Academic Council Meeting No. and Date : 8 / September 04, 2023 Agenda Number : 2 Resolution Number : 34, 35 / 2.6, 2.27

Vidya Prasarak Mandal's
B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme Code : BUBO
Programme : Bachelor of Science

Specific Programme : Botany

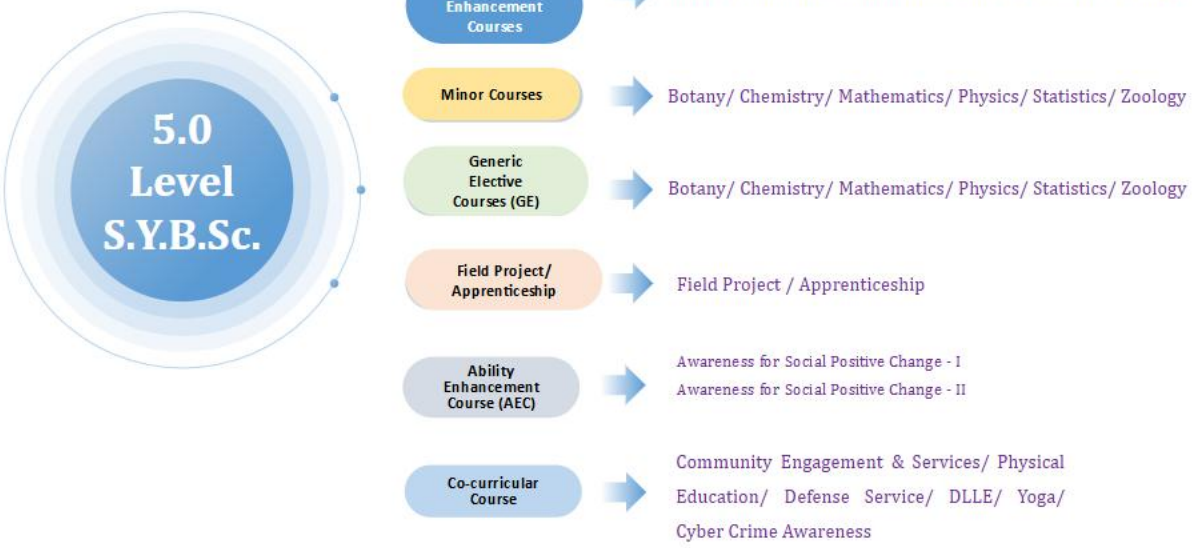
(Major/Minor/Generic)

[S.Y.B.Sc. Botany]
Level 5.0

CHOICE BASED GRADING SYSTEM

Revised under NEP
From academic year 2024 - 2025

Structure of B.Sc. for all Aided Programmes



Preamble: The National Education Policy (NEP) 2020, unveiled by the Government of India, marks a significant paradigm shift in the country's educational landscape. Emphasizing holistic development and a student-centric approach, NEP 2020 aims to revolutionize the education system to meet the evolving needs of the 21st century. With its focus on early childhood care, universalization of education, and technology integration, NEP 2020 envisions an inclusive and equitable education ecosystem that fosters critical thinking, creativity, and innovation. By promoting multidisciplinary learning, vocational education, and flexible curriculum frameworks, NEP 2020 seeks to empower learners with the skills and knowledge necessary to thrive in a rapidly changing world. Furthermore, the policy lays a strong emphasis on teacher training, professional development, and accountability, recognizing educators as the cornerstone of educational reform. As India charts a new course in education with NEP 2020, it aspires to create a generation of empowered and enlightened citizens capable of driving social, economic, and cultural progress.

In the verdant landscapes of Thane, the midst of the bustling metropolis, Vidya Prasarak Mandal (VPM) stands as a bastion of educational enlightenment, a testament to the enduring legacy of Dr. V. N. Bedekar and the indomitable spirit of its founding members. Established in 1935 with a humble vision, VPM has since burgeoned into a sprawling educational conglomerate, catering to the scholastic needs of over 15,000 students across diverse disciplines, from kindergarten to post-graduation. Guided by Dr. V. N. Bedekar's visionary zeal and his son Dr. Vijay Bedekar, VPM has remained steadfast in its commitment to academic excellence and societal progress., Dr. V. N. Bedekar envisaged the creation of an "Island of Knowledge" in Thane, a sanctuary where the flames of learning would illuminate minds and ignite the torch of enlightenment. Within this hallowed institution, the Department of Botany took root in June 1969, with a singular mission to provide quality education to the rural youth and cultivate a deep appreciation for the wonders of the botanical realm. At the heart of the department's pedagogical philosophy lies a commitment to holistic education, characterized by a blend of theoretical rigor and practical application. The Bachelor of Science (B.Sc.) program in Botany, a cornerstone of the department's offerings, epitomizes this ethos, offering students a comprehensive curriculum that spans the breadth and depth of plant sciences.

Structured across six-month semesters, the B.Sc. program encompasses various subjects, including Bryology, Pteridology, Plant Physiology, and Molecular Biology, among others. Embracing an outcome-based approach, the curriculum is designed to equip students with technical proficiency, critical thinking skills, creativity, and a spirit of inquiry. Its unwavering commitment to research and innovation is central to the department's ethos. Encouraged to undertake projects, seminars, and field studies, students are provided with a fertile ground to explore their intellectual curiosity and contribute to the advancement of botanical knowledge. Through state-of-the-art research labs, instrumentation facilities, and computer labs equipped with GIS software, students are empowered to engage in cutting-edge research and address pressing environmental challenges.

Beyond the confines of the classroom, the department fosters a culture of experiential learning, organizing industry visits, internships, and guest lectures by eminent scholars and practitioners. These initiatives not only enrich the academic experience but also provide students with real-world insights and practical skills essential for success in their chosen careers. As graduates of the B.Sc. program in Botany, students are poised to embark on diverse educational and career pathways, ranging from advanced studies in plant sciences to research, government service, and entrepreneurship. Armed with a deep understanding of botanical principles and a passion for environmental stewardship, our alumni emerge as catalysts for change, driving innovation and sustainable development in their respective fields.

Prof.Dr. V.M.Jamdhade
Chairperson, Bos Botany
VPM's B.N.Bandodkar College of Science (Autonomous), Thane

PROGRAMME OUTCOMES (POs) OF BACHELOR OF SCIENCE (B.Sc.)

The Undergraduate Programmes of Science are intended to cater quality education and attain holistic development of learners through the following programme outcomes: **PO1 - Disciplinary Knowledge**

Lay a strong foundation of conceptual learning in science. Instil ability to apply science in professional, social and personal life.

PO2 - Inculcation of Research Aptitude

Ignite spirit of inquiry, critical thinking, analytical skills and problem-solving approach which will help learners to grasp concepts related to research methodology and execute budding research ideas.

PO3 - Digital Literacy

Enhance ability to access, select and use a variety of relevant information e-resources for curricular, co-curricular and extracurricular learning processes.

PO4 - Sensitization towards Environment

Build a cohesive bond with nature by respecting natural resources, encouraging eco-friendly practices and creating awareness about sustainable development.

PO5 - Individuality and Teamwork

Encourage learners to work independently or in collaboration for achieving effective results through practical experiments, project work and research activities.

PO6 - Social and Ethical Awareness

Foster ethical principles which will help in developing rational thinking and becoming socially aware citizens. Build an attitude of unbiased, truthful actions and avoid unethical behaviour in all aspects of life.

