Academic Council Meeting No. and Date : 8 / September 04, 2023

Agenda Number : 2 Resolution Number : 34, 35 / 2.1, 2.22

Vidya Prasarak Mandal's

B. N. Bandodkar College of Science (Autonomous), Thane

Syllabus for

Programme : Bachelor of Science

Specific Programme : BOTANY

[F.Y.B.Sc. BOTANY]

Level 4.5

CHOICE BASED GRADING SYSTEM

Revised under NEP

From academic year 2023 - 2024

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Preamble

Vidya Prasarak Mandal (VPM), Thane is an educational trust, established to provide educational facilities to the city of Thane. Starting with a modest beginning in 1935, it has now grown into an educational society that caters to the needs of about 15,000 students in the Thane campus, from kindergarten to post-graduation in different disciplines of science and humanities, including law and polytechnic. Recently, VPM has set up an Engineering college at Velneshwar, Guhagar Taluka, Ratnagiri District, Maharashtra in the rural area. The list of institutions managed by VPM is given below (along with its year of establishment). Most of its institutions are affiliated with Mumbai University.

In 1956, the birth centenary year of Lokmanya Tilak, a young doctor named Dr. V. N.Bedekar from Vile Parle started his practice in Thane. Inspired by Lokmanya's efforts in the academic field, he joined Vidya Prasarak Mandal and soon became its President.

He had a dream of creating the "Island of Knowledge" (Janyandweepa) in Thane. Thus, with a singular zeal, exemplary perseverance, and with wholehearted support from colleagues, he succeeded in realizing it. Till his death (at the age of 85) he was the guiding light of the institute. After his sad demise, his son Dr. Vijay Bedekar became the President. He is a man of vision. Under his leadership, VPM is a growing tree.

The Department of Botany was established in June 1969. The department is dedicated to providing higher education to rural youth and offers B.Sc. M.Sc. (by research) and Ph.D. degrees in Botany. The department has so far graduated over 1500 graduates, 15 postgraduate students, and over 20 Ph.D. candidates. Alumni from this department are currently employed in a variety of professions, including banking, agriculture, medical, central and state government services, industry, and education. The majority of alumni serve as prominent experts in the fields of environmental protection, education, and industry in Maharashtra. Consulting firms in India and Maharashtra.

The Department has a sufficient amount of infrastructure, including research labs, instrumentation labs with moderate equipment, and computer labs with computers running GIS software. Internet access is made available to the students. Nearly all of the required book recommendations are in the main library. The intake capacity is 20 for B.Sc., M.Sc. by research 02 and for the Ph.D. it is 03.

A three-year degree program in Life (Plant) Sciences, the Bachelor of Science (B.Sc.) program in Botany is offered. The course's duration and syllabus are broken up into semesters. These courses have six-month semesters. This program's subjects are taught via theory lectures, hourly practical’s, and tutorials for a total of 32 credits. Each semester's examination plan is broken down into smaller components, including quizzes, tutorials, vivas, assignments, seminars, sessional and end-of-semester exams, and dissertation research. It includes a broad variety of scientific fields within botany that deal with the study of both lower and higher plants.

The B.Sc. in Botany program offers papers on a wide range of plant sciences, covering both fundamental and advanced topics in Bryology, Pteridology, Gymnosperms, Plant Resource Utilization, and Angiosperms: Phylogeny & Embryology, Phycology, and Cell & Molecular Biology. Plant & Animal Biotechnology, Forestry, Comprehensive Test & Field Botany, Plant Pathology, Plant Physiology, Seminar, Research Methodology, Computational Biology & Bio-statics, Genetic Engineering, Environmental Botany, Mycology, Synopsis Seminar, Biochemistry and Molecular Biology of Plants.

The Bachelor of Science in Botany program's curriculum framework aims to modernize course material and teaching to give the following generation of students a multi-discipline student-centered and outcome-based education.

The emphasis has been on maintaining academic coherence and continuum throughout the program of study and helping build a strong foundation in the subject, ensuring a smooth transition into their careers. This is in addition to structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels.

The emphasis is on reducing repetition, discouraging rote learning, and encouraging learners to approach problems critically and with an open mind.

The curriculum is based on the idea that students learn science more effectively through hands-on training, projects, field studies, industry visits, and internships rather than only in a traditional classroom setting.

This syllabus has been updated to reflect modern technology, which helps students stay up to date on cutting-edge advancements in plant sciences and fosters innovation, curiosity, and a love of learning that will serve them well in their journeys of scientific exploration and adventure after they graduate.

The objective is to provide students with comprehensive information, competencies, professional skills, and a strong, optimistic mind-set that they can use to navigate the current, difficult challenges of the job market.

The Botany curriculum serves as a road map for instructors and students as they go through the subject from the start of the first academic year to the conclusion of the third. This program covers considerably more than just the information in the course as it is described here. It is about the lifelong process of personal improvement that each student acquires from their contacts with the teachers here. On this procedure, I would like to reflect back.

As a requirement for the B.Sc. course, the projects motivate the students to conduct research. Additionally, the students are exposed to seminars, and brief training and a distinguished expert gives a guest lecture. The faculty encourages students' willingness to further their education knowledge of and interest in the topic.

Educational Scope and career options After Bachelor of Science (B.Sc.) Botany

Botany opens up a person's options for education and employment in a variety of science-related fields, including microbiology, biotechnology, and even medical technology. Any aspects of plants that are linked to education are covered, such as agriculture engineering, horticulture, research, etc.

After completing this course, students can pursue M.Sc. and research. There is potential for the student to have an opportunity to work in national and state governments since relevant course topics are provided. The learner also has the option of working for themselves.

Dr.V.M. Jamdhade
Chairmen BOS, & Professor and Head

Eligibility:

Passed 12th standard (HSC) of Maharashtra State Board / CBSE / ICSE board.

Degree Programme: B.Sc. Level: 4.5

Duration: 3 year (Syllabus for First Year semester I & II)

Mode of Conduct:

Statistics Offline lectures / online lectures.

Discipline/Subject: Botany

Specific Programme: B.Sc

Qualification Title: UG certificate

Program Specific Outcome

- The Bachelor of Science in Botany program's program of study aims to transform course material and teaching methods in order to give the next generation of students a multidisciplinary, student-centered, outcome-based education.
- The emphasis has been on maintaining academic consistency and progression throughout the program of study to help students build an excellent foundation in the subject, ensuring that students transition smoothly into their careers. This is in addition to structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels.
- Attention is given to avoiding repetition, limiting rote acquisition of knowledge, and encouraging learners to adopt a problem-solving, critical-thinking, and inquisitive mindset.
- The curriculum pays attention to the idea that practical experience—classroom instruction, projects, fieldwork, visits to industries and internships—is the most effective method to learn the field of science.
- The program of study has been revised to reflect recent advances in technology and helps students keep up with the latest developments on advanced developments in plant sciences. It also encourages imagination, curiosity, and an enthusiasm for learning, all of which will be helpful to them in their journeys of scientific discovery and exciting adventures once they graduate.
- The goal is to provide students with wide-ranging knowledge, competencies, professional skills, and a strong, positive mindset that they can use as a resource while they navigate the present, competitive job marketplace.

Introduction of Botany Program
Choice-based Credit and Grading System
Syllabus Semester -I and II

I. **Aims of Bachelor's degree program in Botany**

The broad aims of the bachelor's degree program in Botany are:

1. To generate an environment that supports kids' complete cognitive growth. Instead of didactic lectures on only theoretical topics, this structure encourages interaction about plants and their significance.
2. To give students the most current knowledge, both theoretical and practical, to support their core competencies and exploration learning. According to this framework, a botany graduate would be qualified to pursue additional discipline-specific courses as well as to start a career in a related field.
3. To create a responsible citizen who is capable of critical thinking and communication as well as possessing the most important property-independent knowledge.
4. To make it achievable for the graduate to prepare for both national and international competitive examinations, especially the UPSC Civil Services Exam and the UGC-CSIR NET.

II. **Outline of Choice Based Credit System:**

1) **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2) **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
3) **Discipline-Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by the main discipline/subject of study).
4) **Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with advisory support by a teacher/faculty member is called dissertation/project.
5) **Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, to seek exposure is called a Generic Elective. P.S.: A core course offered in a discipline/subject may be treated as an elective by another discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
6) **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are courses based on the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on training, competencies, skills, etc.
7) **AE Compulsory Course (AECC):** Environmental Science, English Communication/MIL Communication.
8) **AE Elective Course (AEEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.
9) **Project work/Dissertation** is considered as a special course involving application of knowledge in solving / analysing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline-specific elective paper.

10) **Continuous Internal Evaluation: All** course types—theory, practical, project-based, and field study—include a continuous internal evaluation. The components and their weighting may be decided by the teacher by the guidelines of the university. The internal evaluation components and their proportional weighting should be announced to the students at the start of each learning activity by the relevant teacher. One week before the finish of each semester, the results of the internal evaluation should be displayed on the notice board.

11) **BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN**

K1 - Remembering; K2 - Understanding; K3 - Applying; K4 - Analyzing; K5 - Evaluating

III. Course teaching-learning process:

The learning experiences gained for cognitive development in every student. The practical exercises help to develop an important aspect of the teaching-learning process.The important relevant teaching and learning processes involved in this course are; Class lectures, Seminars, Group discussions and Workshops, Question framing, Short answer type questions, Long answer type questions, Objective-type questions, Multiple-choice questions, Statement, reasoning, and explanation, Project-based learning, Field-based learning, Practical component and experiments, Quizzes. Presentations through Posters and PowerPoint

IV. Theory:

The lesson plan for the week will be prepared before the commencement of the session and followed during the session.The theory topics are covered in lectures with the help of both conventional (chalkboard and Charts) and modern (ICT) methods, including animations.

Emphasis is given on an interactive classroom environment to encourage to students ask questions/ doubts/ queries for clarification/explanation and discussion.

Students are encouraged to refer to reference books in library to inculcate reading habits for a better grasp and understanding of the subject.

Emphasis is given to illustrations- neat, well-labelled outlines and cellular diagrams/ flowcharts for improving creative skills and to substantiate the text content.

On completion of the theory syllabus, previous years' question papers are discussed to apprise students about the general format of semester exam question papers.

V. Practical:

Practical plan for each week will be prepared before the commencement of the session and followed during the session.Every practical session begins with instructions, followed by students doing table work for a detailed microscopic plant study.Plant study is done using fixed plant materials, museum and herbarium specimens, photographs, and permanent slides.The students are instructed about maintaining practical records, which include comments and diagrams.Students are asked to submit practical records regularly, continuously, for checking.On completion of the practical syllabus, Practical Exam Guidelines are discussed to apprise students about the format of the Practical exam.

VI. Theory Examination Pattern:

Internal Assessment – 20 Marks

External examination – 30 Marks (Semester end theory assessment)

Duration - These examinations shall be of two hours duration.

Theory question paper pattern: Attached herewith.

VII. Practical Examination Pattern:

Internal Examination: There will not be any internal examination/ evaluation for practicals.

External (Semester end practical examination) .The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination. In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from the Head of the Department/ Coordinator of the department; failing which the student will not be allowed to appear for the practical examination. Practical paper pattern: Attached herewith.

Eligibility: Passed 12th standard (HSC) of Maharashtra State Board / CBSE / ICSE board or any other equivalent board with Biology as one of the subjects

Duration: 3 years
Mode of Conduct: Laboratory practical / Offline lectures / online lectures.

VIII. **B. Sc. Botany Course outcomes under NEP-2020 program**

- The Bachelor of Science in Botany program's program of study aims to transform course material and teaching methods in order to give the next generation of students a multidisciplinary, student-centered, outcome-based education.
- The emphasis has been on maintaining academic consistency and progression throughout the program of study to help students build an excellent foundation in the subject, ensuring that students transition smoothly into their careers. This is in addition to structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels.
- Attention is given to avoiding repetition, limiting rote acquisition of knowledge, and encouraging learners to adopt a problem-solving, critical-thinking, and inquisitive mindset.
- The curriculum pays attention to the idea that practical experience—classroom instruction, projects, fieldwork, visits to industries and internships—is the most effective method to learn the field of science.
- The program of study has been revised to reflect recent advances in technology and helps students keep up with the latest developments on advanced developments in plant sciences. It also encourages imagination, curiosity, and an enthusiasm for learning, all of which will be helpful to them in their journeys of scientific discovery and exciting adventures once they graduate.
- The goal is to provide students with wide-ranging knowledge, competencies, professional skills, and a strong, positive mindset that they can use as a resource while they navigate the present, competitive job marketplace.

IX. **Program Learning Outcomes.**The B.Sc. Three-year and B.Sc. (Honors) Botany degrees should be achievable for graduates.

X. **Core competency:** Students will develop fundamental skills in the subjects of botany as well as associated fields. The student will be able to identify the major plant groups and contrast the characteristics of lower (such as fungus and algae) and higher (such as angiosperms and gymnosperms) plants. Students will be able to describe the evolution of species as well as understand the genetic variation on the planet using the evidence-based comparative botany approach. The students will be able to discuss the various processes and functions of plants, metabolism, the ideas of genes and the genome, and how an organism's function changes at the level of its cells, tissues, and organs. Students will be able to understand how different types of life adapt, evolve, and interact. Students are supposed to understand how life is connected on Earth and how to trace the energy pyramids using nutrient flow. Students will be able to demonstrate the experimental techniques and processes specific to their specialization in Botany focusing.

XI. ***Attributes of a Botany Graduate***

1) **Analytical ability:** The ability of the students to understand research and react to practical problems will be demonstrated. Using several kinds of scientific techniques, students develop hypotheses, acquire data, and then critically evaluate that data in order to evaluate how well the study supports those hypotheses.
2) **Critical Thinking and problem-solving ability:** After this course, a deeper understanding of foundational concepts and their applications to scientific principles will be achieved. The capability to think critically and solve problems will be nurtured by the students.
3) **Digitally equipped:** Students will learn digital skills and combine important concepts with innovative tools.
4) **Ethical and Psychological strengthening:** Students will become more capable of dealing with psychological problems and will develop their moral and ethical values.

