Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Four B. Sc. Degree Program in Botany

(Faculty of Science and Technology)

CBCS Syllabus

F. Y. B. Sc. (Botany) Semester -II

For Department of Botany

Tuljaram Chaturchand College, Baramati

Choice Based Credit System Syllabus (2023 Pattern)

(As Per NEP 2020)

To be implemented from Academic Year 2023-2024

Title of the Programme: F.Y. B.Sc. (Botany)

Preamble

AES's Tuljaram Chaturchand College of Arts, Science and Commerce (Autonomous) has made the decision to change the syllabi of across various faculties from June, 2023 by incorporating the guidelines and provisions outlined in the National Education Policy (NEP), 2020. The NEP envisions making education more holistic and effective and to lay emphasis on the integration of general (academic) education, vocational education and experiential learning. The NEP introduces holistic and multidisciplinary education that would help to develop intellectual, scientific, social, physical, emotional, ethical and moral capacities of the students. The NEP 2020 envisages flexible curricular structures and learning based outcome approach for the development of the students. By establishing a nationally accepted and internationally comparable credit structure and courses framework, the NEP 2020 aims to promote educational excellence, facilitate seamless academic mobility, and enhance the global competitiveness of Indian students. It fosters a system where educational achievements can be recognized and valued not only within the country but also in the international arena, expanding opportunities and opening doors for students to pursue their aspirations on a global scale.

In response to the rapid advancements in science and technology and the evolving approaches in various domains of Botany and related subjects, the Board of Studies in Botany at Tuljaram Chaturchand College of Arts, Science and Commerce (Autonomous), Baramati - Pune, has developed the curriculum for the first semester of F.Y. B.Sc. Botany which goes beyond traditional academic boundaries. The syllabus is aligned with the NEP 2020 guidelines to ensure that students receive an education that prepares them for the challenges and opportunities of the 21st century. This syllabus has been designed under the framework of the Choice Based Credit System (CBCS), taking into consideration the guidelines set forth by the National Education Policy (NEP) 2020, LOCF (UGC), NCrF, NHEQF, Prof. R.D. Kulkarni's Report, Government of Maharashtra's General Resolution dated 20th April and 16th May 2023, and the Circular issued by SPPU, Pune on 31st May 2023.

A Botany Post Graduates degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Post Graduates in Botany find opportunities in various fields, including urban planning, teaching, environmental science, all plant sciences, organic farming, nursery management, entrepreneurship Mushroom

cultivation, medicinal plant, floriculture, horticulture, propagation methods and plant tissue culture method and many other domains. Throughout their three-year degree program, students explore the significance of plant in life of each and every living organism on Earth. They learn tool, techniques, process which is required to set up agencies including pickles, jam, and jelly medicinal plant, fruit processing, vegetable processing, organic product, organic fertilizer and pesticides producing industries also the can earn the knowledge to produce natural remedies for varies diseases. They became expert in discovery and development of many new therapeutic compounds which are now used in pharmaceutical herbal cosmetics and other compound based industries.

Overall, revising the Botany syllabi in accordance with the NEP 2020 ensures that students receive an education that is relevant, comprehensive, and prepares them to navigate the dynamic and interconnected world of today. It equips them with the knowledge, skills, and competencies needed to contribute meaningfully to society and pursue their academic and professional goals in a rapidly changing global landscape.

Programme Specific Outcomes (PSOs)

PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the disciplines that form a part of a graduate programme. Execute strong theoretical and practical understanding generated from the specific graduate programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skills of analysis, inference, interpretation and problem-solving by observing the situation closely and design the solutions.
PO3	**Social competence:** Display the understanding, behavioural skills needed for successful social adaptation , work in groups, exhibit thoughts and ideas effectively in writing and orally
PO4	**Research-related skills and Scientific temper :** Develop the working knowledge and applications of instrumentation and laboratory techniques. Able to apply skills to design and conduct independent experiments, interpret, establish hypothesis and inquisitiveness towards research.
PO5	**Trans-disciplinary knowledge:** Integrate different disciplines to uplift the domains of cognitive abilities and transcend beyond discipline-specific approaches to address a common problem
PO6	**Personal and professional competence:** Performing dependently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centred national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

Anekant Education Society's

Tuljaram Chaturchand College, Baramati

(Autonomous)

Board of Studies (BOS) in Botany

From 2022-23 to 2024-25

Sr. No.	Name	Designation
1.	Prof. Dr. Bhagwan Mali	Chairman
2.	Prof. Dr. Mahadev Kanade	Member
3.	Prof. Dr. Ajit Telave	Member
4.	Dr. Rupali Chitale	Member
5.	Dr. Madhuri Patil	Member
6.	Mr. Sauraj N. Torane	Member
7.	Ms. Ashwini B. Dudhal	Member
8.	Mr. Prasad J. Bankar	Member
9.	Mr. Sourabh R. Chandankar	Member
10.	Prof. Dr. B. M. Gaykar	Expert from SPPU, Pune
11.	Prof. D. K. Gaikwad	Expert from other university
12.	Dr. Jay Chavan	Expert from other university
13.	Dr. S. Gurumurthy	Expert from allied area
14.	Mr. Gore Nitin Anil	Meritorious Student
15.	Ms. Ligade Komal Sambhaji	Meritorious Student
16.	Mr. Zodage Ram Sanjay	Meritorious Student
17.	Ms. Gargade Rutuja Hanumant	Meritorious Student

Credit Distribution Structure for F.Y. B.Sc. -2023-2024 (Botany)

