AC – 24-05-2024
Item No. – 6.1

As Per NEP 2020

University of Mumbai

Title of the program

A- U.G. Certificate in Botany

B- U.G. Diploma in Botany

C- B.Sc. Botany

D- B.Sc. (Hons.) in Botany

E- B.Sc. (Hons. with Research) in Botany

Syllabus for

Semester – Sem I& II (Scheme III)

Ref: GR dated 20th April, 2023 for Credit Structure of UG

(With effect from the academic year 2024-25 Progressively)

University of Mumbai

(As per NEP 2020)

Sr. No.	Heading	Particulars	
1	**Title of program** **O: _____A**	**A**	**U.G. Certificate in Botany**
	O: _____B	**B**	**U.G. Diploma in Botany**
	O: _____C	**C**	**B.Sc. (Botany)**
	O: _____D	**D**	**B.Sc. (Hons.) inBotany**
	O: _____E	**E**	**B.Sc. (Hons. with Research) in Botany**
2	**Eligibility** **O: _____A**	**A**	H. Sc. Science OR Passed Equivalent Academic Level 4.0
	O: _____B	**B**	Under Graduate Certificate in Botany & Allied Academic Level OR Passed Equivalent Academic Level 4.5
	O: _____C	**C**	Under Graduate Diploma in Botany OR Passed Equivalent Academic Level 5.0
	O: _____D	**D**	Bachelors of Botany with minimum CGPA of 7.5 OR Passed Equivalent Academic Level 5.5
	O: _____E	**E**	Bachelors of Botany with minimum CGPA of 7.5 OR Passed Equivalent Academic Level 5.5
3	**Duration of program** **R: _____**	**A**	One Year
		B	Two Years
		C	Three Years
		D	Four Years
		E	Four Years
4	**Intake Capacity** **R: _____**	120/division	

5	**Scheme of Examination** **R: _____**	NEP 40% Internal 60% External, Semester End Examination Individual Passing in Internal and External Examination	
6	**R: _____ Standards of Passing**	40%	
7	**Credit Structure** **Sem. I - R: _____A** **Sem. II - R: _____B**	Attached herewith	
	Credit Structure **Sem. III - R: _____C** **Sem. IV - R: _____D**		
	Credit Structure **Sem. V - R: _____E** **Sem. VI - R: _____F**		
8	**Semesters**	A	Sem I & II
		B	Sem III& IV
		C	Sem V & VI
		D	Sem VII& VIII
		E	Sem VII & VIII
9	**Program Academic Level**	A	4.5
		B	5.0
		C	5.5
		D	6.0
		E	6.0
10	**Pattern**	Semester	
11	**Status**	New	
12	**To be implemented from Academic Year Progressively**	From Academic Year: 2024-25	

This syllabus is applicable to the IDOL students as well, w.e.f. 2025-26

Sign of the BOS Chairman
Dr. Vasant P. Mali
BOS in Botany

Sign of the Offg. Associate Dean
Dr. Madhav R. Rajwade
Faculty of Science & Technology

Sign of the Offg. Dean
Prof. Shivram S. Garje
Faculty of Science & Technology

Preamble

1) Introduction

The National Education Policy 2020 emphasizes upon quality education for development, self-learning aptitude, scientific temper moral values and social responsibilities in students. The FYBSc syllabus has been designed as per the objectives and guidelines of National Education Policy 2020.

2) Aims and Objectives

The syllabus aims in imparting knowledge related to Plant Sciences, Current trends and advanced developments in the field of Plant Sciences and its interdisciplinary branches.

The objectives of the syllabus are to enable learners to understand the basic concepts of Botany.

3) Learning Outcomes

The Semester I and II will culminate in students acquiring the following skills:

a. Identify the major groups of organisms amongst plants and be able to classify them.

b. Compare and contrast the characteristics of plants.

c. Understand ecological interconnectedness and genetics.

d. Apply the Ayurvedic knowledge gained for common ailments.

e. Demonstrate proficiency in the experimental techniques.

4) Any other point (if any)

The present syllabus also aims to develop Entrepreneur skills and Research aptitude in the learners.

5) Credit Structure of the Program (Sem I, II, III, IV, V & VI)

Undergraduate Certificate in Botany

Credit Structure (Sem. I & II)

	R:_____A								
Level	**Semester**	**Major**		**Minor**	**OE**	**VSC, SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP, CEP, CC, RP**	**Cum. Cr. / Sem.**	**Degree/Cum.Cr.**
		Mandatory	**Electives**							
4.5	I	2+2=4 Plant Science and Human Welfare (2) Practical - I (2)		-		VSC:2, SEC:2 **VSC: Any One** Entrepreneurial Botany (2) Indoor Gardening (2) Gardening and Management (2) Ayurvedic Aahar (2) **SEC: Any One** Tools and Techniques in Plant Sciences (2) Aromatics and Perfumery (2)	AEC:2, VEC:2, IKS:2		22	**UG** **Certificate 44**
	R:_____B									

	II	2+2=4 Cytogenetics, Ecology and Environment Conservation (2) Practical 2 (2)		-	2	VSC:2, SEC:2 Flower Arrangement (2) Bonsai Art (2) Plant Propagation practices (2) Marine Botany (2) **SEC: Any One** Field Survey (2) Organic Farming (2)	AEC:2,	CC:2	22	
	Cum Cr.	8	-	-	2	4+4	4+2+2	2	44	
Exit option: Award of UG Certificate in Major with 40-44 credits and an additional 4 credit score NSQF course / Internship OR Continue with Major and Minor										

Undergraduate Diploma in Botany

Credit Structure (Sem. III & IV)

	R:_____C									
Level	**Semester**	**Major**		**Minor**	**OE**	**VSC, SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP,CEP, CC,RP**	**Cum.Cr. / Sem.**	**Degree/Cum.Cr.**
		Mandatory	**Electives**							
5.0	III Plant Diversity and Human Welfare I (2) Forms and Functions in Plant Science I (2) Practical 3 (2) Practical4 (2)	8		4	2	VSC:2, **Any One** Food Preservation (Drying) (2) Food Preservation (Sugar concentrates) (2) Flowers & Floral Remedies (2) Garden Designing (2)	AEC: 2	FP: 2CC:2	22	**UG Diploma 88**
	R:_____D									
	IV Plant Diversity and Human Welfare II (2) Forms and Functions in Plant Science II (2) Practical 5 (2) Practical 6 (2)	8		4	2	SEC	AEC:2	CEP: 2CC:2	22	
		20		16	8	6+6	8+4+2	8+4	88	
Exit option: Award of UG Diploma in Major and Minor with 80-88 credits and an additional 4 credit score NSQF course / Internship OR Continue with Major and Minor										

B.Sc. (Botany)

Credit Structure (Sem. V & VI)

	R:_____E									
Level	**Semester**	**Major**		**Minor**	**OE**	**VSC, SEC (VSEC)**	**AEC, VEC, IKS**	**OJT, FP, CEP, CC, RP**	**Cum. Cr. / Sem.**	**Degree/ Cum. Cr.**
		Mandatory	**Electives**							
5.5	V Recent Advances in Botany I (2) Applied Botany I (2) IKS- Ethnobotany /Ayurveda (2) Practical 7 (2) Practical 8 (2)	10	4	4		VSC:2 **VSC: Any One** Tree Identification and Vegetation Mapping (2) Scientific Writing in Plant Sciences (2) Forensic Botany (2) Clinical Research: A Botanical Perspective (2)		FP/CEP:2	22	**UG Degree132**
	R:_____F									
	Recent Advances in Botany II (2) Applied Botany II (2) Biostatistic, Economic Botany, and Phytogeography (2) Practical 9 (2) Practical10 (2)	10	4	4				OJT:4	22	
	Cum Cr.	48	8	18	12	8+6	8+4+2	8+6+4	132	
Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor										