Eligibility: Passed FYBSc. Botany (Major/Minor)
Degree Programme: B.Sc.
Level: 5.0
Duration: 3 years (Syllabus for Second Year semester III & IV)
Mode of Conduct: Offline lectures / online lectures.
Discipline/Subject: Botany
Specific Programme: B.Sc. BOTANY
Qualification Title: UG certificate

Discipline/Subject: BOTANY

Program Specific Outcomes

1.	To illustrate skills of identification and classification of different plants and gain a comprehensive understanding about their diversity, structure, function, ecology and economic or therapeutic importance.	L1
2.	To apply botanical knowledge and techniques to solve practical problems in areas such as plant identification, cultivation, conservation, and ecosystem management.	L2
3.	To develop laboratory techniques, critical thinking, scientific reasoning, and analytical and entrepreneur skills through practical sessions.	L3

4.	To critically assess plant-related data and research findings to address challenges in agriculture, forestry, pharmaceutical industry and environmental conservation.	L4
5.	To design and conduct experiments in plant sciences, including tissue culture, genetic studies, and ecological surveys, to generate innovative solutions.	L5
6.	To build a strong foundation to pursue higher studies in botany and related disciplines or enter professional fields such as teaching, research, horticulture, environmental management or industry.	L6

Specific Programme: S.Y.B.Sc. (Botany -Major/ Minor)

Assessment: Weightage for assessments (in percentage) For Major and Minor

Type of Course	Formative Assessment / IA	Summative Assessment
Theory	40%	60%

Curriculum Structure for the Undergraduate degree Programme S.Y.B.Sc Botany

	SEMESTER – III		
Course Code	**Major Course Title**	**No. of Lectures in hrs**	**Credits**
24BUBO3T01	A Plant Diversity Odyssey	30	2
24BUBO3T02	Bridging Botanical Frontiers	30	2
24BUBO3T03	Botanical Wonders	30	2
24BUBO3P01	Practicals based on 24BUBO3T01 and 24BUBO3T02	60	2
24BUBO3P02	Practicals based on 24BUBO3T02 and 24BUBO3T03	60	2
24BUBO3P03	Field Project	60	2
	Total	**270**	**12**
Course Code	**Minor Course Title**		
24BUBO3T04	Green Wealth: Anatomy and Ecology	30	2
	Total	**30**	**2**
Course Code	**Generic - Course Title**		
24BUBO3T05	Plant world : Eco Horticulture	30	2
	Total	**30**	**2**
	Vocational Skill Enhancement Course		
24BU3VSE01	The Journey of Spices	45	2
	Total	**45**	**2**

	SEMESTER – IV		
Course Code	**Major Course Title**	**No of Lectures in hrs**	**Credits**
24BUBO4T01	A Plant Kingdom Journey	30	2
24BUBO4T02	Bridging Botanical Frontiers	30	2
24BUBO4T03	Botanical Explorations	30	2
24BUBO4P01	Practicals based on 24BUBO4T01 and 24BUBO4T02	60	2
24BUBO4P02	Practicals based on 24BUBO4T02 and 24BUBO4T03	60	2
24BUBO4P03	Field Project	60	2
	Total	**270**	**12**
Course Code	**Minor Course Title**		
24BUBO4T04	Biostatistics and Green Spaces	30	2
	Total	**30**	**2**
Course Code	**Generic Course Title**		
24BUBO4T05	Herbal Cosmetics, Biostatistics and Genetics	30	2
	Total	**30**	**2**
	Vocational Skill Enhancement Course		
24BU4SEC01	Horticulture and Gardening-II	45	2
	Total	**45**	**2**

Semester - III

MAJOR COURSE CODE: 24BUBO3T01	(02 Credits)	No of lecture in Hrs. 30

A Plant Diversity Odyssey

COURSE OUTCOME		
Students will be wanted to learn OR on completion of this course, students will be able to learn:		
CO1	Define and explain the objectives, scope, and importance of Phycology, highlighting the contributions of Dr. P. V. Subba Rao and significant research journals and also Analyze the general characteristics, distribution, and life cycle of Division Phaeophyta, with a focus on the systematic position of *Sargassum*.	L1 L4
CO2	Assess the economic significance of algae in food and oxygen production, skincare, cosmetology, and algal farming and evaluate the impact of algal blooms and their role in sustainability initiatives such as the Net Zero Hour.	L5
CO3	Explain the aim, objective, research journals, classification of Bryophytes, ecological roles and economic importance of Bryophytes, life cycle of *Anthoceros,* bryophytes conservation, green dating and contribution of Dr. R. N. Chopra.	L3
CO4	Apply knowledge of palynology in industries such as honey production, coal and oil exploration and forensic science, while also understanding the contribution of Prof.P.K.K. Nair in palynology and the role of institutions like AARC, NCMRWF, and IITM.	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	0	0	0	0
CO 2	0	1	0	0	0	0
CO 3	0	0	0	2	0	2
CO4	0	0	0	1	1	1

Unit	Description	No. of Hours.

I	**Phycology** Definition, objective, scope, pioneer worker (Dr. P. V. Subba Rao), and research journal. General characters of Division Phaeophyta, Distribution. Life cycle, the systematic position of *Sargassum.* Economic importance of Algae in food and oxygen production, skincare and cosmetology, algal farming, algal blooms, and Net Zero Hour	**15**

II	**Bryology** Definition, objective, scope, pioneers' workers, research journal in Bryology and Classification of Bryophytes. Key characteristics of mosses, liverworts, and hornworts. Structure, life cycle, and systematic position of ***Anthoceros,*** Green dating, Economic importance of Bryophyta, Dr. R. N. Chopra. Ecology of Bryophytes. Conservation of Bryophytes. **Palynology:** Pollen, Spores, and Palynology. Definition, objective, scope, pioneers' workers, research journal in Palynology.Application of Palynology in honey industry, coal, and oil exploration, forensic science. Prof.P.K.K. Nair. Agro-allergen Research Centre (AARC), National Centre for Medium Range Weather Forecasting (NCMRWF) - Noida Indian Institute of Tropical Meteorology (IITM)-Pune. **Contemporary Issues**: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. **Self-study**: Self Notes preparation using the departmental library, College Library **Pedagogy**: Seminar, Quiz, Debate **Regional Language**: Experiment discussion, doubt session.	

MAJOR COURSE CODE:24BUBO3T02	**(02 Credits)**	**No of lecture in Hrs. 30**
Bridging Botanical Frontiers		
COURSE OUTCOME		
Students will be wanted to learn OR on completion of this course, students will be able to learn:		
CO1	Explain the objectives, scope, significance and fundamental concepts of plant anatomy, defense mechanisms, and plant ecology, key terms like growth rings, periderm, lenticels, tyloses, heartwood, and sapwood. and describe the ecological adaptations	L2
CO2	Distinguish between normal and anomalous secondary growth, vascular bundles and investigate the root-stem transition.	L4

CO3	Apply knowledge to analyze real-world scenarios, such as biodiversity hotspots, invasive species management, ecological adaptation and urban green space**,** the roles of forests, sacred groves, and other ecosystems in maintaining biodiversity and ecological balance.	L3
CO4	Develop strategies for promoting plant-based solutions to environmental challenges, such as air purification, stress reduction through indoor plants, and cultural practices like **Van Mahotsav.** and assess the significance of contributions by pioneer **Dr. Madhav Gadgil**.	L6

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	3	0	0	0	0	0
CO 2	3	0	0	0	0	0
CO 3	0	0	0	3	0	0
CO 4	0	0	0	2	2	2

Unit	**Description**	**No. of Hours.**
I	**Navigating Plant Anatomy** Definition, objective, scope, pioneers' workers, and research journal. Secondary growth, Types of Vascular Bundles, Normal Secondary Growth in Dicotyledonous stem and root, Growth rings, periderm, lenticels, tyloses, heartwood and sapwood **Distribution of Mechanical tissues**. Inflexibility, Incompressibility, Inextensibility, and Shearing stress **Defense Mechanism in Plants**- Definition, objective, scope. Morphology or structural Defence. Physiological Defence, Biochemical Defence. **Anomalous secondary Growth** of *Biognonia.*Root stem transition.(Contribution of Dr. Kamaljit S. Bawa and Dr. B. M. Johri.)	**15**

