Academic Council Meeting No. and Date : 10 / April 26, 2025

Agenda Number : 3 Resolution Number : 46, 47/ 3.2, 3.7

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

Syllabus for

Programme Code : BUBO
Programme : Bachelor of Science

Specific Programme : Botany

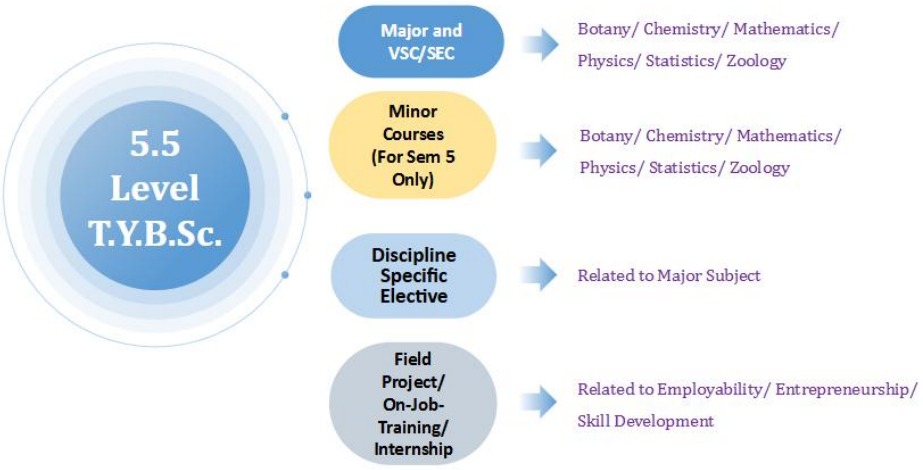
(Major/Minor)

[T.Y.B.Sc. Botany]
Level 5.5

CHOICE BASED GRADING SYSTEM

Revised under NEP
From academic year 2025 - 2026

Structure of B.Sc. for 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 SYBSc. Botany (Major/Minor)
Degree Programme: B.Sc.
Level: 5.5
Duration: 3 years (Syllabus for Third Year semester V & VI)
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: T.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 T.Y.B.Sc Botany

	SEMESTER – V		
Course Code	**Major Course Title**	**No. of Lectures in hrs**	**Credits**
25BUBO5T01	Plant Diversity-III	30	2
25BUBO5T02	Plant Diversity-IV	30	2
25BUBO5T03	Form and Functions- III	30	2
25BUBO5P01	Practical based on **25BUBO5T01** and **25BUBO5T02**	60	2
25BUBO5P02	Practical based on **25BUBO5T01** and **25BUBO5T02**	60	2
25BUBO5P03	Practical based on **25BUBO5T03**	60	2
	Total	**270**	**12**
Course Code	**Discipline-Specific Elective Courses**	**No. of Lectures in hrs**	**Credits**
25BUBO5TE1	Instrumentation	30	2
25BUBO5PE1	Practical based on **25BUBO5TE1**	60	2
25BUBO5TE2	Botanical Aroma Science	30	2
25BUBO5PE2	Practical based on **25BUBO5TE2**	**60**	2
	Total	**90**	**4**
	Vocational Skill Enhancement Course		
25BU5VSC01	Essential Nutrients	45	2
	Total	**90**	**4**
	Minor		
25BUBO5TMN	Instrumentation	30	2
25BUBO5OJT	Field project/Onjob training/Industrial visit	60	2
	Total	**480**	**22**

	SEMESTER – VI		
Course Code	**Major Course Title**	**No of Lectures in hrs**	**Credits**
25BUBO6T01	Plant Diversity-V	30	2
25BUBO6T02	Plant Diversity-VI	30	2
25BUBO6T03	Form and Functions- IV	30	2
25BUBO6T04	Current Trends in Plant Sciences-I	30	2
25BUBO6P01	Practicals based on **25BUBO6T01 and 25BUBO6T02**	60	2
25BUBO6P02	Practicals based on **25BUBO6T01 and 25BUBO6T02**	60	2
25BUBO6P03	Practicals based on **25BUBO6T03 and 25BUBO6T04**	60	2
	Total	**300**	**14**
	Discipline Specific Elective Courses		
25BUBO6TE1	Sustainable Solutions and Cosmetology	30	02
25BUBO6PE1	Practical based on 25BUBO6TE1	30	02
25BUBO6TE2	Pollution Science	30	2
25BUBO6PE2	Practical based on 25BUBO6TE2	30	2
	Total	**90**	**14**
	Vocational Skill Enhancement Course		
25BU6VSC01	Agrotourism	45	2
	Total	**45**	**2**
25BUBO6OJT	Field project/On job training/Industrial visit	**60**	**2**
	Total	**495**	**22**

Semester - V

MAJOR COURSE CODE: 25BUBO5T01	(02 Credits)	No of lecture in Hrs. 30

Plant Diversity-III

COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be able to learn:		
CO1	Compare different microbes, different sterilization techniques, media, staining methods and pure cultures used in study of microbes and describe their history and importance.	L2
CO2	Apply knowledge to distinguish algae from Rhodophyta and Xanthophyta considering their morphological and reproductive structures and describe contribution of pioneers, ecological , economical importance of algae.	L3
CO3	Classify Basidiomycetes and Deuteromycetes considering given examples	L3
CO4	Distinguish between different plant diseases and give their control measures	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	3	0	0	2	2	2
CO 2	3	1	0	2	2	1
CO 3	3	1	0	2	2	1
CO4	3	1	0	2	2	2

Unit	Description	No. of Hours.
I	**Microbiology and Algae (Phycology):** **Microbiology** : Importance of microorganisms in nature and human life. Brief history of microbiology **Types of Microbes**: Bacteria Structure and examples (e.g., *E. coli*, *Lactobacillus*); Algae- Examples (e.g., *Chlorella*, *Spirulina*) Fungi Examples (e.g., Yeast, mold), Viruses- Structure and examples (e.g., Flu virus, HIV); Microbes; Protozoa: Examples (e.g. *Amoeba*, *Paramecium*); Protozoa: Examples (e.g., *Mycoplasma pneumoniae*), Actinomycetes: Examples (e.g., *Streptomyces*). **Sterilization Techniques** - (heat, filtration, chemicals), **Media preparation**, **Deculturing Microbes** **Staining Techniques**- Simple staining vs. Gram staining. **Pure Cultures** - Isolation Techniques-. Methods (streak plate, pour plate,) Growth curve and applications of microbiology **Algae (Phycology):** Division Rhodophyta and Xanthophyta w.r.t. Classification, General Characters of Algae, Distribution, cell structure,	**15**

	pigments, reserve food, range of thallus, reproduction (asexual and sexual), alternation of generations, and economic importance. Structure, life cycle, and systematic position of *Batrachospermum*. **Contributions** made by Prof. Mandayam Osuri Parthasarthy Iyengar. Algae in forensic (crime) investigation, Role of algae in aquaculture. Bioluminescence in dinoflagellates. Ecological importance of seaweeds. Edible algae and superfoods. Economic importance of algae	
II	**Fungi (Mycology) & Plant Pathology** **Mycology:** Classification and General Characteristics: Basidiomycetes and Deuteromycetes, life cycle, and systematic position of *Puccinia* and *Agaricus*. **Plant Pathology:** Study of plant diseases: Causative organism, symptoms, predisposing factors, disease cycle and control measures Tikka disease of Ground nut: *Cercospora*, Ergot of Bajra – Xanthomonas sp and Leaf curl – leaf curl virus **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:25BUBO5T02	**(02 Credits)**	**No of lecture in Hrs. 30**