[Abbreviation - OE – Open Electives, VSC – Vocational Skill Course, SEC – Skill Enhancement Course, (VSEC), AEC – Ability Enhancement Course, VEC – Value Education Course, IKS – Indian Knowledge System, OJT – on Job Training, FP – Field Project, CEP – Continuing Education Program, CC – Co-Curricular, RP – Research Project]

F.Y.B.Sc. Botany (USBT) Course Structure
Semester I

Ladder	Course Type	Title	Credits	Hours	Marks
Major	Theory	Plant Science and Human Welfare	2	30	50
Major	Practical	Practical - I	2	60	50
VSC	Practical	Entrepreneurial Botany	2	60	50
		OR			
VSC	Practical	Indoor Gardening	2	60	50
		OR			
VSC	Practical	Gardening and Management	2	60	50
		OR			
VSC	Practical	Ayurvedic Aahar	2	60	50
SEC	Practical	Tools and Techniques in Plant Sciences	2	60	50
		OR			
SEC	Practical	Aromatics and Perfumery	2	60	50

Semester II

Ladder	Course Type	Title	Credits	Hours	Marks
Major	Theory	Cytogenetics, Ecology and Environment Conservation	2	30	50
Major	Practical	Practical- II	2	60	50
VSC	Practical	Flower Arrangement	2	60	50
		OR			
VSC	Practical	Bonsai Art	2	60	50
		OR			
VSC	Practical	Plant Propagation Practices	2	60	50
		OR			
VSC	Practical	Marine Botany	2	60	50
SEC	Practical	Field Survey	2	60	50
		OR			
SEC	Practical	Organic Farming	2	60	50

Sem. – I

Syllabus
B.Sc. (Botany)
(Sem.- I)

Course Objectives (CO): To enable the students

CO 1.: Recognize different plant types

CO 2.: Understand the concept of plant communication, plant defense mechanism, and Aesthetic Botany.

CO 3.: Comprehend the role of plants in providing food, significance of microgreens, plant-derived beverages like tea, coffee, and squash.

CO 4.: Explore the diverse applications of plants in everyday products, traditional uses of plants in cultural practices.

CO 5.: Acquire the knowledge of hydroponics and aeroponics, vertical gardening, S*pirulina* farming

Course Outcomes (OC): The learner will be able to

OC 1.: Differentiate plant types.

OC 2.: Describe the concept of plant communication, plant defense mechanism, an Aesthetic Botany.

OC 3.: Explain the role of plants in providing food, the significance of microgreens, and plant-derived beverages like tea, coffee, and squash.

OC 4.: Utilize plants in everyday products, and traditional cultural practices.

OC 5.: Illustrate the techniques of hydroponics and aeroponics, vertical gardening, and S*pirulina* farming.

Course I (Mandatory)

Name of the Course: Plant Science and Human Welfare Credits: 2

Module-1: Plant Science (15 Lectures)

1. Biodiversity and Significance of Plants 5 Lectures

1.1.1. General classification of plants.
1.1.2. Various plants types: Herb, Shrub, Tree, Climbers, Creepers.
1.1.3. Botanical marvels: Pitcher plant (*Nepenthes*), Sun dew (*Drosera*), Touch-me-not (*Mimosa*), *Rafflesia*, *Cuscuta*

2. Interesting Facts about plants: 5 Lectures

1.2.1. Do plants talk? (Communication in plants)
1.2.2. Plant movements (example- flower, tendrils etc.)
1.2.3. Plant Defense and mimicry.

3. Aesthetic and Traditional Aspects of Plants 5 Lectures

1.3.1. Aesthetic Botany: Concept, Significance
1.3.2. Gardens and landscapes (Indoor gardening, Terrace and gallery gardening)
1.3.3. Traditional practices involving plants (Example- Banana leaves, coconut, Rice etc.)

Module-2: Plants in Human Welfare (15 Lectures)

1. Plants as Food 5 Lectures

2.1.1. Plants as Food (Root, stem, leaves, tuber, corm, flower, rhizome, fruit, seed used as food with one example)
2.1.2. Microgreens (Fenugreek, Wheatgrass etc.)
2.1.3. Plant derived beverages (Tea, Coffee and Squash)

2. Plants in Daily Life 5 Lectures

2.2.1. Plants used for cosmetics, perfumes, ecofriendly colours, fabrics, soap, shampoo, toothpaste.
2.2.2. Plants used in sports and musical instruments, building infrastructure, furniture, writing- drawing.
2.2.3. Importance of Medicinal Plants - Amla, Brahmi, Chakramuni (Multivitamin plant) and Stevia (Madhuparni).

3. Next Generation Plant Cultivation 5 Lectures

2.3.1. Hydroponics and Aeroponics
2.3.2. Vertical gardening
2.3.3. *Spirulina* farming

Reference books:

1. “Botany for the Future” by Peter H. Raven
2. “Medicinal Plants: A Comprehensive Guide” by S. K. Jain
3. “Plant Physiology” by Lincoln Taiz and Eduardo Zeiger
4. “The Physiology of Flowering Plants: Their Growth and Development” by Roger F. E. Schumacher –
5. “Edible Medicinal and Non-Medicinal Plants: Volume 1, Fruits” by T. K. Lim
6. “Landscaping principles and practices” by Jack E. Ingels
7. "Hydroponics: The Essential Hydroponics Guide: A Step-By-Step Hydroponic Gardening Guide to Grow Fruit, Vegetables, and Herbs at Home" by Andy Jacobson
8. "Vertical Gardening for Beginners: Ideas for Growing Beautiful Space-Saving Gardens Indoors and Outdoors" by Julie Ruth
9. "*Spirulina* in Human Nutrition and Health" by M. E. Gershwin and Amha Belay

Internal Continuous Assessment: 40% (20 marks) Field report, Assignments, Presentation and Quiz	**Semester End Examination: 60% (30 marks)** Any 2 questions out of 4 (15 marks each)

Course II

Name of the Course: Practical- I (Mandatory) **Credits: 2**

Semester I

Microscopy

- Handling of compound microscope and Dissecting microscope

Cryptogamic Botany

- Study of vegetative and reproductive structures of *Zygnema*.
- Study of vegetative and reproductive structures of *Rhizopus.*
- Study of vegetative and reproductive structures of *Riccia*.

Introduction to microbial techniques

- Gram staining of Bacteria.
- Aseptic techniques, preparation of media (PDA, NA), preparation of plates and slants. (Demonstration)

Medicinal Botany

- Grandma's Pouch: Botanical name, common name, family, constituents, biological source and uses of: Tulsi, Ginger, Adulsa and Clove.

Entrepreneurship skills

- Prepare Face mask, Gel, Lotion using botanicals.
- Mushroom cultivation (Demonstration).

Nature Exploration and Digital skills (Internal assignments ANY ONE)

- Field Visit: Exploration of Natural Biodiversity
- Blog writing on Field visits.
- Digital photography.
- Short film on Nature and Biodiversity.

Reference Books

1. College Botany Volume I and II Gangulee, Das and Dutta (latest edition).
2. Cryptogamic Botany Volume I and II by G M Smith McGraw Hill.

Vocational Skill Courses

Name of the Course: Entrepreneurial Botany 60 Hours Credits:02

Course Objectives (CO):

CO 1. To enable the students, learn the different algal and fungal cultivation practices.

CO 2. To enable the students, develop the skills of designing and carving of natural material.

CO 3. To enable the students, understand the making of aroma candles and incense sticks.

CO 4. To enable the students, comprehend the process of preparing herbal teas, natural dyes, organic pesticides, and composting.

CO 5. To enable the students, prepare business plan, marketing strategies and branding products.

Course Outcomes (OC): Learner will be able to

OC 1. Practice the different algal and fungal cultivation practices.

OC 2. Develop the skills of designing and carving of natural material.