II	**Plant Ecology.** Definition, objective, scope, pioneers' workers, and research journal in Plant Ecology. Ecological Adaptations: Hydrophytes, Xerophytes, Mesophytes and Epiphytes. Biodiversity Hotspots. Mangrove Forests. Monsoon Forests: The Western Ghats, including parts of the Konkan region. Endemic Flora. Coastal Vegetation. Urban Green Spaces. Wildfires. Contribution of Dr. Madhav Gadgil Roadside Vegetation. "Van Mahotsav, Indoor plants -purifying the air, reducing stress, and improving concentration. Significance of graveyard plants, Invasive Plant Species. Phenology of plants. Plant-animal interaction. Sacred Groves. **Contemporary Issues**: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. **Self-study**: Self Notes preparation using the departmental library, College Library Pedagogy: Seminar, Quiz, Debate **Regional Language**: Experiment discussion, doubt session.	**15**

MAJOR COURSE CODE: 24BUBO3T03	**(02 Credits)**	**No of lecture in Hrs. 30**
Botanical Wonders		
COURSE OUTCOME		
Students will be wanted to learn OR on completion of this course, students will be able to learn:		
CO1	Explain the concept of Pharmacognosy, pharmacopoeias, monographs and types of substitution and adulteration in herbal drugs and the role of pioneer worker of Indian Pharmacognosy.	L2
CO2	Apply knowledge of secondary metabolites in herbal medicine and explain the health benefits of antioxidant foods and herbal teas	L3 & L5
CO3	Illustrate the scope of Economic Botany, Vavilov's concept of centers of origin and analyze the economic significance of fibre, paper, spice, and oil-yielding plants.	L4
CO4	Utilize knowledge of economic plants (in fibre and spice industry and trade), food allergens, energy and memory-boosting foods for physical and mental health.	L3

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping						
	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	2	0	2	0	0	0
CO 2	0	2	0	0	0	0
CO 3	0	2	0	0	2	0
CO 4	0	2	0	0	2	2

Unit	Description	No. of Hours
I	**Pharmacognosy** Pioneers worker (Dr. Chandrakant Kokate, Father of Indian Pharmacognosy) and Research Journal in Pharmacognosy. Introduction to Pharmacognosy and Pharmacopoeia, Concept of Pharmacognosy, Indian Pharmacopoeia, Indian Herbal Pharmacopoeia, Ayurvedic Pharmacopoeia. Concept of Monograph w.r.t example of *Eclipta alba*. Concept and types of Substitution/ Adulteration, Substitute - E.g., Jaipatri and Jaiphal.Adulterant - E.g., Henna (*Lawsonia inermis*) & p-phenylenediamine (PPD). Career opportunities in the Pharmaceutical Industry. Pharmacognosy. **Secondary metabolites:** Nature's Pharmacy. Alkaloids, Terpenoids: Aromatic Powerhouses. Phenolics: Glycosides and Flavonoids: Nature's Color Palette.Popular Herbal Tea Varieties. Health Benefits of Herbal Teas. **Antioxidant foods** - Flax seeds, Chia Seeds, Carrots, Sweet Potatoes, Spinach, Pumpkin, Tomatoes, Watermelon, Pink Grapefruit, Guava.	**15**
II	**Economic Botany** Introduction, Pioneers Worker (Henry Hurd Rusby: The father of economic botany) and Research Journal in Economic Botany. Concept of centers of origin, and their importance concerning Vavilov's work. Economic Botany Fibre-yielding plants (Cotton, Jute), Paper-yielding plants (Eucalyptus, Bamboo), Spice-yielding plants (Cardamom, Clove, Saffron, and black pepper). Current trends in the Marketing of Fibre and Spices. Oil-yielding plants Groundnut, Mustard, and sesame. **Food allergies-**Peanuts, Tree Nuts, Soybean, Wheat, Sesame, Mustard. **Energy-**boosting foods in their diet can help support mental alertness and cognitive function. Memory-boosting foods into a balanced diet, Food helps support mental health**.** **Contemporary Issues:** Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. **Self-study:** Self Notes preparation using the departmental library, College Library	**15**

	Pedagogy: Seminar, Quiz, Debate **Regional Language:** Experiment discussion, doubt session.	

MAJOR COURSE CODE:24BUBO3P01	**(02 Credits)**	**No of lecture in Hrs. 60**

Practicals based on 24BUBO3T01 and 24BUBO3T02

COURSE OUTCOME

Students will able to learn OR on completion of this course, students will be able to learn:

CO 1	Explain the life stages of *Sargassum*, *Chara*, *Anthoceros*	L2
CO 2	Outline the importance Algae in skincare and cosmetology and Ethnic uses of Bryophytes	L2
CO 3	Show various life stages of *Selaginella and Pinus*	L2
CO 4	Summarize the knowledge about Ethnic uses of Pteridophytes and Gymnosperms, concept of ecology of Hydrophytes, Xerophytes, Mesophytes, Epiphytes, Palynology and other life forms through field visits and laboratory techniques.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	3	0	0	0	3	0
CO 2	0	2	0	0	2	0
CO 3	2	0	0	0	2	0
CO 4	0	2	0	0	2	2

	Name of the experiment
I	**Algae**
1.	Study stages in ***Sargassum and Chara*** life cycle from fresh/ preserved material and permanent slides and uses.
2.	Algae in skincare and cosmetology- Diatomaceous earth, *Laminaria* (Kelp)

II	**Bryophyta**
3.	Study stages in the life cycle of ***Anthoceros*** from fresh/ preserved material.
4.	Ethnic uses of Bryophytes
III	**Pteridophyta**
5.	Life Cycle of ***Selaginella*** **and** ***Salvinia***
6.	Ethnic uses of Pteridophyta
IV	**Gymnosperms**
7.	Life Cycle of ***Pinus***
8.	Ethnic uses Gymnosperms
V	**Plant Ecology**: Study of Hydrophytes, Xerophytes, Mesophytes and Epiphytes
VI	**Palynology:** Mounting of Pollen Grains-*Hibiscus* and *Pancratium*

MAJOR COURSE CODE:24BUBO3P02	**(02 Credits)**	**No of lecture in Hrs. 60**
Practicals based on 24BUBO3T02 and 24BUBO3T03		
COURSE OUTCOME		
Students will able to learn OR on completion of this course, students will be able to learn:		
CO 1	Analyze the structure and function of plant cells by studying epidermal cells of Onion or Rheo, and examine stages of meiosis using smear preparation techniques.	L4
CO 2	Interpret the process of normal secondary growth in Dicotyledonous stems and roots, and apply molecular biology techniques to estimate DNA and RNA from plant materials without standard graphs.	L2 and L3

CO 3	Apply the knowledge to determine the sex and evaluate human karyotypes to identify chromosomal abnormalities such as Cri-du-chat, Down's syndrome, Turner's syndrome, and Klinefelter's syndrome, and assess their genetic implications.	L4
CO 4	Investigate and summarize the plant-based therapies and applications through monographs of *Eclipta alba* and *Lawsonia inermis*, herbal cosmetics, economic plants and different experiments performed during the semester.	L2 and L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	2	0	0	0	2	0
CO 2	2	2	0	0	0	0
CO 3	2	2	0	0	2	0
CO 4	2	2	0	0	2	0

	Name of the experiment
I	**Plant Cell Biology.**
1.	Study of the epidermal cell on Onion /Rheo
2.	Smear preparation and examining various stages of meiosis from suitable plant material
II	**Plant anatomy**:
3.	Normal Secondary Growth in Dicotyledonous stem and root
III	**Genetics and Molecular Biology**
4.	Estimation of DNA from plant material (one Std & one Unknown, No Std Graph)
5.	Estimation of RNA from plant material (one Std & one Unknown, No Std Graph)
6.	Study of Karyotype s – Cri-du-chat, Down's, Turners, Klinefelter Syndromes.
7.	Sex Determination as per the theory
IV	**Plant-Based Therapies and Nutrition**