Plant Diversity-IV

COURSE OUTCOME

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

CO1	Explain Bentham and Hooker's system of classification of flowering plants and identify key morphological features, economic importance of prescribed families.	L2
CO2	Describe the objective, scope and use of plants used in medicine, traditional ceremonies and festivals, with special reference to wild edible plants	L4
CO3	Explain the causes and types of anomalous secondary growth in selected dicot and monocot stems and differentiate between types of stomata based on their structural features.	L3
CO4	Identify the poisonous plants based on their morphological and analyze the nature and impact of toxic substances found in them.	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	1	0	2	2	2
CO 2	3	1	0	2	2	2

CO 3	3	1	0	1	2	2
CO 4	3	1	0	2	2	2

Unit	Description	No. of Hours.
I	**Angiosperms-I**: Bentham and Hooker's system of classification for flowering plants up to family concerning the following the prescribed families' morphological, diagnostic, and economic importance for members **Cappriadaceae**, **Tiliaceae**, **Rubiaceae, Solanaceae**,**Cucurbitaceae**, **Poaceae** **Wild Edible Vegetables and Religious plants**:Introduction, objective and scope of plants used in religious ceremony and festivals and medicinal importance of wild vegetable plants e.g. Bharangi, Takala, Kurdu, Bamboo, Shevala,Kartoli, Raan alu, Korla, Jangli tur,gabholi, Ambada, Kamal, Aghada, Karvanda, Ghol, Hatga and Traditional recipes	**15**
II	**Plant Anatomy and Toxic Plants** **Plant Anatomy:** Causes of Anomalous Secondary Growth. Anomalous secondary growth in the stems of *Salvadora, Mirabilis, Achyranthes, and Dracaena* and storage roots of Radish and Beet. **Types of Stomata**: Anomocytic, Anisocytic, Diacytic, Paracytic, and Graminaceous **Poisonous (toxic) plants:** Morphology and toxic substances in plants: Bead Vine, Heart of Jesus, Giant Milkweed, Dumbcane, Rubber tree, Climbing Lily, Fishtail Palm, Scorpion's Tail, Periwinkle, Lantana, Congress grass, Yellow Oleander **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: 25BUBO5T03	**(02 Credits)**	**No of lecture in Hrs. 30**
Form and Functions- III		
COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be able to learn:		

CO 1	Interpret and apply knowledge of important mechanisms and techniques in molecular biology	L2 & L3
CO 2	Distinguish between different processes in water/ solute transport and apply knowledge of macro/ micronutrients in plant nutrition.	L3 & L4
CO 3	Summarize the concept, significance and different methods Bioaccumulation,Biomagnification, Bioremediation and phytoremediation	L2
CO 4	Discuss the technique and uses of Plant cell suspension, Somatic embryogenesis and Somatic hybridization with appropriate examples.	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	1	0	2	2	2
CO 2	3	1	0	2	2	2
CO 3	3	1	0	3	2	2
CO 4	3	1	0	2	2	2

Unit	Description	
I	**Molecular Biology & Plant Physiology** **Molecular Biology** characteristics of the genetic code, RNA processing (5'Cap, Poly A tail & Splicing), Translation in Prokaryotes. DNA sequence analysis I – Sanger's method, Pyro Sequencing. Polymerase Chain Reaction (PCR), Gene regulation - Concept of Operon, Lac operon and Trp Operon Mechanisms **Plant Physiology** Water relations: Osmosis, Transpiration, Imbibition Solute transport: Passive transport (Simple Diffusion, Facilitated Diffusion), Active transport (Primary and secondary) Transport of ions across the cell (voltage-gated, ligand-gated channels). Mineral Nutrition: Essential elements, Role of Macro (N, P, K, Ca, Fe and Mg) and Micro (Mn, B, Cu, Zn, Mo and Se) nutrients w.r.t physiological functions and deficiency symptoms	**15**
II	**Environmental Botany and Plant Tissue Culture** General concept and significance of Bioaccumulation, Biomagnification, ***Ex-situ*** and ***In -situ*** methods (two) of Bioremediation and phytoremediation Micro-propagation concerning floriculture, e.g., orchids. **Plant cell suspension** cultures for the production of secondary metabolites, with special reference to Shikonin production, stirred tank bioreactor. Somatic embryogenesis (Direct, Indirect), synthetic (artificial) seeds (production and applications), Somatic hybridization (protoplast fusion, hybrid and cybrid) **Contemporary Issues:** Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening	**15**

	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:25BUBO5P01	**(02 Credits)**	**No of lecture in Hrs. 60**

Practical based on 25BUBO5T01 and 25BUBO5T02

COURSE OUTCOME

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

CO 1	Test different methods to observe microbes using varieties of stains and study their growth patterns	L2
CO 2	Select appropriate methods to study aeromicrobiota and physiological processes in microbes.	L2
CO 3	Distinguish algae and fungi by observing their life stages.	L4
CO 4	Report all the observations, results and conclusions about the diversity of plants.	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	3	1	0	2	3	2
CO 2	3	1	0	2	3	2
CO 3	3	1	0	2	2	2
CO 4	1	3	0	2	2	2

	Name of the experiment
1.	Introduction to stains, mordents, simple and differential staining techniques
2.	Determination of Minimum Inhibitory Concentration (MIC) of sucrose against selected microorganism
3.	Study of antimicrobial activity by the disc diffusion method
4.	Study of aeromicrobiota by petriplate exposed method: Fungal culture
5.	Study of aeromicrobiota by petriplate exposed method: Bacterial culture
6.	To study alcoholic fermentation of sugar by microorganisms and anaerobic respiration. (Demonstration - Kuhn's tube)
7.	Study of the Curd organism using Gram's staining
8.	Structure, life cycle, and systematic position of *Batrachospermum*
9.	Structure, life cycle, and systematic position of *Vaucheria*

10.	Structure, life cycle, and systematic position of *Pinnularia*
11.	Structure, life cycle, and systematic position of *Agaricus*
12.	Structure, life cycle, and systematic position of *Puccinia*