OC 3. Understand the making of aroma candles and incense sticks.

OC4. Comprehend the process of preparing herbal teas, natural dyes, organic pesticides, and composting.

OC 5. Prepare business plan, marketing strategies and branding products.

List of Practicals:

1. To study the process of Mushroom Cultivation.
2. To study the techniques of Spirulina Farming.
3. Designing of jewellery using natural material. (Bio jewellery)
4. Vegetable and Fruit Carving techniques.
5. Preparation of Jam, Jelly, Squash.
6. Preparation of ketchup, Pickles, Candies.
7. To study the technique of Resin Art using plant material.
8. Making of Aroma candles.
9. Making of incense sticks.
10. Making of eco-friendly articles.
11. To study the technique of growing Microgreens.
12. Preparation of Herbal teas.
13. Preparation of Natural Dyes.
14. Preparation of organic pesticides.
15. To study the process of Composting.
16. Preparation of Business Plan.
17. Drafting of Marketing strategies.
18. Product Branding.

Reference Books

1. Post-harvest management of horticultural crops, -Saraswathy S.- Agrobios Publication
2. Bhutani RC. 2003. Fruit and Vegetable Preservation. Biotech Books.
3. Ranganna S. 1997. Hand Book of Analysis and Quality Control for Fruit and Vegetable Products. Tata McGraw-Hill.
4. Fruit and Vegetable Preservation: Principles and Practices" –Dr. R. P. Shrivastava and Dr. Sanjeev Kumar, IBDC, New Delhi.
5. A Hand book on Post Harvest Management of fruits and vegetables: P. Jacob John: Day publishing House Delhi.
6. Post harvest Technology of Fruits and Vegetables Handling, Processing, Fermentation and Waste management Vol.1&2 L. R. Verma and V. K. Joshi. Indus publishing company, New Delhi.
7. Handbook of Mushrooms: Nita Bahl.

8. Borkar S, G, and Patil N.M. 2016. Mushroom, A nutritive food and its cultivation. Astral International Pvt. Ltd. New Delhi.
9. Biswas S., Datta M. and Ngachan S.V. (2012) Mushrooms: A Manual for Cultivation, PHI.
10. Selvendran D. (2015) Large Scale Algal Biomass (Spirulina) Production in India. In: D. Das (Ed.) Algal Biorefinery: An Integrated Approach, Springer.
11. Zadrazil F. and Grabbe K. (1983) Edible Mushroom, Biotechnology Vol. 3, Weinheim: Verlag Chemie, Berlin.
12. Mushroom Production and Processing Technology, Pathak Yadav Gour (2010). Published by Agrobios (India).
13. Pandey R.K, S. K Ghosh (1996). A Hand Book on Mushroom Cultivation. Emkey Publications.
14. Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
15. Paul Stamets, J.S. and Chilton, J.S. (2004). Mushroom cultivation A practical guide to growing mushrooms at home, Agarikon Press.
16. Fundamentals of Horticulture (Practical Manual): S.K. Pandey C.S. Pandey: Published by: Dean, College of Agriculture, Jabalpur Jawaharlal Nehru Krishi Vishwavidyalaya Jabalpur, Madhya Pradesh 482004 Tele-fax: 0761- 2681236; web: www.jnkvv.org

Vocational Skill Courses

Name of the Course: Indoor Gardening 60 Hours Credits:02

Course Objectives (CO):

CO 1. To enable students, identify indoor plants, suitable containers, soils and growth media to grow them.

CO 2.To enable students, learn different methods and techniques of potting, repotting of indoor plants.

CO 3. To train students, in care and maintenance of indoor plants.

CO 4. To enable students, control and manage the insect pests affecting indoor plants.

CO 5. To enable students, prepare different types of indoor gardens.

Course Outcomes (OC): Learner will be able to

OC 1. Identify indoor plants, suitable containers, soils and growth media to grow them.

OC 2. Perform different methods and techniques of potting, repotting of indoor plants.

OC 3. Take care and maintain the indoor plants.

OC 4. Control and manage the insect pests affecting indoor plants.

OC 5. Prepare different types of indoor gardens.

List of Practicals:

1. To Study of different Indoor plants: Foliage and flowering plants.
2. To Study of different types of containers and equipments used in indoor gardening.
3. Selection of soil and media for indoor plants.
4. To Study different methods of application of plant growth regulators.
5. Types of accessories used in indoor gardening.
6. Methods of growing indoor plants: Potting.
7. Technique of Repotting of indoor plants.
8. Care and Maintenance of Indoor plants.
9. Insect pest and their control.
10. Preparation of Terrarium/ Bottle Garden.
11. Preparation of Dish Garden.
12. Preparation of kokidama.
13. Techniques of Growing indoor plants in Different Medias. (Soil, Sand, Sphagnum moss etc.)

Reference Books

1. Complete Gardening in India – Gopal Swamiengar
2. Complete Home Gardening – Dey, S.C.
3. Floriculture and Landscaping – Bose, T.K.
4. Floriculture and Landscaping – Deshraj
5. Floriculture in India – Randhawa and Mukhopadhyay
6. Introduction to Landscaping, Designing, Construction and Maintenance – Ronald J. Biondo and Charles B. Schroder
7. Landscape Gardening & Design with Plants – Supriya Kumar Bhattacharjee 8) Landscaping principles and practices – Jack E. Ingels
8. The Art of Home Landscaping. Eckbo, G. 1956.

Vocational Skill Courses

Name of the Course: Gardening and Management **60 Hours Credits:02**

Course Objectives(CO):

CO 1. To enable the students, recognise and use the Horticulture and gardening tools.

CO 2. To enable students, understand the making and caring of Lawns.

CO 3. To enable students, identify suitable horticulture plants for plantation in different seasons, and locations.

CO 4. To enable students, learn different vegetative propagation techniques, irrigation methods, pruning practices and garden management techniques.

CO 5. To enable students, know the common diseases and pests of horticulture plants and use of organic and biopesticides to control them.

Course Outcomes (OC): Learner will be able to

OC 1. Recognise and use the Horticulture and gardening tools.

OC 2. Understand the making and caring of Lawns.

OC 3. Identify suitable horticulture plants for plantation in different seasons, and locations.

OC 4. Perform different vegetative propagation techniques, irrigation methods, pruning practices and garden management techniques.

OC 5. Know the common diseases and pests of horticulture plants and use of organic and biopesticides to control them.

List of Practicals:

1. Introduction to Horticulture and Garden tools.
2. Study of Lawn making and its care (suitable soil for lawns and drainage systems, types of grasses).
3. Identification of suitable horticulture plants for plantation in different seasons (Flowering annuals, vines and climbers, ornamental trees)
4. Identification of suitable horticulture plants for plantation bulbous and foliage plants, cacti and succulents).
5. Identification of suitable horticulture plants for plantation locations (Outdoor, roof-top, balcony, rock gardens, hanging basket).
6. Study of Vegetable Garden (Sowing, raising seedlings, transplantation methods; choosing the right vegetables for the season).
7. Garden management (Weeding, manuring)
8. Irrigation methods used in lawns, parks, and vegetable gardens.
9. Submission of Horticulture plants or hanging basket.
10. Vegetative Propagation techniques by layering.
11. Vegetative Propagation techniques by cutting.
12. Vegetative Propagation techniques by grafting & budding.
13. Pruning Practices: pruning roses, shrubs, and trees.
14. Common diseases and pests of horticulture plants
15. Study of Seed germination, viability tests and storage.
16. Use of organic and biopesticides to control diseases and pests.
17. Field visit to any garden/ park/organisation (Landscape Design) and submission of report.
18. Report writing - Some selected gardens of India.