8.	Study of the monograph of *Eclipta alba* w.r.t. Macroscopy, Microscopy, Ash-Extractive values (demonstration), and TLC
9.	Study of *Lawsonia inermis* w.r.t. Macroscopy, Microscopy, Ash-Extractive values (demonstration), and TLC
10.	Preparation of herbal cosmetics (Face pack, De-tanning cream, and Herbal Hair oil)
11.	Study of sources of Fibres, Paper, and Spices plants (as in theory)

MINOR COURSE CODE:24BUBO3T04	**(02 Credits)**	**No of lecture in Hrs. 30**

Green Wealth: Anatomy and Ecology

COURSE OUTCOME

Students will able to learn OR on completion of this course, students will be able to learn:

CO1	Outline the concept of plant ecology and ecological adaptations in Hydrophytes, Xerophytes, Mesophytes, Epiphytes, Biodiversity, Hotspots, Mangrove Forests, Monsoon Forests, Wildfires	L2
CO2	Evaluate the importance of The Western Ghat, Endemic Flora, Coastal Vegetation, Urban Green Spaces, Indoor plants, Graveyard plants, Phenology of plants, Plant-animal interaction, Sacred Groves, Defence mechanism in plants and Contribution of Dr. Madhav Gadgil	L4
CO3	Appraise the work of pioneer workers in the field of economic botany, introduction to centers of origin	L2
CO4	Categories the economically important plants such as Fibre-yielding, Paper-yielding, Spice-yielding, Oil-yielding, indoor plants , Energy-boosting, Memory-boosting and Food allergies	L4

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	2	0	0	2	0	1
CO 2	2	0	0	3	0	1
CO 3	2	0	0	2	0	1
CO 4	0	2	0	2	0	2

Unit	Description	No. of Hours.
I	**Plant Ecology** **Definition**, objective, scope, pioneers' workers, and research journal in Plant Ecology. **Ecological Adaptations**: –Hydrophytes, Xerophytes, Mesophytes and Epiphytes. Biodiversity Hotspots. Mangrove Forests. Monsoon Forests: The Western Ghats, including parts of the Konkan region. Endemic Flora. Coastal Vegetation. Urban Green Spaces. Wildfires. Roadside Vegetation. Van Mahotsav, Indoor plants - purifying the air, reducing stress, and improving concentration.Contribution of Dr. Madhav Gadgil Significance of graveyard plants. Invasive Plant Species. Phenology of plants. Plant-animal interaction. Sacred Groves. **Defense Mechanism in Plants**- Definition, objective, scope. Morphology or structural defense. Physiological defense, Biochemical defense.	**15**
II	**Economic Botany** **Introduction**, Pioneers Worker (Henry Hurd Rusby: The father of economic botany) and Research Journal in Economic Botany. **Concept of centers of origin**, and their importance concerning Vavilov's work. Fibre-yielding plants (Cotton, Jute), Paper-yielding plants (Eucalyptus, Bamboo), and Spice-yielding plants (Cardamom, Clove, Saffron, and black pepper). Current trends in the Marketing of Fibre and Spices. Oil-yielding plants Groundnut, Mustard, and sesame. **Indoor plants** -purifying the air, reducing stress, and improving concentration. **Food allergies**-Peanuts, Tree Nuts, Soybean, Wheat, Sesame, Mustard. **Energy-boosting foods** in their diet can help support mental alertness and cognitive function. **Memory-boosting foods** into a balanced diet, Food helps support mental health Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. Self-study: Self Notes preparation using the departmental library, College Library Pedagogy: Seminar, Quiz, Debate Regional Language: Experiment discussion, doubt session.	**15**

	Generic	
Course code 24BUBO3T05	**(02 Credits)**	**No of lectures in hrs 30**

Plant world : Eco Horticulture

COURSE OUTCOME

Students will able to learn OR on completion of this course, students will be able to learn:

CO 1	Illustrate different types of gardens and designs, landscaping, and garden features, components of gardens	L2
CO 2	Explain the features of specialized gardens, allied branches of horticulture and idea of topiary garden, Aquaponics and Hydroponics. Rooftop Farming and Green Roofs and contribution of Dr. Appasaheb Pawar. , Dr. B. B. Barwale.	L2
CO 3	Outline the concept of plant ecology and ecological adaptations in Hydrophytes, Xerophytes, Mesophytes and Epiphytes, Biodiversity Hotspots, Mangrove Forests, Monsoon Forests, Wildfires	L2
CO 4	Value the importance of The Western Ghat, Endemic Flora, Coastal Vegetation, Urban Green Spaces, Indoor plants, Graveyard plants, Phenology of plants, Plant-animal interaction, Sacred Groves and Contribution of Dr. Madhav Gadgil.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	0	0	2	0	0
CO 2	2	0	0	2	0	0
CO 3	0	0	0	3	2	0
CO 4	0	0	0	3	2	2

Course: Generic

Plant world: Eco Horticulture

Sr. No.	Topics	No. of Lectures

I	**Horticulture and Gardening** Definition, objective, scope, pioneers' workers, and research journal in Horticulture. Different types of Gardening and design. Landscape features: Edges, Hedges, Arches, Pergolas, Avenues, Flower beds, Trellis and Topiary. Indoor plants & indoor gardens- Hydroponics and Bonsai. **Garden features**: Garden pool, waterfall, fountain, rocks, walk, pavements, bridges, lawns, fences, gates, statues, towers, plant-raised beds and containers. **Specialized Gardens**: Aquatic Garden, Rock Garden, Kitchen Garden, Herbal Garden, Mughal Garden, Buddhist Garden, Terrace Garden, Zodiac and Nakshatra Garden. **Allied branches** – Apiculture – Sericulture. Exhibition: aims and objective. Flower show Thane and Mumbai. **Topiary Gardens**: Kamala Nehru Park, Mumbai, Miracle Garden, Dubai, Durbuy Topiary Park, Belgium, Leven's Hall Manor's Garden, England, Columbus Topiary Park, Ohio, USA. Aquaponics and Hydroponics. Rooftop Farming and Green Roofs. Dr. Appasaheb Pawar. Dr. B. B. Barwale: A pioneer in agricultural biotechnology.	**15**
II	**Plant Ecology** Definition, objective, scope, pioneers' workers, and research journal in Plant Ecology. **Ecological Adaptations**: Hydrophytes, Xerophytes, Mesophytes and Epiphytes. Biodiversity Hotspots. Mangrove Forests. Monsoon Forests: The Western Ghats, including parts of the Konkan region. Endemic Flora. Coastal Vegetation. Urban Green Spaces. Wildfires. Contribution of Dr. Madhav Gadgil. Roadside Vegetation. "Van Mahotsav, Indoor plants -purifying the air, reducing stress, and improving concentration. World Environment Day. Significance of graveyard plants. Invasive Plant Species. Phenology of plants. Plant-animal interaction. Sacred Groves. **Contemporary Issues**: Expert lectures, YouTube Videos, Animations,	**15**
	NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. **Self-study**: Self Notes preparation using the departmental library, College Library Pedagogy: Seminar, Quiz, Debate **Regional Language**: Experiment discussion, doubt session.	