5) **Team Player**: To work efficiently in institutions industry, and society, students will learn teamwork.
6) **Psychological skills**: Graduates are expected to have the fundamental psychological skills required for success in modern-day society, as well as the capacity to interact effectively with fellow citizens and learners from many different kinds of socioeconomic, cultural, and educational backgrounds. Feedback loops, self-compassion, self-reflection, goal-setting, interpersonal interactions, and emotional regulation are aspects of psychological capabilities.
7) **Problem-solving**: Graduates will be expected to have multidisciplinary abilities to solve issues and philosophical viewpoints;
8) **Moral and ethical awareness**: Graduates are expected to comprehend the moral and ethical standards of both India and the rest of the world and act responsibly as citizens. They have to express their essential moral principles enough to differentiate between what the Indian Constitution defines as a crime and what is illegal. Academic and research ethics should be highlighted, including fair benefit sharing, plagiarism, scientific misconduct, and different issues.
9) **Leadership readiness**: To become a more effective leader graduates must have to be familiar with the decision-making process and basic skills in leadership. Creating an objective vision and objective, acquiring the knowledge to become an innovative, motivating leader, along with additional aspects include glimpses of skills.
10) **Independent Learner**: Along with subject-specific skills, general skills, particularly in botany, would be gained as an outcome of the curriculum, preparing students for further higher education, competitive exams, and employment. A curriculum focused on learning outcomes would guarantee uniform academic standards across the nation and a more comprehensive view of their skills. The Botany bachelor's degree and Botany honor program can be either mono- or multi-disciplinary.

XII. **Eligibility Criteria: The** Secondary School Leaving Certificate, which is obtained after successfully completing Grade 12, is the general entry qualification for entry into Semester I of the B.Sc. Botany (Honours) program. Students who meet the entrance criteria, which include certain levels of achievement at the secondary level of education stipulated in the program admission standards, are eligible to enrol in a program of study leading to entry into the first year of the bachelor's degree.

The UGC Guidelines for Multiple Entry and Exit Scheme in Academic Programmes Offered in Higher Education specify that admission to the Bachelor's degree program of study will depend on the evaluation of documentary evidence (including the academic record) of the applicant's ability to undertake and complete a Bachelor's degree program.

XIII. **Choice-based credit system (CBCS):** The CBCS gives students the option to select courses from the list that include core, elective/minor, or skill-based courses. The grading system is being used to evaluate the courses; it is considered to be more accurate than the conventional marks system. As a result, India's whole higher education system has to adopt a unified grading system. The students will benefit from being able to transfer across colleges both inside and outside of India. The standard grading system would also make it possible for prospective employers to evaluate the candidates' performance. The UGC has established the rules to be followed to provide consistency to the assessment process and computation of the Cumulative Grade Point Average (CGPA) based on student performance in examinations.

VPM's B.N.Bandodkar College of Science (Autonomous), Thane
F.Y.B.Sc. (Botany)
Structure of Programme

Semester 1: Major			
Course Code	**Course Title**	**No. of lectures In hrs**	**Credits**
23BUBO1T1	**Plant Diversity - I**	**30**	**2**
23BUBO1T2	**Forms and Function - I**	**30**	**2**
23BUBO1P1	**Botany Practicals based on 23BUBO1T1 and 23BUBO1T2**	**60**	**2**
23BU1SEC7	**Horticulture and Gardening**	**45**	**2**
	Total	**165**	**8**
Semester 1: Minor			
Course Code	**Course Title**	**No. of lectures In hrs**	**Credits**
23BUBO1T3	**Plant Diversity - I**	**30**	**2**
23BUBO1T4	**Form and Function - I**	**30**	**2**
23BUBO1P2	**Botany Practicals based on 23BUBO1T3 and 23BUBO1T4**	**60**	**2**
	Total	**120**	**6**
Semester 1: Generic			
23BUBO1T5	**Thallophyta and Economic Botany**	**30**	**2**
	Total	**30**	**2**
Optional Electives Semester 1 -Interdisciplinary Sciences			
23BUID1T6	**Soft skills and personality development-I**	**30**	**2**
	Total	**30**	**2**
Course Title Semester 1 - (AEC)			
23BUEN1T8	**Basic English Learning course**	**30**	**2**
	Total	**30**	**2**
Semester 1 - Indian Knowledge System			
23BUIK1T9	**Indian Knowledge System**	**30**	**2**
	Total	**30**	**2**

Semester 2: Major			
Course Code	**Course Title**	**No. of lectures In hrs**	**Credits**
23BUBO2T1	**Plant Diversity - II**	**30**	**2**
23BUBO2T2	**Forms and Function - II**	**30**	**2**
23BUBO2P1	**Botany Practicals based on 23BUBO2T1 and 23BUBO2T2**	**60**	**2**
23BU2SEC7	**Floriculture (Flower Arrangement)**	**45**	**2**
	Total	**165**	**8**
Semester 2: Minor			
Course Code	**Course Title**	**No. of lectures In hrs**	**Credits**
23BUBO2T3	**Plant Diversity - II**	**30**	**2**
23BUBO2T4	**Forms and Function - II**	**30**	**2**
23BUBO2P2	**Botany Practicals based on 23BUBO2T3 and 23BUBO2T4**	**60**	**2**
	Total	**120**	**6**
Semester 2: Generic			
23BUBO2T5	**Ayurveda and Medicinal Botany**	**30**	**2**
	Total	**30**	**2**
Optional electives Semester 2-Interdisciplinary sciences			
23BUID2T6	**Soft skills and personality development-II**	**30**	**2**
	Total	**30**	**2**
Course Title Semester 2 (AEC)			
23BUEN2T8	**Scientific *English writing***	**30**	**2**
	Total	**30**	**2**
Semester 2- Indian Knowledge System			
23BUIK2T9	**Indian Knowledge System**	**30**	**2**
	Total	**30**	**2**

Note: AEC , IKS, Open elective syllabus view separately.

UNIVERSITY OF MUMBAI
SYLLABUS FOR FY UG PROGRAM IN BOTANY
(UNDER CBCS AS PER NEP–2020)
UG SEMESTER–I
Major

Course Type	Course Code	Year	Semester	Total Lecture/ hrs	Credit	Duration
Degree Course in B.Sc. Botany - (Major) –Plant Diversity-I	23BUBO1T1	**B.Sc. - I**	**1**	**30**	**02**	**06 Months**

Pre-requisite: Students should know about the fundamentals of algae, fungi, and Bryophytes.

Course objectives

1.	To study plants mentioned in Vedas
2.	To study the classification, distinguishing characteristics, geographic distribution, and reproductive cycle of Micr Algae, and Fungi.
3.	To recognize the contribution of eminent personalities the in scientific study of Microbes, Algae, and Fungi
4.	To identify and describe causal organisms, symptoms, and control measures of various viral and fungal disease
5.	Know the ecological and economic importance of algae, fungi, lichens, and bryophytes

Course Outcomes:

On the successful completion of the course, students will be able to:

1)	Gain an insight into traditional knowledge of plants used in Vedas: Past and present	**K1**
2)	Learn about the morphology, structure, reproduction, and life cycle of Algae, Fungi, Lichen, and Bryophytes	**K1 & K3**
3)	Study the various classes and major types of Algae, Fungi, and Bryophytes and variations in life cycles and life histories	**K1 & K2**
4)	Understand the fundamentals of economic importance and biomedical applications of selected species of Algae, Fungi, Lichen, and Bryophytes	**K2 & K3**
5)	Apply knowledge in identifying and controlling various viral and fungal diseases	**K5**
6)	Create an idea to seek a suitable job in relevant industries or to become a potential entrepreneur based on knowledge and hands-on Practicals achieved during the course.	**K6**

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit	Title of the Topic	L.
I	**Algae-Phycology and Fungi (Mycology)**	
1.1	Introduction, objective and Scope and general characters of Algae and Fungi	**15**
1.2	Structure, life cycle, and systematic position of *Nostoc*	
1.3	Economic importance of algae [*Ulva* (Biofuel), *Spirulina* (Nutraceutical), *Gelidium* (Agar)]. Contributions made by Prof. Mandayam Osuri Parthasarathy Iyengar. Introduction, objectives,	

	and Importance of Applied Botany. Various Disciplines of Botany and their applications to human welfare. Agharkar Research Institute (ARI)-Pune	
II	**Bryophyta (Bryology)**	***15***
2.1	Introduction, objective, and scope and general characters of Bryophyta	
2.2	Structure, life cycle, and systematic position of *Riccia*.	
2.3	Economic importance of Bryophytes (*Marchantia*, Riccia, and Peat moss).Moss in indoor gardening- Kokedama (moss ball) for hanging plants, use of moss in Hanging baskets, Moss Sticks for climbers, use of Moss for Bottle garden.	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters	
	Pedagogy: Seminar, Quiz, Debate, collection of and identification and preservation of local area bryophytes and report on it. Collection study of fresh and marine Algae available in the local area. Observation and collection of plant diseases and report on them.	

	Suggested Readings
1.	Ajay Singh. Plants in Ancient Indian Civilizations by BOTANY IN VEDAS
2.	B.R. Vashishta, (1998). Fungi. S. Chanda & Company, New Delhi
3.	B.R. Vashishta, (1998). The Algae. S. Chanda & Company, New Delhi
4.	C.G. Bose. Manual of Indian Botany
5.	C.L. Chopra, (1982). Algae. S. Chanda & Company, New Delhi
6.	Chopra, R. N. 2005. Biology of bryophytes. New Age International (P) Ltd. New Delhi, India.
7.	Dr. P.K. Mishra. Botany in Vedas Publisher: Write And Print Publications
8.	Gangulee, Das & Kar. 2001. College Botany Vol. II. New Central Book Agency Pvt. Ltd., Calcutta.
9.	O.P. Sharma. (2002).Textbook of Fungi. Tata McGraw-Hill Publications, New Delhi.
10.	Pandey, P.B. 2014. College Botany - 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.

Course Type	Course Code	Year	Semester	No. of Practical / Week -	Credit	Duration
Degree Course in B.Sc. Botany - (Major) **–Plant Diversity-I**	23BUBO1P1	**B.Sc. -I**	**I**	**01**	**01**	**06 Months**

	Name of the experiment	P/Week
I	**Basic Hands-on training**	
1.	Introduction to the dissecting and compound microscope	**1**
2.	Introduction basic stains, sectioning, mounting, and staining technique	**1**
III	**Algae**	
3.	Study of stages in the life cycle of *Nostoc* & *Spirogyra* from fresh/ preserved material and permanent slides	1
4.	Economic importance of algae: *Ulva* (Biofuel), *Spirulina* (Nutraceutical), *Gelidium* (Agar)	1
IV	**Fungi**	
5.	Study of stages in the life cycle of *Rhizopus* & *Aspergillus* from fresh/ preserved material and permanent slides.	1
6.	Economic importance of Fungi: Mushroom, Yeast, wood rotting fungi (*Ganoderma*).	1
V	**Bryophyta**	
7.	Study of stages in the life cycle of *Riccia* from fresh/ preserved material.	1
8.	Economic importance of Bryophytes: Medicinal (*Marchantia* sp., *Riccia*, and Peat moss.),	1

	Suggested Readings
1.	Bendre and Kumar. Practical Volume 1 and 2 Rastogi Publication, Meerut 1st 2008
2.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi.
3.	Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.
4.	Sambamurty, A.V.S.S. (2006). A textbook of algae. I.K International Publishing House, Pvt. Ltd.
5.	Trivedi P.C.Medicinal Plants: Ethnobotanical approach Agrobios India 2006
6.	Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.

Course Type	Course Code	Year	Semester	Total Lecture / hrs	Credit	Duration
Degree Course in B.Sc. Botany - (Major/Minor) – Forms and Function -I	23BUBO1T2	B.Sc. -I	I	30	02	06 Months

Pre-requisite: Students should know about the fundamentals of Ecology, Genetics, and Biostatistics.

Course objectives

The main objectives of this course are to:

1.	To learn about different cell organelles and important processes within the cell
2.	To study the ultra-structure of the nucleus & its function also the characteristics of the genetic code, transcription, and translation processes.
3.	To inculcate knowledge and create awareness about ecological and environmental concepts, issues, and solutions to environmental problems
4.	To learn the basic principles of Biostatistics.
5.	To impart knowledge to solve biological problems.