Reference Books

1. Arora, J.S. 2006. Introductory Ornamental Horticulture. Kalyani Publishers, Ludhiana
2. Bimaldas Chowdhury and Balai Lal Jana. 2014.Flowering Garden trees. Pointer publishers, Jaipur. India.
3. Bose, Chowdhury and Sharma. 1991.Tropical Garden Plants in colour. Horticulture and allied publishers, 3D Madhab
4. Chatterjee street Kolkata. Bose, T.K. Mukherjee, D. 2004. Gardening in India. Oxford& IBH Publishers.
5. Chadha, K.L. and Chaudhary, B. 1986. Ornamental Horticulture in India. Publication and Information division. ICAR, New Delhi.
6. K.V. Peter. 2009.Ornamental plants. New India publishing agency, Pitampura, New Delhi.
7. Randhawa, G.S. Amitabha Mukhopadhyay, 2004. Floriculture in India. Allied Publishers Pvt. Ltd., New Delhi. Richard Bird. 2002.
8. Flowering trees and shrubs. Printed in Singapore by Star Standard Industries Pvt. Ltd.
9. Adriance, G.W. and F.R. Brison, 1000. Propagation of Horticultural Plants. Biotech Books, New Delhi.
10. Chadha, K.L., P. N. Ravindran and Leela Sahijran (Eds) 1000. Biotechnology in Horticulture and Plantation crops. Malhotra Publishing House, New Delhi.
11. Hartmann, H.T. and D.E. Kester, 1975. Plant Propagation: Principles and Practices. Prentice. Hall, New Delhi.
12. Singh, S.P. 1989. Mist Propagation. Metropolitan Book Co., New Delhi.
13. Wright, R C M. 1974. Simple Plant Propagation. Ward Lock, London.
14. Ropwatika sangpoanp: Dr Aba Patil.
15. Ropwatika: Ravindra Katole. Godwa Publication.

Vocational Skill Courses

Name of the Course: Ayurvedic Aahar 60 Hours Credits:02

Course Objectives (CO):

CO 1. To enable students, understand the concept of Tridosha and aahar.

CO2.To enable students, identify the foods with relation to rutuchakra, taste and composition.

CO 3. To enable students, prepare immunity boosting, iron rich nutritious food.

CO 4. To enable students, estimate proteins and vitamins in foods.

CO 5. To enable students, gain knowledge of managing diseases with ayurvedic aahar.

Course Outcomes (OC): Learner will be able to

OC 1. Understand the concept of Tridosha and aahar.

OC 2. Identify the foods with relation to rutuchakra, taste and composition.

OC 3. Prepare immunity boosting, iron rich nutritious food.

OC 4. Estimate proteins and vitamins in foods.

OC 5. Manage diseases with ayurvedic aahar.

List of Practicals:

1. Study of Tridosha concept (Prakriti nidaan)
2. Study of Ahar According to Different Prakriti.
3. Study of sattvic, tamasic and Rajasic foods (any two examples of each)
4. Identification of foods as per rutuchakra
5. Study of food based on six taste (Rasa) (two examples of each).
6. Preparation of Iron rich ayurvedic aahar (Nachani satva, aliv laddu)
7. Preparation of immunity boosting dish (amala palak, amala candy)
8. Making a diet plan to manage diseases (diabetes, constipation) with ayurvedic aahar.
9. Study of Examples of incompatibility/antagonistic (*Viruddha-Aahara*)
10. Estimation of Proteins from plant resources used in ayurvedic aahar (Lowry's method)
11. Estimation of vitamin **C** from fruits. (Amla, Citrus)
12. Study (identification) of Fiber rich vegetables (carrot, sweet potato), leafy vegetables (spinach, fenugreek) and dalia.

13. Preparation of medicated mattha, nachani satva, ambil.
14. Preparation of medicated soup
15. Preparation of nutritious foods (methi ladu, dink ladu, dry fruit ladu, urad daal ladu).
16. Preparation of ayurvedic energy drink.

Reference Books

1. Mukund Sabnis (2012). Viruddha Ahara: A critical view. AYU | Jul-Sep 2012 | Vol 33 | Issue 3.
2. Chetan Ram Meghwal, Vikram singh, Mamta kumara meena, Ashok Kumar Sharma, K. L. Sharma, Rekhrajmeena, Ayushi Nigam. (2023). A Review Study of Food According to Prakriti and Doshas. International Research Journal of Ayurveda & Yoga Vol. 6 (1),56-59.
3. Pradeep Kumar Suryawanshi. Ahara (Ancient Secret of Diet in Ayurveda & Yoga), ChaukhambaSurbharatiPrakashan
4. P.H. Kulkarni. AyurvedicAahar: The Scientific Diet. Sri Satguru Publications
5. Dr. Ganesh Karajkhede. AyurvediyaAharVimarsh. N M Publications.
6. Rastogi S {2014) Ayurvedic Science of Food and Nutrition. ASIN: BOOHWMV094, Springer: ISBN-13:978-1461496274
7. Rastogi S (2010) Building bridges between Ayurveda and modern science. Int J Ayurveda Res. 1(1):41-46.
8. FSSAI regulations on Ayurveda Aahar Regulations 2022. Gazette of India CG-DL-E-07052022-235642. New Delhi, Friday, May 6, 2022/ Vaisakha 16, 1944.
9. Frawley D (2012) Ayurvedic healing: A comprehensive guide. Lotus Press, India. https:/ /iksindia.org/: Indian Knowledge Systems

Skill Enhancement Courses

Name of the Course: Tools and Techniques in Plant Science

60 Hours **Credits:02**

Course Objectives (CO):

CO 1. To enable students, understand the essential laboratory techniques used in plant science.

CO 2. To enable students, identify the foods with relation to rutuchakra, taste and composition.

CO 3. To enable students, prepare immunity boosting, iron rich nutritious food.

CO 4. To enable students, estimate proteins and vitamins in foods.

CO 5. To enable students, gain knowledge of managing diseases with ayurvedic aahar.

Course Outcomes (OC): Learner will be able to

OC 1. Understand the concept of Tridosha and aahar.

OC 2. Identify the foods with relation to rutuchakra, taste and composition.

OC 3. Prepare immunity boosting, iron rich nutritious food.

OC 4. Estimate proteins and vitamins in foods.

OC 5. Manage diseases with ayurvedic aahar.

List of Practicals:

Module 1: Introduction to Laboratory Tools and Instruments

1.1 Study of Basic Laboratory Instruments (Microscope, Colorimeter, Autoclave, Oven, Incubator, Laminar Air Chamber, Tilak Air Sampler)

1.2 Study of stains and staining techniques

Module 2: Microscopy and staining Techniques

2.1 Microslide Preparation—Whole Mounts, Smears, Squashes

2.2 Plant Microtechnique (T.S., L.S., R.L.S., T.L.S.)

Module 3: Separation techniques

3.1 Separation of Amino Acids by Paper Chromatography

3.2 Separation of Sugars by Thin-Layer Chromatography

Module 4: Biochemical analysis

4.1 Qualitative Tests for plant Metabolites (Proteins, Carbohydrates, Alkaloids, Tannins)

4.2 Study and verification of Beer and Lambert's Law

Module 5: Basic Molecular Technique

5.1 Genomic DNA Extraction

Module 6. Soil Analysis Techniques

6.1 Determination of temperature and pH of different Soil Samples

Module 7. Computer Techniques

71. Study of photo micrographic techniques

7.2. Use of computer for preparation of Tables, Graphs and Presentations (MS Office)

Suggested Readings:

1. Plummer, D.T. (1996). *An Introduction to Practical Biochemistry.* Tata McGraw-Hill Publishing Co. Ltd. New Delhi. 3rd edition.
2. Ruzin, S.E. (1999). *Plant Microtechnique and Microscopy,* Oxford University Press, New York, U.S.A.
3. Ausubel, F., Brent, R., Kingston, R. E., Moore, D.D., Seidman, J.G., Smith, J.A., Struhl, K. (1995). *Short Protocols in Molecular Biology.* John Wiley & Sons. 3rd edition.
4. Zar, J.H. (2012). *Biostatistical Analysis.* Pearson Publication. U.S.A. 4th edition.

