

As per NEP 2020

**SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA,
SAWANTWADI**



Title of the Programme: Science

B.Sc. (Botany)

A: Certificate in Botany: 2023-2024

B: Diploma in Botany: 2024-2025

C: Degree in Botany: 2025-2026

Syllabus for

Sem-I and Sem-II

Reference GR dated 16th May 2023 for Credit structure

**SHRI PANCHAM KHEMRAJ MAHAVIDYALAYA,
SAWANTWADI**



(As per NEP 2020)

Sr. No.	Headings	Particulars
1	Title of the Program	Science- Botany
2	Eligibility	H.S.C. Science
	Duration of the Programme	1- Certificate 2- Diploma 3- Advance Diploma 4- Research Degree
	Scheme of Examination	External : 60 Internal: 40 Separate passing in External and Internal examination
	Standard of Passing	40.00%
	Program Academic Level	4.5 Certificate 5.0 Diploma 5.5 Advance Diploma 6.0 Research Degree
	Pattern	Semester Pattern
	Status	New
	To Be Implemented from the academic year	4.6 Certificate 2023-2024 6.0 Diploma 2024-2025 5.5 Advance Diploma 2025-2026 6.0 Research Degree 2026-2027

Preamble

Shri Pancham Khemaraj Mahavidyalaya, Sawantwadi (Autonomous) believes in implementing several measures to bring equity, efficiency and excellence in higher education system in conformity to the guidelines laid down by the University Grants Commission (UGC). In order to achieve these goals, all efforts are made to ensure high standards of education by implementing several steps to enhance the teaching-learning process, examination and evaluation techniques and ensuring the all-round development of learners.

The four-year course in B.Sc. Botany has been designed to have a progressive and innovative curriculum in order to equip our learners to face the future challenges in the field of higher education.

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

A Botany Post Graduates degree equips students with the knowledge and skills necessary for a diverse range of fulfilling career paths. Post Graduates in Botany find opportunities in various fields, including urban planning, teaching, environmental science, all plant sciences, organic farming, nursery management, entrepreneurship Mushroom cultivation, medicinal plant, floriculture, horticulture, propagation methods and plant tissue culture method and many other domains. Throughout their three-year degree program, students explore the significance of plant in life of each and every living organism on Earth. They learn tool, techniques, process which is required to set up agencies including pickles, jam, and jelly medicinal plant, fruit processing, vegetable processing, organic product, organic fertilizer and pesticides producing industries also the can earn the knowledge to produce natural remedies for varies diseases. They became expert in discovery and development of many new therapeutic compounds which are now used in pharmaceutical herbal cosmetics and other compound based industries.

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

Aims and Objective

- To recognize the principles behind and importance of many botanical phenomena.
- To conduct experiments to understand the plants and environment relationship.
- To use the knowledge and abilities gained to solve nutrition related real time problems.
- To develop and use a broad view for environmental problem-solving abilities.

Program Outcomes

After Completing the Programme, Students will be able to,

PO1	Demonstrate comprehensive knowledge and understanding of science that form a part of an undergraduate programme of study.	Disciplinary knowledge
PO2	Express scientific knowledge, concepts and ideas effectively in writing and orally; Communicate with others using appropriate media; confidently share one's views and express herself/himself; demonstrate the ability to listen carefully, read and write analytically, and present complex information in a clear and concise manner to	Communication Skills
PO3	Apply analytical thought to a body of knowledge; analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence; identify relevant assumptions or implications; formulate coherent arguments; critically evaluate practices, policies and theories by following scientific approach to knowledge	Critical thinking
PO4	Extrapolate from what one has learned and apply their competencies to solve different kinds of non familiar problems, rather than replicate curriculum content knowledge; and apply one's learning to real life situations.	Problem solving
PO5	Evaluate the reliability and relevance of evidence; identify logical flaws and holes in the arguments of others; analyse and synthesise data from a variety of sources; draw valid conclusions and support them with evidence	Analytical reasoning
PO6	Enquire, ask appropriate questions, to recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; Plan, execute and report the results of an experiment or investigation.	Research-related skills
PO7	Work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group, and act together as a group or a team in the interests of a common cause and work efficiently as a	Cooperation/Team work
	Analyse, interpret and draw conclusions from	