Course Outcomes

On the successful completion of the course, students will be able to:

1.	Understand the general structure of prokaryotic and eukaryotic cells, the plant cell wall, plasma membrane, and Chloroplast.	**K2**
2.	Learn about the ecosystem, biotic and abiotic components, and energy pyramids	**K3**
3.	Gain knowledge and comprehend classical Mendelian genetics- mono-hybrid, dihybrid; test cross; back cross ratio	**K2 & K3**
4.	Remembering elementary bio-statistics and the role of model organisms in genetics	**K1**
5.	Analyze or interpret the results achieved in practical sessions in the context of existing theory and knowledge.	**K4**
6.	Create an idea to seek a suitable job in relevant industries or to become a potential entrepreneur based on knowledge and hands-on practical's achieved during the course. Analyze and solve biologically related problems using bio-statistical formulae.	**K5 & K6**

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Unit	Title of the Unit	L
I	**Plant Cell Biology**	15
1.1	Introduction, objective and scope and general characters of plant cell biology	
1.2	The general structure of Prokaryotic and Eukaryotic cells. The general structure of plant cell: Cell wall, Plasma membrane (bilayer lipid structure, fluid mosaic model).	
1.3	Types of Plastids: Chromoplasts (Chloroplast) and types of Leucoplast, Ultra-structure and functions of the following cell organelle: Chloroplast. The Centre for Cellular & Molecular Biology (CCMB)-Hyderabad	
II	**Genetics and Biostatistics**	**15**
2.1	Introduction, objective and scope and general characters of plant genetics and Biostatistics	
2.2	Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.	
	Biostatistics: Mean, Median, and Mode, Standard deviation	
2.3	ICAR-NBPGR RS, Akola-Maharashtra. Plant model organism – Introduction to *Arabidopsis.* Contribution of *P.C. Mahalanobis Indian statistician. Indian Statistical Institute-Kolkata.*	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars – webinars for strengthening the subject matters.	**02**

	Pedagogy: Seminar, quiz, debate, visit to instrument/tissue culture lab and report on it. Visit to Municipal Corporation dumping garden and report on it.	**02**

	Suggested Readings
1)	De Robertis E. D. P., Cell Biology and Molecular Biology, 8th edition, Lea and Febinger, 1987.
2)	Mahajan B.K., Methods in Biostatistics: For medical students and research workers, Jaypee Brothers Medical Publishers, 2008.
3).	Odum E. P., Barrett G. W., Principles of Ecology, Brooks and Cole, 2004.
4).	P S S Sunder Rao Introduction to Biostatistics and Research Methods
5).	Sharma. P. D. 1993. Ecology and Environment, Rastogi Pub., New Delhi
6).	Verma P. S., Agarwal V.K., Textbook of Environmental Biology, S. Chand, 2000.
7).	Powar, C.B. and Daginawala, H.F. (1982). General Microbiology Vol. II. Himalaya Publishers, Bombay.
8).	Jain S. K. & Mudgal V., A Handbook Of Ethnobotany, Bishen Singh Mahendra Pal Singh, Debra Dun, 1999
9).	Bhattacharya K., M. R. Majumdar and S. G. Bhattacharya. (2006). A text Book of Palynology, New Central Book Agency (P) Ltd., Kolkata, India.

Course Type	**Course Code**	**Year**	**Semester**	**No. of Practical / Week -**	**Credit**	**Duration**
Certificate Course in Basic Botany -(Major)- Forms and Function- I	23BUBO1P1	**B.Sc. -I**	**I**	**01**	**01**	**06 Months**

	Name of the experiment	**P/Week**
I	**Plant Cell Biology**	
1.	Identification of Prokaryotic and Eukaryotic cells with the help of photomicrograph.	1
2.	Identification of plant cell -Cell wall, Plasma membrane (bilayer lipid structure, fluid mosaic model) with the help of photomicrograph.	1
3.	Identification of cell organelles with the help of photomicrograph: Plastids: Chromoplasts (Chloroplast) and types of Leucoplast.	1
4.	Starch grains of Potato and Rice.	1
II.	**Genetics**	
5	**Study of Karyotype s:** *Aloe Vera, Allium cepa.*	1
6	Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.	1
III	**Biostatistics**	
7	Calculation of mean, median, and mode.	1
8	Calculation of standard deviation.	1
9	Graph preparation using simple data from experiments	1

	Suggested Readings
1.	B P Pandey Modern Practical Botany Vol-I
2.	Bendre and Kumar.Practical Volume 1 and 2 Rastogi Publication, Meerut 1st 2008
3.	Cell and Molecular Biology: Concept and Experiments Vol. 2 Karp, G.John Wiley and Sons, Inc., USA.1999
4.	Molecular Biology of the Cell Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter Garland Publishing Inc, New York.2nd 1989
5.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi
6.	Practical in Botany F.Y.B.Sc. Sem I & II Sheth Publication, Publisher: Sheth Author: Golatkar
7.	Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.
8.	Rastogi, V B Fundamentals of Biostatistics Ane Book India 2nd edition
9.	Russel. Genetics Wesley Longman inc publishers,5th.2000
10.	Singh B.D.Genetics, Kalyani Publication, Ludhiana 2004

SEMESTER-II MAJOR SYLLABUS

Course Type	Course Code	Year	Semester	Total Lecture/ hrs	Credit	Duration
Degree Course in B.Sc. Botany -(Major) – Plant Diversity-II	23BUBO2T1	B.Sc. -I	II	30	02	06 Months

Pre-requisite: Students should know about the fundamentals of Pteridophytes, Gymnosperms, and Plant Taxonomy.

Course Objectives

The main objectives of this course are to:

1.	To understand the enormous diversity and range of diversity and range of diversification of all species in the world
2.	To realize the fundamental values of diversity and their importance to human welfare.
3.	To define and characterize the diversity of lower vascular plants to understand the dynamics of diversity to realize the significance of diversity.
4.	To understand and conceptualize the classification and life cycle of members belonging to Pteridophytes and Gymnosperms.
5.	To be familiar with the basic concepts and principles of plant systematics.
6.	The concept of landscape gardening concerning ornamental Pteridophytes and Gymnosperms
7.	The plants that attract butterflies and thus suitable for a butterfly garden

Course Outcomes

On the successful completion of the course, students will be able to:

1.	To understand the goals of diversity of plants important and characterizes.	K2
2.	To understand the subject knowledge provide multiple goods to satisfy social need.	K3
3.	To understand the cultural and economic needs of the owners such as food.	K2 & K3
4.	To acquire plant-based medicines, ornamental and spiritual well-being, fodder, and fuel wood	K1
5.	Apply knowledge of plant systematics in identifying families and plants	K4
6.	Apply the medicinal and economic aspects of Bryophytes, Pteridophytes, and Gymnosperms for the benefit of human welfare.	K5 & K6

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit	Title of the Unit:	L.
I	**Pteridophytes and Gymnosperms**	
1.1	**Introduction, objective and scope, and general characters of Pteridophyta and Gymnosperms**	

1.2	Structure life cycle, systematic position, and alternation of generations in *Nephrolepis.*	**15**
1.3	Structure life cycle systematic position and alternation of generations in *Cycas.*Economic importance of Gymnosperms - *Pinus* wood, turpentine oil, and seeds. *The contribution* **made by Janaki Ammal**.	
II	**Plant Taxonomy**	
2.1	Introduction, objective and scope and general characters of plant taxonomy	
2.2	**Study of the following families:** Malvaceae, Apocynaceae, Amaryllidaceae	
2.3	**Important plants in butterfly garden** : [*Lantana* (Ghaneri), *Hamelia* (Firebush), *Stachytarpheta* (Jamaican spike), *Calotropis* (Rui)].Pioneer in plant taxonomy .	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters.	**02**
	Pedagogy: Seminar, quiz, debate, visit to the local area and identify the flora of the College campus and report on it.Herbarium local wild plants.	**02**

Suggested Readings	
1)	Biswas, C. and Johrc, B.M. 1977. The Gymnosperms. Narosa Publishing House, New Delhi.
2)	Gangulee, Das &Kar. (2001). College Botany Vol II. New Central Book Agency Pvt. Ltd. Calcutta.
3)	P.C Vashista, (1992). Pteridophyta. Chand & Co., New Delhi.
4)	B.P. Pandey, (1981). Gymnosperms. Chand & Co., New Delhi.
5)	B.P. Pandey, (1994). A Textbook of Botany - Pteridophyta. Chand & Co. New Delhi.
6)	Rashid, (1995). An introduction to Pteridophytes. Vikas Publishing House, Pvt. Ltd., New Delhi.
7)	A.C. Dutta, (2007). Botany, Oxford University Press, New Delhi
8)	Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford and IBH Pvt. Ltd. New Delhi. 3rd edition.
9)	Gangulee H.C., Kar, A.K. and Santra S.C. (2011). College Botany Vol II. 4th Edition New Central Book Agency.
10)	Pandey, B.P. (2010). College Botany Vol II. S. Chand and Company Ltd., New Delhi, India.
11)	Cooke, T., 1967. The Flora of the Presidency of Bombay. Vol. I, II, III. Botanical Survey of India. Calcutta.
12)	Pandey, B.P., Angiosperms-Taxonomy, Embryology and Anatomy, S. Chand and Co., New Delhi

Course Type	**Course Code**	**Year**	**Semester**	**No. of Practical / Week -**	**Credit**	**Duration**
Degree Course in B.Sc. Botany - (Major) – Plant Diversity-II	**23BUBO2P1**	**B.Sc. -I**	**II**	**01**	**01**	**06 Months**

	Name of the experiment	**P/Week**
I	**Pteridophyta**	
1)	Study of stages in the life cycle of *Nephrolepis*: Mounting of Ramentum, Hydathodes	1
2.	T.S. of the pinna of *Nephrolepis* passing through sorus.	1
1.	Identification of living fossil Pteridophyta – Horsetails (*Equisetum*)	1

2.	**Ornamental Gardening**: Identification of Ornamental Pteridophytes [*Adiantum* (Maidenhair fern),*Platycerium* (Staghorn fern), *Asplenium* (Bird's nest fern)]	1
II.	**Gymnosperms**	
3.	*Cycas*: T.S of the leaflet (*Cycas* pinna)	1
4.	Identification of coralloid root, Megasporophyll & Microsporophyll. Slide preparation of microspores of *Cycas*	1
5.	Identification of photomicrographs of *Pinus* wood and seed. Identification of turpentine oil.	1
6.	Identification of Ornamental Gymnosperm [*Araucaria* (Christmas tree), *Zamia* (Cardboard palm), *Thuja* (Morpankhi)]	1
III	**Plant Taxonomy**	
7	**Study of the following families:** Malvaceae, Apocynaceae, Amaryllidaceae	3
8	**Important plants in butterfly garden** : [*Lantana* (Ghaneri), *Hamelia* (Firebush), *Stachytarpheta* (Jamaican spike), *Calotropis* (Rui)].	1

Suggested readings	
1.	B P Pandey Modern Practical Botany Vol-I
2.	Bendre and Kumar.Practical Volume 1 and 2 Rastogi Publication, Meerut 1st 2008
3.	Cell and Molecular Biology: Concept and Experiments Vol. 2 Karp, G. John Wiley and Sons, Inc., USA.1999
4.	Molecular Biology of the Cell Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter Garland Publishing Inc, New York.2nd 1989
5.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi.
6.	Golatkar V D . Practical in Botany F.Y.B.Sc. Sem I & II Sheth Publication, Publisher: Sheth
7.	Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.
8.	Rastogi, V B Fundamentals of Biostatistics Ane Book India 2nd
9.	Russel, Genetics, Wesley Longman inc publishers 5th 2000
10.	Singh B.D.Genetics, Kalyani Publication, Ludhiana 20

Course Type	**Course Code**	**Year**	**Semester**	**Total Lecture/ hrs**	**Credit**	**Duration**
Degree Course in B.Sc. Botany - (Major) – Forms and Function -II	**23BUBO2T2**	**B.Sc. -I**	**II**	**30**	**02**	**06 Months**

Pre-requisite: Students should know about the fundamentals of Plant Anatomy, Plant Physiology, and Ethnobotany.	
Course Objectives	
The main objectives of this course are to:	
1.	Learn about simple, complex, and sensory plant tissues

2)	Understand the pigment system and photosynthesis i.e. the light reactions and dark reactions	
3)	Get familiar with the concept of primary and secondary metabolites.	
4)	Get Traditional knowledge of medicines from Grandma's pouch and Ayurveda	
5)	Apply methods to transform Ethnobotanical knowledge into value-added products.	
Course Outcomes		
On the successful completion of the course, students will be able to:		
1.	Study the function and organization of woody stems derived from primary growth in Dicot and Monocot plants	**K1**
2.	Understand the various concepts of plant development and reproduction	**K2**
3.	Apply their idea on sectioning and dissection of plants to demonstrate various stages of plant development.	**K3**
4.	Validate the plant physiological scientific hypothesis by using various experiments	**K4**
5.	Gain awareness about the various process involved in the energy production in plants and metabolic pathways.	**K1**
6.	Recall or remember the concept of ethnobotany and Assess the methods to transform ethnobotanical knowledge into value-added products.	**K2 & K6**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

Unit	**Title of the Unit:**	**L**
I	**Plant Anatomy**	**15**
1.1	**Introduction, objective and scope and general characters of plant anatomy**	
1.2	Simple tissues, complex tissues. Primary structure of Dicot and Monocot root, stem, and leaf.	
1.3	**Epidermal tissue system:** Unicellular, multicellular, stellate, peltate, T-shaped leaf hair, Monocot, and Dicot stomata. **Sensory tissue** - concerning insectivorous plants [*Drosera* (Dewdrop), *Dionaea,*(Venus fly-trap), *Utricularia* (Bladder wort)] and *Mimosa* (Touch me not). Jagdish Chandra Bose, Father of Indian Plant Anatomy.	
II	**Plant Physiology**	**15**
2.1	**Introduction, objective and scope and general characters of Plant Physiology**	
2.2	**Photosynthesis:** Light reactions, photolysis of water, photo phosphorylation (cyclic and non-cyclic), carbon fixation phase (C3, C4, and CAM pathways)	
2.3	**Floral pigments:** Anthocyanin, Carotenoids. Dr.Prafullachandra Vishnu Sane - Indian molecular biologist and plant physiologist, pioneering studies on photosynthesis.	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters.	**02**
	Pedagogy: Seminar, quiz, debate, visit to the local area and identify the Medicinal plants from College Campus and report on it.	**02**

Suggested Readings	
1.	Pandey, B.P. 1993. Plant anatomy, S. Chand & Co, New Delhi
2.	Pandey, S. N. and Chadha, A. 2009. Plant anatomy and embryology. Vikas Publishing House Pvt. Ltd., New Delhi.
3.	Sharma, P.C. 2017. Text Book of Plant Anatomy. Arjun Publishing House, New Delhi.
4.	Verma V., Plant Physiology, ANE books, 2009.
5.	Verma, (1998). Textbook of Economic Botany, Embay Publishers, New Delhi
6.	Salisbury, F.B. and Ross, C.W. (1991) Plant physiology. (4th Ed), Wadsworth Publishing Company, Beverly.
7.	Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
8.	Pandey, B.P. (1992). Economic Botany. (S. Chand and Sons Co., New Delhi)
9.	Jain, S. K. (1995). A manual of Ethnobotany. Scientific Publishers, Jodhpur.

