Marks/ 6 L)

3.1 **Spices** - Black pepper and Turmeric- Origin, morphology, Botanical name, family, part used, chemical content, uses and byproducts.
3.2 **Beverages- Tea, Coffee**- Botanical name, family, part used, chemical content, uses.
3.3 **Oils**- Groundnut and Soybean General description, classification of oils Extraction, their use sand health.
3.4 Implications of (Botanical name, family & uses)

Unit-4: Fibers and Timber (6 Marks/ 6 L)

4.1 Botanical Source, Family, Common Name and uses of
a) Fibers -Cotton and Coir: Occurrence, Structure and Classification of fibers. Importance, Sources, and Uses.
b) Timber-Teak and Sisam: Origin, morphology, Botanical Name, family, part used and its uses.

Unit-5: Medicinal Plants (6 Marks/ 6 L)

5.1 Introduction, Importance and Sources.
5.2 **Hirda, Behada and Amla**: Botanical Source, Origin, morphology, Botanical name, family, and Plant part used, Active chemical content, uses and byproducts.
5.3 **Korphad, Adulsa and Gulvel**- Botanical Source, Origin, morphology, Botanical name, family and Plant part used, Active chemical content, uses and by products.

Suggested Readings:

1. Aiyer, A. K. Y. N. (1954). Field Crops in India. The Bangalore Printing and Publishing Company, Bangalore.
2. Bendre, Ashok and Ashok Kumar (1998-1999). Economic Botany for undergraduate Students. Rastogi Publications, Meerut, India.
3. Hill, A.F. (1952). Economic Botany, 2nd Ed. McGraw Hill Co. Pvt. Ltd. NewYork.
4. Pandey, S. N.and Archana (1996). Economic Botany. Vikas Publishing house, New Delhi.
5. Pal. B. P. (1996). Wheat Monograph. Council of Agricultural Research, New Delhi.
6. Pruthi J. S. (1976). Spices and Condiments, National Book Trust, Delhi.
7. Sambamurthy A. V. S. S. and Sambamurthy, N. S. (1889). A Text book of Economic Botany. Wiley Estern Ltd. New Delhi.
8. Sharma B. K.and Awasthi, P. B.(1984). Economic Botany. Prakash book Depot, Bareilly.
9. Kochhar, S. L.(2012).Economic Botany in Tropics. Mac Millan & Co.New Delhi, India.
10. Wickens,G.E.(2001).Economic Botany: Principles & Practices, Kluwer Academic Publishers, The Netherlands.
11. Chrispeels, M. J.and Sadava, D .E.(1994).Plants. Genes and Agriculture, Jones & Bartlett.
12. Jacob Thankamma (1975). Foods, Drugs And Cosmetics: A Consumer Guide. The Mac Millan Company of India Ltd. Delhi.
13. Parthasarathy, S. V. (1972). Sugarcane in India. K. C.P. Ltd., Madras.
14. Kannaiyana, S. and A. Gopalam (Ed.)(2007).Agro biodiversity: Crop Genetic Resources and Conservation. Vol.I. Associated Publishing Co., New Delhi, India.
15. Majumdar, D. K.(2011).Pulse Crop Production: Principles And Technologies. RHZ Learning (P.) Ltd., New Delhi, India.
16. Mitra, S. K. and Borse, T. K.(Ed.)(1996).Fruits: Tropical And Subtropical, Naya Prakash, Calcutta, India.
17. A Text Book of Economic Botany A.V.S.Samba Murty, N.S.Subrahmanyam.
18. S. L. Kochhar. Economic Botany in the Tropics
19. V. Verma. A Text Book of Economic Botany-
20. S. N. Pandey, A. Chaddha. A Text Book of Botany Volume III Ram P. Rastogi, B. N. Mehrotra. Compendium of Indian Medicinal Plants- Volume I,
21. Economic Botany-Beryl Brintnall Simpson ,Molly Conner-Ogorzaly.
22. Albert F. Hill and O.P.Sharma (1996),Hill's Economic Botany, Tata Mc-Graw-Hill Publishing Company Limited, New Delhi.
23. Samba Murty A.V.S.S. and Subrahmanyam N.S.(1989).Atext book of Economic Botany, Wiley Eastern Limited, New Delhi.
24. Verma V. (1982).A text book of Economic Botany, Emkay Publications, New Delhi.
25. Pandey B. P. (1990), Economic Botany, S. Chand and Company Ltd., New Delhi.

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B. Sc. (Honors/Research) Second Year Semester - IV, Level- 5.0
MIN-5, Course Code: BOT-MNP-246 B
Course Title: Practical based on BO-223

Course Code: BOT-MNP-246 B	**Course Category: MIN-5**
Course Title: Practical Based on BOT-MN-246 A	**Type: Practical**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. To study botanical sources, characteristics and utilities of plants and plant products.
2. To know the industrial applications of various plants and plant products.
3. To visit plant-based industries to prepare a scientific report of the visit.