Note: This course is designed to provide foundational skills in plant science laboratory techniques. The practical assessments and final project are structured to evaluate students' proficiency and understanding, preparing them for potential careers in plant science research and related fields.

Skill Enhancement Courses

Name of the Course: Aromatics and Perfumery

60 Hours **Credits:02**

Course Objectives(CO):

CO 1. To enable students, understand the aromatic plants and their cultivation.

CO 2. To enable students, to Understand the various raw materials for cosmetics and perfumes.

CO 3. To enable students, to develop the various perfumes and cosmetics products.

CO 4. To enable students, to understand essential laboratory techniques for extraction of essential oils.

Course Outcomes (OC): Learner will be able to

OC 1. Understand the basics of cultivation aromatic plants a.

OC 2. Develop perfumes and cosmetics products w.r.t. raw materials, large scale manufacturing.

OC 3. Functional and physiochemical evaluation of essential oils.

OC 4. Learn physical and chemical properties for the classification of essential oils..

OC 5. Learn to develop value added products using essential oil.

List of Practicals:

Module 1. Introduction to Aromatic plants

1.1 Introduction and cultivation of some common aromatic flowering plants (Rose, Jasmine)

1.2 Cultivation practices of aromatic grasses like – Lemongrass, citronella

Module 2. Extraction techniques of essential oil

2.1. Laboratory scale distillation of aromatic plants (hydro distillation and hydro-steam distillation.

2.2. Types of solvents and Laboratory scale solvent extraction by soxhlet apparatus

Module 3. Classification and Analysis of Essential oil.

3.1. Classification of essential oil based on chemical composition

3.2. Physical Properties of oil

3.3. Chemical properties of oil

Module 4. Essentials of perfume making

4.1. Determination of oil content

4.2. Measurements, Dilution Rates & Calculations for perfumes

Module 5. Understanding the Essential Oil Profiles and Odor Profiling

5.1. **Citrus Odor Types** (Grapefruit, Lemon, Sweet Orange)

5.2. Herbal Odor Types (Basil, Peppermint, Rosemary)

5.3. Floral Odor Types (Geranium, Rose)

5.4. Woody Odor Types (Cedarwood, Cypress)

5.5. Spicy Odor Types (Black Pepper, Ginger)

5.6. Earthy Odor Types (Patchouli, Vetiver)

5.7. Camphorous Odor Types (Eucalyptus, Tea Tree)

Module 6. Basic perfume product development

6.1 Preparation of Oil based perfumes

6.2.Preparation of alcohol based perfumes

6.3.Preparation of gel based room and car fresheners using essential oil

Module 7. Value addition using essential oil

7.1. **First Aid Applications with Essential Oils**

7.2. **Essential Oils and Meditation**

7.3. Making of house hold products (Incense sticks, mosquito repellent sticks, dhoops)

Module 8. Field experience and Project

8.1. Field Visit to essential oils and perfumery Institute/Industry.

8.2. Submission of any two products developed by students.

Suggested Readings:

1. Eiri Board. (2008). Handbook of Essential Oils Manufacturing and Aromatic Plants5/E edition, Engineers India Research Institute (India), New Delhi.
2. Kochhar, S.L. (2016). Economic Botany – A Comprehensive Study, 5th Edition. New Delhi, India: Cambridge University Press.
3. Başer, K.H.C., Buchbauer, G. (2020). Handbook of Essential Oils: Science, Technology, and Applications, 3rd edition, CRC Press.
4. Earnest Guenther, "The Essential Oils" vol. I Robert E. Kreiger Publishing Co. Huntington, New York, 1972.
5. M.S. Balsem, S.D. Genshon, M.M. Rieger, E. Sagarin, S.J. Strianase, "Cosmetics, Science and Technology, Vol. I, II and II, Wiley-Interscience, A Division of John Wiley and Sons., Inc., New York, London, Sydney, Toronto, 1972, Ed. By M.S. Balsam and M.S. Sagarin.
6. Paul Z. Bedoukian, "Perfumery and Flavouring Synthetics" II Edn, Elsevier Publishing Co., Amsterdam, London, New York, 1967. 4. J. Stephan Jellinick," Formulation and Functions of Cosmetics", Wiley Interscience, a Division of John Wiley & Sons., Inc.
7. Mareel I. Billot, F.V. Wells," Perfumery Technology" Ellis Harwood Ltd., Halrted Press, a Division of John Wiley & Sons., Inc. New York, London. 1975

Note: This course is designed to provide foundational entrepreneur skills to influence students for small scale start ups. The practical assessments and final project are structured to evaluate students' proficiency and understanding, preparing them for potential careers in Aromatics and Perfumery and related fields.

Sem. – II

Course I (Mandatory)

Name of the Course: Cytogenetics, Ecology and Environment Conservation (2 credits)

Course Objectives (CO):

CO 1. To enable the students, to identify the structure and functions of the Cell and cell organelles in plants.

CO 2. To enable the students to understand the Cell cycle and cell division in plants.

CO 3. To enable the students to apply the biostatistical concepts.

CO 4. To enable the students, to comprehend ecology and environment conservation.

CO 5. To enable the students, to carry out a thorough study of the active constituents of medicinal plants

Course Outcomes (OC): The Learner will be able to

OC 1. Identify the structure and functions of the Cell and cell organelles in plants.

OC 2. Understand the Cell cycle and cell division in plants.

OC 3. Comprehend the biostatistical application.

OC 4. Apply the biostatistical concepts.

OC 5. Carry out a thorough study of the active constituents of medicinal plants with an emphasis on the use of plant-based food as medicine.

Module 1: Cytogenetics	**15 Lectures**
1. Ultrastructure and functions of Cell wall, Plasma membrane **(2 Lectures)**	
2. Ultrastructure and functions of the cell organelles – Chloroplast, Endoplasmic reticulum, Mitochondrion **(2 Lectures)**	
3. Cell cycle, Mitosis in Plant Cells and its significance **(2 Lectures)**	
4. History, Concept and Definition, Genetic Terminologies- Gene, Genome, Allele, Locus, Traits, Genotype, Phenotype, Dominant, Recessive, Co-dominance, Heredity, Inheritance, Variation, Homozygous, Heterozygous, Back Cross and Test Cross. **(1 Lecture)**	
5. Mendelian Genetics - Law of Dominance, Law of Segregation, Law of Independent Assortment, Monohybrid Cross, Dihybrid Cross, Incomplete Dominance and Co-Dominance. **(3 Lectures)**	

6. Multiple alleles and Multiple genes **(2 Lectures)**
7. Gene Interaction – Introduction and definition, Concept of epistatic and non-epistatic interactions. **(3 Lectures)**

Module 2: Ecology and Environment conservation **15 Lectures**

1. Introduction to Ecology: Concept, need and Scope. **(1 Lectures)**
2. Ecosystem - Types of ecosystems (Terrestrial & Aquatic), functions of ecosystem. **(2 Lectures)**
3. Environmental problems and its Impact - Natural & artificial ecological imbalance, climate change (ozone depletion, greenhouse effect). **(3 Lectures)**
4. Environment Health and its management: Waste disposal, water, sanitation & recycling of wastes, Nuclear hazards and human health risks. **(3 Lectures)**
5. Conservation - Introduction, Definition & importance of Conservation, in situ and ex situ conservation. **(6 Lectures)**
    - Ex-situ conservation: botanical gardens and zoological parks, seed bank, gene bank.
    - In-situ conservation: Wildlife sanctuaries, National parks, Biosphere reserves.
    - Ecotourism.