Level	Semester	Major		Minor	GE/OE	VSC, SEC (VSEC)	AEC, VEC, IKS	OJT, FP, CEP, CC, RP	Cum. Cr./ Sem.	Degree/ Cum. Cr.
		Mandatory	**Electives**							
4.5	**I**	**BOT-101-MJM**:Diversity of Cryptogams **BOT-102-MJM**:Industrial Botany-I **BOT-103-MJM**: Botany Practical-I **Credits-2+2+2**	-	**--**	**BOT-116-OE:** Horticulture **BOT-117-OE:** Floriculture Credit- 2+2	**BOT-121-VSC:** Organic Farming **BOT-126-SEC:** Fruit Processing Credit- 2+2	**ENG-131-AES:** Functional English-I **BOT- 135-VEC:** Environmental Science **BOT-137- IKS :**Botany in Ayurveda Credit- 2+2+2	Co-curricular Course (CC) Credit- 2	22	**UG Certificate 44**
	II	**BOT-151-MJM:**Diversity of Phanerogams **BOT-152-MJM**: Industrial Botany-II **BOT-153-MJM**: Botany Practical-II Credits-2+2+2	-	**BOT-161-MN**: Gardening and Nursery Management Credits-2	**BOT-166-OE:** Economic Botany **BOT-167-OE:** Seed Technology Credit- 2+2	**BOT-171-VSC:** Plant Tissue Culture **BOT-176-SEC:** Mushroom Cultivation Credit- 2+2	**ENG-181-AEC:** Functional English – II **BOT-185-VES:** Digital and Technological Solutions Credit- 2+2	Co-curricular Course (CC) Credit- 2	22	
	Cum Cr.	**12**	**-**	**2**	**8**	**8**	**10**	**4**	**44**	
Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor										

Course Structure for F.Y. B. Sc. (Botany) (2023 Pattern)

Sem	Course Type	Course Code	Title of Course	Theory/ Practical	No. of Credits
I	Major Mandatory	BOT-101-MJM	Diversity of Cryptogams	Theory	02
	Major Mandatory	BOT-102-MJM	Industrial Botany - I	Theory	02
	Major Mandatory	BOT-103-MJM	Botany Practical - I	Practical	02
	Open Elective (OE)	BOT-116-OE	Horticulture	Theory	02
	Open Elective (OE)	BOT-117-OE	Floriculture	Practical	02
	Vocational Skill Course (VSC)	BOT-121-VSC	Organic Farming	Theory	02
	Skill Enhancement Course (SEC)	BOT-126-SEC	Fruit Processing	Practical	02
	Ability Enhancement Course (AEC)	ENG-131-AEC	Functional English -1	Theory	02
	Value Education Course (VEC)	BOT-135-VEC	Environmental Science	Theory	02
	Indian Knowledge System (IKS)	BOT-137-IKS	Botany in Ayurveda	Theory	02
	Co- curricular Course (CC)	--	To be selected from the Basket	Theory	02
	Total Credit Semester - I				**22**
II	Major Mandatory	BOT-151-MJM	Diversity of Phanerogams	Theory	02
	Major Mandatory	BOT-152-MJM	Industrial Botany - II	Theory	02
	Major Mandatory	BOT-153-MJM	Botany Practical - II	Practical	02
	Minor	BOT-161-MN	Gardening and Nursery Management	Theory	02
	Open Elective (OE)	BOT-166-OE	Economic Botany	Theory	02
	Open Elective (OE)	BOT-167-OE	Seed Technology	Practical	02
	Vocational Skill Course (VSC)	BOT-171-VSC	Plant Tissue Culture	Theory	02
	Skill Enhancement Course (SEC)	BOT-176-SEC	Mushroom Cultivation	Practical	02
	Ability Enhancement Course (AEC)	ENG-181-AEC	Functional English -1	Theory	02
	Value Education Course (VEC)	BOT-185-VEC	Digital and Technological Solutions	Theory	02
	Co- curricular Course (CC)	--	To be selected from the Basket	Theory	02
	Total Credit Semester - II				**22**
	Cumulative Credits Semester I + Semester II				**44**

CBCS Syllabus as per NEP 2020 for F.Y. B. Sc. Botany (2023 Pattern)

Name of the Programme : B. Sc. Botany
Program Code : USBT
Class : F. Y. B. Sc.
Semester : II
Course Type : Major Mandatory (Theory)
Course Code : BOT-151-MJM
Course Title : Diversity of Phanerogams
No. of Credits : 02
No. of Teaching Hours : 30

Course Objectives:

1. To understand the diversity in Phanerogams.
2. To give knowledge of identification of Phanerogams.
3. To understand the scope of Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
4. To impart the basic skills in conservation of Phanerogams.
5. To give knowledge of economic importance of Phanerogams.
6. To in carve the external characteristics of flowering plants in mind of students.
7. To create awareness about the local flora with respect to Phanerogams.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO4. Know different methods of conservation of Phanerogams.
CO5. Study the applications of cryptogams.
CO6. Describe and identify the flowering plants.
CO7. Understand the local flora with respect to Phanerogams.

Topics and Learning Points:

Unit - 1 **(10L)**

1.1 Gymnosperms: Occurrence and General Characters, Life cycle of Cycas, Economic importance of Gymnosperms. **(6L)**

1.2 Angiosperms: Occurrence and General Characters, means of evolutionary Success of Angiosperms, Comparative account of monocotyledons and dicotyledons. **(4L)**

Unit - 2 **(10L)**

2.1 Types and modifications of root, stem and leaf **(5L)**

2.2 **Morphology of Inflorescence:** Types and significance of inflorescence: Racemose (raceme, spike, corymb, umbel, catkin, spadix and capitulum), Cymose (solitary, monochasial, dichasial, polychasial), Special types (Verticillaster, Cyathium, and Hypanthodium). **(5L)**

Unit – 3 **(10L)**

3.1 **Morphology of Flower:** Parts of typical flower, Types of flower (complete, incomplete), insertion of floral whorls. **Floral whorls:** Calyx, corolla, perianth, aestivation, modifications of calyx (pappus, petalloid, spurred). **Forms of corolla:** polypetalous (cruciform and papilionaceous) gamopetalous (infundibuliform, bilabiate), **Androecium:** structure of stamen, fixation, cohesion and adhesion of anthers; **Gynoecium:** structure of carpel. Types of placentation. **(8L)**

3.2 **Morphology of Fruit: Types of fruits:** Simple and dry: Achene, Cypsela, Legume, Follicle and Capsule, **Fleshy:** Drupe, berry, Hespiridium and pepo. **Aggregate:** Etaerio of berries and Etaerio of follicles. **Multiple fruits:** Syconus and Sorosis. **(2L)**

References:

1. Gangulee and Kar (2006) : College Botany, New Central Book Agency (P) Ltd. Kolkata
2. Naik V. N. (1994) : Taxonomy of Angiosperms, Tata Mc Graw Hill Publishing Comp., New Delhi
3. Dutta S. C. (1988) : Systematic Botany, Wiley Eastern Ltd., New Delhi
4. Gangulee, Das and Datta (2002) : College Botany, Vol. I., New Central Book Agency, Kolkata.
5. Singh V. and D. K. Jain (2010) : Taxonomy of Angiosperms, Rastogy Publications, Meerut.
6. Pandey B. P. (2009) : A Text Book of Botany- Angiosperms, S. Chand and Comp. Ltd. New Delhi
7. Lawrence GHM (2012) : Taxonomy of vascular plant, Scientific Publishers, (India) Jodhpur.
8. Eames A.J. (1961) : Morphology of the angiosperms, Mc. Graw Hill, New York.
9. Ashok Bendre & Ashok Kumar (1993) : A Text Book of Practical Botany II, Rastogi Publ., Meerut.
10. Dutta A. C. (2003) : Botany for Degree Students,. Oxford University Press, New Delhi.
11. Singh, V., P. C. Pande & D. K. Jain. (2011) : A text book of Botany: Angiosperms, Rastogi publications.

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc. (Sem II) **Subject**: Botany
Course: Diversity of Phanerogams **Course Code**: BOT-151-MJM
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3		2			1			3
CO 2	3		2			1			3
CO 3	3				2	1	1	1	1
CO 4		3	1	1			1		
CO 5					1				1
CO 6	3				1				1
CO 7		3				2			

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO6. Describe and identify the flowering plants.

PO2: Critical Thinking and Problem Solving

CO4. Know different methods of conservation of Phanerogams.
CO7. Understand the local flora with respect to Phanerogams.

PO 3: Social competence

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO4. Know different methods of conservation of Phanerogams.

PO 4: Research-related skills and Scientific temper

CO4. Know different methods of conservation of Phanerogams.

PO5: Trans-disciplinary Knowledge

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.
CO5. Study the applications of Phanerogams.
CO6. Describe and identify the flowering plants.

PO6: Personal and Professional Competence

CO1. Describe the morphology and reproductive structure of Phanerogams.
CO2. Identify, describe and study in detail life cycle of Phanerogams.
CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO7. Understand the local flora with respect to Phanerogams.

PO 7: Effective Citizenship and Ethics

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO4. Know different methods of conservation of Phanerogams.

PO 8: Environment and Sustainability

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

PO 9: Self-directed and Life-long Learning

CO1. Describe the morphology and reproductive structure of Phanerogams.

CO2. Identify, describe and study in detail life cycle of Phanerogams.

CO3. Know scope of the Phanerogams diversity with special reference to Gymnosperms and Angiosperms.

CO5. Study the applications of Phanerogams.

CO6. Describe and identify the flowering plants.

Name of the Programme	**: B. Sc. Botany**
Program Code	**: USBT**
Class	**: F. Y. B. Sc.**
Semester	**: II**
Course Type	**: Major Mandatory (Theory)**
Course Code	**: BOT-152-MJM**
Course Title	**: Industrial Botany - II**
No. of Credits	**: 02**
No. of Teaching Hours	**: 30**

Course Objectives:

1. To give knowledge of Bio-fuel Industry.
2. To give knowledge of organic farming with respect to Biopesticides and Biofertilizers.
3. To give knowledge of industrially important fungi and their applications.
4. To give knowledge of Pharmaceutical Industry.
5. To impart the career opportunities in biopesticide and biofertilizer industry.
6. To make expertise in preparation of biopesticides and biofertilizers.
7. To impart the basic skills in the field of Pharmaceutical industry.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Get knowledge of Biopesticide and Biofertilizer.
CO2. Acquire knowledge of organic farming with respect to Biopesticides and Biofertilizers.
CO3. Know scope of the industrially important fungi and their applications.
CO4. Get knowledge of Pharmaceutical Industry.
CO5. Know career opportunities in biopesticide and biofertilizer industry.
CO6. Get expertise in preparation of biopesticides and biofertilizers.
CO7. Get expertise in the field of Pharmaceutical industry.

Unit - 1 **(10L)**

1.1 Bio-fuel Industry: Introduction and advantages. Concept of biofuel and its need. Plants used for bio-fuel production. Commercial significance. **(4L)**

1.2 Industrial Mycology: Introduction, Important genera of fungi used in various industries and their products. Products and applications of *Penicillium*, *Aspergillus* and yeast. Commercial significance. **(6L)**

Unit - 2 **(10L)**

2.1 Bio-Fertilizer Industry: Bio fertilizers: concept and need. Commercial significance. **(4L)**

2.2 Types of bio-fertilizers: Nitrogen fixing biofertilizer: *Rhizobium*, Blue green algae. *Anabaena* associated with *Azolla*. Phosphate solubilizing Biofertilizer: Bacteria and Fungi, Mycorrhiza, Vermicompost, Jivamrut, Panchgavya, **(6L)**

Unit – 3 **(10L)**

3.1 Bio-pesticide Industry: Concept and need of bio-control, Commercial significance or importance of bio-pesticides, Integrated Pest Management (IPM). Types of bio pesticides, Preparation of Panchgavya, Agniastra, Bramhastra, Dashparni Ark. **(4L)**

3.2 Pharmaceutical Industry: Concept of nutraceuticals and cosmeceuticals. Types of pharmaceutical products: Churna, Asava and Arishta. Manufacture of Churna *(Triphala* churna*)*, Arishta (Ashokarishta) and Asava (Kumariasava). Drug plants with reference to botanical source, active principles and medicinal uses of *Adhatoda*, *Tinospora*, *Asparagus*, Amla and *Aloe vera*. **(6L)**

References:

1. The Complete Book on Organic Farming and Production of Organic Compost (2018) : NPCS Board of Consultants & Engineers, Asia Pacific Business Press Inc.
2. The Organic Farming Manual: A Comprehensive Guide to Starting and Running a Certified Organic Farming [Ann Larkin Hansen] (2010) : Storey Publications.
3. Kar A, (2008) : Pharmacognosy and Pharmacobiotechnology, New Age international (P) Limited, Publishers (formerly Wiley Eastern Limited).
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13. Agrios, G.N. (2006) : Plant Pathology, Elsevier Academic Press.
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17. Zhiqiang A. N. (2004) : Handbook of Industrial Mycology. CRC Press
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19. A.C. Gaur (2010) : (Biofertilizers in Sustainable Agriculture. IARI, New Delhi
20. The Complete Technology Book on Biofertilizer and Organic Farming. (2013) : NIIR Board.