PO8	Quantitative/Qualitative data; and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective.	Scientific reasoning
PO9	Criticize sensibility to lived experiences, with self-awareness and reflexivity of both self and society.	Reflective thinking
PO10	Use of ICT in a variety of learning situations, demonstrate, access, evaluate, and use a variety of relevant information sources; and use appropriate software for analysis of data.	Information/digital literacy
PO11	Work independently, identify appropriate resources required for a project, and manage a project through to completion	Self-directed learning
PO12	Retain knowledge of the values and beliefs of multiple cultures and a global perspective; Engage in a multicultural society and interact respectfully with diverse groups.	Multicultural competence
PO13	Embrace moral/ethical values in life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work. identify ethical issues, avoid unethical behaviour such as fabrication, falsification or misrepresentation of committing plagiarism, not adhering to intellectual property rights; appreciate environmental and sustainability issues; adopt objective, unbiased and truthful actions in all aspects of work.	Moral and ethical awareness/reasoning
PO14	Map the tasks of a team or an organization, and set direction, formulate an inspiring vision, build a team who can help achieve the vision, motivate and inspire team members to engage with that vision, use management skills to guide people to the right destination, in a smooth and efficient way.	Leadership readiness/qualities
PO15	Acquire knowledge and skills, including 'learning how to learn', that are necessary for participating in learning activities throughout life, through self-paced and self-directed learning aimed at personal development, meeting economic, social and cultural objectives, adapt to changing trades and demands of work place	Lifelong learning

Program Specific Outcome: After successful completion of this programme (Botany) learners are able to

PSO1	Explain how Plant perform various functions at the level of the gene, cell, tissue, organ and organism as collective.
PSO2	Compare and contrast the characteristics of plant groups, Identify and classify plants of various division up to class level on basis of basic knowledge of plant morphology, anatomy etc. in real life observations.
PSO3	Apply scientific methods to questions in botany by formulating testable hypotheses, collecting data that address these hypotheses, and analysing those data to assess the degree to which their scientific work supports their hypotheses.
PSO4	Demonstrate proficiency in the experimental techniques and analytical methods for Various areas and current trends in plant science.



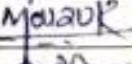



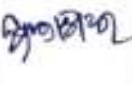



Proposed First Year Credit Structure as per NEP 2020

Department of Botany

Proposed Structure for Major / Minor/OE/VSE/SEC/VEC/IKS/VEC

Semester	Paper Code	Paper Title	Type	Credits
I (Level 4.5)	S101BOT (Major)	Plant diversity I	Theory	2
	S102BOT (Major)	Form and Function I	Theory	2
	S103BOP (Major)	Practical I	Practical	2
	S104BOT (Minor)	Plant diversity I	Theory	2
	S105BOT (Minor)	Form and Function I	Theory	2
	BOTOE01(GE/OE)	Gardening and Nursery Management (रोपवाटिका व्यवस्थापन)	Generic Elective	2
	BOTSEC01(SEC)	Mushroom Cultivation	Voc. Skill	2
	BOTVSC01 (VSC)	Practical related to Minor	Skill	2
II (Level 4.5)	S106BOT (Major)	Plant diversity II	Theory	2
	S107BOT (Major)	Form and Function II	Theory	2
	S108BOP (Major)	Practical II	Practical	2
	S109BOT (Minor)	Plant diversity II	Theory	2
	S110BOT (Minor)	Form and Function II	Theory	2
	S111BOP (Minor)	Practical-II	Practical	2
	BOTOE02(GE/OE)	Economic Botany(आर्थिक वनस्पतिशास्त्र)	Generic Ele.	2
	BOTOE03(GE/OE)	Floriculture (फुलशेती)	Open Ele.	2
	BOTSEC02(SEC)	Fruit processing	Skill Enh.	2
	BOTIK01	Botany in Ayurveda	IKS	2