MAJOR COURSE CODE:25BUBO5P02	**(02 Credits)**	**No of lecture in Hrs. 30**

Practical based on 25BUBO5T01 and 25BUBO5T02

COURSE OUTCOME

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

CO 1	Dissect plant parts of angiospermic plants and observe their morphology	L4
CO 2	Identify wild vegetables, toxic plants, stomata and anomalous secondary growth in plants using laboratory techniques	L2
CO 3	Summarize plant diseases, mycoses in man and animal	L5
CO 4	Record results, observations and inferences	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	3	1	0	2	2	1
CO 2	3	1	0	2	2	1
CO 3	3	1	0	3	2	1
CO 4	3	3	0	1	1	1

	Name of the experiment
1.	Morphological, diagnostic, and economic importance for members of the family Capparidaceae
2.	Morphological, diagnostic, and economic importance for members of the family Cucurbitaceae
3.	Morphological, diagnostic, and economic importance for members of the family Rubiaceae.
4.	Morphological, diagnostic, and economic importance for members of the family Solanaceae
5.	Morphological, diagnostic, and economic importance for members of the family Tiliaceae
6.	Morphological, diagnostic, and economic importance for members of the family Poaceae
7.	Identification of wild vegetables
8.	Identification of toxic plants

9.	Identification of types of stomata
10.	Study of anomalous secondary growth
11.	Study of different Mycoses of man and animals (5 as per theory)
12.	Study of plant diseases: Causative organism, symptoms, predisposing factors, disease cycle and control measures Tikka disease of Ground nut: Cercospora
13.	Study of plant diseases: Causative organism, symptoms, predisposing factors, disease cycle, and control measures Ergot of Bajra—Xanthomonas sp
14.	Study of plant diseases: Causative organism, symptoms, predisposing factors, disease cycle, and control measures. Leaf curl – leaf curl virus

MAJOR COURSE CODE:25BUBO5P03	**(02 Credits)**	**No of lecture in Hrs. 60**

Practicals Based on 25BUBO5T03

COURSE OUTCOME

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

CO 1	Analyze RNA processing and DNA sequencing using different methods	L4
CO 2	Estimate the mineral content from the plants and water quality parameters from the water samples	L2
CO 3	Identify, Demonstrate different techniques in physiology, molecular biology and plant tissue culture	L2
CO 4	Compile all the observations, results and inferences	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	1	1	1	1	1
CO 2	3	1	0	1	1	1
CO 3	3	1	0	1	1	1
CO 4	2	1	0	0	1	1

	Name of the experiment
1.	Predicting the sequence of amino acids in the polypeptide chain that will be formed following translation (Eukaryotic)
2.	DNA sequencing by Sanger's Method
3.	DNA sequencing by Pyro Sequencing Method
4.	Demonstration of PCR

5.	Estimation of Phosphate phosphorus (Plant acid extract - 3 Tube Method)
6.	Estimation of Iron (Plant acid extract - 3 Tube Method)
7.	Estimation of Calcium and Magnesium (Titrimetric Method)
8.	Determine the rate of transpiration under different conditions of Sunlight, Shade and Wind
9.	Estimation of the acidity of the given water sample
10.	Estimation of the alkalinity of the given water sample
11.	Estimation of Dissolved oxygen demand in the given water sample
12.	Estimation of Biological Oxygen Demand in the given water sample
13.	Estimation of Hardness in the given water sample.
14.	Identification – Hairy root culture, somatic embryogenesis, Stirred Tank Bioreactor, Hybrid-Cybrid flowchart
15.	Preparation of artificial seed using an axillary bud

COURSE CODE: 25BUBO5TE1	**(02 Credits)**	**No of lecture in Hrs. 30**

Instrumentation

COURSE OUTCOME

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

CO1	Acquire knowledge to study technique and working principles of microtomy and microscopy	L3
CO2	Summarize the techniques and working principle of Colorimeter, Spectrophotometer, Centrifuge and Sonicator	L3
CO3	Outline construction, working principle and applications of Paper chromatography, TLC and HPTLC	L4
CO4	Distinguish between column, ion exchange, molecular sieve, Adsorption chromatography and gel electrophoresis considering their working principles.	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	2	1	0	2	1
CO 2	3	1	1	0	2	1
CO 3	3	1	0	0	1	2
CO4	3	2	0	0	1	2

Unit	Description	No. of Hours.
I	**Microscopy, Microtomy and Colorimetry-Spectrophotometry** Construction, working principle and applications of Compound Microscope, Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM), Microtome, Colorimeter, Spectrophotometer, Centrifuge and Uses of Sonicator	**15**
II	**Chromatography & Electrophoresis** Construction, working principle and applications of Paper chromatography (PC), Thin Layer Chromatography (TLC), HPTLC, Column Chromatography (Adsorption chromatography, ion exchange chromatography, molecular sieve chromatography), gel electrophoresis. 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: 25BUBO5PE1	**(02 Credits)**	**No of lecture in Hrs. 30**
Practical based on 25BUBO5TE1		
COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be able to learn:		
CO 1	Demonstrate the working of basic and advance laboratory instruments (as in theory)	L3
CO 2	Experiment to verify Beer Lambert's Law, pH of the different samples, types of Buffers, Normality and Molarity solutions.	L3
CO 3	Adapt Paper chromatography, TLC and RFLP techniques to study the samples	L6
CO 4	Compile all the observations, results and inferences	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	1	1	0	1	1
CO 2	3	1	1	2	2	2
CO 3	3	1	0	1	1	1
CO 4	3	1	0	1	1	0

	Name of the experiment
1.	Handling of Glassware and instruments
2.	Study of Compound Microscope with the help of permanent slides.
3.	Study of Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM)
4.	Study of Microtome (Demonstration)
5.	Study of Beer Lambert's Law (Lambda-max determination)
6.	Verification of Beer Lambert's Law by Standard graph
7.	Determination pH using different solutions (pH Strip Method)
8.	Preparation of specified molar, normal and stock solutions
9.	Study of Buffer solutions (Acetate, Phosphate and Tris Buffer)
10.	Study of working of Colorimeter, Spectrophotometer, Centrifuge and Sonicator (Demonstration)
11.	Paper chromatography of amino acids by strip method
12.	TLC of fatty acids
13.	Experiment based on separation of dyes/ plant pigments using silica gel column (Demonstration)
14.	Study of Electrophoretic instruments
15.	Study of Restriction Fragment Length Polymorphism (RFLP) with the help of problems.