(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc. (Sem II) **Subject**: Botany
Course: Industrial Botany II **Course Code**: BOT-152-MJM
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								1
CO 2	3	3	2	2	1		1	1	2
CO 3	3	2			1	1	1	1	1
CO 4	3		1	1	1				
CO 5		1			1				
CO 6		2		1					
CO 7		2		1					

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Get knowledge of Biopesticide and Biofertilizer.
CO2. Acquire knowledge of organic farming with respect to Biopesticides and Biofertilizers.
CO3. Know scope of the industrially important fungi and their applications.
CO4. Get knowledge of Pharmaceutical Industry.

PO2: Critical Thinking and Problem Solving

CO2. Acquire knowledge of organic farming with respect to Biopesticides and Biofertilizers.
CO3. Know scope of the industrially important fungi and their applications.
CO5. Know career opportunities in biopesticide and biofertilizer industry.
CO6. Get expertise in preparation of biopesticides and biofertilizers.
CO7. Get expertise in the field of Pharmaceutical industry.

PO 3: Social competence

CO2. Acquire knowledge of organic farming with respect to Biopesticides and Biofertilizers.
CO4. Get knowledge of Pharmaceutical Industry.

PO 4: Research-related skills and Scientific temper

CO2. Acquire knowledge of organic farming with respect to Biopesticides and Biofertilizers.
CO4. Get knowledge of Pharmaceutical Industry.
CO6. Get expertise in preparation of biopesticides and biofertilizers.
CO7. Get expertise in the field of Pharmaceutical industry.

PO5: Trans-disciplinary Knowledge

CO5. Know career opportunities in biopesticide and biofertilizer industry.

PO6: Personal and Professional Competence

CO3. Know scope of the industrially important fungi and their applications.

PO 7: Effective Citizenship and Ethics

CO3. Know scope of the industrially important fungi and their applications.

PO 8: Environment and Sustainability

CO2. Acquire knowledge of organic farming with respect to Biopesticides and Biofertilizers.

CO3. Know scope of the industrially important fungi and their applications.

PO 9: Self-directed and Life-long Learning

CO1. Get knowledge of Biopesticide and Biofertilizer.

CO2. Acquire knowledge of organic farming with respect to Biopesticides and Biofertilizers.

CO3. Know scope of the industrially important fungi and their applications.

Name of the Programme	**: B. Sc. Botany**
Program Code	**: USBT**
Class	**: F. Y. B. Sc.**
Semester	**: II**
Course Type	**: Major Mandatory (Practical)**
Course Code	**: BOT-153-MJM**
Course Title	**: Botany Practical - II**
No. of Credits	**: 02**
No. of Teaching Hours	**: 60**

Course Objectives:

1. To give knowledge of handling of microscope.
2. To give practical knowledge about identification of the Phanerogams.
3. To introduce the students with botanical terms for description of flowering plants.
4. To impart basic skills in preparation of fungal products.
5. To give hands-on training of preparation of bio-fertilizers.
6. To give hands-on training of preparation of bio-pesticides.
7. To give hands-on training of preparation of pharmaceutical products.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Get expertise in handling of microscope.
CO2. Identify the Phanerogams.
CO3. Describe flowering plants using botanical terms.
CO4. Get knowledge of preparation of fungal products.
CO5. Get knowledge of preparation of bio-fertilizers.
CO6. Get knowledge of preparation of biopesticides
CO7. Get knowledge of preparation of pharmaceutical products.

Practicals

1. Study of *Cycas.* (1P)
2. Modifications of root. (1P)
3. Modifications of and stem. (1P)
4. Study of leaf (types: simple and compound; sessile and petiolate; venation: parallel and reticulate and modifications). (1P)
5. Study of Inflorescence a) Racemose: Raceme, Spike, Spadix, Catkin, Umbel and Capitulum. b) Cymose: Solitary cyme, Uniparous cyme: helicoid and scorpiod, Biparous cyme and Multiparous cyme. (1P)
6. Study of special type of nflorescence : Verticillaster, Hypanthodium and Cyathium. (1P)
7. Study of flower with respect to Calyx, Corolla and Perianth. (1P)
8. Study of flower with respect to Androecium and Gynoecium. (1P)
9. Study of fruits with suitable examples: Simple fruit: fleshy - Berry and Drupe; Dry: Achene, Cypsella and Legume Agrregate fruit: Etaerio of follicles and Etaerio of Berries. Multiple fruit: Syconus and Sorosis. (1P)
10. Study of industrially important fungi and their products : *Ganoderma*: *Ganoderma* tablets, *Aspergillus* : citric acid; *Yeast*: Bakery products; *Penicillium*: Penicillin (1P)
11. Preparation of Biofertilizer - Compost and applications of microbial biofertilizers. (1P)

12. Preparation of Biopesticide: Dashparni Ark, Bramhastra, Agniatra. (1P)
13. Study of medicinal plants - *Adhatoda*, *Tinospora*, *Asparagus*, Amla and *Aloe vera*. (1P)
14. Preparation of Churna and Asava. (1P)
15. One botanical excursion to study Phanerogams / Visit to one of the Pharmaceutical / Biopesticide / Biofertilizer / bio-fuel industry. (Visit report is compulsory).

(Note: Visit mentioned in the practical no. 15 is compulsory. It carries 10 marks at the time of practical examination).

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc. (Sem II) **Subject**: Botany
Course: Botany Practical II **Course Code**: BOT-153-MJM
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								
CO 2	3	3				3			1
CO 3	3	2							1
CO 4	3		3						
CO 5	3	1		1	1		1	1	2
CO 6	3	1		1	1		1	1	2
CO 7	3	1		1	1		1	1	2

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Get expertise in handling of microscope.
CO2. Identify the Phanerogams.
CO3. Describe flowering plants using botanical terms.
CO4. Get knowledge of preparation of fungal products.
CO5. Get knowledge of preparation of bio-fertilizers.
CO6. Get knowledge of preparation of biopesticides
CO7. Get knowledge of preparation of pharmaceutical products.