Committee for creation of Syllabus

Sr. No.	Name	College Name	Designation	Signature
1.	Prof. (Dr.) Dethu U. L.	Head, P.G. Department of Botany Shri Pancham Khemraj Mahavidyalaya, Sawantwadi	Chairman, BOS	
2.	Dr. Aparadh V.T	Shri Pancham Khemraj Mahavidyalaya, Sawantwadi	Member	
3.	Dr. Pawar U.R.	Shri Pancham Khemraj Mahavidyalaya, Sawantwadi	Member	
4.	Mrs. Sawant S. S.	Shri Pancham Khemraj Mahavidyalaya, Sawantwadi	Member	
5.	Dr. Pawar Nilesh .V	Assistant Professor, The New College Kolhapur Phone: 9860282394 Email: nileshsu@gmail.com	Subject experts from outside the university are to be nominated by the Academic Council	
6.	Dr. Patil M.S.	Assistant Professor, S. G.M. College, Karad Phone: 9226824947 Email: manasipatil202@gmail.com	Subject experts from outside the university are to be nominated by the Academic Council	
7.	Dr. Kashetti Ramesh P.	Anandibai Raorane Arts, Commerce, and Science College Vaibhavwadi Phone: 9730460853 Email: kashettiramesh@gmail.com	Expert nominated by the VC	
8.	Dr. Naik Vinayak R.	Vardanjali Herbals, Goregaon (E), Mumbai Mobile: 8928207443 Email: drvinayaknaik01@gmail.com	Representative from Industry/corporate sector/allied areas nominated by the Principal	
9.	Dr, Naikwade Pratap V.	Assistant professor Athalye Sapre Pitre College, Devrukh Mobile:9595821891 naikwade.pratap@gmail.com	Experts from outside the Autonomous college whenever special courses of studies are to be formulated to be nominated by the Principal	
10.	Mr. Ghaware Pandurang Prabhakar	Botany Executive Shree Swami Samarth Enterprises, Thane 7588451052 pandurangghaware75@gmail.com	Post Graduate Meritorius Alumni	

Letter Grades and Grade points

Semester GPA/Program CGPA/Semester Program	Percentage of Marks	Alpha- sign / letter grade result
9.00-10.00	90.00-100	O (Outstanding)
8.00-9.00 \geq	80.0-90.0	A+ (Excellent)
7.00-8.00	70.0-80.0	A(Very Gppd)
6.00-7.00	60.0-70.0	B+(Good)
5.50-6.00	55.0-60.0	B(Above Average)
5.00-5.50	50.0-55.0	C(Average)
4.00-5.00	40.0-50.0	P(Pass)
Below 4.00	Below 40.0	F(Fail)
AB (absent)		Absent

Course Code and Title: S101BOT (MAJOR): PLANT DIVERSITY I

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-I
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Learning Objectives:

- To know the basics of cryptogams.
- To understand the plant diversity with special reference to cryptogams diversity.
- To give knowledge of identification of cryptogams.
- To understand the scope of the cryptogams diversity with special reference Algae,
- Fungi, Bryophytes

Learning Outcomes:

After Completing the course, Student will be able to

- Explain Occurrence, structure, reproduction of *Nostoc*, *Spirogyra*, *Rhizopus*, *Aspergillus* and *Riccia*
- Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
- Differentiate modes of nutrition in fungi
- Evaluate economic importance of algae, fungi and bryophytes
- Justify different stages in the life cycle of *Nostoc*, *Spirogyra*, *Rhizopus*, *Aspergillus* and *Riccia*.

Unit - I	ALGAE	10 Lectures
	1.1 Structure, life cycle and systematic position of <i>Nostoc</i> .	
	1.2 Structure, life cycle and systematic position of <i>Spirogyra</i> .	
	1.3 Economic importance of Algae.	
	<i>Ulva</i> (Biofuel),	
	<i>Spirulina</i> (Neutraceutical),	
	<i>Gelidium</i> (Agar)	
Unit – II	FUNGI	10 Lectures
	2.1 Structure, life cycle and systematic position of <i>Rhizopus</i> .	
	2.2 Structure, life cycle and systematic position of <i>Aspergillus</i> .	
	2.3 Economic importance of Fungi.	
	Mushroom, yeast, wood rotting Fungi.	
	2.4 Modes of nutrition in Fungi (Saprophytism and Parasitism).	
Unit – III	BRYOPHYTA	10 Lectures
	3.1 General characters of Hepaticae	
	3.2 Structure, life cycle and systematic position of <i>Riccia</i> .	