Course Type	Course Code	Year	Semester	No. of Practical / Week -	Credit	Duration
Certificate Course in Basic Botany – Forms and Function- II	23BUBO2P1	B.Sc. -I	II	01	01	06 Months

	Name of the experiment	P/Week
I	**Anatomy :**	
1.	Primary structure of Dicot and Monocot root.	1
2.	Primary structure of Dicot and Monocot stem.	1
3.	Study of Dicot and Monocot stomata.	1
4.	Epidermal outgrowths: with the help of mountings: As in theory	1
5.	Study of sensory tissue in *Drosera* (Dewdrop), *Dionaea* (Venus fly-trap), *Utricularia* (Bladder-wort)] and *Mimosa* (Touch me not)	1
II	**Physiology :**	
6.	Separation of chlorophyll pigments by strip paper chromatography.	1
7.	Study of absorption maxima of chlorophyll and carotenoid pigment by colorimetric method	1
8	Change in color because of change in pH: Anthocyanin: black grapes/Purple cabbage	1
9.	To study the effect of different concentration of CO2 on the rate of photosynthesis	1
10.	To study the effect of light intensity (by changing the distance) on the rate of photosynthesis using aquatic plants.	1

	Suggested Readings
1.	Bendre and Kumar. Practical Volume 1 and 2 Rastogi Publication, Meerut 1st 2008
2.	Indian Herbal Pharmacopoeia Indian drug Manufacturers' Association Mumbai: Indian drug Manufacturers' Association 2002
3.	Pandey B.P. Economic Botany S. Chand Publishers 1978
4.	Pandey, B.P. (2001). Plant Anatomy. S. Chand and Company Ltd., Ram Nagar, New Delhi.
5.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi.

After complete of this course, students will Job opportunities/ Entrepreneurship:

India is mostly an agricultural nation, which expands its use and utility. Technology is developing rapidly. There are several career and professional prospects with this degree. The following fields offer career prospects in both the public and commercial sectors:

Plantation Manager, Seed Technologies Firm, Operations Manager in Fertilizer Units, Agribusiness Development Manager, Food Processing Units in Government, Subject Matter Specialist in different Krishi Vigyan Kendras (KVKs), Crop production - fruit, vegetables, nursery stock, Landscape design, Landscape construction and management, Parks management, Sports turf construction and management including football pitches, bowling greens, racecourses, golf courses, Horticultural education and training, Retails sales outlets - garden centers, florists, horticultural materials suppliers. Garden supervisors in Municipal Corporations, Gardens, Curators, Horticulture officers, Section officers, Landscaping officers, Food Safety

Officers, Agriculture Field Officers, Horticulture Managers, Farm Managers, Nursery operators, and other positions are available.

Semester End Examination (30 Marks): Question Paper Pattern

i. These examinations shall be of 1.30 Hours duration. Maximum marks 30.
ii. There shall be four questions each of 12+12+06 marks. In each unit, there will be one question and the third one will be based on the entire syllabus or as per the directive of BOS.
iii. All questions shall be compulsory with internal choice within the questions.
iv. Questions may be subdivided into sub-questions a, b,c,…, and the allocation of marks depending on the weightage of the topic.

Theory Examination: Suggested Format of Question paper Major/Minor and Generic

Duration: 1.30 Hours **All questions are compulsory** **Total Marks: 30**

Q. 1	Answer ***any two*** of the following		**12**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit I	
	d	Based on Unit I	
Q. 2	Answer ***any two*** of the following		**12**
	a	Based on Unit II	
	b	Based on Unit II	
	c	Based on Unit II	
	d	Based on Unit II	
Q. 3	Answer ***any four*** of the following		**06**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit II	
	d	Based on Unit II	

Evaluation Scheme Internals

Internals	Active Participation & Leadership qualities	Total
15	**05**	**20**

Curriculum and Extracurricular (30M) (Internal following topic)

Research – Presentation/ Paper review/ Book review/ Project/ Publication of Research Paper

OR

Writing skills - Essay writing/ Report on - Campus visit/ Industry Visit/ Field Trip/ Visit to a garden/ Report on Conference – Workshop – Seminar – Webinar attended/ Intercollegiate competition participation/ Science movies review/ Assignment/ Case studies on topics assigned

OR

Skill development – Flip the class/ Open Viva/ Debate/Group Discussion/ Quiz/ e-herbarium/ Photo gallery-Nature Photography, Flora & Fauna/ Botanical illustrations/ Model making/ Survey of the topic assigned

OR

Innovation: Using Plant resources/Animal resources to frame new names (Human beings), Slogan making (Use of any Language)/Construct Botanical Calendar

OR

Green Campus efforts - Raising and maintaining plant/ maintenance of the departmental garden

OR

Active participation in Departmental Club (Botany Club/ Movie & Journal Club)

OR

Class test (Sem Sem-1 paper-1 and 2 Sem-2 Paper-1 and 2

OR

Certification from Swayam / NPTEL (Courses in Biosciences), Certificate courses related to Botanical sciences (minimum 5 hours = 10 marks in only one paper)

OR

Collection of germplasm and Soil boll preparation

OR

Entrepreneurship Skill: Preparation and Trading of Mocktail/Squash/Syrup using seasonal fruits/ preserved products/ Garlands/Gajra/Bouquet/Tulsi plant/Paper bags/Paper envelope

OR

Skills and knowledge: Introduction to Basic MS-Excel/ Advanced MS-Excel /Python (minimum 5 hours = 10 marks in only one paper).

OR

Social: Visit tribal areas and report on traditional practices.

OR

Religious: Visit religious places and report on botanical sources

OR

Plant /Animals/Birds: Pet care/Pet friend/nature lovers/Bird lovers/Friends of farmers
National integration: Blood donation,

* **Note** – If a candidate failed to submit assigned work in time due to genuine reason, then it can be compensated by assigning a new task for the benefit of the candidate .

Introduction of Botany Program
Choice-based Credit and Grading System
MINOR Syllabus Semester -I and II

I. **Aims of Bachelor's degree program in Botany**

The broad aims of the bachelor's degree program in Botany are:

1. To generate an environment that supports kids' complete cognitive growth. Instead of didactic lectures on only theoretical topics, this structure encourages interaction about plants and their significance.
2. To give students the most current knowledge, both theoretical and practical, to support their core competencies and exploration learning. According to this framework, a botany graduate would be qualified to pursue additional discipline-specific courses as well as to start a career in a related field.
3. To create a responsible citizen who is capable of critical thinking and communication as well as possessing the most important property-independent knowledge.
4. To make it achievable for the graduate to prepare for both national and international competitive examinations, especially the UPSC Civil Services Exam and the UGC-CSIR NET.

II. **Outline of Choice Based Credit System:**

1) **Core Course:** A course, which should compulsorily be studied by a candidate as a core requirement is termed as a Core course.
2) **Elective Course:** Generally a course which can be chosen from a pool of courses and which may be very specific or specialized or advanced or supportive to the discipline/ subject of study or which provides an extended scope or which enables an exposure to some other discipline/subject/domain or nurtures the candidate's proficiency/skill is called an Elective Course.
3) **Discipline-Specific Elective (DSE) Course**: Elective courses may be offered by the main discipline/subject of study referred to as Discipline Specific Elective. The University/Institute may also offer discipline related Elective courses of interdisciplinary nature (to be offered by the main discipline/subject of study).
4) **Dissertation/Project**: An elective course designed to acquire special/advanced knowledge, such as supplement study/support study to a project work, and a candidate studies such a course on his own with advisory support by a teacher/faculty member is called dissertation/project.
5) **Generic Elective (GE) Course**: An elective course chosen generally from an unrelated discipline/subject, to seek exposure is called a Generic Elective. P.S.: A core course offered in a discipline/subject may be treated as an elective by another discipline/subject and vice versa and such electives may also be referred to as Generic Elective.
6) **Ability Enhancement Courses (AEC)/Competency Improvement Courses/Skill Development Courses/Foundation Course:** The Ability Enhancement (AE) Courses may be of two kinds: AE Compulsory Course (AECC) and AE Elective Course (AEEC). "AECC" courses are courses based on the content that leads to Knowledge enhancement. They ((i) Environmental Science, (ii) English/MIL Communication) are mandatory for all disciplines. AEEC courses are value-based and/or skill-based and are aimed at providing hands-on training, competencies, skills, etc.
7) **AE Compulsory Course (AECC):** Environmental Science, English Communication/MIL Communication.
8) **AE Elective Course (AEEC):** These courses may be chosen from a pool of courses designed to provide value-based and/or skill-based instruction.
9) **Project work/Dissertation** is considered as a special course involving application of knowledge in solving / analysing /exploring a real-life situation / difficult problem. A Project/Dissertation work would be of 6 credits. A Project/Dissertation work may be given in lieu of a discipline-specific elective paper.

10) **Continuous Internal Evaluation: All** course types—theory, practical, project-based, and field study—include a continuous internal evaluation. The components and their weighting may be decided by the teacher by the guidelines of the university. The internal evaluation components and their proportional weighting should be announced to the students at the start of each learning activity by the relevant teacher. One week before the finish of each semester, the results of the internal evaluation should be displayed on the notice board.

11) **BLOOM'S TAXONOMY BASED ASSESSMENT PATTERN**

K1 - Remembering; K2 - Understanding; K3 - Applying; K4 - Analyzing; K5 - Evaluating

III. Course teaching-learning process:

The learning experiences gained for cognitive development in every student. The practical exercises help to develop an important aspect of the teaching-learning process.The important relevant teaching and learning processes involved in this course are; Class lectures, Seminars, Group discussions and Workshops, Question framing, Short answer type questions, Long answer type questions, Objective-type questions, Multiple-choice questions, Statement, reasoning, and explanation, Project-based learning, Field-based learning, Practical component and experiments, Quizzes. Presentations through Posters and PowerPoint

IV. Theory:

The lesson plan for the week will be prepared before the commencement of the session and followed during the session.The theory topics are covered in lectures with the help of both conventional (chalkboard and Charts) and modern (ICT) methods, including animations.

Emphasis is given on an interactive classroom environment to encourage to students ask questions/ doubts/ queries for clarification/explanation and discussion.

Students are encouraged to refer to reference books in library to inculcate reading habits for a better grasp and understanding of the subject.

Emphasis is given to illustrations- neat, well-labelled outlines and cellular diagrams/ flowcharts for improving creative skills and to substantiate the text content.

On completion of the theory syllabus, previous years' question papers are discussed to apprise students about the general format of semester exam question papers.

V. Practical:

Practical plan for each week will be prepared before the commencement of the session and followed during the session.Every practical session begins with instructions, followed by students doing table work for a detailed microscopic plant study.Plant study is done using fixed plant materials, museum and herbarium specimens, photographs, and permanent slides.The students are instructed about maintaining practical records, which include comments and diagrams.Students are asked to submit practical records regularly, continuously, for checking.On completion of the practical syllabus, Practical Exam Guidelines are discussed to apprise students about the format of the Practical exam.

VI. Theory Examination Pattern:

Internal Assessment – 20 Marks

External examination – 30 Marks (Semester end theory assessment)

Duration - These examinations shall be of two hours duration.

Theory question paper pattern: Attached herewith.

VII. Practical Examination Pattern:

Internal Examination: There will not be any internal examination/ evaluation for practicals.

External (Semester end practical examination) .The students are required to present a duly certified journal for appearing at the practical examination, failing which they will not be allowed to appear for the examination. In case of loss of Journal and/ or Report, a Lost Certificate should be obtained from the Head of the Department/ Coordinator of the department; failing which the student will not be allowed to appear for the practical examination. Practical paper pattern: Attached herewith.

Eligibility: Passed 12th standard (HSC) of Maharashtra State Board / CBSE / ICSE board or any other equivalent board with Biology as one of the subjects

Duration: 3 years

Mode of Conduct: Laboratory practical / Offline lectures / online lectures.

VIII. **B. Sc. Botany Course outcomes under NEP-2020 program**

- The Bachelor of Science in Botany program's program of study aims to transform course material and teaching methods in order to give the next generation of students a multidisciplinary, student-centered, outcome-based education.
- The emphasis has been on maintaining academic consistency and progression throughout the program of study to help students build an excellent foundation in the subject, ensuring that students transition smoothly into their careers. This is in addition to structuring the curriculum to be more in-depth, focused, and comprehensive with significant skill-set for all exit levels.
- Attention is given to avoiding repetition, limiting rote acquisition of knowledge, and encouraging learners to adopt a problem-solving, critical-thinking, and inquisitive mindset.
- The curriculum pays attention to the idea that practical experience—classroom instruction, projects, fieldwork, visits to industries and internships—is the most effective method to learn the field of science.
- The program of study has been revised to reflect recent advances in technology and helps students keep up with the latest developments on advanced developments in plant sciences. It also encourages imagination, curiosity, and an enthusiasm for learning, all of which will be helpful to them in their journeys of scientific discovery and exciting adventures once they graduate.
- The goal is to provide students with wide-ranging knowledge, competencies, professional skills, and a strong, positive mindset that they can use as a resource while they navigate the present, competitive job marketplace.

IX. **Program Learning Outcomes.**The B.Sc. Three-year and B.Sc. (Honors) Botany degrees should be achievable for graduates.