COURSE CODE: 25BUBO5TE2	**(01 Credits)**	**No of lecture in Hrs. 15**
Botanical Aroma Science		
COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be able to learn:		
CO1	Describe history, importance of natural fragrances and their sources, extraction techniques and uses of essential oils	L2
CO2	Choose appropriate method for floral distillation, making attar, blend perfumes and make agarbatti	L3
CO3	Collect relevant information, procedures and techniques to make natural scented candles, air fresheners, bath and skin care products	L3
CO4	Explain sustainability and eco friendly practices to design, packaging, branding the products and methods and techniques of marketing	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	3	1	0	2	1	2
CO 2	3	1	0	1	1	2
CO 3	3	1	1	2	2	2
CO4	3	1	0	2	2	2

Unit	Description	No. of Hours.
I	**Botanical origin** **Introduction to Natural Fragrances** – History, importance, and market demand. **Essential Oils & Their Sources** – Plants used in attar, perfume, and incense. **Extraction Techniques** – Steam distillation, cold pressing, solvent extraction. **Making Rose Water (Gulab Jal) & Floral Distillates** – Simple DIY methods. **Attar Making** – Traditional and modern preparation techniques. **Perfume Blending Basics** – Top, middle, and base notes in fragrance creation.	**15**
II	**Botanical products** **Agarbatti & Dhoop Making** – Herbal ingredients and preparation. **Scented Candles** – Infusing natural fragrances into wax. **Room Fresheners & Air Purifiers** – Making herbal sprays and sachets. **Natural Body Oils & Balms** – DIY herbal-infused oils for skincare. **Scented Soaps & Bath Products** – Simple methods of fragrance infusion. **Floral Powders & Dry Perfumes** – Making traditional fragrant powders. **Packaging & Branding** – How to create marketable aromatic products. **Marketing & Business Opportunities** – Selling handmade fragrance products. **Sustainability & Eco-friendly Practices** – Ethical sourcing and waste management 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:	**(01 Credits)**	**No of lecture in Hrs. 30**

25BUBO5PE2		

Practicals based on 25BUBO5TE2

COURSE OUTCOME

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

CO 1	Use the appropriate methods to extract essential oil and to prepare attar, gulab jal, hair oil, bath powder, candles and incense sticks using natural ingredients.	L3
CO 2	Prepare dhoop cones, resin incense, natural perfume, room freshener,potpourri, lip balm, floor cleaner, herbal-infused honey,scented handkerchiefs	L6
CO 3	Adapt eco-friendly, natural methods to develop skin care, body care, air purifying, plant pest resistant products.	L6
CO 4	Compile all the data related to experiments	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	1	0	1	2	2
CO 2	3	1	0	1	2	2
CO 3	3	1	0	2	1	2
CO 4	3	1	1	1	1	1

	Name of the experiment
1.	Essential Oil Extraction & Natural Fragrance Creation
2.	Cold Press Extraction of Citrus Oils
3.	Traditional Attar Preparation
4.	DIY Gulab Jal (Rose Water) Making
5.	To infuse herbal extracts into oil for hair care.
6.	To create an herbal bath powder from natural ingredients.
7.	To make aromatic candles with essential oils.
8.	To make natural incense sticks at home.
9.	To recycle flowers into dhoop cones.
10.	To make natural resin incense for purification.
11.	To create a natural perfume using essential oils.
12.	To prepare a chemical-free room freshener.
13.	To prepare a natural potpourri for home fragrance.

14.	To prepare a herbal lip balm.
15.	To make a natural floor cleaner.
16.	To make herbal-infused honey.
17.	To make naturally scented handkerchiefs.
18.	To reuse waste flowers for fragrance extraction.
19.	To prepare a natural skin care product by drying and grinding citrus peels.
20.	To create eco-friendly dhoop cones using cow dung and herbal powders.
21.	To make a natural face mask using multani mitti and herbal ingredients.
22.	To create a chemical-free kajal using natural soot and oils.
23	To prepare traditional sindoor using turmeric and lime.
24	To create an organic pesticide using neem, garlic, and chili extracts.

COURSE CODE: 25BU5VSC01	**(02 Credits)**	**No of lecture in Hrs. 45**
Essential Nutrients		
COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be able to learn:		
CO1	Classify types of Carbohydrates, amino acids and proteins based on their contents, sources and role in human diet	L2
CO2	Apply knowledge to discuss about good fats, bad fats, vitamins and minerals considering their sources,types and functions in human nutrition	L3
CO3	Choose appropriate methods and ingredients to prepare Energy-Boosting Smoothies, Diabetic-Friendly Sweet Dish, Natural Drink, analyse the ingredients of packaged food and estimate vitamins, minerals and secondary metabolites from different plant sources	L6
CO4	Compile all the procedures, methods, techniques, ingredients, observations, results and inferences.	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	1	0	1	`1	0
CO 2	3	1	0	1	1	0
CO 3	3	1	0	1	1	1
CO4	3	1	1	1	1	1

Unit	Description	No. of Hours.
I	**Nutrients I** **Introduction to Nutrients**: Macronutrients & Micronutrients, Importance in daily diet and common deficiencies (Fe, Protein, Vitamins), Plants and Animal based nutrient sources **Carbohydrates:** Simple vs. Complex carbohydrates, Energy production and plant sources **Proteins & Amino Acids:** Plant-based: Pulses, Soy Animal-based: Eggs, Dairy, Fish, Fats & Omega-3 Fatty Acids, Protein supplements (Artificial vs. natural) **Good fats vs. bad fats**—sources: Nuts, Flaxseeds, Fish oil, Fat-Soluble Vitamins (A, D, E, K), Functions and dietary sources **Water-Soluble Vitamins:** (B-complex, C, Biotin), Role in skin, hair, and metabolism **Major Minerals:** Calcium, Iron, Zinc, Magnesium, Selenium, Cobalt, Molybdenum, Phosphorus, Sources (Plant and Animal Origin) and health benefits	**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.	

VSEC COURSE CODE:25BU5VSC01	**(02 Credits)**	**No of lecture in Hrs. 30**
Practicals based on 25BU5VSC01		
COURSE OUTCOME		
	Name of the experiment	
1.	Identifying Nutrients in Common Foods – Simple lab tests for proteins, carbohydrates, and fats.	
2.	Vitamin C Estimation – Lemon and guava juice using iodine titration	
3.	Iron Content Detection – Spinach, jaggery using color reaction tests	
4.	Extraction of Flavonoids – From tea leaves or citrus peels	
5.	Simple Cooking Experiment – Retaining nutrients (boiling vs. steaming) while cooking	
6.	Probiotic Fermentation – Making homemade curd or fermented foods	
7.	Extraction of Lycopene from tomatoes using simple solvent methods	
8.	Curcumin Extraction—From turmeric powder.	