References:

1	College Botany Volume I and II by Gangulee, Das and Dutta. Central Education Enterprises.
2	Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill.
3	Text book of Fungi by O.P. Sharma, Tata McGraw.
4	Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi.
5	Bryophyta by B.R.Vashishta, S Chand Publication
6	Introductory Phycology by Kumar, H. D. 1988, Affiliated East-West Press Ltd., New York.

Course Code and Title: S102BOT (MAJOR): FORM AND FUNCTION I

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-I
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Learning Objectives:

- To know the basics of genetics and ecology
- To understand the cell biology with special reference to ultrastructure and function of Cell wall, plasma membrane and cell organelles.
- To give knowledge of types of ecosystem.

Learning Outcomes:

- On successful completion of this course students will be able to:
- Define the Ecology, Ecosystem, multiple alleles
- Explain the type of cells with their differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics
- Describe terrestrial and aquatic ecosystems, the basic principles of Genetics, epistatic and non-epistatic gene interactions
- Differentiate prokaryotic and eukaryotic cell, types of gene interaction, ecosystems
- Justify the Mendelian ratios, prokaryotic and eukaryotic cell, ecosystems

Unit - I	CELL BIOLOGY	10 Lectures
	1.1 General structure of plant cell: cell wall Plasma membrane (bilayer lipid structure, fluid mosaic model)	
	1.2 Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast	
Unit – II	ECOLOGY	10 Lectures
	2.1 Ecology: Introduction	
	2.2 Food chains and Food webs	
	2.3 Types of pyramids, energy flow in an ecosystem.	
	2.4 Types of ecosystems: aquatic and terrestrial.	
Unit – III	CYTOGENETICS	10 Lectures
	3.1 Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.	
	3.2 Epistatic and non-epistatic interactions;	
	3.3 Multiple alleles.	
	3.4 Introduction of chromosome.	
	3.5 Principles of chromosomal aberration (structural changes: deletion, duplication, inversion and translocation).	

References:

1	Cell Biology by C.B. Powar.
2	Cell Biology by De Robertis.
3	Genetics by Russel. Wesley Longman inc publishers. (5th edition).
4	Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.

Course Code and Title: S103BOP (MAJOR): PRACTICAL I BOTANY

Level: 4.5	Credits: 02	Semester-I
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Learning Outcome: On successful completion of this course students will be able to:

- Explain Occurrence, structure, reproduction of *Nostoc*, *Spirogyra*, *Rhizopus*, *Aspergillus* and *Riccia*
- Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
- Differentiate modes of nutrition in fungi
- Evaluate economic importance of algae, fungi and bryophytes
- Understand the differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics.

A. EXTERNAL experiments	
1	Study of stages in the life cycle of <i>Nostoc</i> from fresh/ preserved material.
2	Study of stages in the life cycle of <i>Spirogyra</i> from fresh/ preserved material.
3	Study of stages in the life cycle of <i>Rhizopus</i> from fresh/ preserved material and permanent slides
4	Study of stages in the life cycle of <i>Aspergillus</i> from fresh/ preserved material.
5	Study of stages in the life cycle of <i>Riccia</i> from fresh/ preserved Material.
6	Cell inclusions: Starch grains (<i>Solanum tuberosum</i> and <i>Oryza sativa</i>); Aleurone Layer (<i>Zea mays</i>); Cystolith (<i>Ficus</i>); Raphides (<i>Pistia/ Colocasia</i>); Sphaeraphides (<i>Opuntia</i>).
7	Calculation of mean, median and mode
8	Calculation of standard deviation
9	Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart
B. INTERNAL experiments	
1	Identification of cell organelles with the help of photomicrograph: Plastids: Chloroplast, Amyloplast, Endoplasmic Reticulum and Nucleus.
2	Study of stages in the life cycle of <i>Nostoc</i> & <i>Spirogyra</i> from permanent slides
3	Study of stages in the life cycle of <i>Aspergillus</i> from permanent slides.
4	Study of stages in the life cycle of <i>Riccia</i> from permanent slides.
5	Economic importance of Fungi: Mushroom, yeast, wood rotting Fungi.
6	Economic importance of algae: <i>Ulva</i> (Biofuel), <i>Spirulina</i> (Neutraceutical), <i>Gelidium</i> (Agar)
7	Examining various stages of mitosis in root tip cells.
8	Identification of plants adapted to different environmental conditions: (No sections in ecology, only identification and description of specimens. Morphological adaptations only) Hydrophytes: Floating: Free floating (<i>Pistia</i>); Rooted floating (<i>Nymphaea</i>); Submerged (<i>Hydrilla</i>) Mesophytes (any common plant); Hygrophytes (<i>Cyperus</i>) Xerophytes: Succulent (<i>Opuntia</i>); Woody Xerophyte (<i>Nerium</i>); Halophyte (<i>Avicennia pneumatophore</i>)