COURSE CODE: **24BU3VSE01**	**(02 Credits)**	**No of lecture in Hrs. 45**
The Journey of Spices		
COURSE OUTCOME		

Students will able to learn OR on completion of this course, students will be able to learn:		
CO1	Outline the Indian Culinary Traditions, Historical Significance of Condiments, Importance of Condiments Used in Indian Cooking, Maharashtra Cuisine. Regional Diversity and Influences	L2
CO2	Summarize Traditional Maharashtrian Condiments. Dried powders, Chutneys, Sauces. Peanut Garlic Chutney,Dry Coconut Chutney, Kala Masala and Malvani Masala, Goda Masala, and Kolhapuri Thecha	L2
CO3	List out the importance of Spices, Herbs, and Condiments and culinary uses of Ajwain, Aniseed, Asafoetida, Bay leaf, Cardamom, Cinnamon, Cloves, Coriander seeds, Cumin seeds, Chilli, Fenugreek, Nutmeg, Mustard, Pepper, Poppy Seeds, Turmeric, Curry leaf, Stone flower	L1
CO4	Compile the data of various ways of using Spices, Storage, Usage Tips making of Spice Mix and Masala, Dharampal Gulati	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	0	0	0	2	0
CO 2	2	0	0	0	2	0
CO 3	0	2	0	0	2	0
CO4	0	2	0	0	2	0

Unit	Description	No. of Hours
I	**Introduction to Condiments** Overview of Indian Culinary Traditions. Historical Significance of Condiments in Indian Cooking. Overview of Indian Cuisine. Importance of Condiments Used in Indian Cooking. Overview of Maharashtra Cuisine. Regional Diversity and Influences. Traditional Maharashtrian Condiments. Dried powders, Chutneys, Sauces. Peanut Garlic Chutney (Shengdana Lasun Chutney), Dry Coconut Chutney (Sukka Khobra Chutney) Kala Masala and Malvani Masala, Goda Masala, and Kolhapuri Thecha.	

	The Art of Using Herbs and Spices Importance of Herbs and spices. Spices that are usually used in day-to-day cookery. Spices, Herbs, and Condiments and culinary uses- Ajwain, Aniseed, Asafoetida, Bay leaf, Cardamom, Cinnamon, Cloves, Coriander seeds, Cumin seeds, Chilli, Fenugreek, Nutmeg, Mustard, Pepper, Poppy Seeds, Turmeric, Curry leaf, Stone flower, Various Ways of Using Spices, Storage, and Usage Tips. Spice Mix (Blending of spice) and Masala. Dharampal Gulati, "Spice King of India. Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. Self-study: Self Notes preparation using the departmental library, College Library Pedagogy: Seminar, Quiz, Debate Regional Language: Experiment discussion, doubt session.	**15**

	Name of the experiment
1.	Introduction identification of spices, herbs, and condiments traditional Maharashtra Stone Khalbatta, Ruchana, and Pata
2.	Preparation of Chutney- Onion, Tomato, Coriander, Pudina, Raw Mango, Papaya, Sesame, Jawas, Red Chill, Thecha, Kharda and Curry leaves chutney.
3.	Spices, Herbs, and Condiments and culinary uses- Ajwain, Aniseed, Asafoetida, Bay leaf, Cardamom, Cinnamon, Cloves, Coriander seeds, Cumin seeds, Chilli, Fenugreek, Nutmeg, Mustard, Pepper, Poppy Seeds, Turmeric, Curry leaf, Stone flower,
4.	Peanut Garlic Chutney (Shengdana Lasun Chutney), Dry Coconut Chutney (Sukka Khobra Chutney), Wet Khobra chutney, Brinjal Bharit.
5.	Preparation of Solkadhi, Garlic and Ginger paste, Amchoor, Chai Masala, and Pickle masala. Tomato Purry.Wada Pav Masala, Matki Usal, Peanut Gul Wadi, Rajgira-Gul Laddo, Soups Vegetables, Veg-Pulava, Till Laddo
6.	Bombil Fry (Bombay Duck Fry) Bangda Fry/Veg Cutlet with traditional spices and condiments
7.	Visit to spices and condiments small-scale industry

	References
1	"The Penguin Book of Indian Spices" by Arun Kapil
2	"Indian Spice Magic: Indian Cooking Made Easy with Spices" by Sanjeev Kapoor
3	"Indian Spices and Condiments as Natural Healers" by Dr. S. K. Sharma
4	"The Essential Indian Spices Cookbook" by Sunita Kohli
5	"Indian Spice Kitchen: Essential Ingredients and Over 200 Authentic Recipes" by Monisha Bharadwaj
6	The Indian Cooking Course: Techniques - Masterclasses - Ingredients - 300 Recipes" by Monisha Bharadwaj
7	Masala: Indian Cooking for Modern Living" by Mallika Basu
8	"Savoring Spices and Herbs: Recipe Secrets of Flavor, Aroma, and Color" by Julie Sahni
9	"Economic Botany: Plants in Our World" by B.P. Pandey and S.C. Trivedi
10	"Economic Botany: Principles and Practices" by B.D. Sharma and S. K. Jain

Semester - IV

MAJOR COURSE CODE: 24BUBO4T01	(02 Credits)	No of lecture in Hrs. 30

A Plant Kingdom Journey

COURSE OUTCOME

Students will able to learn OR on completion of this course, students will be able to learn:

CO1	Explain the objectives, scope, and pioneers of plant taxonomy, contribution of Dr. V. D. Vartak. Analyze traditional and modern classification systems, principles of nomenclature, and the role of herbaria and botanical gardens in plant systematics.	L4
CO2	Choose Bentham and Hooker's classification to study vegetative and floral characteristics of selected families. Also outline the economic importance of plants, sacred groves, and the role of taxonomy in human welfare.	L3
CO3	Explain the objectives, scope, of Fungi, Lichens, and Plant Pathology, and contribution of Dr. T. K. Bose and Dr. N. C. Nair. Analyze the general characteristics of Ascomycetes, the life cycle of Xylaria, and the role of mycorrhizal symbiosis, biofertilizers, and biocontrol agents in sustainable agriculture.	L4
CO4	Apply knowledge of plant pathology to identify symptoms, causative organisms, and control measures for plant diseases and also explain the economic and ecological significance of lichens in spices, cosmetics, and urban air pollution monitoring, while assessing the impact of climate change and pollinator decline.Maharashtra's leadership in bio-research and contributions from institutions like NBRI, CRRI, and IISc.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	3	0	0	0	0	0
CO 2	3	0	0	0	0	3
CO 3	2	0	0	2	2	2
CO4	0	2	0	2	2	0

Unit	Description	No. of Hours.

I	**Plant Taxonomy:** Definition, objective, scope, pioneers' workers, and research journal. Angiospermic Classification systems. Introduction to Traditional classification (Bentham & Hooker system; Linnaean system) and Modern classification (Angiosperm Phylogeny Group (APG) system). Objectives and Goal of plant systematics and plant nomenclature. Concept of monomial, binomial and polynomial nomenclature. Principles of International Code of Nomenclature for algae, fungi and plants. Sacred grooves. With the help of Bentham and Hooker's system of Classification for flowering plants study the vegetative, floral characteristics and economic importance of the following families: Capparidaceae, Brassicaceae, Apiaceae, and Palmae. Functions of Herbarium, Inflorescences, Aestivation, Morphology of Fruits, important herbaria, and botanical gardens of the world and India. Plant Taxonomy and Human Welfare. Contribution of Dr.V.D. Vartak in plant taxonomy.	**15**
II	**Mycology**: Definition, objective, scope, pioneers' workers, and research journal. Fungi and Lichen: General characters of Ascomycetes. Structure, life cycle, and systematic position of *Xylaria.* **Biofertilizers and Bio-control Agents**: Maharashtra is a hub for research and development of bio-fertilizers and bio-control agents derived from beneficial microorganisms. Infectious Disease Surveillance and Epidemiology. National Botanical Research Institute (NBRI)-Lucknow, Central Rice Research Institute (CRRI)-Cuttack, Indian Institute of Science (IISC)-Bangalore. Mycorrhizal Symbiosis **Interesting facts** - Bioluminescent fungi - *Armillaria s*ps., *Mycena* sps., **Plant Pathology**, and Lichens: Definition, objective, scope, pioneers' workers, and research journal in Lichen Plant Pathology: Symptoms, causative organism, disease cycle, and control measures. Powdery Mildew, Yellow Vein Mosaic Bhindi, and Citrus canker. Little leaf of Brinjal. **Lichens as spices** – Parmelia and Lichens in cosmetics – Usnea, Predacious fungi. Dr. T. K. Bose and Dr. N. C. Nair. Climate Change Vulnerability, pollinator decline, Urban air pollution. **Contemporary Issues:** Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. **Self-study:** Self Notes preparation using the departmental library, College Library **Pedagogy:** Seminar, Quiz, Debate **Regional Language:** Experiment discussion, doubt session.	**15**