Reference Books:

1. Genetics by Russel. Wesley Longman Inc. publishers.
2. Plant Physiology by Taiz and Zeiger Sinauer Associates Inc. Publishers
3. Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.
4. Cell Biology by De Robertis
5. Biostatistics and Biometry by Parihar and Parihar
6. Introduction to Biostatistics by Pranab Kumar Banerjee

Name of the Course: Practicals - 2 (Mandatory) 60 Hours Credits:02

List of Practicals:

Vascular cryptogams

- Study of vegetative and reproductive structures of *Adiantum*.

Phanerogams

- Study of vegetative and reproductive structures of *Cycas*.
- Morphology of Non-essential whorls-Calyx and Corolla.
- Morphology of Essential whorls. Androecium and Gynoecium.

Cytology

- Study of various stages of mitosis in root tip cells (*Allium*).
- To perform karyotyping on root tip cells of *Allium cepa* to observe and analyse chromosome morphology.

Biostatistics

- Calculation of mean, median and mode, standard deviation.
- Graphical representation of data: Frequency polygon, Histogram, Ogive, Bar diagram, Pie-charts. (Using Excel Sheet)

Ecological Adaptations (Morphology)

- Morphological Adaptations of plants. (Mesophytes, Xerophytes). (Identification)
- Morphological Adaptations of plants. (Hydrophytes, Halophytes, Epiphytes). (Identification)

Nature Conservation

- Field Visit: Exploration of In-Situ / Ex-Situ Conservation Methods in Botany (Visit)
- Collection of seed of wild plants from natural habitat and preparation of Seed bank (Ex-situ) and Seed ball.

Reference Books

1. College Botany Volume I and II Gangulee, Das and Dutta latest edition. Central Education enterprises
2. Cryptogamic Botany Volume I and II by G M Smith McGraw Hill.
3. Taxonomy of Angiosperms by A.V.S.S. Sambamurty
4. Taxonomy of Angiosperms – Taxonomy, Systematic Botany, Economic Botany, Ethnobotany, Saras Publication
5. A Text Book of Botany: Angiosperms by B.P.Pandey
6. Manual of Ethnobotany by S. K. Jain (latest edition)
7. An introduction to Ethnobotany by S. K. Jain and Ashok K. Jain, deep Publications.
8. Herbal Remedies by Urjita Jain.

Vocational Skill Courses

Name of the Course: Flower Arrangement **60 Hours Credits:02**

Course Objectives (CO):

CO 1. To enable students, identify the foliage and cut flowers used in different occasions.

CO 2. To enable students, learn the basic styles and shapes in flower arrangement.

CO 3. To enable students, prepare different flower arrangements.

CO 4. To enable students, study methods of Drying and preservation of flowers.

CO 5. To enable students, select the suitable types of containers and accessories for flower arrangement.

Course Outcomes (OC): Learner will be able to

OC 1. Identify the foliage and cut flowers used in different occasions.

OC 2. Understand the basic styles and shapes in flower arrangement.

OC 3. Prepare different flower arrangements.

OC 4. Perform Drying and preservation of flowers.

OC 5. Select the suitable types of containers and accessories for flower arrangement.

List of Practicals:

1. Identification of cut flowers: flowers on special occasions.
2. Study of different foliage used in flower arrangement.
3. Different types of containers and accessories for flower arrangement.
4. To study basic styles and shapes in flower arrangement.
5. Preparation of various type of garlands, Gajra, Venni etc.
6. Preparation of Rangoli by using various types of flowers.
7. Preparation of various types of bouquets.
8. Japanese style of flower arrangement: Ikebana, Moribana.
9. To study methods of Drying and preservation of flowers.
10. Dry flower arrangement.
11. Preparation of pot pourrie.
12. Preparation of Greeting card /Book mark using dry flower arrangement.
13. Arrangement of flower for different areas and occasions.
14. Visit to nearby florist / Flower market.
15. Visit / Organise exhibition of cut flowers and floral arrangement.

Reference Books

1. Jean Taylor Creative Flower Arrangements. Random House UK; New edition (27 November 1993)
2. Purnima Shah. Silence Speaks - A book about Japanese flower arrangements (Ikebana). Buddha Bamboo; 1ST edition (2016)
3. Stella Coe. Art of Japanese Flower Arrangement.
4. Fiona Barnett. Flower Arranging: A Complete Guide to Creative Floral Arrangements. Southwater publisher
5. Charlene Tarbox. Creative Haven Beautiful Flower Arrangements Colouring Book. Dover Publications Inc.; Clr Csm edition

Vocational Skill Courses

Name of the Course: Bonsai Art 60 Hours Credits:02

Course Objectives (CO):

CO 1. To enable the students, know different types of containers, tools and accessories used in bonsai.

CO 2. To enable the students, identify suitable plants, soil and media for Bonsai.

CO 3. To enable the students, learn Bonsai management practices and their care techniques.

CO 4. To enable the students, prepare different styles of Bonsai.

CO 5. To enable the students, gain knowledge about Insect pest and diseases and their control.

Course Outcomes (OC): Learner will be able to

OC 1. Select different types of containers, tools and accessories used in bonsai.

OC 2. Identify suitable plants, soil and media for Bonsai.

OC 3. Perform bonsai management practices and their care techniques.

OC 4. Prepare different styles of Bonsai.

OC 5. Deal with Insect pest and diseases and their control.

List of Practicals:

1. Study of Different types of containers used in bonsai.
2. Study of tools and accessories used in Bonsai making.
3. Study of best suitable plants for Bonsai.
4. Selection of soil and media for bonsai
5. Bonsai management practices: Media Potting, Re-Potting and watering.
6. Bonsai care techniques: Pruning, pinching and defoliation.
7. Study of upright (formal styles) in Bonsai.
8. Study of Upright (Informal style) in Bonsai.
9. Preparation of Bonsai: Cascade, Semi-cascade.
10. Preparation of Bonsai: Forest style.
11. Insect pest and diseases and their control.
12. Visit to Bonsai exhibition/Nursery.

Reference Books

1. Dr. N. Mangadevi, Bonsai-Emesco Books publisher

2. Dey.S.C.- Bosnai : An art of miniature plant culture- Ankur publisher
3. Paul Lesniewicz., 1994. Bonsai in your home. Sterling publishing Co, New York.
4. A.B. Patil – Bonsai.
5. Bonsai Vaman vriksha kala- Malti Nagarkar and Vijay Nakgarkar. Continental Publisher.
6. Intermediate Bonsai- Thomas Zane

Vocational Skill Courses

Name of the Course: Plant Propagation Practices

60 Hours Credits:02

Course Objectives (CO):

CO 1. To enable the students, identify garden implements and suitable potting mixture.

CO 2. To train the students, in potting, repotting techniques, and preparation of nursery beds.

CO3. To enable the students, learn methods of seed treatment and application of growth hormones.

CO 4.To enable the students, in the skills of plant propagation.

Course Outcomes (OC): Learner will be able to

OC 1. Identify garden implements and suitable potting mixture.

OC 2. Perform potting, repotting and preparation of nursery beds.

OC 3. Apply methods of seed treatment and application of growth hormones for Plant Propagation.

OC 4. Perform plant propagation practices.

List of Practicals:

1. Study of Garden implements.
2. Preparation of Potting Mixture.
3. Potting & Repotting techniques.
4. Preparation of nursery beds.
5. Methods of Seed Treatment.
6. Application & methods of plant growth regulators.
7. Perform various methods of cutting.
8. Perform various methods of layering.
9. Perform various methods of grafting.
10. Perform various methods of budding.
11. Perform propagation by specialized structure- rhizome, suckers, runners, offset, bulb, corm, tuber, etc.
12. Visit to Plant nursery.