Course Code and Title: S104BOT (MINOR): PLANT DIVERSITY I

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-I
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Learning Objectives:

- To know the basics of cryptogams.
- To understand the plant diversity with special reference to cryptogams diversity.
- To give knowledge of identification of cryptogams.
- To understand the scope of the cryptogams diversity with special reference Algae,
- Fungi, Bryophytes

Learning Outcomes:

After Completing the course, Student will be able to

- Explain Occurrence, structure, reproduction of *Nostoc*, *Spirogyra*, *Rhizopus*, *Aspergillus* and *Riccia*
- Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
- Differentiate modes of nutrition in fungi
- Evaluate economic importance of algae, fungi and bryophytes
- Justify different stages in the life cycle of *Nostoc*, *Spirogyra*, *Rhizopus*, *Aspergillus* and *Riccia*.

Unit - I	ALGAE	10 Lectures
	1.1 Structure, life cycle and systematic position of <i>Nostoc</i> .	
	1.2 Structure, life cycle and systematic position of <i>Spirogyra</i> .	
	1.3 Economic importance of Algae.	
	<i>Ulva</i> (Biofuel),	
	<i>Spirulina</i> (Neutraceutical),	
	<i>Gelidium</i> (Agar)	
Unit – II	FUNGI	10 Lectures
	2.1 Structure, life cycle and systematic position of <i>Rhizopus</i> .	
	2.2 Structure, life cycle and systematic position of <i>Aspergillus</i> .	
	2.3 Economic importance of Fungi.	
	2.4 Modes of nutrition in Fungi (Saprophytism and Parasitism).	
Unit – III	BRYOPHYTA	10 Lectures
	3.1 General characters of Hepaticae	
	3.2 Structure, life cycle and systematic position of <i>Riccia</i> .	

References:

1	College Botany Volume I and II by Gangulee, Das and Dutta. Central Education Enterprises.
2	Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill.
3	Text book of Fungi by O.P. Sharma, Tata McGraw.
4	Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi.
5	Bryophyta by B.R.Vashishta, S Chand Publication
6	Introductory Phycology by Kumar, H. D. 1988, Affiliated East-West Press Ltd., New York.

Course Code and Title: S105BOT (MINOR): FORM AND FUNCTION I

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-I
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Learning Objectives:

- To know the basics of genetics and ecology
- To understand the cell biology with special reference to ultrastructure and function of Cell wall, plasma membrane and cell organelles.
- To give knowledge of types of ecosystem.

Learning Outcomes:

- On successful completion of this course students will be able to:
- Define the Ecology, Ecosystem, multiple alleles
- Explain the type of cells with their differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics
- Describe terrestrial and aquatic ecosystems, the basic principles of Genetics, epistatic and non-epistatic gene interactions
- Differentiate prokaryotic and eukaryotic cell, types of gene interaction, ecosystems
- Justify the Mendelian ratios, prokaryotic and eukaryotic cell, ecosystems

Unit - I	CELL BIOLOGY	10 Lectures
	1.1 General structure of plant cell: cell wall Plasma membrane (bilayer lipid structure, fluid mosaic model)	
	1.2 Ultra structure and functions of the following cell organelles: Endoplasmic reticulum and Chloroplast	
Unit – II	ECOLOGY	10 Lectures
	2.1 Ecology: Introduction	
	2.2 Food chains and Food webs	
	2.3 Energy pyramids, energy flow in an ecosystem.	
	2.4 Types of ecosystems: aquatic and terrestrial.	
Unit – III	GENETICS & CYTOLOGY	10 Lectures
	3.1 Genetics: Introduction of chromosome.	
	3.2 Principles of chromosomal aberration (structural changes: deletion, duplication, inversion and translocation).	
	3.3 Mendelian Genetics- monohybrid, dihybrid; test cross; back cross ratios.	
	3.4 Epistatic and non-epistatic interactions;	
	3.5 Multiple alleles.	