Course Outcomes:

1. Knowledge of identifying economically important plant species.
2. Identification and classification skills: Students should acquire the ability to identify economically important plant species using taxonomic keys and other identification methods.
3. Understanding of medicinal plants and natural products: including the bioactive compounds they contain and their potential uses in pharmaceuticals, Herbal medicine and other health-related industries.

Experiments:

Practical No. 1: To identify, describe botanical source, plant parts used, chemical content and uses of:
Wheat, Maize

Practical No. 2: To identify, describe botanical source, plant parts used, chemical content and uses of:
Pigeon Pea (Tur), Green gram (Moong bean).

Practical No. 3: To identify, describe botanical source, plant parts used, chemical content and uses of:
Jowar and Nachani.

Practical No. 4: To identify, describe botanical source, plant parts used, chemical content and uses of:
Black pepper and Turmeric

Practical No. 5: To identify, describe botanical source, plant parts used, chemical content and uses of:
Lucerne (*Alfalfa*) and Berseem (*Trifolium*)

Practical No. 6: To identify, describe botanical source, plant parts used, chemical content and uses of: **Tea and Coffee**

Practicals No. 7 and 8: To identify, describe botanical source, plant parts used, chemical content and uses of: **Groundnut oil and Soyabean oil**

Practicals No. 9 and 10: To identify, describe botanical source, plant parts used and uses of: **Cotton & Coir**

Practicals No. 10 and 12: To identify, describe botanical source, plant parts used and uses of: **Teak and Sesame**

Practical No. 13 and 14: To study following medicinal plants w.r.t. botanical source, active principles, plant part used and uses of: **Hirda, Behada and Amla.**

Practical No. 15: To study following medicinal plants w.r.t botanical source, active principles, plant part used and uses of: **Korphad, Adulsa and Gulvel**

***NOTE:**

i) Visit to any one of the following plant-based industries is compulsory: Cotton mill/ Dal mill/ Oil industries
ii) A Scientific report of the visit should be submitted at the time of practical examination.
iii) A duly certified Journal is compulsory at the time of practical examination.
iv) Visit to Garden: 2 Excursion Tour: 2

Suggested Reading:

1. Bendre, Ashok and Ashok Kumar (1998-1999). Economic Botany for Undergraduate Students. Rastogi Publications, Meerut, India.
2. Pandey B. P. (1990), Economic Botany, S. Chandand Company Ltd., New Delhi.
3. Pandey, S. N. and Archana (1996). Economic Botany. Vikas Publishing house, New Delhi.
4. Pruthi J. S. (1976). Spices and Condiments, National Book Trust, Delhi.
5. S. N. Pandey, A. Chaddha. A Text Book of Botany Volume III Ram P. Rastogi, B. N. Mehrotra. Compendium of Indian Medicinal Plants- Volume I.
6. Sambamurthy A. V. S. S. and Sambamurthy, N. S. (1889). A Text book of Economic Botany. Wiley Estern Ltd. New Delhi.
7. Sharma B. K.and Awasthi, P. B. (1984). Economic Botany, Prakash book Depot, Bareilly.
8. Verma V. (1982). A textbook of Economic Botany, Emkay Publications, New Delhi.

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B. Sc. (Honors/Research) Second Year, Semester- IV, Level- 5.0
OE-4, Course Code: BOT-OE-247
Course Title: Industrial Botany

Course Code: BOT-OE-247	**Course Category: OE-4**
Course Title: Industrial Botany	**Type: Theory**
Total Contact Hours: (2/week)	**Course Credits: 02**
College Assessment (CA) Marks: 20	**University Assessment (UA): 30**

Course Objectives:

1. Introduce students to the basic concepts of Industrial Botany.
2. To make the students aware about sustainable use of plants.
3. To study sources of Industrial Botany.
4. To create foundation for further jobs.
5. To facilitate students for taking up and shaping a successful career in botany.

Course Outcomes: After completing this course, student will be able to

1. Students will be able to: learn and understand about industrial methods.
2. Students will be able to: find job opportunity.
3. Students will be able to: to start small startup.
4. Students will be able to: utilize plant for industrial purpose.
5. Students will be able to: utilize the subject and its practicable applicability.