X. **Core competency:** Students will develop fundamental skills in the subjects of botany as well as associated fields. The student will be able to identify the major plant groups and contrast the characteristics of lower (such as fungus and algae) and higher (such as angiosperms and gymnosperms) plants. Students will be able to describe the evolution of species as well as understand the genetic variation on the planet using the evidence-based comparative botany approach. The students will be able to discuss the various processes and functions of plants, metabolism, the ideas of genes and the genome, and how an organism's function changes at the level of its cells, tissues, and organs. Students will be able to understand how different types of life adapt, evolve, and interact. Students are supposed to understand how life is connected on Earth and how to trace the energy pyramids using nutrient flow. Students will be able to demonstrate the experimental techniques and processes specific to their specialization in Botany focusing.

XI. ***Attributes of a Botany Graduate***

1) **Analytical ability:** The ability of the students to understand research and react to practical problems will be demonstrated. Using several kinds of scientific techniques, students develop hypotheses, acquire data, and then critically evaluate that data in order to evaluate how well the study supports those hypotheses.
2) **Critical Thinking and problem-solving ability:** After this course, a deeper understanding of foundational concepts and their applications to scientific principles will be achieved. The capability to think critically and solve problems will be nurtured by the students.
3) **Digitally equipped:** Students will learn digital skills and combine important concepts with innovative tools.
4) **Ethical and Psychological strengthening:** Students will become more capable of dealing with psychological problems and will develop their moral and ethical values.
5) **Team Playe**r: To work efficiently in institutions industry, and society, students will learn teamwork.

6) **Psychological skills**: Graduates are expected to have the fundamental psychological skills required for success in modern-day society, as well as the capacity to interact effectively with fellow citizens and learners from many different kinds of socioeconomic, cultural, and educational backgrounds. Feedback loops, self-compassion, self-reflection, goal-setting, interpersonal interactions, and emotional regulation are aspects of psychological capabilities.
7) **Problem-solving**: Graduates will be expected to have multidisciplinary abilities to solve issues and philosophical viewpoints;
8) **Moral and ethical awareness**: Graduates are expected to comprehend the moral and ethical standards of both India and the rest of the world and act responsibly as citizens. They have to express their essential moral principles enough to differentiate between what the Indian Constitution defines as a crime and what is illegal. Academic and research ethics should be highlighted, including fair benefit sharing, plagiarism, scientific misconduct, and different issues.
9) **Leadership readiness**: To become a more effective leader graduates must have to be familiar with the decision-making process and basic skills in leadership. Creating an objective vision and objective, acquiring the knowledge to become an innovative, motivating leader, along with additional aspects include glimpses of skills.
10) **Independent Learner**: Along with subject-specific skills, general skills, particularly in botany, would be gained as an outcome of the curriculum, preparing students for further higher education, competitive exams, and employment. A curriculum focused on learning outcomes would guarantee uniform academic standards across the nation and a more comprehensive view of their skills. The Botany bachelor's degree and Botany honor program can be either mono- or multi-disciplinary.

XII. **Eligibility Criteria: The** Secondary School Leaving Certificate, which is obtained after successfully completing Grade 12, is the general entry qualification for entry into Semester I of the B.Sc. Botany (Honours) program. Students who meet the entrance criteria, which include certain levels of achievement at the secondary level of education stipulated in the program admission standards, are eligible to enrol in a program of study leading to entry into the first year of the bachelor's degree.

The UGC Guidelines for Multiple Entry and Exit Scheme in Academic Programmes Offered in Higher Education specify that admission to the Bachelor's degree program of study will depend on the evaluation of documentary evidence (including the academic record) of the applicant's ability to undertake and complete a Bachelor's degree program.

XIII. **Choice-based credit system (CBCS):** The CBCS gives students the option to select courses from the list that include core, elective/minor, or skill-based courses. The grading system is being used to evaluate the courses; it is considered to be more accurate than the conventional marks system. As a result, India's whole higher education system has to adopt a unified grading system. The students will benefit from being able to transfer across colleges both inside and outside of India. The standard grading system would also make it possible for prospective employers to evaluate the candidates' performance. The UGC has established the rules to be followed to provide consistency to the assessment process and computation of the Cumulative Grade Point Average (CGPA) based on student performance in examinations.

Course Contents (syllabus): Minor Course

Semester	Course Code	Course Title	Credits	Hours
I	23BUBO1T3	Plant Diversity- I	02	30
	23BUBO1T4	Forms and Function -I	02	30
	23BUBO1P2	Practical based on Paper 1 and paper 2	02	60
II	23BUBO2T3	Plant Diversity- II	02	30
	23BUBO2T4	Forms and Function -II	02	30
	23BUBO2P2	Practical based on Paper 1 and paper 2	02	60

UNIVERSITY OF MUMBAI
SYLLABUS FOR FY UG PROGRAM IN BOTANY (UNDER CBCS AS PER NEP–2020)
UG SEMESTER–I
Minor

Course Type	Course Code	Year	Semester	Total Lecture/ hrs	Credit	Duration
Degree Course in B.Sc. Botany - (Minor) –Plant Diversity-I	23BUBO1T3	**B.Sc. -I**	**1**	**30**	**02**	**06 Months**

Pre-requisite: Students should know about the fundamentals of algae, fungi, and Bryophytes.

Course objectives

1.	To study plants mentioned in Vedas
2.	To study the classification, distinguishing characteristics, geographic distribution, and reproductive cycle of Microbes, Algae, and Fungi.
3.	To recognize the contribution of eminent personalities the in scientific study of Microbes, Algae, and Fungi
4.	To identify and describe causal organisms, symptoms, and control measures of various viral and fungal diseases
5.	Know the ecological and economic importance of algae, fungi, lichens, and bryophytes

Course Outcomes:

On the successful completion of the course, students will be able to:

1)	Gain an insight into traditional knowledge of plants used in Vedas: Past and present	**K1**
2)	Learn about the morphology, structure, reproduction, and life cycle of Algae, Fungi, Lichen, and Bryophytes	**K1 & K3**
3)	Study the various classes and major types of Algae, Fungi, and Bryophytes and variations in life cycles and life histories	**K1 & K2**
4)	Understand the fundamentals of economic importance and biomedical applications of selected species of Algae, Fungi, Lichen, and Bryophytes	**K2 & K3**
5)	Apply knowledge in identifying and controlling various viral and fungal diseases	**K5**
6)	Create an idea to seek a suitable job in relevant industries or to become a potential entrepreneur based on knowledge and hands-on Practicals achieved during the course.	**K6**

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit	Title of the Topic	L.
I	**Algae-Phycology and Fungi (Mycology)**	
1.1	Introduction, objective and Scope and general characters of Algae and Fungi	**15**
1.2	Structure, life cycle, and systematic position of *Nostoc*	
1.3	Economic importance of algae [*Ulva* (Biofuel), *Spirulina* (Nutraceutical), *Gelidium* (Agar)]. Contributions made by Prof. Mandayam Osuri Parthasarathy Iyengar. Introduction, objectives, and Importance of Applied Botany. Various Disciplines of Botany and their applications to human welfare. Agharkar Research Institute (ARI)-Pune	

II	**Bryophyta (Bryology)**	
2.1	Introduction, objective, and scope and general characters of Bryophyta	***15***
2.2	Structure, life cycle, and systematic position of *Riccia*.	
2.3	Economic importance of Bryophytes (*Marchantia*, Riccia, and Peat moss).Moss in indoor gardening-Kokedama (moss ball) for hanging plants, use of moss in Hanging baskets, Moss Sticks for climbers, use of Moss for Bottle garden.	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters	
	Pedagogy: Seminar, Quiz, Debate, collection of and identification and preservation of local area bryophytes and report on it. Collection study of fresh and marine Algae available in the local area. Observation and collection of plant diseases and report on them.	

	Suggested Readings
1.	Ajay Singh. Plants in Ancient Indian Civilizations by BOTANY IN VEDAS
2.	B.R. Vashishta, (1998). Fungi. S. Chanda & Company, New Delhi
3.	B.R. Vashishta, (1998). The Algae. S. Chanda & Company, New Delhi
4.	C.G. Bose. Manual of Indian Botany
5.	C.L. Chopra, (1982). Algae. S. Chanda & Company, New Delhi
6.	Chopra, R. N. 2005. Biology of bryophytes. New Age International (P) Ltd. New Delhi, India.
7.	Dr. P.K. Mishra. Botany in Vedas Publisher: Write And Print Publications
8.	Gangulee, Das & Kar. 2001. College Botany Vol. II. New Central Book Agency Pvt. Ltd., Calcutta.
9.	O.P. Sharma. (2002).Textbook of Fungi. Tata McGraw-Hill Publications, New Delhi.
10.	Pandey, P.B. 2014. College Botany - 1: Including Algae, Fungi, Lichens, Bacteria, Viruses, Plant Pathology, Industrial Microbiology and Bryophyta. Chand Publishing, New Delhi.

Course Type	Course Code	Year	Semester	No. of Practical / Week -	Credit	Duration
Degree Course in B.Sc. Botany - (Minor) –Plant Diversity-I	23BUBO1P2	B.Sc. -I	I	01	01	06 Months

	Name of the experiment	P/Week
I	Basic Hands-on training	
	Introduction to the dissecting and compound microscope	1
	Introduction basic stains, sectioning, mounting, and staining technique	1
III	Algae	
	Study of stages in the life cycle of *Nostoc* & *Spirogyra* from fresh/ preserved material and permanent slides	1
	Economic importance of algae: *Ulva* (Biofuel), *Spirulina* (Nutraceutical), *Gelidium* (Agar)	1

IV	Fungi	
	Study of stages in the life cycle of *Rhizopus* & *Aspergillus* from fresh/ preserved material and permanent slides.	1
	Economic importance of Fungi: Mushroom, Yeast, wood rotting fungi (*Ganoderma*).	1
V	Bryophyta	
	Study of stages in the life cycle of *Riccia* from fresh/ preserved material.	1
	Economic importance of Bryophytes: Medicinal (*Marchantia* sp., *Riccia*, and Peat moss.),	1

	Suggested Readings
1.	Bendre and Kumar. Practical Volume 1 and 2 Rastogi Publication, Meerut 1st 2008
2.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi.
3.	Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.
4.	Sambamurty, A.V.S.S. (2006). A textbook of algae. I.K International Publishing House, Pvt. Ltd.
5.	Trivedi P.C.Medicinal Plants: Ethnobotanical approach Agrobios India 2006
6.	Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.

Course Type	**Course Code**	**Year**	**Semester**	**Total Lecture / hrs**	**Credit**	**Duration**
Degree Course in B.Sc. Botany -(Minor) – Forms and Function -I	23BUBO1T4	**B.Sc. -I**	**I**	**30**	**02**	**06 Months**

Pre-requisite: Students should know about the fundamentals of Ecology, Genetics, and Biostatistics.

Course objectives

The main objectives of this course are to:

1.	To learn about different cell organelles and important processes within the cell
2.	To study the ultra-structure of the nucleus & its function also the characteristics of the genetic code, transcription, and translation processes.
3.	To inculcate knowledge and create awareness about ecological and environmental concepts, issues, and solutions to environmental problems
4.	To learn the basic principles of Biostatistics.
5.	To impart knowledge to solve biological problems.

Course Outcomes

On the successful completion of the course, students will be able to:

1.	Understand the general structure of prokaryotic and eukaryotic cells, the plant cell wall, plasma membrane, and Chloroplast.	**K2**
2.	Learn about the ecosystem, biotic and abiotic components, and energy pyramids	**K3**
3.	Gain knowledge and comprehend classical Mendelian genetics- mono-hybrid, dihybrid; test cross; back cross ratio	**K2 & K3**
4.	Remembering elementary bio-statistics and the role of model organisms in genetics	**K1**
5.	Analyze or interpret the results achieved in practical sessions in the context of existing theory and knowledge.	**K4**
6.	Create an idea to seek a suitable job in relevant industries or to become a potential entrepreneur based on knowledge and hands-on practical's achieved during the course.Analyze and solve biologically related problems using bio-statistical formulae.	**K5 & K6**

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 – Create

Unit	Title of the Unit	L
I	**Plant Cell Biology**	15
1.1	Introduction, objective and scope and general characters of plant cell biology	
1.2	The general structure of Prokaryotic and Eukaryotic cells. The general structure of plant cell: Cell wall, Plasma membrane (bilayer lipid structure, fluid mosaic model).	
1.3	Types of Plastids: Chromoplasts (Chloroplast) and types of Leucoplast, Ultra-structure and functions of the following cell organelle: Chloroplast. The Centre for Cellular & Molecular Biology (CCMB)-Hyderabad	
II	**Genetics and Biostatistics**	**15**
2.1	Introduction, objective and scope and general characters of plant genetics and Biostatistics	
2.2	Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios. Biostatistics: Mean, Median, and Mode, Standard deviation	
2.3	ICAR-NBPGR RS, Akola-Maharashtra. Plant model organism – Introduction to *Arabidopsis.* Contribution of *P.C. Mahalanobis Indian statistician. Indian Statistical Institute-Kolkata.*	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters.	**02**
	Pedagogy: Seminar, quiz, debate, visit to instrument/tissue culture lab and report on it. Visit to Municipal Corporation dumping garden and report on it.	**02**

	Suggested Readings
1)	De Robertis E. D. P., Cell Biology and Molecular Biology, 8th edition, Lea and Febinger, 1987.
2)	Mahajan B.K., Methods in Biostatistics: For medical students and research workers, Jaypee Brothers Medical Publishers, 2008.
3).	Odum E. P., Barrett G. W., Principles of Ecology, Brooks and Cole, 2004.
4).	P S S Sunder Rao Introduction to Biostatistics and Research Methods
5).	Sharma. P. D. 1993. Ecology and Environment, Rastogi Pub., New Delhi
6).	Verma P. S., Agarwal V.K., Textbook of Environmental Biology, S. Chand, 2000.
7).	Powar, C.B. and Daginawala, H.F. (1982). General Microbiology Vol. II. Himalaya Publishers, Bombay.
8).	Jain S. K. & Mudgal V., A Handbook Of Ethnobotany, Bishen Singh Mahendra Pal Singh, Debra Dun, 1999
9).	Bhattacharya K., M. R. Majumdar and S. G. Bhattacharya. (2006). A text Book of Palynology, New Central Book Agency (P) Ltd., Kolkata, India.