References:

1	Cell Biology by C.B. Powar.
2	Cell Biology by De Robertis.
3	Genetics by Russel. Wesley Longman inc publishers. (5th edition).
4	Fundamentals of Ecology by E P Odum and G W Barrett. Thompson Asia Pvt Ltd. Singapore.

BOTOE01(GE/OE): NURSERY MANAGEMENT (रोपवाटिका व्यवस्थापन)

Level: 4.5	Credits: 02	Lectures: 30 L
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Learning Outcomes

- The students will be able to identify different types of nursery plants and classify them based on soil and climate.
- The students will be able to use various tools and implements to raise nursery
- The students will be able to demonstrate the skills of vegetative propagation techniques and use modern methods of plant multiplication.
- The students will be able to design garden layout and make a plan for an orchard in a given area.

Unit - I	INTRODUCTION TO NURSERY	05 Lectures
	Introduction to nursery: Basic concept and principles of nursery and its managements.	
Unit – II	LAYOUT AND MANAGEMENT	05 Lectures
	Layout and management of commercial nursery: Nursery- site selection, layout, records, potting, repotting, Progeny orchard.	
Unit – III	NURSERY TOOLS & STRUCTURES	10 Lectures
	Nursery (tools and implements), Propagation Structures: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, etc.	
Unit – IV	NURSERY MANAGEMENT	10 Lectures
	Nursery management of major crops, Problems in nursery management and its control, Insect/pest/disease control in nursery.	

References:

1	Handbook of Gardening by Gopal Swami Aingar, 1975.
2	Handbook of Horticulture by CPWD.
3	Plant Propagation and Nursery Management by ICAR e Krishi Shiksha and TNAU
4	Resource Book on Horticulture Nursery Management by FDCM.
5	Flora of Sahyadri by Shriknat Inganhallikar.

BOTSEC01(SEC): MUSHROOM CULTIVATION

Level: 4.5	Credits: 02	Lectures: 60 L
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Learning Objectives:

- Enable the students to identify edible and poisonous mushrooms
- Provide hands on training for the preparation of bed for mushroom cultivation and spawn production
- Give the students an industrial exposure to help them in understanding the establishment and functioning of mushroom farms
- Value addition of the mushroom products
- Learn marketing strategies - local to cross country
- Understand the available financial schemes and application processes for establishing a farm
- Give the learners an experience in research for qualitative and quantitative mushroom production
- Mushroom Cultivation

Learning Outcome:

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

- Identify edible types of mushroom
- Gain the knowledge of cultivation of different types of edible mushrooms and spawn production
- Manage the diseases and pests of mushrooms
- Develop competency in self-employment and income generation
- Packaging, Storing and grading of mushroom; post harvest procedures
- Apply for different Government, Non Government Schemes for establishing a production unit
- Markets available for commercial production
- Develop research aptitude

PRACTICALS/ EXPERIMENTS	
1	Study of external characters of mushroom
2	Study of internal characters
3	Study of different species of mushrooms
4	Life cycle of typical mushroom
5	Nutritional values of mushrooms
6	Medicinal usages of mushrooms
7	Media preparation for Spawn culture
8	Composition of compost and bed preparation
9	Preparation of different types of compost
10	Pasteurization of compost and sterilization processes
11	Seeding technique of spawn in compost
12	Harvesting stage and methodology
13	Packaging and labelling process
14	Recipes in mushroom cuisine

References:

1	S.Kannaiyan & K.Ramasamy (1980). A hand book of edible mushroom, Today & Tomorrows printers & publishers, New Delhi.
2	Nailoke Pauline Kadhila, Favian Sinvula Mubiana, and Keumbo Lorna Haluendo, 2012: Mushroom Cultivation- A Beginners Guide; Published by University of Namibia
3	Nita Bhal. (2000). Handbook on Mushrooms. 2nd ed. Vol. I and II. Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.
4	Pathak, V. N. and Yadav, N. (1998). Mushroom Production and Processing Technology. Agrobios, Jodhpur.
5	Tripathi, D.P. (2005) Mushroom Cultivation, Oxford & IBH Publishing Co. PVT.LTD, New Delhi.