MAJOR COURSE CODE:24BUBO4T02	(02 Credits)	No of lecture in Hrs. 30

Bridging Botanical Frontiers

COURSE OUTCOME

Students will able to learn OR on completion of this course, students will be able to learn:

CO1	Apply theoretical and practical knowledge to describe aim, objectives, pioneers, research journals in horticulture and garden features, skills related to landscape gardening	L3
CO2	Outline different types of gardens and wonders of plants, Indoor plants, Hydroponics and Bonsai techniques	L2
CO3	Analyze chemical reactions and metabolic pathways involved in respiration, photoperiodism, flowering mechanism and vernalization	L4
CO4	Explain aim, objectives, scope of applied branches of botany with respect to iology, biotechnology, bioinformatics and nanotechnology	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	1	1	0	0	0
CO 2	0	0	0	3	0	3
CO 3	2	0	0	2	1	3
CO 4	2	2	0	0	0	2

Unit	Description	No. of Hours.
I	**Horticulture:** Definition, objective, scope, pioneers' workers, and research journal in Horticulture. Different types of Gardening and design. Landscape features: Edges, Hedges, Arches, Pergolas, Avenues, Flower beds, Trellis and Topiary. Indoor plants & indoor gardens- Hydroponics and Bonsai. **Garden features**: Garden pool, waterfall, fountain, rocks, walk, pavements, bridges, lawns, fences, gates, statues, towers, plant-raised beds, and containers. **Specialized Gardens**: Aquatic Garden, Rock Garden, Kitchen Garden, Herbal Garden, Mughal Garden, Buddhist Garden, Terrace Garden, Zodiac, and Nakshatra Garden. **Wonders of plants**- Rafflesia, Victorea regia, carnivorous plants- pitcher, Venus Flytrap, Dionea. Sundew, Bladderwort, Adansonia, Sequoia, Strangler Fig, plant mimicry – orchids.	15

II	**Plant Physiology** Definition, objective, scope, pioneers' workers, and research journal. Introduction to Plant Physiology and Sustainable Agriculture. **Respiration**: Aerobic: Glycolysis, TCA Cycle, ETS & Energetic of respiration. Anaerobic respiration: Ethanol fermentation and Lactic acid fermentation. **Photoperiodic receptors**: Phytochromes: Physic-chemical properties of phytochrome, PrPfr interconversion, the role of phytochrome in the flowering of SDPs and LDPs. Cryptochromes: function in plants **Physiology of flowering. Vernalization**: mechanisms and applications. ABC model of flower development. Contribution of Govindjee Prof. S. P. Bhatnagar and P. B. Gahan. **Plant Biotechnology, Bioinformatics and Nanotechnology**: Definition, objective, scope, pioneers' workers, and research journal in Biotechnology and Nanotechnology Scopes in Agriculture. Bioinformatics: Introduction, Branches of Bioinformatics, Aim, Scope, and Research Areas of Bioinformatics. **Contemporary Issues:** Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. **Self-study:** Self Notes preparation using the departmental library, College Library **Pedagogy:** Seminar, Quiz, Debate **Regional Language:** Experiment discussion, doubt session	**15**

MAJOR COURSE CODE: 24BUBO4T03	**(02 Credits)**	**No of lecture in Hrs. 30**
Botanical Explorations		
COURSE OUTCOME		
Students will be wanted to learn OR on completion of this course, students will be able to learn:		
CO 1	Recall fundamental concepts, objectives, scope, and contributions of pioneers in plant tissue culture, microbiology, molecular biology, and biostatistics. Analyze key concepts such as totipotency, MS medium, microbial ultrastructure, and statistical methods like the Chi-square test and correlation.	L4
CO 2	Apply knowledge of plant tissue culture techniques, microbial culturing, and molecular biology in biological research. Evaluate the economic importance of bacteria and viruses and assess the role of biostatistics in data analysis and experimental design in life sciences and role of Pioneer workers.	L3

CO 3	Explain the objectives, scope, research journals and contributions of pioneers in plant cytogenetics. Interpret chromosome numerical aberrations, classical genetic concepts and epistatic interactions.	L2
CO 4	Assess the significance of chromosomal variations and genetic interactions in plant breeding and cytogenetics research. Evaluate mechanisms of sex determination in plants and their significance in plant reproduction and evolution.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	0	1	0	0	0
CO 2	2	2	0	1	0	1
CO 3	2	0	0	1	0	0
CO 4	2	2	0	1	0	0

Unit	Description	No. of Hours.
I	**Plant tissue culture:** Definition, objective, scope, pioneers' workers, and research journal. Introduction to Plant Tissue Culture - Aim, Objectives and Uses, Laboratory organization and techniques in plant tissue culture and Totipotency. Concept of Culture medium, components, MS-Medium, Callus induction, and Organogenesis - Shoot-Root-Temerity culture. **Microbiology-**Definition, objective, scope, pioneers' workers, and research journal in Microbiology. History and scope of Microbiology. Culturing: Sterilization, media, **Bacteria**, Ultrastructure of Bacteria. **Viruses,** Ultrastructure of viruses. Economic importance of Bacteria and Viruses. **Molecular Biology**. Definition, objective, scope, pioneers' workers, and research journal. **Biostatistics:** Definition, objective, scope, pioneer workers, and research journal and roles. Importance of biostatistics in biological research. Basic concepts and terminology in statistics, Chi-square test. Correlation – Calculation of coefficient of correlation. Prof.Prasanta Chandra Mahalanobis.	**15**

II	**Plant Cytogenetics**: Definition, Introduction, Pioneers workers and Research Journal in Plant Cytogenetics. Chromosome numeric aberrations - Euploidy (Monoploidy, diploidy, polyploidy - auto polyploidy, allopolyploidy), Aneuploidy - Monosomy, trisomy. Classical Genetics and Sex Determination. Epistatic interactions - Recessive type (9:3:4), Dominant type (12:3:1), and non epistatic interactions (9:3:3:1). Sex determination in monoecious and dioecious plants.	**15**
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. **Self-study:** Self Notes preparation using the departmental library, College Library **Pedagogy:** Seminar, Quiz, Debate **Regional Language:** Experiment discussion, doubt session	

MAJOR COURSE CODE:24BUBO4P01	**(02 Credits)**	**No of lecture in Hrs. 60**

Practicals based on 24BUBO4T01 & 24BUBO4T02

COURSE OUTCOME

Students will be wanted to learn OR on completion of this course, students will be able to learn:

CO 1	Classify the cryptogams and phanerogams according to their morphological features	L2
CO 2	Summarize the information about different types of fungal diseases, lichens and bioluminescent fungi	L2
CO 3	List out the plants which exhibit wonders, ecological indicator property, importance in indoor gardening	L4
CO 4	Vist different field locations and appreciate the cryptogams and phanerogams and discuss the Morphology; Inflorescences, Aestivation, Types of Fruits and economic importance of angiosperms	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	3	0	0	0	0	0
CO 2	2	0	0	2	0	0