Course Type	Course Code	Year	Semester	No. of Practical / Week -	Credit	Duration
Certificate Course in Basic Botany -(Minor)- Forms and Function- I	23BUBO1P2	B.Sc. -I	I	01	01	06 Months

	Name of the experiment	P/Week
I	**Plant Cell Biology**	
1.	Identification of Prokaryotic and Eukaryotic cells with the help of photomicrograph.	1
2.	Identification of plant cell -Cell wall, Plasma membrane (bilayer lipid structure, fluid mosaic model) with the help of photomicrograph.	1
3.	Identification of cell organelles with the help of photomicrograph: Plastids: Chromoplasts (Chloroplast) and types of Leucoplast.	1
4.	Starch grains of Potato and Rice.	1
II.	**Genetics**	
5	**Study of Karyotype s:** *Aloe Vera, Allium cepa.*	1
6	Phenotype/Genotype, Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.	1
III	**Biostatistics**	
7	Calculation of mean, median, and mode.	1
8	Calculation of standard deviation.	1
9	Graph preparation using simple data from experiments	

	Suggested Readings
1.	B P Pandey Modern Practical Botany Vol-I
2.	Bendre and Kumar.Practical Volume 1 and 2 Rastogi Publication, Meerut 1st 2008
3.	Cell and Molecular Biology: Concept and Experiments Vol. 2 Karp, G.John Wiley and Sons, Inc., USA.1999
4.	Molecular Biology of the Cell Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter Garland Publishing Inc, New York.2nd 1989
5.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi
6.	Practical in Botany F.Y.B.Sc. Sem I & II Sheth Publication, Publisher: Sheth Author: Golatkar
7.	Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.
8.	Rastogi, V B Fundamentals of Biostatistics Ane Book India 2nd edition
9.	Russel. Genetics Wesley Longman inc publishers,5th.2000
10.	Singh B.D.Genetics, Kalyani Publication, Ludhiana 2004

SEMESTER-II MINOR SYLLABUS

Course Type	Course Code	Year	Semester	Total Lecture/ hrs	Credit	Duration
Degree Course in B.Sc. Botany - (Minor) – Plant Diversity-II	23BUBO2T3	B.Sc. -I	II	30	02	06 Months

Pre-requisite: Students should know about the fundamentals of Pteridophytes, Gymnosperms, and Plant Taxonomy.

Course Objectives

The main objectives of this course are to:

1.	To understand the enormous diversity and range of diversity and range of diversification of all species in the world
2.	To realize the fundamental values of diversity and their importance to human welfare.
3.	To define and characterize the diversity of lower vascular plants to understand the dynamics of diversity to realize the significance of diversity.
4.	To understand and conceptualize the classification and life cycle of members belonging to Pteridophytes and Gymnosperms.
5.	To be familiar with the basic concepts and principles of plant systematics.
6.	The concept of landscape gardening concerning ornamental Pteridophytes and Gymnosperms
7.	The plants that attract butterflies and thus suitable for a butterfly garden

Course Outcomes

On the successful completion of the course, students will be able to:

1.	To understand the goals of diversity of plants important and characterizes.	**K2**
2.	To understand the subject knowledge provide multiple goods to satisfy social need.	**K3**
3.	To understand the cultural and economic needs of the owners such as food.	**K2 & K3**
4.	To acquire plant-based medicines, ornamental and spiritual well-being, fodder, and fuel wood	**K1**
5.	Apply knowledge of plant systematics in identifying families and plants	**K4**
6.	Apply the medicinal and economic aspects of Bryophytes, Pteridophytes, and Gymnosperms for the benefit of human welfare.	**K5 & K6**

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit	Title of the Unit:	L.
I	**Pteridophytes and Gymnosperms**	**15**
1.1	**Introduction, objective and scope, and general characters of Pteridophyta and Gymnosperms**	
1.2	Structure life cycle, systematic position, and alternation of generations in *Nephrolepis.*	
1.3	Structure life cycle systematic position and alternation of generations in *Cycas.*Economic importance of Gymnosperms - *Pinus* wood, turpentine oil, and seeds. *The contribution* **made by Janaki Ammal**.	
II	**Plant Taxonomy**	
2.1	Introduction, objective and scope and general characters of plant taxonomy	
2.2	**Study of the following families:** Malvaceae, Apocynaceae, Amaryllidaceae	
2.3	**Important plants in butterfly garden** : [*Lantana* (Ghaneri), *Hamelia* (Firebush), *Stachytarpheta* (Jamaican spike), *Calotropis* (Rui)].Pioneer in plant taxonomy .	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters.	**02**
	Pedagogy: Seminar, quiz, debate, visit to the local area and identify the flora of the College campus and report on it.Herbarium local wild plants.	**02**

Suggested Readings	
1)	Biswas, C. and Johrc, B.M. 1977. The Gymnosperms. Narosa Publishing House, New Delhi.
2)	Gangulee, Das &Kar. (2001). College Botany Vol II. New Central Book Agency Pvt. Ltd. Calcutta.
3)	P.C Vashista, (1992). Pteridophyta. Chand & Co., New Delhi.
4)	B.P. Pandey, (1981). Gymnosperms. Chand & Co., New Delhi.
5)	B.P. Pandey, (1994). A Textbook of Botany - Pteridophyta. Chand & Co. New Delhi.
6)	Rashid, (1995). An introduction to Pteridophytes. Vikas Publishing House, Pvt. Ltd., New Delhi.
7)	A.C. Dutta, (2007). Botany, Oxford University Press, New Delhi
8)	Singh, G. (2012). Plant Systematics: Theory and Practice. Oxford and IBH Pvt. Ltd. New Delhi. 3rd edition.
9)	Gangulee H.C., Kar, A.K. and Santra S.C. (2011). College Botany Vol II. 4th Edition New Central Book Agency.
10)	Pandey, B.P. (2010). College Botany Vol II. S. Chand and Company Ltd., New Delhi, India.
11)	Cooke, T., 1967. The Flora of the Presidency of Bombay. Vol. I, II, III. Botanical Survey of India. Calcutta.
12)	Pandey, B.P., Angiosperms-Taxonomy, Embryology and Anatomy, S. Chand and Co., New Delhi

Course Type	Course Code	Year	Semester	No. of Practical / Week -	Credit	Duration
Degree Course in B.Sc. Botany -(Minor) – Plant Diversity-II	**23BUBO2P2**	**B.Sc. -I**	**II**	**01**	**01**	**06 Months**

	Name of the experiment	P/Week
I	**Pteridophyta**	
1)	Study of stages in the life cycle of *Nephrolepis*: Mounting of ramentum, Hydathodes	1
2.	T.S. of the pinna of *Nephrolepis* passing through sorus.	1
1.	Identification of living fossil Pteridophyta – Horsetails (*Equisetum*)	1
2.	**Ornamental Gardening**: Identification of Ornamental Pteridophytes [*Adiantum* (Maidenhair fern),*Platycerium* (Staghorn fern), *Asplenium* (Bird's nest fern)]	1
II.	**Gymnosperms**	
3.	*Cycas*: T.S of the leaflet (*Cycas* pinna)	1
4.	Identification of coralloid root, Megasporophyll & Microsporophyll. Slide preparation of microspores of *Cycas*	1
5.	Identification of photomicrographs of *Pinus* wood and seed. Identification of turpentine oil.	1
6.	Identification of Ornamental Gymnosperm [*Araucaria* (Christmas tree), *Zamia* (Cardboard palm), *Thuja* (Morpankhi)]	1
III	**Plant Taxonomy**	
7	**Study of the following families:** Malvaceae, Apocynaceae, Amaryllidaceae	3
8	**Important plants in butterfly garden** : [*Lantana* (Ghaneri), *Hamelia* (Firebush), *Stachytarpheta* (Jamaican spike), *Calotropis* (Rui)].	1

Suggested readings	
1.	B P Pandey Modern Practical Botany Vol-I
2.	Bendre and Kumar.Practical Volume 1 and 2 Rastogi Publication, Meerut 1st 2008
3.	Cell and Molecular Biology: Concept and Experiments Vol. 2 Karp, G. John Wiley and Sons, Inc., USA.1999
4.	Molecular Biology of the Cell Albert B. Bray, D Lewis, J Raff, M. Robert, K. and Walter Garland Publishing Inc, New York.2nd 1989
5.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi.
6.	Golatkar V D . Practical in Botany F.Y.B.Sc. Sem I & II Sheth Publication, Publisher: Sheth
7.	Purohit, S.D., Kundra, G. K. and Singhvi, A. (2013). Practical Botany (part I). Apex Publishing House Durga Nursery Road Udaipur, Rajasthan.
8.	Rastogi, V B Fundamentals of Biostatistics Ane Book India 2nd
9.	Russel, Genetics, Wesley Longman inc publishers 5th 2000
10.	Singh B.D.Genetics, Kalyani Publication, Ludhiana 20

Course Type	Course Code	Year	Semester	Total Lecture/ hrs	Credit	Duration
Degree Course in B.Sc. Botany - (Minor) – Forms and Function -II	**23BUBO2T4**	**B.Sc. -I**	**II**	**30**	**02**	**06 Months**

Pre-requisite: Students should know about the fundamentals of Plant Anatomy, Plant Physiology, and Ethnobotany.		
Course Objectives		
The main objectives of this course are to:		
1.	Learn about simple, complex, and sensory plant tissues	
6)	Understand the pigment system and photosynthesis i.e. the light reactions and dark reactions	
7)	Get familiar with the concept of primary and secondary metabolites.	
8)	Get Traditional knowledge of medicines from Grandma's pouch and Ayurveda	
9)	Apply methods to transform Ethnobotanical knowledge into value-added products.	
Course Outcomes		
On the successful completion of the course, students will be able to:		
1.	Study the function and organization of woody stems derived from primary growth in Dicot and Monocot plants	**K1**
2.	Understand the various concepts of plant development and reproduction	**K2**
3.	Apply their idea on sectioning and dissection of plants to demonstrate various stages of plant development.	**K3**
4.	Validate the plant physiological scientific hypothesis by using various experiments	**K4**
5.	Gain awareness about the various process involved in the energy production in plants and metabolic pathways.	**K1**
6.	Recall or remember the concept of ethnobotany and Assess the methods to transform ethnobotanical knowledge into value-added products.	**K2 & K6**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

Unit	Title of the Unit:	L
I	**Plant Anatomy**	15
1.1	**Introduction, objective and scope and general characters of plant anatomy**	
1.2	Simple tissues, complex tissues. Primary structure of Dicot and Monocot root, stem, and leaf.	
1.3	**Epidermal tissue system:** Unicellular, multicellular, stellate, peltate, T-shaped leaf hair, Monocot, and Dicot stomata. **Sensory tissue** - concerning insectivorous plants [*Drosera* (Dewdrop), *Dionaea,*(Venus fly-trap), *Utricularia* (Bladder wort)] and *Mimosa* (Touch me not). Jagdish Chandra Bose, Father of Indian Plant Anatomy.	

II	**Plant Physiology**	**15**
2.1	**Introduction, objective and scope and general characters of Plant Physiology**	
2.2	**Photosynthesis:** Light reactions, photolysis of water, photo phosphorylation (cyclic and non-cyclic), carbon fixation phase (C3, C4, and CAM pathways)	
2.3	**Floral pigments:** Anthocyanin, Carotenoids. Dr.Prafullachandra Vishnu Sane - Indian molecular biologist and plant physiologist, pioneering studies on photosynthesis.	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters.	**02**
	Pedagogy: Seminar, quiz, debate, visit to the local area and identify the Medicinal plants from College Campus and report on it.	**02**

Suggested Readings	
1.	Pandey, B.P. 1993. Plant anatomy, S. Chand & Co, New Delhi
2.	Pandey, S. N. and Chadha, A. 2009. Plant anatomy and embryology. Vikas Publishing House Pvt. Ltd., New Delhi.
3.	Sharma, P.C. 2017. Text Book of Plant Anatomy. Arjun Publishing House, New Delhi.
4.	Verma V., Plant Physiology, ANE books, 2009.
5.	Verma, (1998). Textbook of Economic Botany, Embay Publishers, New Delhi
6.	Salisbury, F.B. and Ross, C.W. (1991) Plant physiology. (4th Ed), Wadsworth Publishing Company, Beverly.
7.	Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
8.	Pandey, B.P. (1992). Economic Botany. (S. Chand and Sons Co., New Delhi)
9.	Jain, S. K. (1995). A manual of Ethnobotany. Scientific Publishers, Jodhpur.

Course Type	Course Code	Year	Semester	No. of Practical / Week -	Credit	Duration
Certificate Course in Basic Botany (MINOR) – Forms and Function- II	23BUBO2P2	B.Sc. -I	II	01	01	06 Months

	Name of the experiment	P/Week
I	**Anatomy :**	
1.	Primary structure of Dicot and Monocot root.	1
5.	Primary structure of Dicot and Monocot stem.	1
6.	Study of Dicot and Monocot stomata.	1
7.	Epidermal outgrowths: with the help of mountings: As in theory	1
8.	Study of sensory tissue in *Drosera* (Dewdrop), *Dionaea* (Venus fly-trap), *Utricularia* (Bladder-wort)] and *Mimosa* (Touch me not)	1
II	**Physiology :**	
9.	Separation of chlorophyll pigments by strip paper chromatography.	1
10.	Study of absorption maxima of chlorophyll and carotenoid pigment by colorimetric method	1
11.	Change in color because of change in pH: Anthocyanin: black grapes/Purple cabbage	1
12.	To study the effect of different concentration of CO2 on the rate of photosynthesis	
13.	To study the effect of light intensity (by changing the distance) on the rate of photosynthesis using aquatic plants.	