Course Code and Title: BOTVSC01 (VSC) PRACTICAL RELATED TO MINOR BOTANY

Level: 4.5	Credits: 02	Semester-I
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Learning Outcome: On successful completion of this course students will be able to:

- Explain Occurrence, structure, reproduction of *Nostoc*, *Spirogyra*, *Rhizopus*, *Aspergillus* and *Riccia*
- Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
- Differentiate modes of nutrition in fungi
- Evaluate economic importance of algae, fungi and bryophytes
- Understand the differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics.

A. EXTERNAL experiments	
1	Study of stages in the life cycle of <i>Nostoc</i> from fresh/ preserved material.
2	Study of stages in the life cycle of <i>Spirogyra</i> from fresh/ preserved material.
3	Study of stages in the life cycle of <i>Rhizopus</i> from fresh/ preserved material and permanent slides
4	Study of stages in the life cycle of <i>Aspergillus</i> from fresh/ preserved material.
5	Study of stages in the life cycle of <i>Riccia</i> from fresh/ preserved Material.
6	Cell inclusions: Starch grains (<i>Solanum tuberosum</i> and <i>Oryza sativa</i>); Aleurone Layer (<i>Zea mays</i>); Cystolith (<i>Ficus</i>); Raphides (<i>Pistia/ Colocasia</i>); Sphaeraphides (<i>Opuntia</i>).
7	Calculation of mean, median and mode
8	Calculation of standard deviation
9	Frequency distribution, graphical representation of data- frequency polygon, histogram, pie chart
B. INTERNAL experiments	
1	Identification of cell organelles with the help of photomicrograph: Plastids: Chloroplast, Amyloplast, Endoplasmic Reticulum and Nucleus.
2	Study of stages in the life cycle of <i>Nostoc</i> & <i>Spirogyra</i> from permanent slides
3	Study of stages in the life cycle of <i>Aspergillus</i> from permanent slides.
4	Study of stages in the life cycle of <i>Riccia</i> from permanent slides.
5	Economic importance of Fungi: Mushroom, yeast, wood rotting Fungi.
6	Economic importance of algae: <i>Ulva</i> (Biofuel), <i>Spirulina</i> (Neutraceutical), <i>Gelidium</i> (Agar)
7	Examining various stages of mitosis in root tip cells.
8	Identification of plants adapted to different environmental conditions: (No sections in ecology, only identification and description of specimens. Morphological adaptations only) Hydrophytes: Floating: Free floating (<i>Pistia</i>); Rooted floating (<i>Nymphaea</i>); Submerged (<i>Hydrilla</i>) Mesophytes (any common plant); Hygrophytes (<i>Cyperus</i>) Xerophytes: Succulent (<i>Opuntia</i>); Woody Xerophyte (<i>Nerium</i>); Halophyte (<i>Avicennia pneumatophore</i>)

MAJOR SUBJECTS

Paper No.	Semester	Paper Code	Title of Paper	No of Credits	No of Lectures In Hours
I	II	S106BOT (Major)	Plant diversity II	2	30
II		S107BOT (Major)	Form and Function II	2	30
III		S108BOP (Major)	Practical II	2	60

SEM -II

SEM -II			
S106BOT (Major)	Plant diversity II	Theory	2
S107BOT (Major)	Form and Function II	Theory	2
S108BOP (Major)	Practical II	Practical	2
S109BOT (Minor)	Plant diversity II	Theory	2
S110BOT (Minor)	Form and Function II	Theory	2
S111BOP (Minor)	Practical-II	Practical	2
BOTOE02(GE/OE)	Economic Botany	Generic Ele.	2
BOTOE03(GE/OE)	Floriculture फुलशेती	Open Ele.	2
BOTSEC02(SEC)	Fruit processing	Skill Enh.	2
BOTIK01	Botany in Ayurveda	IKS	2