CO 3	2	0	0	2	0	2
CO 4	2	0	0	2	0	0

	Name of the experiment
I	Study the vegetative, floral characteristics and economic importance of the following families: Capparidaceae, Brassicaceae, Verbenaceae, and Palmae
1.	Study of stages in the life cycle of *Xylaria* and *Mucor* from fresh/ preserved material and permanent slides.
2.	Study of fungal diseases as prescribed for theory
3.	Study of Lichens (crustose, foliose, & fruticose).
II	Study of Bioluminescent fungi and economic importance of lichens with the help of permanent slides/ photomicrographs
4.	Wonders of plants- Rafflesia, Victorea regia, carnivorous plants- pitcher, Venus Flytrap, Dionea. Sundew, Bladderwort, Adansonia, Sequoia, Strangler Fig, Plant mimicry – Orchids.
5.	Plants as ecological indicators - *Oscillatoria*, Lichens/Moss, *Salvadora, Butea, Calotropis, Polygonum*
6.	Plants used in indoor gardening: *Phalaenopsis* (Moth orchid), *Echeveria, Zebrina* (Wandering Jew), *Liriope* (Spider plant*), Sansevieria* (Mother-in-law's Tongue), and *Dieffenbachia* (Dumb cane)
III	Study of one plant from each family prescribed for theory: morphological peculiarities and economic importance of the members of these families as per the theory
7	Morphology; Inflorescences, Aestivation, and Types of Fruits

MAJOR COURSE CODE:24BUBO4P02	**(02 Credits)**	**No of lecture in Hrs. 60**
Practicals based on 24BUBO4T02 & 24BUBO4T03		
COURSE OUTCOME		
Students will be wanted to learn OR on completion of this course, students will be able to learn:		

CO 1	Demonstrate ecological instruments such as soil thermometers, pH meters, and wind anemometers to analyze soil properties sterilization techniques and the preparation of MS media for plant tissue culture,	L2
CO 2	Solve problems related to Simpson's Diversity Index; Chi-square test and correlation coefficient to biological data;	L6
CO 3	Evaluate physiological processes like Q10 in germinating seeds and solute potential using the plasmolysis method.	L5
CO 4	Design formal and informal gardens, integrating principles of private and public garden planning	L5
Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping		

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	3	0	0	2	2	0
CO 2	0	3	0	0	2	0
CO 3	2	0	0	0	2	0
CO 4	2	2	0	0	0	0

	Name of the experiment
I	**Environmental Botany and Ecology**
1)	Study of the working of the following Ecological Instruments- Soil thermometer, Soil testing kit, pH Meter, Wind anemometer
2)	Mechanical analysis of soil by the sieve method & Soil pH
3)	Problems based on Simpson's Diversity Index
II	**Plant Physiology**
4)	Q10 – germinating seeds using Phenol red indicator
5)	NR activity – *in-vivo*
6)	Determining of solute potential of plant tissue by the plasmolysis method
III	**Plant Tissue Culture, Biostatistics and Bioinformatics**
7)	Various sterilization techniques - (Wet & Dry Sterilization)

8)	Calculation and Preparation of MS medium (25ml, 50 ml, and 100 ml) - (liquid and solid media)
9)	Chi-square test
10)	Calculation of coefficient of correlation
11)	Preparation of garden plans – formal and informal gardens, private and public garden
12)	Cytogenetics -Problem based on theory

MINOR COURSE CODE:24BUBO4T04	**(02 Credits)**	**No of lecture in Hrs. 30**
Biostatistics & Green Spaces		
COURSE OUTCOME		
Students will be able to learn OR on completion of this course		
CO1	Interpret the basic concepts and terminology of statistics, importance of biostatistics, chi-square test and correlation of coefficient and work of a Prof. Chandra Mahalanobis	L2
CO2	Explain the definition, objective, scope, pioneers' workers, and research journal in Biotechnology and Nanotechnology. Bioinformatics, Plant tissue culture, Microbiology	L2
CO3	Illustrate different types of gardens and designs, land scaping, features and components of gardens	L2
CO4	Outline the features of Rafflesia, Victorea regia, carnivorous plants- pitcher, Venus Flytrap, Dionea. Sundew, Bladderwort, Adansonia, Sequoia, Strangler Fig, plant mimicry – Orchids	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	**PO 2**	**PO 3**	**PO 4**	**PO 5**	**PO 6**
CO 1	2	3	0	0	0	0
CO 2	2	2	0	1	0	0
CO 3	0	2	0	2	0	1
CO 4	1	2	0	1	0	0

Unit	Description	No. of Hours.
I	**Biostatistics** **Definition,** objective, scope, pioneer workers, and research journal and roles. Importance of biostatistics in biological research. Basic concepts and terminology in statistics, Chi-square test. Correlation – Calculation of coefficient of correlation. Prof.Prasanta Chandra Mahalanobis. **Plant Biotechnology**, Bioinformatics and Nanotechnology: Definition, objective, scope, pioneers' workers, and research journal in Biotechnology and Nanotechnology. **Bioinformatics**: Introduction, Branches of Bioinformatics, Aim, Scope, and Research Areas of Bioinformatics. **Plant tissue culture**: Definition, objective, scope, pioneers' workers, and research journal. **Microbiology**-Definition, objective, scope, pioneers' workers, and research journal in Microbiology	**15**
II	**Horticulture** **Definition**, objective, scope, pioneers' workers, and research journal in Horticulture. Different types of Gardening and design. **Landscape features**: Edges, Hedges, Arches, Pergolas, Avenues, Flower beds, Trellis, and Topiary. Indoor plants & indoor gardens- Hydroponics and Bonsai. **Garden features**: Garden pool, waterfall, fountain, rocks, walk, pavements, bridges, lawns, fences,gates, statues, towers, plant-raised beds, and containers. **Specialized Gardens**: Aquatic Garden, Rock Garden, Kitchen Garden, Herbal Garden, Mughal Garden, Buddhist Garden, Terrace Garden, Zodiac, and Nakshatra Garden	**15**

Generic		
Course code **24BUBO4T05**	**(02 Credits)**	**No of lecture in Hrs. 30**
Herbal Cosmetics, Biostatistics and Genetics		
COURSE OUTCOME		
Students will be able to learn OR on completion of this course		
CO1	Explain Definition, objective, scope, pioneers' workers, and research journal. Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios, Chromosomal abnormalities in human, Variegation in Four O'Clock plant; Applications in crop improvement and Contribution of Dr.	L2

	Janaki Ammal- plant breeding	
CO2	Outline the aim, objective, scope and pioneer workers of biotechnology, agricultural bioinformatics, nanotechnology and bioinformatics	L2
CO3	Outline the aim, objective, scope, examples and pioneer workers in the field of Microbiology and Molecular biology	L2
CO4	Interpret the basic concepts and terminology of statistics, importance of biostatistics, chi-square test, correlation of coefficient and importance of work of Prof.Prasanta Chandra Mahalanobis.	L5

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	2	2	0	0	0	0
CO 2	2	2	0	0	0	1
CO 3	1	2	0	1	0	1
CO 4	1	1	0	1	0	1

Unit	Description	No. of Hours.
I	**Plant Cytogenetics**: Definition, Introduction, Pioneers workers and Research Journal in Plant Cytogenetics.Phenotype/Genotype, Mendelian Genetics-monohybrid, dihybrid; test cross; back cross ratios. **Chromosomal abnormalities in humans** (Cri-du-chat, Down's, Turners, Klinefelter Syndromes), Genetic counseling. Contribution of Dr. Janaki Ammal-plant breeding, Variegation in Four o'clock plant; Applications in crop improvement. Chromosome numeric aberrations - Euploidy (Monoploidy, diploidy, polyploidy - auto polyploidy, allopolyploidy), Aneuploidy - Monosomy, trisomy. **Plant Biotechnology, Bioinformatics and Nanotechnology**: Definition, objective, scope, pioneers' workers, and research journal in Biotechnology and Nanotechnology Scopes in Agriculture. Bioinformatics: Introduction, Branches of Bioinformatics, Aim, Scope, and Research Areas of Bioinformatics.	**15**