	Suggested Readings
1.	Bendre and Kumar. Practical Volume 1 and 2 Rastogi Publication, Meerut 1st 2008
2.	Indian Herbal Pharmacopoeia Indian drug Manufacturers' Association Mumbai: Indian drug Manufacturers' Association 2002
3.	Pandey B.P. Economic Botany S. Chand Publishers 1978
4.	Pandey, B.P. (2001). Plant Anatomy. S. Chand and Company Ltd., Ram Nagar, New Delhi.
5.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi.

After complete of this course, students will Job opportunities/ Entrepreneurship:

India is mostly an agricultural nation, which expands its use and utility. Technology is developing rapidly. There are several career and professional prospects with this degree. The following fields offer career prospects in both the public and commercial sectors:
Plantation Manager, Seed Technologies Firm, Operations Manager in Fertilizer Units, Agribusiness Development Manager, Food Processing Units in Government, Subject Matter Specialist in different Krishi Vigyan Kendras (KVKs), Crop production - fruit, vegetables, nursery stock, Landscape design, Landscape construction and management, Parks management, Sports turf construction and management including football pitches, bowling greens, racecourses, golf courses, Horticultural education and training, Retails sales outlets - garden centers, florists, horticultural materials suppliers. Garden supervisors in Municipal Corporations, Gardens, Curators, Horticulture officers, Section officers, Landscaping officers, Food Safety Officers, Agriculture Field Officers, Horticulture Managers, Farm Managers, Nursery operators, and other positions are available.

Semester End Examination (30 Marks): Question Paper Pattern

v. These examinations shall be of 1.30 Hours duration. Maximum marks 30.

vi. There shall be four questions each of 12+12+06 marks. In each unit, there will be one question and the third one will be based on the entire syllabus or as per the directive of BOS.
vii. All questions shall be compulsory with internal choice within the questions.
viii. Questions may be subdivided into sub-questions a, b,c,…, and the allocation of marks depending on the weightage of the topic.

Theory Examination: <u>Suggested Format of Question paper Major/Minor and Generic</u>

Duration: 1.30 Hours
All questions are compulsory **Total Marks: 30**

Q. 1	Answer ***any two*** of the following		**12**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit I	
	d	Based on Unit I	
Q. 2	Answer ***any two*** of the following		**12**
	a	Based on Unit II	
	b	Based on Unit II	
	c	Based on Unit II	
	d	Based on Unit II	
Q. 3	Answer ***any four*** of the following		**06**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit II	
	d	Based on Unit II	

Evaluation Scheme Internals

Internals	Active Participation & Leadership qualities	Total
15	**05**	**20**

<u>Curriculum and Extracurricular (30M) (Internal following topic)</u>

Research – Presentation/ Paper review/ Book review/ Project/ Publication of Research Paper

OR

Writing skills - Essay writing/ Report on - Campus visit/ Industry Visit/ Field Trip/ Visit to a garden/ Report on Conference – Workshop – Seminar – Webinar attended/ Intercollegiate competition participation/ Science movies review/ Assignment/ Case studies on topics assigned

OR

Skill development – Flip the class/ Open Viva/ Debate/Group Discussion/ Quiz/ e-herbarium/ Photo gallery-

Nature Photography, Flora & Fauna/ Botanical illustrations/ Model making/ Survey of the topic assigned

OR

Innovation: Using Plant resources/Animal resources to frame new names (Human beings), Slogan making (Use of any Language)/Construct Botanical Calendar

OR

Green Campus efforts - Raising and maintaining plant/ maintenance of the departmental garden

OR

Active participation in Departmental Club (Botany Club/ Movie & Journal Club)

OR

Class test (Sem Sem-1 paper-1 and 2 Sem-2 Paper-1 and 2

OR

Certification from Swayam / NPTEL (Courses in Biosciences), Certificate courses related to Botanical sciences (minimum 5 hours = 10 marks in only one paper)

OR

Collection of germplasm and Soil boll preparation

OR

Entrepreneurship Skill: Preparation and Trading of Mocktail/Squash/Syrup using seasonal fruits/ preserved products/ Garlands/Gajra/Bouquet/Tulsi plant/Paper bags/Paper envelope

OR

Skills and knowledge: Introduction to Basic MS-Excel/ Advanced MS-Excel /Python (minimum 5 hours = 10 marks in only one paper).

OR

Social: Visit tribal areas and report on traditional practices.

OR

Religious: Visit religious places and report on botanical sources

OR

Plant /Animals/Birds: Pet care/Pet friend/nature lovers/Bird lovers/Friends of farmers
National integration: Blood donation,

* **Note** – If a candidate failed to submit assigned work in time due to genuine reason, then it can be compensated by assigning a new task for the benefit of the candidate .

SEM- 1 and 2: Generic Course

Semester	Course Code	Course Title	Credits	L.
I	23BUBO1T5	Thallophyta and Economic Botany	02	30
II	23BUBO2T5	Ayurveda and Medicinal Botany	02	30

Course Type	Course Code	Year	Semester	Total Lecture/ hrs	Credit	Duration
Certificate Course in Basic Botany - (GENERIC)- Thallophyta and Economic Botany	23BUBO1T5	**B.Sc. -I**	**I**	**30**	**02**	**06 Months**

Pre-requisite: Students should know about the fundamentals of Thallophyta and the traditional uses of the plants.

Course Objectives

The main objectives of this course are to:

1.	To understand the enormous diversity and range of diversity and range of diversification of all species in the world
2.	To realize the fundamental values of diversity and their importance to human welfare.
3.	To define and characterize the diversity of lower vascular plants to understand the dynamics of diversity to realize the significance of diversity.
4.	To familiarize knowledge of plants with immense economic values.
5.	To be familiar with the basic concepts and principles of plant systematics.

Course Outcomes

On the successful completion of the course, student will be able to:

1.	To understand the goals of diversity of plants important and characterizes.	**K2**
2.	To understanding the subject Knowledge on the conservation of natural bio-resources and various other hotspots augment students to explore their therapeutic values economically, culturally, and aesthetically.	**K3**
3.	To understanding the Gain an insight into traditional knowledge of plants used in Vedas: Past and present.	**K2 & K3**
4.	To acquired plant-based medicines, ornamental and spiritual well-being, fodder, and fuel wood	**K1**
5.	Apply contextual knowledge on the importance of ethical environmental principles, norms, and consequent responsibilities relevant to biodiversity conservation practice and sustainable use of plants	**K4**
6.	Apply the medicinal economic and traditional aspect of plants for the benefit of human welfare.	**K5 & K6**

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

	Paper I – Thallophyta and Economic Botany	**L.**
Unit I	**Thallophyta**	**15**
1.1	Introduction objective and scope of algae, fungi, and Bryophyta	
1.2	General structure (Morphology) of *Riccia*, the economic importance of Bryophytes (*Marchantia*, Peat moss).Economic importance of algae, fungi (02 examples).	

1.3	**Moss in indoor gardening-** Kokedama (moss ball) for hanging plants, use of moss in Hanging baskets, Moss Sticks for climbers, use of Moss for Bottle garden. Contributions made by Prof. Mandayam Osuri Parthasarathy Iyengar.Agharkar Research Institute (ARI)-Pune.	
2.1	**Introduction objective and scope of economic botany**	**15**
2.2	**Spices:** Morphology and uses with special reference to fennel, clove coriander, and black pepper **Beverages:** Tea, Coffee (morphology and uses), **Drug-yielding plants**: Therapeutic and habit-forming drugs with special reference to *Papaver* and *Cannabis*.	
2.3	**Oils**: Sesame, Castor, linseed, **Timber**: Sal and teak, **Rubber-**Rubber, **Tobacco**: Tobacco (Morphology, uses and health hazards)	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters.	**02**
	Pedagogy: Seminar, Quiz, Debate, collection of and identification and preservation of local area bryophytes and report on it. Collection study of fresh and marine Algae available in the local area. Observation and collection of plant diseases and report on it.	**02**

	Suggested Readings
1.	Gangulee, Das &Kar. (2001). College Botany Vol II. New Central Book Agency Pvt. Ltd. Calcutta.
2.	Indian Herbal Pharmacopoeia Indian drug Manufacturers' Association Mumbai: Indian drug Manufacturers' Association 2002
3.	Pandey B.P. Economic Botany S. Chand Publishers 1978
4.	Pandey, B.P. (2001). Plant Anatomy. S. Chand and Company Ltd., Ram Nagar, New Delhi.
5.	Pandey, B.P. (2014). Modern Practical Botany Vol. I. S. Chand and Company Ltd.Ramnagar, New Delhi.
6.	Verma, (1998). Textbook of Economic Botany, Embay Publishers, New Delhi
7.	Salisbury, F.B. and Ross, C.W. (1991) Plant physiology. (4th Ed), Wadsworth Publishing Company, Beverly.
8.	Trivedi P C, 2006. Medicinal Plants: Ethnobotanical Approach, Agrobios, India.
	Pandey, B.P. (1992). Economic Botany. (S. Chand and Sons Co., New Delhi)
9.	Jain, S. K. (1995). A manual of Ethnobotany. Scientific Publishers, Jodhpur.

SEMESTER-II: AYURVEDA AND MEDICINAL BOTANY

Course Type	Course Code	Year	Semester	Total Lecture/ hrs	Credit	Duration
Certificate Course in Basic Botany (GENERIC) – Ayurveda and Medicinal Botany	23BUBO2T5	**B.Sc. -I**	**II**	**30**	**02**	**06 Months**

Pre-requisite: Students should know about the fundamentals of Ayurveda.

Course Objectives

The main objectives of this course are to:

6.	To understand the enormous diversity and range of diversity and range of diversification of all species in the world
7.	To realize the fundamental values of diversity and their importance to human welfare.
8.	To define and characterize the diversity of lower vascular plants to understand the dynamics of diversity to realize the significance of diversity.
9.	To familiarize knowledge of plants with immense economic values
10.	To be familiar with the basic concepts and principles of plant systematics.
11.	The concept of Ayurveda concerns plants used in traditional practices.
12.	The plants that attract butterflies and thus suitable for a butterfly garden

Course Outcomes

On the successful completion of the course, students will be able to:

1.	To understand the goals of diversity of plants important and characterizes.	**K2**
2.	To understand the subject Knowledge of the conservation of natural bio-resources and various other hotspots augment students to explore their therapeutic values economically, culturally, and aesthetically.	**K3**
3.	To understand the Gain insight into traditional knowledge of plants used in Vedas: Past and present.	**K2 & K3**
4.	To acquire plant-based medicines, ornamental and spiritual well-being, fodder, and fuel wood	**K1**
5.	Apply contextual knowledge on the importance of ethical environmental principles, norms, and consequent responsibilities relevant to biodiversity conservation practice and sustainable use of plants	**K4**
6.	Apply the medicinal economic and traditional aspects of plants mentioned in the Vedas for the benefit of human welfare.	**K5 & K6**

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

	Paper – I Ayurveda and Medicinal Botany	**L.**
Unit I	**History of Botanical Science and Ayurveda**	**15**
1.1	**History of Botanical Science** - Vedas to Present. Introduction, Examples of plants used since the Vedic era are Aghada, Rui, Pimpal, Vad, and Udumber	
1.2	**Ayurveda:** Concept of Tridosha and Five Elements, Formulations in Ayurveda (Swarna Bhasma, Triphala Churna, Chyawanprash (Avaleh), Bhrungadi-Vati)	
1.3	Central Council for Research in Ayurvedic Sciences (CCRAS), Central Council for Research in Yoga and Naturopathy (CCRYN), Central Council for Research in Unani Medicine (CCRUM),	
Unit II	**Medicinal Botany**	***15***
2.1	Primary and Secondary metabolites of plants	
2.2	**Grandma's pouch plants** concerning the botanical source, part of the plant used, and active constituent's present and medicinal uses: Tulsi, Adulsa, Sunth, Haldi, Chandan, and Lavang.	
2.3	Role of plants in healing Diabetes, Anaemia, Obesity, and Skin disorders.Central Council for Research in Ayurvedic Sciences (CCRAS), Central Council for Research in Yoga and	

	Naturopathy (CCRYN), Central Council for Research in Unani Medicine (CCRUM)	
	Contemporary Issues: Expert lectures, YouTube Videos, Animations, NPTEL, MOOC videos, and online seminars –webinars for strengthening the subject matters.	**02**
	Pedagogy: Seminar, Quiz, Debate, Submission of Grandamas Pouch.	**02**

Semester End Examination (30 Marks): Question Paper Pattern
These examinations shall be of 1.30 Hours duration. Maximum marks 30.
There shall be four questions each of 12+12+06 marks. In each unit, there will be one question and the third one will be based on the entire syllabus or as per the directive of BOS.
All questions shall be compulsory with internal choice within the questions.
Questions may be subdivided into sub-questions a, b,c,…, and the allocation of marks depending on the weightage of the topic.