PO2: Critical Thinking and Problem Solving

CO2. Identify the Phanerogams.
CO3. Describe flowering plants using botanical terms.
CO5. Get knowledge of preparation of bio-fertilizers.
CO6. Get knowledge of preparation of biopesticides
CO7. Get knowledge of preparation of pharmaceutical products.

PO 3: Social competence

CO4. Get knowledge of preparation of fungal products.

PO 4: Research-related skills and Scientific temper

CO5. Get knowledge of preparation of bio-fertilizers.
CO6. Get knowledge of preparation of biopesticides

CO7. Get knowledge of preparation of pharmaceutical products.

PO5: Trans-disciplinary Knowledge

CO5. Get knowledge of preparation of bio-fertilizers.
CO6. Get knowledge of preparation of biopesticides
CO7. Get knowledge of preparation of pharmaceutical products.

PO6: Personal and Professional Competence

CO2. Identify the Phanerogams.

PO 7: Effective Citizenship and Ethics

CO5. Get knowledge of preparation of bio-fertilizers.
CO6. Get knowledge of preparation of biopesticides
CO7. Get knowledge of preparation of pharmaceutical products.

PO 8: Environment and Sustainability

CO5. Get knowledge of preparation of bio-fertilizers.
CO6. Get knowledge of preparation of biopesticides
CO7. Get knowledge of preparation of pharmaceutical products.

PO 9: Self-directed and Life-long Learning

CO2. Identify the Phanerogams.
CO3. Describe flowering plants using botanical terms.
CO5. Get knowledge of preparation of bio-fertilizers.
CO6. Get knowledge of preparation of biopesticides
CO7. Get knowledge of preparation of pharmaceutical products.

Name of the Programme	**: B. Sc. Botany**
Program Code	**: USBT**
Class	**: F. Y. B. Sc.**
Semester	**: II**
Course Type	**: Minor (Theory)**
Course Code	**: BOT-161-MN**
Course Title	**: Gardening and Nursery Management**
No. of Credits	**: 02**
No. of Teaching Hours	**: 30**

Course Objectives:

1. To give knowledge and develop skills in raising nursery.
2. To give knowledge and develop skills in preparation of garden.
3. To provide basic knowledge about tools, equipment's and growing structures in nursery.
4. To provide basic knowledge about tools, equipment's and preparation of bonsai.
5. To impart the career opportunities in nursery.
6. To impart career opportunities in development of different garden styles.
7. To provide an opportunity to students to develop inter-disciplinary skills.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Get knowledge and skill in raising nursery.
CO2. Acquire knowledge and skill in preparation of garden.
CO3. Get knowledge about tools, equipment's and growing structures in nursery.
CO4. Prepare and maintain bonsai.
CO5. Perform nursery planning and management.
CO6. Make familiar with various garden styles.
CO7. Perform communication and professionalism development activities.

Unit - 1 **(10L)**

1.1 History, Importance, Scope and Business opportunities in Gardening and Nursery. Role of women in buildup of small scale nursery and kitchen garden. **(4L)**

1.2 Types of gardens: terrace garden, water/aquatic garden, rock garden, bottle garden, dish garden, vertical garden, rose garden, butterfly garden, meditation garden and oxygen park plant garden. **(6L)**

Unit - 2 **(10L)**

2.1 Garden styles: Hindu gardens, natural garden, wild garden, Mughal gardens, Persian Gardens, Italian gardens, French gardens, English gardens, Japanese gardens, popular Gardens in India. **(6L)**

2.3 Bonsai: styles, plants, containers, and tools, cultural practices, special practices, care and Maintenance. **(4L)**

Unit - 3 **(10L)**

3.1 Nursery: Concept and types of Nurseries: Ornamental plants nursery, Nursery of Forest plants, Nursery of fruit plants, Nursery of medicinal plants, Vegetable nursery.

Commercial applications of nursery. **(6L)**

3.2 Nursery Practices: Types of seed bed/ Nursery bed: Flat, Raised and Sunken. Sowing of Seeds, Preparation of polybag nursery or pot nursery, Nursery Management: irrigation and fertigation. (**4L)**

References:

1. Arora T. S. (2007). Introductory Ornamental Horticulture, Kalyani Publishers, New Delhi.
2. Bose T. K. and Mukherjee D. (1972). Gardening in India. Oxford Publishing Co. New Delhi
3. Kumar N. (1997). Introduction to Horticulture, Rajlaxmi Publications, Nagercoil
4. G. S. Randhawa (1986). Floricuture in India, Allied Publishers.
5. Vishnu Swarup (2008). Garden Flowers, ICAR Publications, New Delhi.

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc. (Sem II) **Subject**: Botany
Course: Gardening and Nursery Management **Course Code**: BOT-161-MN
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3	2	1	1				1	
CO 2	3	2		1		1		1	1
CO 3	3								
CO 4	3			2					
CO 5		3							
CO 6	3		1						
CO 7						3	1		

Justification for the mapping

PO1: Disciplinary Knowledge
CO1. Get knowledge and skill in raising nursery.
CO2. Acquire knowledge and skill in preparation of garden.
CO3. Get knowledge about tools, equipments and growing structures in nursery.
. CO4. Prepare and maintain bonsai.
CO6. Familiar with various garden styles.

PO2: Critical Thinking and Problem Solving
CO1. Get knowledge and skill in raising nursery.
CO2. Acquire knowledge and skill in preparation of garden.
CO5. Perform nursery planning and management.

PO 3: Social competence
CO1. Get knowledge and skill in raising nursery.
CO6. Familiar with various garden styles.

PO 4: Research-related skills and Scientific temper
CO1. Get knowledge and skill in raising nursery.
CO2. Acquire knowledge and skill in preparation of garden.
CO4. Prepare and maintain bonsai.

PO6: Personal and Professional Competence
CO2. Acquire knowledge and skill in preparation of garden.
CO7. Perform communication and professionalism development activities.

PO 7: Effective Citizenship and Ethics
CO7. Perform communication and professionalism development activities.