Reference Books

1. Adriance, G.W. and F.R. Brison, 1000. Propagation of Horticultural Plants. Biotech Books, New Delhi.
2. Chadha, K.L., P.N.Ravindran and Leela Sahijran (Eds) 1000. Biotechnology in Horticulture and Plantation crops. Malhotra Publishing House, New Delhi.
3. Hartmann, H.T. and D.E. Kester, 1975. Plant Propagation: Principles and Practices. Prentice. Hall, New Delhi.
4. Singh, S.P. 1989. Mist Propagation. Metropolitan Book Co., New Delhi.
5. Wright, R C M. 1974. Simple Plant Propagation. Ward Lock, London.
6. Ropwatika sangpoanp Dr Aba Patil,
7. Ropwatika: Ravindra Katole. Godwa Publication

Vocational Skill Courses

Name of the Course: Marine Botany 60 Hours Credits:02

Course Objectives (CO):

CO1. To enable students, understand the characteristics features of the marine phytoplanktons and marine fungi.

CO 2. To enable students, study the value-added products and medicinal uses of marine algae.

CO 3. To enable students, identify mangrove plants.

CO4.To enable students, comprehend the characteristic features of Mangroves, mangrove associates and sea grasses.

CO 5. To enable students, realise the ecological importance and medicinal uses of mangroves.

Course Outcomes (OC): Learner will be able to

OC 1. Understand the characteristics features of the marine phytoplanktons and marine fungi.

OC 2. Study the value-added products and medicinal uses of marine algae.

OC 3. Identify mangrove plants.

OC 4. Comprehend the characteristic features of Mangroves, mangrove associates and sea grasses.

OC 5. Realise the ecological importance and medicinal uses of mangroves.

List of Practicals:

1. Study of marine phytoplanktons.
2. Study of characteristic features (Morphological, Photosynthetic pigments, reserve food material) of Chlorophyta (*Enteromorpha, Chaetomorpha, Ulva, Caulerpa*- any two).
3. Study of characteristic features (Morphological, Photosynthetic pigments, reserve food material) of Phaeophyta (Padina*, Dictyota, Sargassum*- any two)
4. Study of characteristic features (Morphological, Photosynthetic pigments, reserve food material) of Rhodophyta (*Gracilaria, Gelidium, Hypnea* - any two).
5. Study of marine fungi.

6. Identification of value-added products from marine algae.
7. Medicinal uses of seaweeds.
8. Identification of mangrove plants.
9. Study of Morphological characteristic features of Mangroves and mangrove associates.
10. Study of characteristic features of sea grasses.
11. Study of sand dune plants (*Ipomea, Suaeda, Derris, Sesuvium*).
12. Study of anatomical features of mangrove plants (Salt gland & pneumatophore).
13. Ecological significances and Medicinal uses of mangroves.
14. Study of pH of soil from mangrove vegetation.

Reference Books

1. Chapman VJ (1976). Coastal Vegetation. 2nd edition.Pergamon Press. New York.
2. Desikachary, T.V. (1975). Marine Plants.N.C.E.R.T. New Delhi.
3. Kumar H.D. Introduction to Phycology.
4. Kumar H. D. and Singh H.N. (1990). Algae Affiliated East West Press Pvt. Ltd. Publ. New Delhi.
5. McConnaughey,B.H. (1974). Introduction to Marine Biology.
6. Ranade,D.R. and Gadre,R.V. (1988). Microbial Aspects of Anaerobic Digestion. Laboratory Manual. M.A.C.S. Pune.
7. Sambamurthy, A.V.S.S. (2005). A Text Book of Algae.
8. Santhanam,R.; Ramnathan, N.; Venkataramanjan, K.and Jegathanam, G.(1987). Phytoplankton of Indian Seas, and Aspects of Marine Botany. Daya Publication Home. Delhi.
9. Sen Neera and Kumudranjan Naskar, (2003). Algal Flora of Sunderbans.
10. Sharma O. P. (1986) A Text Book of Algae Tata McGraw Hill Publication Publications
11. Stein, J.R. (1973). Handbook of Phycological Methods. Cambridge University Press.
12. Trainor, F.R. Introductory Phycology.
13. Vashishta, B.R. (1995). Algae. S. Chand and Co.Ltd. New Delhi
14. B.D. Borse et al. Fresh water and Marine Fungi of India. Lambart Publication.
15. B.D. Borse. Marine fungi of India (Monograph). Broadway Publishing House.

Skill Enhancement Courses

Name of the Course: Field Study Techniques

60 Hours **Credits:02**

Course Objectives (CO):

CO 1. To develop skill among the first-year botany students, focusing on essential field study techniques in botany.

CO 2. To enable students, to Understand basics of biodiversity analysis and measurement

CO 3. To inculcate skills that can pave the way for a promising career in field and environmental botany.

CO 4. To provide hand on training and experiential learning of various aspects of field survey techniques.

Course Outcomes (OC): Learner will be able to

OC 1. Understand vegetation type and analyze vegetation.

OC2. Develop skill useful for forest Mensuration for programs like tree census etc.

OC 3. Understand basic parameters of soil profiling

OC 4. Calculate diversity using Simpson's index and comment on biodiversity status of the studied area.

OC 5. Analyse water samples for hydrobiological assessments

List of Practicals:

Module 1: Field visit and Vegetation Analysis

- Vegetation study by field visit for habit and habitat study
- Study of quadrat Method (List quadrat and Chart quadrat)
- Line and Belt Transect Studies (demonstration)
- Data collection using questionnaires
- Photography technique (Geo tag photographs) and Use of GPS for Field Survey and Plant location

Module 2: Forest Mensuration

- Keys for Identification of trees
- Measurement of Diameter of trees in field
- Measurement of height of trees in field
- Volume measurement of trees

Module 3: Soil analysis

- Soil profiling using pH meter and thermometer

Module 4: Biodiversity Indexing

- Study of Biodiversity by Simpson's Diversity Index

Module 5: Hydrobiological studies

- Collection and Fixing of Plankton Samplings
- Analysis of BOD of water sample
- Analysis of COD of water sample

Suggested Readings:

Bonham, C. D. 1989. Measurements of terrestrial vegetation. John Wiley, New York, New York, USA. 338pp.

Bookhout, T.A. (ed). 1994. Research and management techniques for wildlife and habitats. The Wildlife Society, Bethesda, Maryland. 740 pp.

Standard Methods for the Examination of Water and Wastewater (20th edn). American Public Health Association, Washington DC (1999)

Simpson, E.H. (1949) Measurement of Diversity. Nature, 163, 688.

Krebs, C. H. J. (1989). Ecological methodology Univ. of British Columbia Harper Collins Publisher. PP. 645.

Okpiliya, F. I. (2012). Ecological Diversity Indices: Any Hopefor One Again?. Journal of Environment and Earth Science. Vol.2, (10): 45-52

Forest Management. Directorate of Forests, Government of West Bengal, 2016

John A. Kershaw Jr., Mark J. Ducey, Thomas W. Beers, Bertram Husch (2016). Forest Mensuration. John Wiley & Sons, Ltd.

B. U.S. Environmental Protection Agency. March, 1979. Methods for chemical analysis of water and wastes. EPA-6004-79-020. Environmental Monitoring and Support Laboratory, Office of Research and Development, Cincinnati, OH 45268.

C. Black, C.A. 1965. Methods of soil analysis. Part 2. ASA, 677 Segoe Rd S, Madison, WI 53711

Note: This course emphasizes hands-on learning to equip students with practical skills essential for a successful career in botany. The comprehensive modules cover a wide array of field study techniques, providing a solid foundation for future endeavours in the field.

Skill Enhancement Courses

Name of the Course: Organic Farming

60 Hours **Credits:02**

Course Objectives (CO):

CO 1. To spread knowledge about organic agriculture.

CO 2. To provide information and abilities needed to engage in organic food production and sustainable agriculture.

CO 3. To create awareness about certification process, packaging, and marketing of organic products.

CO 4. To spread idea of an organic ecosystem and educate oneself on biological magnification and its relevance in the modern world.