Theory Examination: Suggested Format of Question paper Major/Minor and Generic

Duration: 1.30 Hours
All questions are compulsory **Total Marks: 30**

Q. 1	Answer ***any two*** of the following		**12**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit I	
	d	Based on Unit I	
Q. 2	Answer ***any two*** of the following		**12**
	a	Based on Unit II	
	b	Based on Unit II	
	c	Based on Unit II	
	d	Based on Unit II	
Q. 3	Answer ***any four*** of the following		**06**
	a	Based on Unit I	
	b	Based on Unit I	
	c	Based on Unit II	
	d	Based on Unit II	
	e	Based on Unit I	

Evaluation Scheme Internals

Internals	Active Participation & Leadership qualities	Total
15	**05**	**20**

Curriculum and Extracurricular (30M) (Internal following topic)

Research – Presentation/ Paper review/ Book review/ Project/ Publication of Research Paper

OR

Writing skills - Essay writing/ Report on - Campus visit/ Industry Visit/ Field Trip/ Visit to a garden/ Report on Conference – Workshop – Seminar – Webinar attended/ Intercollegiate competition participation/ Science movies review/ Assignment/ Case studies on topics assigned

OR

Skill development – Flip the class/ Open Viva/ Debate/Group Discussion/ Quiz/ e-herbarium/ Photo gallery-Nature Photography, Flora & Fauna/ Botanical illustrations/ Model making/ Survey of the topic assigned

OR

Innovation: Using Plant resources/Animal resources to frame new names (Human beings), Slogan making (Use of any Language)/Construct Botanical Calendar

OR

Green Campus efforts - Raising and maintaining plant/ maintenance of the departmental garden

OR

Active participation in Departmental Club (Botany Club/ Movie & Journal Club)

OR

Class test (Sem Sem-1 paper-1 and 2 Sem-2 Paper-1 and 2

OR

Certification from Swayam / NPTEL (Courses in Biosciences), Certificate courses related to Botanical sciences (minimum 5 hours = 10 marks in only one paper)

OR

Collection of germplasm and Soil boll preparation

OR

Entrepreneurship Skill: Preparation and Trading of Mocktail/Squash/Syrup using seasonal fruits/ preserved products/ Garlands/Gajra/Bouquet/Tulsi plant/Paper bags/Paper envelope

OR

Skills and knowledge: Introduction to Basic MS-Excel/ Advanced MS-Excel /Python (minimum 5 hours = 10 marks in only one paper).

OR

Social: Visit tribal areas and report on traditional practices.

OR

Religious: Visit religious places and report on botanical sources

OR

Plant /Animals/Birds: Pet care/Pet friend/nature lovers/Bird lovers/Friends of farmers

National integration: Blood donation,

* **Note** – If a candidate failed to submit assigned work in time due to genuine reason, then it can be compensated by assigning a new task for the benefit of the candidate.

SKILL ENHANCEMENT COURSE ONLY MAJOR BOTANY STUDENTS

HORTICULTURE AND GARDENING
SEM-I

Course Code - 23BU1SEC7	23BU1SEC7 Theory + Practical			Credit 02	45 hrs	
Course Type	**Course Code**	**Year**	**Semester**	**No. of L / Week**	**Credit**	**Duration**
Certificate Course in Basic Botany - (Major)- Horticulture and Gardening	23BU1SEC7	**B.Sc. -I**	**I**	**01**	**02**	**06 Months**

Pre-requisite: Students should know about the fundamentals of horticulture and gardening.		
Course Objectives		
The main objectives of this course are to:		
1.	To understand the importance and objectives of different organizations, agencies, NGOs, and business opportunities in horticulture.	
10)	To apply advanced plant propagation techniques and their management.	
11)	To study the future scope of organic farming and different garden operations for crop improvement.	
12)	To build knowledge about manures, fertilizers, and garden implements.	
Course Outcomes		
On the successful completion of the course, students will be able to:		
1.	Understand the scope and importance of different NGOs and Organizations related to horticulture.	**K1**
2.	To develop a sense of entrepreneurship and new venture creation in horticulture.	**K3**
3.	Build the skills of entrepreneurship and would be able to create new ventures.	**K6**
4.	Execute the different propagation techniques of horticultural plants.	**K4**
5.	Know the application of different garden operations for crop improvement.	**K2**
6.	Develop different processing techniques and use them in marketing.	**K5 & K6**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create		

Course Type	Course Code	Year	Semester	No. L	Credit	Duration
Horticulture and Gardening	23BU1SEC7	B.Sc. -I	I	15	01	06 Months

Unit	Title of the Unit	L
I	**Introduction to Horticulture:** Definition, importance, and objectives of Horticulture, branches of Horticulture. **Branches of Horticulture.** Branches and objectives of Horticulture. Important Horticulture Research Institutes in India, Horticulture Consultancy	05
II	**Propagation of Horticultural plants, definition**, scope, and importance of plant propagation. **By Seeds** Advantages and disadvantages, method of seed propagation Production of seeds, Handling, Collection and Storage Sowing, Transplanting of seedlings and Hardening Seed treatment to control diseases Seedling diseases and their control. **By specialized Vegetative structures**: Bulbs, Tubers, Corms, Rhizomes, Rootstock, runners, Offsets and suckers	05
II	**Layering and grafting. Layering** – Definition, Types: Simple, compound, (Serpentine) Tip, Trench, Mound, Air Layering. **Grafting-**Definition, advantages, and disadvantages. Types: Splice, Whip/ Tongue, side, veneer, cleft, bark, epicotyls, approach, repair grafting – enarching, bridge and bracing. Stock- Scion relationships and Incompatibility.	05

PRACTICAL: (SKILL ENHANCEMENT COURSE)
ONLY MAJOR BOTANY STUDENTS

Course Type	Course Code	Year	Semester	No. of Practical / Week -	Credit	Duration
Horticulture and Gardening	23BU1SEC7	B.Sc. -I	I	01	01	06 Months

1	Identification of different chemical fertilizers. Identification of organic manures-farm yard manure, Vermicomposting, cakes, bonemeal.
2	Preparation of the following Natural insecticides- Neem Arka and Tobacco Extract.
3	Propagation of horticultural crops through cuttings, buddings, grafting, layering, runners and suckers, and seeds.
4	Study garden tools and implements.
5	Study of pots, potting, de-potting, and Repotting
6	Preparation of potting mixtures, and poly-bags.
7	Field visit to the nursery

Suggested readings	
1.	George Scott Williams. Nursery Crops and Landscape Designs for Agribusiness Studies". Vero Media Inc; 1984.
2.	Alagarsamy Nithya Devi, Alagarsamy Ramesh Kumar, Valliappan Lakshmanan. Floriculture, Landscaping and Turf Management". India: LAP Lambert Academic Publishing; 2012. 224p
3.	R.C. Upadhyaya. Propagation of Horticultural Crops" [Internet]. India: Anmol Publisher; 2008 [cited 2023 Jun 21]. 264 p
4.	Chadha, K.L. (2001). Textbook of Horticulture. ICAR, New Delhi.
5.	Azad, K. C. and Sharma, V. K. (2000). Horticulture Technology (Vol. I&II). Deep and Deep

	Publications, New Delhi, India.

SEC Examination pattern

1. **External exams** based on : Unit-1, Unit-2, and Unit-3.(Conducted by the department)
2. **Total Marks:** External Exam:30
3. **Internal**:20 Marks
4. **Practical:50 Marks (CIAP)**

SKILL ENHANCEMENT SEM-II

Floriculture (Flower arrangement)

	23BU2SEC7	23BU2SEC7 Theory + Practical			**02**	**45 hrs**
Course Type	**Course Code**	**Year**	**Semester**	**No. of Lecture (Hr) / Week -**	**Credit**	**Duration**
Certificate Course in SEC: Floriculture (Flower arrangement)	23BU2SEC7	**B.Sc. -I**	**I**	**01**	**01**	**15 hrs**

Pre-requisite: Students should know about the fundamentals of Ayurveda.

Course Objectives

The main objectives of this course are to:

1.	Knowledge and understanding of flowers and vegetables in a detailed manner.
2.	The role of fruits and vegetables in our day-to-day life.
3.	Transfer of appropriate knowledge from one topic to another within the subject.
4.	Understand the evolving state of knowledge in a rapidly developing field.
5.	Use research-based knowledge and research methods including the procedure of how to start a small-scale business of flowers etc.,
6.	Help students to build up business strategies for fruits, flowers, and vegetables. etc.
7.	The plants that attract butterflies and thus suitable for a butterfly garden

Course Outcomes

On the successful completion of the course, students will be able to:

1.	To remember the goals of Floriculture.	**K1**
2.	To Understand the evolving state of knowledge in a rapidly developing Floriculture field.	**K2**
3.	To Identification and storage of seasonal flowers.	**K3 & K4**
4.	Evaluate garden designs of different countries.	**K5**
5.	Application of flower arrangements for different areas and occasions.	**K6**
6.	Apply the medicinal economic and traditional aspects of plants mentioned in the Vedas for the benefit of human welfare.	**K5 & K6**

K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 - Evaluate; K6 - Create

Unit	Title of the Topic	L.
I	**Introduction to a flower arrangement: Scope of flower arrangement.** • Principles of flower arrangement. • Elements of design for flower arrangement. • Equipment and materials required for flower arrangement • Economics of greenhouse production of Gerbera	05
II	**Flower arrangement – Styles** • Western flower arrangement • Japanese flower arrangement: Ikebana and Moribana • Indian flower arrangement	05
III	**Floriculture Business** • Processes in Dry Flower Arrangements • Floral resin art • Floral Bookmarks • Florist shop management • Flower farming business	05

PRACTICAL SEM-II: Floriculture

Course Type	Course Code	Year	Semester	No. of Practical / Week -	Credit	Duration
Certificate Course in Basic Botany - Floriculture	23BU2SEC7	B.Sc. - I	II	01	01	30 hrs.

1.	Equipment and material required for flower arrangement
2.	Flower arrangements –Indian (Gajara, Veni, Garland)
3.	Flower arrangements floating rangoli/Bio-Rangoli), Japanese and Western type (demonstration)
4.	Indian flower arrangement
5.	Western flower arrangement
6.	Japanese flower arrangement
7.	Floral Bookmarks
8.	Dry Flower arrangements
9.	Floral resin art
10.	Field visit to the nursery

Suggested readings

1. Adams, C., M.Earlyand J.Brrok(2011).Principles of Horticulture.
2. Agrawal, P.K. (1993). Hand Book of Seed Technology, Dept. of Agriculture and
3. Bose T.K. and Mukherjee, D. (1972). Gardening in India, Oxford and IBH Publishing Co., Cooperation, National Seed Corporation Ltd., New Delhi.
4. Jules J. (1979). Horticultural Science. (3rd Ed.), W.H. Freeman and Co., San Francisco,
5. Kumar, N. (1997). Introduction to Horticulture, Rajalakshmi Publications, Nagercoil. New Delhi.
6. Randhawa, G.S. and Mukhopadhyay, A. (1986). Floriculture in India. Allied Publishers.
7. Sandhu, M.K. (1989). Plant Propagation, Wile Eastern Ltd., Bangalore, Madras. The USA.

SEC Examination pattern

1. **External exams** based on: Unit-1, Unit-2, and Unit-3.(Conducted by the department)
2. **Total Marks:** External Exam:30
3. **Internal**:20 Marks

4. Practical:50 Marks (CIAP)

After complete of this course, students will Job opportunities/ Entrepreneurship:

India is mostly an agricultural nation, which expands its use and utility. Technology is developing rapidly. There are several career and professional prospects with this degree. The following fields offer career prospects in both the public and commercial sectors:

Plantation Manager, Seed Technologies Firm, Operations Manager in Fertilizer Units, Agribusiness Development Manager, Food Processing Units in Government, Subject Matter Specialist in different Krishi Vigyan Kendras (KVKs), Crop production - fruit, vegetables, nursery stock, Landscape design, Landscape construction and management, Parks management, Sports turf construction and management including football pitches, bowling greens, racecourses, golf courses, Horticultural education and training, Retails sales outlets - garden centers, florists, horticultural materials suppliers. Garden supervisors in Municipal Corporations, Gardens, Curators, Horticulture officers, Section officers, Landscaping officers, Food Safety Officers, Agriculture Field Officers, Horticulture Managers, Farm Managers, Nursery operators, and other positions are available.

Semester End Examination (15 Marks): Question Paper Pattern

1. These examinations shall be of 45 min duration. Maximum marks 10.

Curriculum and Extracurricular (10M) (Internal following topic)

Research – Presentation/ Paper review/ Book review/ Project/ Publication of Research Paper

OR

Writing skills - Essay writing/ Report on - Campus visit/ Industry Visit/ Field Trip/ Visit to a garden/ Report on Conference – Workshop – Seminar – Webinar attended/ Intercollegiate competition participation/ Science movies review/ Assignment/ Case studies on topics assigned

OR

Skill development – Flip the class/ Open Viva/ Debate/Group Discussion/ Quiz/ e-herbarium/ Photo gallery- Nature Photography, Flora & Fauna/ Botanical illustrations/ Model making/ Survey of the topic assigned

OR

Innovation: Using Plant resources/Animal resources to frame new names (Human beings), Slogan making (Use of any Language)/Construct Botanical Calendar

OR

Green Campus efforts - Raising and maintaining plant/ maintenance of the departmental garden

OR

Active participation in Departmental Club (Botany Club/ Movie & Journal Club)

OR

Class test (Sem Sem-1 paper-1 and 2 Sem-2 Paper-1 and 2

OR

Certification from Swayam / NPTEL (Courses in Biosciences), Certificate courses related to Botanical sciences (minimum 5 hours = 10 marks in only one paper)

OR

Collection of germplasm and Soil boll preparation

OR

Entrepreneurship Skill: Preparation and Trading of Mocktail/Squash/Syrup using seasonal fruits/ preserved products/ Garlands/Gajra/Bouquet/Tulsi plant/Paper bags/Paper envelope

OR

Skills and knowledge: Introduction to Basic MS-Excel/ Advanced MS-Excel /Python (minimum 5 hours = 10 marks in only one paper).

OR

Social: Visit tribal areas and report on traditional practices.

OR

Religious: Visit religious places and report on botanical sources

OR

Plant /Animals/Birds: Pet care/Pet friend/nature lovers/Bird lovers/Friends of farmers **National integration**: Blood donation,
* **Note** – If a candidate failed to submit assigned work in time due to genuine reason, then it can be compensated by assigning a new task for the benefit of the candidate.