9.	Piperine Extraction-Black pepper
10.	Tannin Test—Tea vs. Pomegranate Peel Extraction.
11.	Making Herbal Detox Water—Lemon, mint, Cucumber Infusion
12.	Diet Chart Preparation—For different age groups (children, adults, elderly, and diabetic patients).
13.	Making a Balanced Meal—Cooking with Fibre, Recipe—Using turmeric, black pepper, and Ginger
14.	Making a High-Protein Snack—Sprouts salad, peanut chikki
15.	Preparation of Omega-3 Rich Foods – Foods—Flaxseed chutney, fish recipes.
16.	Homemade Natural Electrolyte Drink – Use coconut water, lemon, and salt.
17.	Food Label Analysis – Understanding packaged food ingredients.
18.	Making a Simple Collagen-Rich Drink—Using Fruit, Seeds, and Gelatin.
19.	Preparation of a High-Iron Meal—Spinach dal, Ragi dosa
20.	Making a Natural Sleep-Enhancing Drink—Warm Turmeric Milk and Chamomile Infusion
21.	Energy-Boosting Smoothies—Peanut butter, banana, dates, and oats
22.	Diabetic-Friendly Sweet Dish—Using Jaggery and Nuts
23	Prepare mint-lemon or cucumber-ginger infused water—observe flavour change after 2 hours.

MINOR COURSE CODE: 25BUBO5TMN	**(02 Credits)**	**No of lecture in Hrs. 30**

Instrumentation

COURSE OUTCOME

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

CO1	Acquire knowledge to study technique and working principles of microtomy and microscopy	L3
CO2	Summarize the techniques and working principle of Colorimeter, Spectrophotometer, Centrifuge and Sonicator	L3
CO3	Outline construction, working principle and applications of Paper chromatography, TLC and HPTLC	L6
CO4	Distinguish between column, ion exchange, molecular sieve, Adsorption chromatography and gel electrophoresis considering their working principles.	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	2	1	0	2	2
CO 2	3	2	1	0	2	2
CO 3	3	2	1	0	2	2
CO4	3	2	1	0	2	2

Unit	**Description**	**No. of Hours.**
I	**Microscopy, Microtomy and Colorimetry-Spectrophotometry** Construction, working principle and applications of Compound Microscope, Transmission Electron Microscope (TEM), Scanning Electron Microscope (SEM), Microtome, Colorimetar, Spectrophotometer, Centrifuge Uses of Sonicator	**15**
II	**Chromatography & Electrophoresis** Construction, working principle and applications of Paper chromatography (PC), Thin Layer Chromatography (TLC), HPTLC, Column Chromatography (Adsorption chromatography, ion exchange chromatography, molecular sieve chromatography), gel electrophoresis 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**

SEMESTER VI

MAJOR COURSE		
Course code 25BUBO6T01	**(02 Credits)**	**No of lectures in hrs 30**

Plant Diversity- V

COURSE OUTCOME

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

CO 1	Explain the General characters of Class Musci, Lepidophyta, Calamophyta and Pteridophyta.	L2
CO 2	Discuss the Structure, life cycle, and systematic position of *Marchantia, Pellia, Adiantum, Equisetum, and Marselia*	L2
CO 3	Illustrate the general characters and life cycles of *Gnetum* and *Ephedra*, and explain the objectives and scope of palaeobotany including its botanical and geological aspects.	L2
CO 4	Summarize the contribution of Prof.Birbal Sahni, Birbal Sahni, Professor T.S. Mahabale, Dr. Vijay Bedekar in Palaeobotany and Conservation of Museums and Monuments	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	2	2	1
CO 2	3	1	0	2	2	1
CO 3	3	1	0	2	2	1
CO 4	3	0	0	1	1	0

Unit	Description	No. of Hours.
I	**Bryophyta & Pteridophyta** General characters of Class Musci, Structure, life cycle, and systematic position of *Marchantia, Pellia,* General characters Lepidophyta and Calamophyta, General characters Pteridophyta, and Life Cycle of *Adiantum, Equisetum, and Marselia*	**15**
II	**Gymnosperms & Palaeobotany** General characters of Gnetophyta, Life Cycle of *Gnetum* and *Ephedra.* Palaeobotany: Introduction, objective, and scope of botanical and geological aspects. Detailed study of the fossil forms: *Pteridophyta: Lepidodendron;* **Gymnosperms:** *Pentoxylon.* Contribution of Prof.Birbal Sahni, Birbal Sahni Institute of Palaeobotany, Lucknow. Contribution of Professor T.S. Mahabale Palaeobotany.BSIP. The Contribution of Dr. Vijay Bedekar in the Conservation of Museums and Monuments **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: **25BUBO6T02**	**(02 Credits)**	**No of lecture in Hrs. 30**

Plant Diversity- VI

COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be able to learn:		
CO1	Distinguish between dicot families from each other using Bentham and Hooker's system of classification and based on their economic uses	L4
CO2	Discuss morphological characters of monocot family using Bentham and Hooker's system of classification and based on their economic uses and religious significance of plants (with respect to source and family)	L2
CO3	Explain the process of plant succession and anatomical and ecological of hydrophytes, xerophytes, mesophytes, epiphytes, halophytes	L2
CO4	Discriminate between processes of Microsporogenesis, Megasporogenesis, types of ovule, process of fertilization, types of embryo sac and types of embryo	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	1	0	1	1	0
CO 2	3	1	0	1	1	0
CO 3	3	1	0	1	1	0
CO4	3	1	0	0	1	0

Unit	**Description**	**No. of Hours.**
I	**Angiosperms-II & Wild Vegetables** Study of Angiosperm families (Bentham and Hooker's system of classification): Leguminosae (Fabaceae), Combretaceae, Asclepiadaceae, and Labiatae, Monocot Family. For the morphological peculiarities and economic importance of the plants. Source, family and religious significance of plants: Durga Puja (7 millets), (Apta) Dasera, Diwali (Tagetus), Holy (Palas, Mango, Fig, Amaltas), Gudipadava (Neem), Makarsankrati (Sesame), Mahashivratri (Bel), Janmasthami (Drumsticks), Christmas (Aurocaria), Ganesh Chaturthi (Shami**,** Durva).	**15**

II	**Ecological Plant Anatomy & Embryology** **Hydrophytes:** submerged, floating, Mesophytes, Epiphytes, Xerophytes, Halophytes **Plant succession**: Concept, general process, significance and types (Xerosere and Hydrosere) **Embryology** Microsporogenesis, Megasporogenesis - Development of monosporic type—examples of all embryo sacs. Types of ovules, Double fertilization and its significance, Development of Dicot embryo—*Capsella* 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: **25BUBO6T03**	**(02 Credits)**	**No of lecture in Hrs. 30**

Form and Functions- IV

COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be able to learn:		
CO1	Explain the types of carbohydrate, lipid, proteins and enzymes	L2
CO2	Analyze the physiological effects of various plant hormones with respect to their commercial applications and enzyme kinetics including enzyme inhibitors	L4
CO3	List the types of mutation and discuss the Ame's test and DNA microarray technique.	L1
CO4	Solve problems based on the student T-test, regression analysis and ANOVA.	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	1	0	2	2	0
CO 2	3	1	0	2	2	2
CO 3	3	1	1	0	1	1
CO4	3	1	2	1	1	1