PO 8: Environment and Sustainability
CO1. Get knowledge and skill in raising nursery.
CO2. Acquire knowledge and skill in preparation of garden.

PO 9: Self-directed and Life-long Learning

CO3. Get knowledge about tools, equipments and growing structures in nursery.

Name of the Programme	**:**	**B. Sc. Botany**
Program Code	**:**	**USBT**
Class	**:**	**F. Y. B. Sc.**
Semester	**:**	**II**
Course Type	**:**	**Open Elective (Theory)**
Course Code	**:**	**BOT-166-OE**
Course Title	**:**	**Economic Botany**
No. of Credits	**:**	**02**
No. of Teaching Hours	**:**	**30**

Course Objectives:

1. To know plant biology.
2. To give knowledge about botanical aspects of economically important plants.
3. To impart and origins of important plats utilized as food, fiber, fodder, medicine, dye.
4. To demonstrate a deeper knowledge of a chosen medicinal plant.
5. To impart the career opportunities agriculture.
6. To evaluate the importance of plants and their different roles.
7. To study use of different plant structures.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Understand basics of commercial source of plant part.
CO2. Utilize knowledge about plants utilized in food, fiber, fodder, medicine, dye.
CO3. Use knowledge about different plants and their commercial produts.
CO4. Develop agro based industries on their own.
CO5. Develop business opportunity in agriculture industry.
CO6. Get expertise to develop agro based industries.
CO7. Get expertise in field of economic Botany.

Topics and Learning

Study of the following plants with respect to Botanical name, family, method of cultivation, part used, economic importance of at least three plants of each category.

Unit: I **(10 L)**

1.1 Definition and applications of Economic Botany. (1L)

1.2 Study of the following plants with respect to Botanical name, family, method of cultivation, part used, economic importance of at least three plants of each category. (1L)

1.3 Cereals: Rice, Wheat, Maize. (1L)

1.4 Millets: *Sorghum*, Ragi, Bajra (2L)

1.5 Pulses : Soyabean, Peanut, Chick-pea (2L)

1.6 Fibre plants: Cotton, Jute, Agave, *Pentatropis nivalis* (2L)

1.7 Rubber and its products (1L)

Unit II: **(10L)**

2.1 Oil yielding plants: Coconut Sunflower, Safflower, Palm. (2L)

2.2. Timber: Rosewood, Teakwood, Mahogani (2L)

2.3 Spices: Clove, Cardamom, Cinnamon (2L)

2.4 Beverages: Coffee, Tea, Kokum (2L)

2.5 Aromatic plants: Rose, *Geranium*, Sandalwood (2L)

Unit III **(10L)**

3.1 Fruit: Mango, Grapes, Dragon fruit. (2L)

3.2 Medicinal Plants: Awala, Adulsa, Aloe-vera. (2L)

3.3. Vegetables: Potato, Brinjal, Tomato. (2L)

3.4 Nuts: Cashewnut, Walnut, Almond. (2L)

3.5 Gum and Resin: Agarwood, *Pinus*,Babul. (2L)

References:

1. Verma V. (2013) : Textbook of Economic Botany, Ane Books Pvt. Ltd.
2. Kochhar S. L. (2012) : Economic Botany in the Tropics, , Macmillan Publisher.
3. Gerald E. Wickens (2001) : Economic Botany: Principles and Practices, Springer Publication.
4. Agner, H.H., & Hikino, & Farns worth, N: Economic & Medicinal plant research, Vol.1- 3, (Academic Press)
5. Pandey, B.P. (1992). Economic Botany. (S. Chand and Sons Co., New Delhi).
6. Verma, (1998). Text book of Economic Botany, Embay Publishers, New Delhi

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc. (Sem II) **Subject**: Botany

Course: Economic Botany **Course Code**: BOT-166-OE

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								2
CO 2	3	2						1	
CO 3	3								
CO 4			2						
CO 5						2			
CO 6	3					3	1		
CO 7				1					

Justification for the mapping

PO: Disciplinary Knowledge

CO1. Understand basics of commercial source of plant part.

CO2. Utilize knowledge about plants utilized in food, fiber, fodder, medicine, dye.

CO3. Use knowledge about different plants and their commercial produts.

CO6. Get expertise to develop agro based industries.

PO2: Critical Thinking and Problem Solving

CO2. Utilize knowledge about plants utilized in food, fiber, fodder, medicine, dye.

PO 3: Social competence

CO4. Develop agro based industries on their own.

PO 4: Research-related skills and Scientific temper

CO7. Get expertise in field of economic Botany.

PO6: Personal and Professional Competence

CO5. Develop business opportunity in agriculture industry.

CO6. Get expertise to develop agro based industries.

PO 7: Effective Citizenship and Ethics

CO6. Get expertise to develop agro based industries.

PO 8: Environment and Sustainability

CO2. Utilize knowledge about plants utilized in food, fiber, fodder, medicine, dye.

PO 9: Self-directed and Life-long Learning

CO1. Understand basics of commercial source of plant part.

Name of the Programme	**:**	**B.Sc. Botany**
Program Code	**:**	**USBT**
Class	**:**	**F.Y. B.Sc.**
Semester	**:**	**II**
Course Type	**:**	**Open Elective Practical.**
Course Code	**:**	**BOT -167-OE**
Course Title	**:**	**Seed Technology.**
No. of Credits	**:**	**02**
No. of Teaching Hours	**:**	**60**

A) Course objectives:

1. To assess seed quality through practical technique such as germination testing and seed dormancy and seed health analysis.
2. To develop proficiency in seed cleaning, sorting, and conditioning process to ensure production of high quality seeds.
3. To acquire practical knowledge of seed enhancement technologies to improve germination and seedling vigor.
4. To develop skills in identifying and managing seed borne diseases and pests both in the field and during storage.
5. To study various methods of seed storage.
6. To study various instruments used in seed industry.
7. To learn how to package seeds securely and label them accurately.