Course Content:

Unit-1: Introduction to Industrial Botany (6 Marks/ 6 L)

1.1 Introduction, definition and scope.
1.2 Importance of Industrial Botany.
1.3 Plant and industries relationship.

Unit-2 Fermentation Industry (6 Marks/ 6 L)

2.1 Introduction, Definition and Types: Aerobic and Anaerobic.
2.2 Microbes involved in fermentation.
2.3 Industrial production of Ethanol w.r.to

i) Pure culture
ii) Substrate
iii) Sterilization
iv) Fermentation
v) Recovery of end product

Unit-3: Dal Mill (6 Marks/ 6 L)

3.1 Introduction
3.2 Scope and importance
3.3 Manufacturing process

Unit- 4: Biofertilizer Industry (6 Marks/ 6 L)

4.1 Definition, Concept and Importance
4.2 Types of biofertilizers
4.3 Methods of cultivation of
A) Blue Green Algae (BGA)
a) Preparation of culture media- De'smedium(modified)
b) Isolation and Inoculation
c) Mass Cultivation of BGA (G.S.Venkatraman,1963)
d) Utilization of BGA in Agriculture.
B) Rhizobium Culture
a) Isolation from root nodules of Leguminous plants
b) Pure culture (YEMA Medium)
C) Mass production
a) Methods of application in Agriculture
b) Agronomic importance.

Unit-5: Bio-pesticide Industry (6 Marks/ 6 L)

5.1 Concept and Importance of bio-pesticides
5.2 Source, Preparation and uses of Azadirectin as bio-pesticide
5.3 Commercial significance of biopesticides.

Suggested Readings:

2. Atkin, F.C.(1972).Mushroom Growing Today. Faber and Faber Ltd. London,U.K. Casida L.E. (1968) Industrial Microbiology. John Willey & Sons.
3. Gaur A. C. Biofertilizers in Sustainable Agriculture. IARI, New Delhi.
4. Hui. Y.H.(2008) Handbook of Fruits and Fruit Processing John Wiley & amp; Sons, 04-Aug-2008.
5. Kofler, L.A. and Hickey,R.J.(1954).Industrial Fermentations,Vol.I.Chemical Publishing Co. Inc.New York, USA.
6. Mitra Debabrata, Guha J. and Chaudhari S. K.(1991).Studies In Botany Vol.II. Moulik Library, Kolkata.
7. Mukharji S.K.(2004). College Botany Vol.III. New Central Book Agency(P)Ltd. Kolkata, India.
8. Pandey S. N. and Archana(1996). Economic Botany. Vikas Publishing House, New Delhi, India.
9. Pathak, Y. G.(1998). Mushroom Production and Processing Technology,Agribios, Jodhapur, India.

10. Somani,L.L., Bhandari S. C. and K. K. Vyas (1990). Biofertilizers, Scientific Publication, Jodhapur, India.
11. Subbarao N. S.(1995). Biofertilizers In Agriculture And forestry.OxfordandIBH publishing Company Pvt. Ltd. NewDelhi.
12. Sueli Rodrigues; Fabiano Andre Narciso Fernandes(2012).AdvancesinFruit Processing Technologies. CRC Press.
13. Zhiqiang A.N.(2004) Handbook of Industrial Mycology. CRC Press Gary Leatham (1993) Frontiers in Industrial Mycology, Springer.

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ASSESSMENT AND EVALUATION POLICY

Illustrative Components of Internal Continuous Assessment (CA) and Semester-End Examination (UA)

A candidate shall be declared to have passed the program if he/she secures at least 40% of marks in both, internal assessment (CA) and semester end examination (UA) independently/separately, i.e., there shall be separate of head of passing.

Internal Continuous Assessment for 2 Credit Course

Theory

Assessment Components	**Internal Continuous Assessment (College Assessment-CA) (20 Marks)**			**Semester-End Examination (University Assessment-UA) (30 Marks)**
	Class Test (Test-1&2 each of 10 Marks)	**Attendance** (In regular classes / Practical's etc.)	**Other Assessment** (Home Assignments/ Group Discussion/ Quiz / Seminar)	
Marks	**10**	**5**	**5**	**30**
Week of the activity	**Week 6 and Week 10**	**Weekly**	**Week 7**	**Declared by College Authority**

Internal Continuous Assessment for 4 Credit Course

Assessment Components	**Internal Continuous Assessment(CA) (40 Marks)**			**Semester-End Examination (UA) (60 Marks)**
	Class Test (Test-1 & 2 each of 15 Marks)	**Class Participation**(In regular classes / Practical's etc.)	**Other Assessment** (Home Assignments/ Group Discussion/ Quiz /Seminar)	
Marks	**30**	**05**	**05**	**60**
Week of the activity	**Week 6 and Week 10**	**Weekly**	**Week 7**	**Declared by College Authority**

Practical

Assessment Components	Internal Continuous Assessment(CA) (20 Marks)			Semester-End Examination (UA) (30 Marks)
	Submission of Potted Plants/Wild Seed Bottle	Class Participation and Practical Based Viva Voce	Field Work and Journal Completion	
Marks	05	05	10	30
Week of the activity	Week 6 and Week 10	Weekly	Week 7	Declared by College Authority