Unit	**Description**	**No. of Hours.**
I	**Biochemistry & Plant Physiology II** Carbohydrates (3 types with examples), lipids (fatty acids and glycerol), proteins (amino acids)	**15**

	Enzymes: nomenclature, classification, mode of action, enzyme kinetics, Michaelis-Menten equation, competitive, non-competitive, un-competitive and allosteric inhibitors. Physiological effects and commercial applications of Auxins, Gibberellins, Cytokinins and Abscisic acid.	
II	**Genetics & Biostatistics** **Gene mutations:** Definition, types of mutations (substitution mutations: Mis-sense, non-sense, neutral and silent; frameshift mutations: addition and deletion), the Ame's test, DNA Microarray **Test of significance:** Student's *t*-test (paired and Unpaired, Regression analysis and ANOVA (one way) **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: 25BUBO6T04	**(02 Credits)**	**No of lecture in Hrs. 30**

Current Trends in Plant Sciences- I

COURSE OUTCOME

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

CO 1	Distinguish different traditional plants used as medicine and edible food considering their history, sources, benefits and methods of propagation	L2
CO 2	Describe plants used as medicines in ethnoveterinary practices	L2
CO 3	Analyze techniques of plant genetic transformation with examples of GM plants and ethical issues related to this technique.	L4
CO 4	Explain monographs of drugs considering their biological, chemical, geographical and therapeutic characters and Pharmacology including preclinical and clinical trials	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	1	0	2	2	0
CO 2	3	3	0	2	2	1
CO 3	3	1	1	2	1	1
CO 4	3	1	0	1	1	1

Unit	Description	No. of Hours.
I	**Ethnobotany and Ethnoveterinary** **Ethnobotany:** Definition, history, sources of data, and methods of study. Applications of ethnobotany w.r.t Ethno-medicines, agriculture, and edible plants; traditional medicines used by tribals in Maharashtra towards various ailments: *Rubia cordfolia, Phyllanthus, Centella, Terminalia, Tridax, Momordica charantia, Syzygium cuminii* **Ethnoveterinary**: Importance of Application of Ethnoveterinary Medicine in India and Maharashtra. Study the following ethnoveterinary plants. *Annona squamosa*, *Azadirachta indica*, *Calotropis procera*, *Cocos nucifera*, *Ficus benghalensis, Musa paradisiaca, Ocimum sanctum* and *Tagetes erecta.*	**15**
II	**Plant Biotechnology-I & Medicinal Botany** **Plant genetic transformation** - (Ri and Ti plasmid mediated), GM plants: construction of transgenes and applications w.r.t.. Golden Rice, Bt-Cotton, Bt.Brinjal, banana vaccine. Ethical issues. **Monographs** of drugs concerning biological sources, geographical distribution, common varieties, macro- and microscopic characters, chemical constituents, therapeutic, uses, adulterants *Strychnos* seeds, *Senna* leaves, Clove buds, *Allium sativum, Acorus calamus* and *Curcuma longa.* Introduction to Pharmacology, preclinical and clinical trials (phase I, II and III)	**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:25BUBO6P01	**(02 Credits)**	**No of lecture in Hrs. 30**

Practicals Based on 25BUBO6T01 and 25BUBO6T02

COURSE OUTCOME

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

CO 1	Show different stages of life cycle of Bryophytes and Pteridophytes	L3
CO 2	Describe different stages life cycle of Gymnosperms	L1
CO 3	Explain fossils, sporophyte in Bryophyte, Sori,Soral arrangement in Pteridophytes, economic importance of Bryophytes	L4
CO 4	Record the diversity of plants, their ecological, economic importance	L1

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

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

	Name of the experiment
1.	Study of stages in the life cycle of the following Bryophyta from fresh / preserved material and permanent slides *Marchantia, Pelia* and *Funaria*
2.	Economic importance of Bryophyta
3.	Types of Sporophytes in Bryophyta (from permanent slides)
4.	Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides *Adiantum*
5.	Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides *Marselia*
6.	Study of stages in the life cycles of the following Pteridophytes from fresh / preserved material and permanent slides *Lycopodium*/*Equisetum*
7.	Economic importance of Pteridophyta
8.	Types of Sori and Soral Arrangement in Pteridophytes
9.	Study of plant fossils *Lepidodendron* and *Pentoxylon*
10.	Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides *Gnetum*
11.	Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides *Ephedra*
12	Study of stages in the life cycles of the following Gymnosperms from fresh / preserved material and permanent slides *Zamia*

COURSE CODE:25BUBO6P02	**(02 Credits)**	**No of lecture in Hrs. 30**

Practicals based on 25BUBO6T01 and 25BUBO6T02

COURSE OUTCOME

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

CO 1	Describe the dicot and monocot families using Benthum and Hooker's system of classification	L2
CO 2	Demonstrate the process of genus species identification, *in vivo* pollen tube formation	L2

CO 3	Discuss different steps of microsporogenesis, megasporogenesis, mounting of dicot and monocot seeds, importance of plants in religious ceremonies.	L2
CO 4	Report about diversity of the plants, economic and ecological importance	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	3	1	0	1	1	1
CO 2	3	0	0	1	1	1
CO 3	3	0	1	1	1	1
CO 4	3	0	1	1	1	1

	Name of the experiment
1.	Study of one plant from each of the following Angiosperm families as per Bentham and Hooker's system of classification. Morphological peculiarities and economic importance of the members of the above-mentioned Angiosperm families. Monocot Family
2.	Leguminosae (Fabaceae)
3.	Combretaceae
4.	Asclepiadaceae
5.	Labiatae
6.	Morphology of Fruits
7.	Identification of Genus and Species
8.	Identification of plants used in religious ceremonies
9.	Mounting of Monocot (Maize) and Dicot (Castor and Gram) embryo
10.	*In vivo* growth of pollen tube in *Portulaca*/*Vinca*
11.	Study of various stages of Microsporogenesis, Megasporogenesis and Embryo Development with the help of permanent slides / photomicrographs

COURSE CODE: 25BUBO6P03	**(02 Credits)**	**No of lecture in Hrs. 30**

Practical Based on 25BUBO6T03 and 25BUBO6T04

COURSE OUTCOME

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

CO 1	Examine the reducing sugar, activity of amylase, effect of GA on seed germination with the help proper techniques and methods	L1

CO 2	Distinguish between mutations in DNA and interpret the results of DNA and Protein using Microarrays and Ame's test	L2
CO 3	Interpret the results after performing, t-test, regression, ANOVA, Macroscopic, Microscopic, Chemical tests for various plants.	L2
CO 4	Compile the data Ri and Ti plasmid, GM plants, Ethnobotany, Ethnoveterinary and herbal colours formed, their relevant methods and results of physiological, biochemical, statistical,molecular biology experiments	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	1	2	0
CO 2	3	0	1	1	1	0
CO 3	3	0	1	1	1	1
CO 4	3	0	0	2	2	1