B) Course Outcomes:

By the end of course students will be able to

1. Learn practical technique such as germination testing and seed dormancy and seed health analysis.
2. Develop proficiency in seed cleaning, sorting, and conditioning process to ensure production of high quality seeds.
3. Acquire practical knowledge of seed enhancement technologies to improve germination and seedling vigor.
4. Know seed enhancement technologies to improve germination and seedling vigor.
5. Develop of skills in identifying and managing seed borne diseases and pests both in the field and during storage.
6. Know various instruments used in seed industry.
7. Know of various methods of seed storage.

Practicals:

1. Study of methods of seed storage.
2. Study of methods of packaging of seeds.
3. Study of seed borne fungi, Bactria and pathogens that causes diseases to crop.
4. Study of instruments used in seed industry.
5. Preparation of seed bank.
6. Study of methods of seed dressing and breaking of seed dormancy.
7. Compare the germination rates of different seed varieties under various conditions (light, temperature, moisture.
8. Test the viability of seed.
9. Examine the impacts of various seed coatings (e.g. Fungicides, nutrients) on germination and early plant growth.
10. Study methods for sorting and grading seeds based on size, weight and density.

11. Study the relationship between seed size and germination rates.
12. Investigate the nutrients uptake efficiency of different seedlings.
13. Study the seed vigor index.
14. Visit to seed shop/ seed industry and make a report.
15. Submission of at least 10 types of seeds of different plants at the time of exam.

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc. (Sem II) **Subject**: Botany
Course: Seed Technology **Course Code**: BOT-167-OE
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1		1		3					
CO 2			2			1	3		1
CO 3	3	1		2					
CO 4	3	1		2					
CO 5				3				1	
CO 6	3								
CO 7	3				1				

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Expertise in practical technique such as germination testing and seed dormancy and seed health analysis.
CO2. Development of proficiency in seed cleaning, sorting, and conditioning process to ensure production of high quality seeds.
CO3. Acquiring practical knowledge of seed enhancement technologies to improve germination andseedling vigor.
CO4. Knowledge of seed enhancement technologies to improve germination and seedling vigor.
CO5. Development of skills in identifying and managing seed borne diseases and pests both in the fieldand during storage.
CO6. Knowledge of various instruments used in seed industry.
CO7. Knowledge of various methods of seed storage.

PO2: Critical Thinking and Problem Solving

CO1. Expertise in practical technique such as germination testing and seed dormancy and seed health analysis.
CO3. Acquiring practical knowledge of seed enhancement technologies to improve germination andseedling vigor.
CO4. Knowledge of seed enhancement technologies to improve germination and seedling vigor.

PO 3: Social competence

CO2. Development of proficiency in seed cleaning, sorting, and conditioning process to ensure production of high quality seeds.

PO 4: Research-related skills and Scientific temper

CO1. Expertise in practical technique such as germination testing and seed dormancy and seed health analysis.
CO3. Acquiring practical knowledge of seed enhancement technologies to improve germination andseedling vigor.
CO4. Knowledge of seed enhancement technologies to improve germination and seedling vigor.
CO5. Development of skills in identifying and managing seed borne diseases and pests both in the fieldand during storage.

PO5: Trans-disciplinary Knowledge
CO7. Knowledge of various methods of seed storage.

PO6: Personal and Professional Competence
CO2. Development of proficiency in seed cleaning, sorting, and conditioning process to ensure production of high quality seeds.

PO 7: Effective Citizenship and Ethics
CO2. Development of proficiency in seed cleaning, sorting, and conditioning process to ensure production of high quality seeds.

PO 8: Environment and Sustainability
CO5. Development of skills in identifying and managing seed borne diseases and pests both in the fieldand during storage.

PO 9: Self-directed and Life-long Learning
CO2. Development of proficiency in seed cleaning, sorting, and conditioning process to ensure production of high quality seeds.

Name of the Programme	**:**	**B. Sc. Botany Program**
Class	**:**	**F. Y. B. Sc.**
Semester	**:**	**II**
Course Type	**:**	**Vocational Skill Course (VSC) (Practical)**
Course Code	**:**	**BOT-171-VSC**
Course Title	**:**	**Plant Tissue Culture**
No. of Unit	**:**	**03**
No. of Teaching Hours	**:**	**30**

Course objectives:

1. Define the basic concepts of Plant tissue culture as a biotechnology tool.
2. Recognize the importance of plant tissue culture technique.
3. Practice the different techniques used in plant tissue culture.
4. Explain and analyze the role of Plant tissue culture technique.
5. Describe how to regenerate plants using the different techniques of Plant tissue culture.
6. Prepare nutrient media for plant tissue culture.
7. Initiate callus formation from explants.

Course outcome:

By the end of course students will be able to

CO1. Students will be able to understand the basic concepts of plant tissue culture as a biotechnology tool.

CO2. Students will be able to understand the importance of plant tissue culture technique.

CO3. Students will get the knowledge about different techniques used in plant tissue culture.

CO4. Students will be able to understand the role of plant tissue culture technique.

CO5. Students will be able to understand how to regenerate plants using the different techniques of Plant tissue culture.

CO6. Students will get the knowledge about how to prepare nutrient media for plant tissue culture.

CO7. Students will be able to understand observation of callus development at the cut surface of explants.

Practicals:

1. Study of infrastructure of laboratory of plant tissue culture.
2. Study of instruments used in plant tissue culture.
3. Study of sterilization methods used in plant tissue culture.
4. Preparation of MS- media used in plant tissue culture. Part-I
5. Preparation of MS- media used in plant tissue culture. Part- II
6. Selection of explants for plant tissue culture.
7. Inoculation and incubation methods in plant tissue culture. Part-I
8. Inoculation and incubation methods in plant tissue culture. Part-II
9. Study of hardening methods in plant tissue culture.
10. Preparation of explants and callus induction.

11. Sub culture and maintenance of callus.
12. Study of embryo and endosperm culture.
13. Study of anther culture.
14. Study of pollen culture.
15. Submission of project report.

Choice Based Credit System Syllabus (2023 Pattern)
(As Per NEP 2020)

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc. (Sem II) **Subject**: Botany
Course: Plant Tissue Culture **Course Code**: BOT-171-VSC (P)
Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	2								
CO 2		3							
CO 3				3					
CO 4	2								
CO 5									2
CO 6	3								
CO 7	3								

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Students will be able to understand the basic concepts of plant tissue culture as a biotechnology tool.