Course Outcomes (OC): Learner will be able to

OC 1. Get comprehensive knowledge and practical skills in organic farming practices

OC 2. To Understand various methods of organic compost preparation,

OC 3. Acquire skills to control pest and disease using botanicals, natural pesticides.

OC 4. Get hands on training and experiential learning on vermiculture techniques, bio-pesticide application, and sustainable post-harvest management.

.

List of Practicals:

Module 1: Organic Compost Making and analysis

1.1 Aerobic Composting Methods

1.2 Anaerobic Composting Techniques

1.3 Physicochemical properties of compost

Module 2: Green Manures and its application

2.1 Different plants used as green manures and their applications

Module 3: Biofertilizers and bio inoculants

3.1 Different types of biofertilizers and Methods of Biofertilizer Applications

3.2. Types of bioinoculants and their applications

Module 4: Pest and Disease Control using biological methods

4.1 Preparation of Neem Products

4.2 Use of Other Botanicals for Pest and Disease Control (Custard apple seeds/ garlic/ chilli paste/ Tobacco leaves/ Marigold flowers) (**Any two**)

4.3. Preparation of Panchagavya, Jeevamrutam

4.4. Preparation of dashparni extract

Module 5. Field visit and report submission

Suggested Readings:

1. Sharma, Arun K. 2002. A Handbook of Organic Farming. Agrobios, India.
2. Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya Publishers.
3. Alvares, C. 1996. The Organic Farming Source Book. The Other India Press, Mapusa, Goa.
4. Gupta, M., 2004. Organic Agriculture Development in India. ABD publishers, Jaipur, India.
5. S.P. Palaniappan, K. Annadurai, 1999. Organic Farming- Theory and Practice, Scientific Publishers, Jodhpur, India.
6. Dr.Pratiksha Raghuvanoki. Handbook of Organic Farming.
7. Organic Farming: The Ecological System- Agronomy Monograph 54, ASA, USA.
8. Subha Rao, N.S. 200, Soil Microbiology, Oxford & IBH Publishers, New Delhi.
9. Dongarjal R. P. and Zade S.B. 2019. Insect Ecology and Integrated Pest Management, Akinik Publications, New Delhi.
10. 10. Guideline of National Project on Organic Farming, Department of Agriculture and Cooperation, INM Division, Ministry of Agriculture, Govt. of India
11. Dushyent Gehlot. 2005. Organic Farming- standards, accreditation, certification and inspection. Agribios, India.

Note: This course is meticulously designed to instil practical skills and knowledge in sustainable agriculture and organic farming. The emphasis on hands-on experience, coupled with theoretical insights, aims to empower students to consider a bright career in the field of sustainable agriculture. The final project encourages students to apply their learning to develop a business proposal in the realm of organic farming.

QUESTION PAPER PATTERN
(External and Internal)

Format of Question Paper: External Theory (Mandatory) 30 marks **Time:- 1 hr 30 minutes**			
Q. No.	Descriptor	Module	Marks
	Note: • Attempt any two questions out of four questions. • All questions carry equal marks. • Draw neat and labelled diagrams wherever necessary		
Q 1	**Answer the following:**		
A		**1**	**08**
B		**2**	**07**
Q 2	**Answer the following:**		
A		**1**	**08**
B		**2**	**07**
Q 3	**Answer the following:**		
A		**2**	**08**
B		**1**	**07**
Q4	**Answer the following:**		
A		**2**	**08**
B		**1**	**07**

Internal Theory (Mandatory) 20 marks

Continuous Evaluation through:	Quizzes, Class Tests, presentation, project, role play, creative writing, assignment etc. (at least 3)

Practical Internal (Mandatory)20 MARKS	
Continuous Evaluation through:	**Project / Survey /Field Visit/ Industrial Visit etc. - 10 marks** **Report of the same: 5 marks** **Viva: 5 marks**

Practical External (Mandatory)
Time: - 3 hr 30 min

	Format of Practical Question Paper:30 MARKS	
Q1		**10 MARKS**
Q2		**10 MARKS**
Q3	**Identification (Two Spots)**	**05 MARKS**
Q3	**Journal**	**05 MARKS**

Note: - PRACTICAL BOOK/JOURNAL

The students are required to perform 75% of the Practical for the journal to be duly certified. The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination.

Practical External (VSC)
Time:- 03hrs

	Format of Practical Question Paper:	30 MARKS
Q1		10 MARKS
Q2		10 MARKS
Q3	Identification (Two Spots)	05 MARKS
Q3	Journal	05 MARKS

Practical Internal (VSC) 20 Marks

Continuous Evaluation through:	Visit report /Skill development Report	05 MARKS
	Project / Product Prototype Submission	10 MARKS
	Viva-voce	05 MARKS

Letter Grades and Grade Points:

Semester GPA/ Programme CGPA Semester/ Programme	% of Marks	Alpha-Sign/ Letter Grade Result	Grading Point
9.00 - 10.00	90.0 - 100	O (Outstanding)	10
8.00 - < 9.00	80.0 - < 90.0	A+ (Excellent)	9
7.00 - < 8.00	70.0 - < 80.0	A (Very Good)	8
6.00 - < 7.00	60.0 - < 70.0	B+ (Good)	7
5.50 - < 6.00	55.0 - < 60.0	B (Above Average)	6
5.00 - < 5.50	50.0 - < 55.0	C (Average)	5
4.00 - < 5.00	40.0 - < 50.0	P (Pass)	4
Below 4.00	Below 40.0	F (Fail)	0
Ab (Absent)	-	Ab (Absent)	0

Signature of the Team

S. No	Name	Signature
1.	Dr. Vasant P. Mali	
2.	Dr. Uttam L. Dethe	
3.	Dr. D. Meena S. Rao	
4.	Dr. Laxmishree S. Chengala	
5.	Dr. Mandakini R. Ingle	
6.	Dr. Suraj Gajbhiye	
7.	Dr. Vijay Chavan	
8.	Dr. Rohan Gavankar	
9.	Dr. Smita Jadhav	
10.	Mrs. Neha Sawant	
11.	Dr. Rafi Ahmed	
12.	Dr. Devangi Chachad	
13.	Dr. Mona Kejriwal	
14.	Dr. Nivas Joshi	
15.	Dr. Lakshmi Girish	
16.	Dr. Deepa Verma	
17.	Dr. Janhavi Arekar	
18.	Dr. Moinuddin Vakil	
19,	Dr. Pratap Naikwade	
20.	Dr. Asmita Raut	
21.	Dr. Kalpit Mhatre	
22.	Dr. Poonam Panaskar	
23	Mr. Jitendra Patil	

Appendix B

Justification for B.Sc. (Botany)

1.	Necessity for starting the course:	**Botany is the foundation of life. It is interdisciplinary and practical based. It enables students to address the future prospects with scientific mindset.**
2.	Whether the UGC has recommended the course:	**Yes**
3.	Whether all the courses have commenced from the academic year 2024-25	**The course has already commenced at the University and for academic year 2024-25 it is restructured under NEP 2020.**
4.	The courses started by the University are self-financed, whether adequate number of eligible permanent faculties are available?	**This course is aided / self financed based on the sanction given by University of Mumbai to affiliated colleges from time to time.**
5.	To give details regarding the duration of the Course and is it possible to compress the course?:	**1 year** **Not Possible to Compress**
6.	The intake capacity of each course and no. of admissions given in the current academic year:	**The intake capacity is variable from College to College based on the sanctions received from the University of Mumbai.**
7.	Opportunities of Employability / Employment available after undertaking these courses:	**Employability, Self employment**

Sign of the BOS Chairman **Dr. Vasant P. Mali** **BOS in Botany**	**Sign of the Offg. Associate Dean** **Dr. Madhav R. Rajwade** **Faculty of Science & Technology**	**Sign of the Offg. Dean** **Prof. Shivram S. Garje** **Faculty of Science & Technology**