	Name of the experiment
1.	Estimation of reducing sugars by DNSA method
2.	Effect of temperature on the activity of amylase
3.	Effect of substrate variation on the activity of amylase
4.	Effect of GA on seed germination
5.	Identification of types of mutations from given DNA sequence
6.	Study of DNA and Protein Microarrays and Ame's Test
7.	t-test (paired and unpaired)
8.	Problems based on regression analysis
9.	ANOVA
10.	Study of plants mentioned in theory for Ethnobotany (transfer to sem vi)
11.	Study of plants mentioned in theory for Ethnoveterinary
12.	Preparation of Herbal Colours using Botanical Sources
13.	Macroscopic/ Microscopic characters and Chemical tests for active constituents of the *Allium sativum, Acorus calamus, Curcuma longa*
14.	Macroscopic/ Microscopic characters and Chemical tests for active constituents of the *Senna angustifolia, Strychnos nux-vomica* and *Eugenia caryophyllata*
15.	Study of Ri and Ti plasmid, GM plants as mentioned in theory

MAJOR COURSE CODE: 25BUBO6TE1	**(02 Credits)**	**No of lecture in Hrs. 30**
Sustainable Solutions & Cosmetology		
COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be		

able to learn:		
CO1	Explain levels, importance, threats, status of biodiversity, methods of conservation	L4
CO2	Discuss different Eco-Friendly energies and SDGs	L2
CO3	Summarize about standardization of herbal cosmetics and Drug and Cosmetic Act 1940	L5
CO4	Describe the applications of herbal cosmetics	L1

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	1	2	2	1
CO 2	3	0	0	2	2	1
CO 3	3	0	0	2	2	2
CO4	2	0	0	2	2	2

Unit	Description	No. of Hours.
I	**Sustainable Solutions** **Biodiversity Conservation:** Biodiversity levels, importance, threats, status of biodiversity in the world and India, methods of conservation of biodiversity. **SDGs:** Concept, pillar and importance of sustainable development, Sustainable Development Goals (SDGs), Eco-friendly practices **Eco-Friendly energies:** Geothermal, Wind, Solar and Hydroelectric energy, Concept of ESIA (Environment-Social Impact Assessment) and its applications	**15**
II	**Cosmetology** **Cosmetology:** Current status of herbal cosmetics industry in India, collection and processing of herbal drugs, natural and artificial drying of plant materials, physical and chemical methods of standardization, qualitative and quantitative estimations of phytoconstituents, Drug and Cosmetic Act 1940 **Applications** of herbs in the following herbal cosmetics: herbal shampoo, herbal hair dye, herbal hair oil, herbal hair cream, herbal hair gel, herbal face mask, and herbal bath oil**.** **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: 25BUBO6PE1	(02 Credits)	No of lecture in Hrs. 30

Practicals Based on 25BUBO6TE1

COURSE OUTCOME

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

CO 1	Examine the herbal ingredient in products	L4
CO 2	Solve the problems based on simpson diversity index and select quadrat method to study plant diversity	L3
CO 3	Demonstrate preparation of the compost and herbal products	L2
CO 4	Compile the data of national park, wildlife sanctuary, sacred groves, Ramsar sites, eco friendly energy and energy devices, Sustainable Development Goals and all relevant experiments enlisted in the practicals.	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	2	2	1
CO 2	3	0	0	2	2	0
CO 3	3	0	0	2	2	1
CO 4	3	0	1	1	2	2

	Name of the experiment
1.	Study of Sustainable Development Goals (SDGs)
2.	Compost preparation (Demonstration)
3.	Study of ecofriendly energy and energy devices (Solar Cooker, Solar water heaters, wind mills, geothermal energy and green vehicles)
4.	Study of national park, wildlife sanctuary, sacred groves, Ramsar sites
5.	Study of biodiversity by list quadrat
6.	Determination of simpson diversity index
7.	Identification tests of herbal ingredients - Tannins, Alkaloids, Glycosides, Essential oils, Flavonoids
8.	Preparation cum Demonstration of herbal creams, shampoo, lotions and other cosmetics i) Aloe vera gel, ii) Hair packs, ii) Hair Oils, iv) Face packs (Pimple face pack and regular face pack), v) Herbal shampoo

MAJOR COURSE CODE: 25BUBO6TE2	(02 Credits)	No of lecture in Hrs. 30

Pollution Science

COURSE OUTCOME		
Students will be able to learn OR on completion of this course, students will be able to learn:		
CO1	Outline the types of pollutions	L2
CO2	Summarize the types of pollutants, their sources and their effects	L2
CO3	Explain Sources and Effects of soil pollution	L2
CO4	Discuss the Control measures/ Alternatives of soil pollution	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	1	0	3	2	2
CO 2	3	1	0	3	2	2
CO 3	3	1	0	3	2	2
CO4	3	1	0	3	2	2

Unit	Description	No. of Hours.
I	**Introduction** **Introduction Pollution –** Definition; Types –Air, Water Soil, Noise, Thermal, Radioactive and Solid waste, Natural and Anthropogenic 2 Air Radioactive Pollution and · Definition; Major air pollutants and their sources; Effects – On Biological system – Animals, humans & plants, On Non, Biological systems – material; physical environment, Green House Effect, Ozone depletion, Smog, Acid Rain, Global warming.	15
II	**Soil pollution** **Definition;** Sources/ routes of contamination · Effects – On soil quality/ productivity – Acidification, Alkalinization, Salinization, Sodification, Desertification, Heavy metal deposition etc. · On Biological system – on soil microorganisms, on plants. · Control measures/ Alternatives – i) Biofertilizers & biological pest management; ii) Organic farming & other agricultural interventions; iii) Appropriate irrigation & drainage techniques; iv) Lime& gypsum application. Case studies – Declining soil productivity in the Punjab & v) Haryana; desertification in India, Western Maharashtra. **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:25BUBO6PE2	(02 Credits)	No of lecture in Hrs. 30

Practicals Based on 25BUBO6TE2

COURSE OUTCOME

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

CO 1	Interpret the results of dust particles, Air Quality Index, floating debris after collecting and observing the data	L2
CO 2	Make posters, working models and charts exhibiting greenhouse effect, ozone depletion or acid rain, water conservation and water filtration	L6
CO 3	Examine the pH of different water, effect different soils on seed germination	L4
CO 4	Survey the local soil	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	3	1	1	2	2	1
CO 2	3	2	2	2	2	2
CO 3	3	2	2	2	2	1
CO 4	3	1	1	1	1	1

	Name of the experiment
1.	To study the deposition of dust particles on plant leaves in different areas
2.	To compare Air Quality Index (AQI) using mobile apps at different locations
3.	To collect and observe floating debris or microplastics in a water sample.
4.	To construct a simple water filtration unit using sand, gravel, and charcoal
5.	To measure the pH of different water samples using natural indicators
6.	To observe and record the texture and color of various soil samples.
7.	To study the effect of polluted vs clean soil on seed germination.
8.	To study a local site affected by soil erosion and prepare a report
9.	To demonstrate the greenhouse effect using a plastic bottle setup
10.	To create posters explaining ozone depletion or acid rain
11.	To make a working model of a traditional water conservation structure
12.	To prepare a model or chart showing ozone layer depletion.