CO4. Students will be able to understand the role of plant tissue culture technique.

CO6. Students will get the knowledge about how to prepare nutrient media for plant tissue culture.

CO7. Students will be able to understand observation of callus development at the cut surface of explants.

PO2: Critical Thinking and Problem Solving

CO2. Students will be able to understand the importance of plant tissue culture technique.

PO 4: Research-related skills and Scientific temper

CO3. Students will get the knowledge about different techniques used in plant tissue culture.

PO 9: Self-directed and Life-long Learning

CO5. Students will be able to understand how to regenerate plants using the different techniques of Plant tissue culture.

Name of the Programme	**:**	**B. Sc. Botany**
Program Code	**:**	**USBT**
Class	**:**	**F. Y. B. Sc.**
Semester	**:**	**II**
Course Type	**:**	**Skill Enhancement Course (SEC)**
Course Code	**:**	**BOT-176-SEC**
Course Title	**:**	**Mushroom Cultivation**
No. of Credits	**:**	**02**
No. of Teaching Hours	**:**	**60**

Course Objectives:

1. To know the nutrient value of mushroom.
2. To study the morphology and types of Mushrooms.
3. To provide hands-on training for the preparation of bed for mushroom cultivation.
4. To know the spawn production technique.
5. To aware the identification of edible and poisonous Mushrooms.
6. To understand the diseases. Post harvesting techniques of mushrooms.
7. To facilitate self-employment and scope of mushroom cultivation in small scale industry.

Course Outcomes:

By the end of the course, students will be able to:

CO1. Get knowledge nutrient value of mushroom.
CO2. Acquire knowledge morphology and types of Mushrooms.
CO3. Get skills of hands-on training for the preparation of bed for mushroom cultivation.
CO4. Get skills spawn production technique.
CO5. Understand the difference between edible and poisonous Mushrooms.
CO6. Get the knowledge of identification of diseases and post harvesting techniques of mushrooms.
CO7. Get the scope of plant tissue culture expert in self- employment and small scale industry.

Practicals

1. Study of different parts of a typical mushroom & variations in mushroom morphology.
2. Study of sterilization of glassware, equipment's and culture media used in mushroom cultivation.
3. Study of preparation culture media: Potato Dextrose medium, Richards's medium.
4. Study of preparation of spawn: Grain spawn, Straw spawn, Sawdust spawn.
5. Study of preparation of compost and compost formulations.
6. Study of mushroom bed preparation - paddy straw, sugarcane trash, maize straw, banana leaves.
7. Study of cultivation of white button mushroom.
8. Study of cultivation of paddy straw mushroom.
9. Study of cultivation of oyster mushroom.
10. Study of cultivation of milky mushroom.
11. Study of nutrients profiling mushroom.
12. Study of medicinal values of mushroom.

13. Study of hands on training in mushroom cultivation farm.
14. Study of diseases of mushrooms and their control measures.
15. One botanical excursion to study mushroom cultivation unit (Visit report is compulsory).

References.

1. Kannaiyan, S. Ramasamy, K. (1980). A hand book of edible mushroom, Today & Tomorrows Printers & Publishers, New Delhi.
2. Pandey. B. P. (1996). A textbook of fungi. Chand and Company N Delhi.
3. Subrata Biswas, M. Datta, S. V. Ngachan. (2012) Mushrooms: A Manual for Cultivation. PHI Learning Pvt Ltd.
4. R. Gogoi, Y. Rathaiah, T.R. Borah. (2006).Mushroom cultivation technology. Scientific Publishers, Jodhpur, India.
5. M. H. Pinkerton. (2013). Commercial Mushroom Growing. British Library cataloguing-in-Publication data.
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10. S. Kannaiyan & K. Ramasamy (1980). A hand book of edible mushroom. Today & Tomorrows printers & publishers, New Delhi.
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12. Marimuthu, T. Krishnamoorthy, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms, Department of Plant Pathology, Tamil Nadu Agricultural University, Coimbatore.
13. Swaminathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., Mysore Road, Bangalore.
14. Tewari, Pankaj Kapoor, S.C., (1988). Mushroom cultivation. Mittal Publications, Delhi.
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16. Mushroom Production and Processing Technology, Pathak Yadav Gour (2010) Published by Agrobios (India).
17. Harander Singh 1991. Mushrooms-The art of cultivation- Sterling Publishers.

Mapping of Program Outcomes with Course Outcomes

Class: F.Y.B. Sc. (Sem II) **Subject**: Botany

Course: Mushroom Cultivation **Course Code**: BOT-176-SEC

Weightage: 1= weak or low relation, 2= moderate or partial relation, 3= strong or direct relation

	Programme Outcomes (POs)								
Course Outcomes	PO1	PO2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO9
CO 1	3								1
CO 2	3	1							1
CO 3			2	3		1			
CO 4				3					
CO 5	3						1		
CO 6	3				1				
CO 7								1	

Justification for the mapping

PO1: Disciplinary Knowledge

CO1. Get knowledge nutrient value of mushroom.
CO2. Acquire knowledge morphology and types of Mushrooms.
CO5. Get identification of edible and poisonous Mushrooms.
CO6. Get identification of diseases and post harvesting techniques of mushrooms.

PO2: Critical Thinking and Problem Solving

CO2. Acquire knowledge morphology and types of Mushrooms.

PO 3: Social competence

CO3. Get skills of hands-on training for the preparation of bed for mushroom cultivation.

PO 4: Research-related skills and Scientific temper

CO3. Get skills of hands-on training for the preparation of bed for mushroom cultivation.
CO4. Get skills spawn production technique.

PO5: Trans-disciplinary Knowledge

CO6. Get identification of diseases and post harvesting techniques of mushrooms.

PO6: Personal and Professional Competence

CO3. Get skills of hands-on training for the preparation of bed for mushroom cultivation.

PO 7: Effective Citizenship and Ethics

CO5. Get identification of edible and poisonous Mushrooms.

PO 8: Environment and Sustainability

CO7. Get self- employment and small scale industry.

PO 9: Self-directed and Life-long Learning

CO1. Get knowledge nutrient value of mushroom.
CO2. Acquire knowledge morphology and types of Mushrooms.