II	**Plant tissue culture:** Definition, objective, scope, pioneers' workers, and research journal. Introduction to Plant Tissue Culture **Microbiology-**Definition, objective, scope, pioneers' workers, and research journal in Microbiology. **Bacteria**, Definition, objective, scope, pioneer workers, and research journal. Introduction to Bacteria. **Viruses,** Definition, objective, scope, pioneers' workers, and research journal. Economic importance of Bacteria and Viruses. **Molecular Biology**. Definition, objective, scope, pioneers' workers, and research journal. **Biostatistics:** Definition, objective, scope, pioneer workers, and research journal and roles. Importance of biostatistics in biological research. Basic concepts and terminology in statistics, Chi-square test. Correlation– Calculation of coefficient of correlation. Prof.Prasanta Chandra Mahalanobis. **Contemporary Issues**: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. Self-study: Self Notes preparation using the departmental library, College Library Pedagogy: Seminar, Quiz, Debate Regional Language: Experiment discussion, doubt session.	**15**

COURSE CODE: 24BU4SEC01	**(02 Credits)**	**No of lecture in Hrs. 45**
Horticulture and Gardening-II		
COURSE OUTCOME		
Students will be wanted to learn OR on completion of this course, students will be able to learn:		
CO1	Explain the concept of Arboriculture, Gardening, Landscaping, types of trees, Formal style garden, Informal style garden, planning, creating and establishment of the garden, Home Garden, Public Garden, Educational institutions, commercial complexes, and companies	L2
CO2	Outline the schemes for entrepreneurship in horticulture, institutes, types, and significance of Green House,Organic farming practices, preservation methods and contribution of research laboratories, compost, Oil cakes, and, chemical fertilizers	L2
CO3	Experiment of preparation of Squashes, Dish and Bottle Garden,Pickles, Compost, propagation techniques, gardens	L2

CO4	Summarize all the experiments in journals and the techniques of Cultivation /propagation of plants, effect of fertilizers,Container gardening, caring of plants and visiting nursery, performing field projects	L2

Grading will be as 3: High(>60%), 2: Moderate(40%-60%), 1: Low(<40%), 0: No mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6
CO 1	1	1	0	0	0	0
CO 2	1	1	0	1	1	1
CO 3	2	2	0	1	0	1
CO4	2	2	0	1	0	1

Unit	Description	No. of Hours.
I	**Horticulture and Techniques**. Arboriculture: introduction, cultivation aspects of trees, common shade trees, benefits of arboreta. Gardening: Introduction, Formal style, Informal style, planning a garden, creating a garden, establishment of the garden. Landscaping: Home Garden, Public Garden. Educational institutions, commercial complexes, and companies. **Schemes:** Available from banks, Departments, and Private organizations for developing entrepreneurship in Horticulture. (Nurseries/ Agriclinics/ Hopcoms/ NABARD/ National Horticulture Board (NHB). **Green House**: Introduction, types, and significance. Organic Farming: Organic farming practices – Raising green manure crops (Leguminous Crops). **Herbal Garden**: Introduction, types, and significance. Introduction, preservation methods, preparation of jam, jelly, squash, syrups, and pickles. National Research Centre for Citrus (NRCC), Nagpur, Mango and Grape Research Station, Pune.	15
II	**Manures, Fertilizers, and biopesticides**. Manures: Definition, importance, important manures. FYM (compost), Oil cakes, green manure, Organic manures, and Vermicomposting. **Fertilizers**: Definition, types – straight, compound, and mixed. Nitrogenous (NH4)2SO4, Urea, Ca (NO3)2, NH4Cl, Phosphatic (Super-phosphate, Bone meal Potassic (Muriate of potash, K2SO4).	

	Biofertilizers: Definition types Bacteria, Cyanobacteria, Mycorrhiza, Seaweeds. Definition scopes and important bio-pesticides. **Friends of farmers**: Cattle, Lady Bug, Millipedes, Hummingbirds, Butterflies, Moths, Bats, Owls, Earthworm, Rat, Snake. Institute. Maharashtra State Horticulture Development Agency (MSHDA), Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth (DBSKKV), Dapoli, Dr. R. H. Richharia. Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters. Self-study: Self Notes preparation using the departmental library, College Library Pedagogy: Seminar, Quiz, Debate Regional Language: Experiment discussion, doubt session.	

	Name of the experiment
1	Preparation of squashes
2	Preparation of Dish and Bottle Garden
3	Preparation of Pickles
4	Preparation of compost using different lab and kitchen waste
5	Propagation of horticultural Plants/ornamental flowers through seeds
6	Propagation of kitchen garden plants through the seeds
7	Water Garden
8	Estimation of germination percentage of seeds
9	Calculation of fertilizer doses for various vegetable crops as per recommendation for N, P, and K
10	Garden maintenance and pest
11	Preparation of Biodegradable plates using leaf
12	Cultivation /propagation of plants and care for them
13	Container gardening by planting flowers, herbs, or vegetables in containers
14	Visit to Nursery
15	Field projects

SEM III &IV

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Curriculum Structure for the Undergraduate Degree Programme S.Y.B.Sc Botany

	SEMESTER – III	Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)			Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)			
Course Code	**Major Course Title**	**EM**	**EN**	**SD**	**PE**	**GE**	**HV**	**ES**
24BUBO3T01	A Plant Diversity Odyssey	√	--	--	--	--	--	--
24 BUBO3T02	Bridging Botanical Frontiers	√	--		--	--	--	√
24BUBO3T03	Botanical Wonders	√	--		--	--	--	--
24BUBO3P01	Practical based on **24BUBO3T01** and **24BUBO3T02**	–	–	√	--	--	--	--
24BUBO3P02	Practical based on **24BUBO3T02** and **24BUBO3T03**	–	–	√				
24BUBO3P03	Field Project	–	–	√				
	Minor Course Title							
24BUBO3T04	Green Wealth: Anatomy and Ecology	√	--	--	--	--	–	√

Course Code	Generic - Course Title							
24BUBO3T05	Plant World : Eco Horticulture	√	√	√	--	--	--	√
	Voocational Skill Inhencement Course (VSC)							
24BU3VSE01	**The Journey of Spices**	–	√	√	–	–	–	–
09	***Total***	**05**	**02**	**05**	**01**	**00**	**01**	**00**

	SEMESTER – IV	**Course imparts Employability (EM), Entrepreneurship (EN), Skill Development (SD)**			**Course integrates with Professional Ethics (PE), Gender Equity (GE), Human Value (HV), Environmental Sustainability (ES)**			
Course Code	**Major Course Title**	**EM**	**EN**	**SD**	**PE**	**GE**	**HV**	**ES**
24BUBO4T01	A Plant Kingdom Journey	√	--	--	--	--	--	√
24BUBO4T02	Bridging Botanical Frontiers	√	--	--	--	--	--	--
24BUBO4T03	Botanical Explorations	√	--	_	--	--	--	--

24BUBO4P01	Practical based on **24BUBO4T01** and **24BUBO4T02**	**--**	**_**	√	**--**	**--**	**--**	**--**
24BUBO4P02	Practical based on **24BUBO4T02** and **24BUBO4T03**	–	**_**	√	–	–	–	–
24BUBO4P03	Field project	√	√	√	–	–	–	–
	Minor Course Title							
24BUBO4T04	Biostatistics and Green Spaces	√	**--**	**--**	**--**	**--**	**--**	√
	Generic - Course Title							
24BUBO4T05	Herbal Cosmetics, Biostatistics and Genetics	√	**--**	**--**	**--**	**--**	**--**	√
	Vocational Skill Enhancement Course							
24BU4SEC01	Horticulture and Gardening- II	√	√	√	√	**--**	**--**	√
09	***Total***	**07**	**02**	**04**	**01**	**00**	**00**	**04**