MAJOR COURSE CODE: 25BU6VSC01	(02 Credits)	No of lecture in Hrs. 45

Agro-Tourism

COURSE OUTCOME

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

CO1	Discuss about history, evolution and benefits of agro-tourism	L2
CO2	Explain different activities, attractions, festivals and farming practices taking place in agrotourism	L2
CO2	Prepare insect repellents, herbal tea bags, sunscreen, organic jaggery, fruit based vinegar, plant perfume, bath powder, bio enzyme cleaner, Agro based handicrafts, sugar solutions for cut flowers, hydroponics, preserved fruits jaggery based food, butter, butter milk, traditional food and dishes with wild edible plants	L6
CO2	Compile the data mentioned in the syllabus	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	1	0	2	2	2
CO 2	3	1	0	2	2	1
CO 3	3	1	1	2	2	2
CO4	3	1	0	2	2	2

Unit	Description	No. of Hours.
I	**Agrotourism -I** **Introduction** to Agro-Tourism **What is Agro-Tourism**?: Definition, scope, and concept of farm-based tourism. **History & Evolution**: Traditional farming practices and tourism growth in India. **Benefits of Agro**: Tourism: Rural employment, sustainable development, and eco-tourism impact. **Agro-Tourism Activities & Attractions**: Farm Stays & Rural, Accommodations: Village life experiences. **Festivals & Event:** Local festivals (Pola, Makar Sankranti, Gudhi Padwa) and their role in tourism. **Farming Practices in Agro-Tourism:** Organic Farming & Permaculture–Sustainable farming, organic produce, composting. Hydroponics & Urban Farming–Simple ways to grow food without soil.	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:25BU6VSC01	**(02 Credits)**	**No of lecture in Hrs. 45**
Practicals based on 25BU6VSC01		
	Name of the experiment	
1.	Natural Insect Repellent from Plants- Use leaves of Neem, Tulsi, and Lemongrass to make a natural insect repellent spray.	
2.	Effect of Sugar on Flower Longevity: Keep fresh-cut flowers in different solutions (plain water, sugar water, salt water).	
3.	Natural Plant Perfume (Essential Oil Extraction)- Crush rose petals, jasmine, or lavender and heat them in water	
4.	Growing Plants Without Soil (Hydroponics at Home)	
5.	Natural Sunscreen from Plant Extracts	
6.	Making Herbal Tea Bags	
7.	Preparation of Organic Jaggery	
8.	Making Fruit-Based Vinegar	
9.	Preparation of Herbal Bath Powder (Ubtan)	
10.	Making Farm-Based Bio-Enzyme Cleaners	
11.	Preservation of Fruits & Vegetables Using Sun, Shade, and Oven Drying	
12.	Extraction of Natural Gum from Trees	
13.	Study of Indigenous Agro-Based Handicrafts	
14.	Identification of Wild Edible Plants and Their Uses	
15.	Preparation of Herbal Tooth Powder	
16.	Homemade Probiotic Drink (Fermented Rice Water)	
17.	Making Wild Edible Plant Dishes	
18.	Making Jaggery-Based Sweet Dishes	
19.	Making Fresh Butter & Buttermilk	
20.	Traditional Chulha Cooking Experience	

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1	Ajay Singh. Plants in Ancient Indian Civilizations by BOTANY IN VEDAS

2	B.R. Vashishta, (1998). Fungi. S. Chanda & Company, New Delhi
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VPM's B.N. Bandodkar College of Science (Autonomous), Thane

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

	SEMESTER – V	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**
25BUBO5T01	Plant Diversity III	√	–	–	–	–	–	–
25BUBO5T02	Plant Diversity IV	√	–	–	–	–	–	–
25BUBO5T03	Form and Functions III	√	-	–	–	–	–	–
25BUBO5P01	Practical based on **25BUBO5T01 and 25BUBO5T02**	√	–	√	–	–	–	–
25BUBO5P02	Practical based on **25BUBO5T01 and25BUBO5T02**	√	–	√	–	–	–	–
25BUBO5P03	Practical based on**25BUBO5T03**	√	–	√	–	—	–	–
25BUBO5TE1	Instrumentation	√	–	-	–	–	–	-
25BUBO5PE2	Practical based on **25BUBO5TE1**	√	–	√	–	–	–	–
25BUBO5TE2	Botanical Aroma Science	√	√	–	√	–	–	√
25BUBO5PE2	Practical based on **25BUBO5TE2**	√	√	√	√	–	–	√
25BU5VSC01	Essential nutrients	√	√	√	–	–	–	√
	Minor Course Title							
25BUBO5TMN	Instrumentation	√	–	√	–	–	–	–
25BUBO5OJT	On-Job-Training	√	–	√		–	–	—
Total	**13**	**13**	**03**	**08**	**02**	**01**	**–**	**3**

	SEMESTER – VI	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**
25BUBO6T01	Plant Diversity III	√	–	–	–	–	–	–
25BUBO6T02	Plant Diversity IV	√	–	–	–	–	–	–
25BUBO6T03	Form and Function III	√	–	–	–	–	–	–
25BUBO6T04	Current Trends in Plant Science I	√	–	–	–	–	–	–
25BUBO6P01	Practicals based on **25BUBO6T01 and 25BUBO6T02**	√	–	√	–	–	–	–
25BUBO6P02	Practicals based on **25BUBO6T01 and 25BUBO6T02**	√	–	√	–	–	–	–
25BUBO6P03	Practicals based on **25BUBO6T03 and 25BUBO6T04**	√	–	√	–	–	–	–
25BUBO6TE1	Sustainable solutions and Cosmetology	√	√	-	–	–	–	√
25BUBO6PE1	Practicals based on **25BUBO6TE1**	√	√	√	–	–	–	√
25BUBO6TE2	Pollution science	√	–	–	–	–	–	√
25BUBO6PE2	Practicals based on **25BUBO6TE2**	√	–	√	–	—	–	√
25BU6VSC01	Agrotourism	√	√	√	–	–	–	√
25BUBO6OJT	On-Job-Training	√	–	√	–	–	–	–
Total	**13**	**13**	**03**	**07**	**–**	**–**	**–**	**05**