Course Code and Title: S106BOT (MAJOR): PLANT DIVERSITY II

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-II
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Learning Objectives:

- To know the basics of vascular cryptogams.
- To understand the plant diversity with special reference to phanerogams diversity.
- To give knowledge of identification of angiosperms and gymnosperms.
- To understand the scope of the cryptogams diversity with special reference Algae,
- Fungi, Bryophytes

Learning Outcomes:

After Completing the course, Student will be able to

- Explain occurrence, structure, reproduction of *Nephrolepis* and *Cycas*.
- Identify and classify angiospermic plants on basis of general characters and principles of taxonomy
- Understand basic terminology regarding plant body.
- Evaluate economic importance of gymnosperm & angiospermic plants.
- Justify different stages in the life cycle of *Nephrolepis* and *Cycas*.

Unit - I	PTERIDOPHYTES	10 Lectures
	1.1 General characters of Pteridophytes	
	1.2 Structure life cycle, systematic position and alternation of generations in <i>Nephrolepis</i> .	
	1.3 Stelar evolution.	
Unit – II	GYMNOSPERMS	10 Lectures
	2.1 General characters of Gymnosperms.	
	2.2 Structure life cycle systematic position and alternation of generations in <i>Cycas</i> .	
	2.3 Economic importance of Gymnosperms.	
Unit – III	ANGIOSPERMS	10 Lectures
	3.1 LEAF MORPHOLOGY: typical leaf, simple leaf and types of compound leaves, venation, phyllotaxy, types of stipules	
	3.2 Inflorescence: types of Racemose and Cymose	
	3.3 Special type of inflorescence: Cyathium, Verticillaster, Hypanthodium.	
	3.4 Study of following families: Malvaceae, Amaryllidaceae.	

References:

1	College Botany Volume I and II by Gangulee, Das and Dutta. Central Education Enterprises.
2	Kato, M. 1983. Classification of major groups of pteridophytes. J. Fac. Sci. Univ. Tokyo III, 13: 263–283.
3	Eames, A. J. 1936. Morphology of vascular plants. Lower groups. New York London: MacGraw-Hill.
4	Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill.

5	Bentham, G., Hooker, J. D. 1880. <i>Genera Plantarum</i> 3, 1. Gymnospermae. London: L. Reeve, pp. 417–447.
6	<i>Cryptogamic Botany</i> Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi.
7	Fitzpatrick, H. M. 1929. Coniferae: keys to the genera and species, with economic notes. <i>Sci. Proc. R. Dublin Soc.</i> II, 19: 189–260.
8	Bentham, G., Hooker, J.D. 1862–1883. <i>Genera Plantarum</i> , 3 vols. London: various publishers.
9	Corner, E.J.H. 1976. <i>The seeds of dicotyledons</i> , 2 vols. Cambridge: Cambridge University Press.

Course Code and Title: S107BOT (MAJOR): FORM AND FUNCTION II

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-II
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Learning Objectives:

- To know the basics of plant physiology.
- To understand the medicinal importance of plants and traditional remedies of human related diseases.
- To give knowledge of plant tissue system.

Learning Outcomes:

On successful completion of this course students will be able to:

- Understand photosynthetic steps and why plants are important for mankind.
- Explain the type of tissues with their differentiation on basis of functions.
- Describe importance of primary and secondary metabolites for living things.
- Explore ethnomedicinal plants of their area.

Unit - I	ANATOMY	10 Lectures
	1.1 Simple tissues, complex tissues.	
	1.2 Primary structure of dicot and monocot root, stem and leaf.	
	1.3 Epidermal tissue system: types of hair, monocot and dicot stomata.	
Unit – II	PHYSIOLOGY	10 Lectures
	2.1 Photosynthesis: Light reactions, photolysis of water.	
	2.2 Photophosphorylation (cyclic and non cyclic).	
	2.3 Carbon fixation phase (C3, C4 and CAM pathways).	
Unit – III	MEDICINAL BOTANY	10 Lectures
	3.1 Concept of primary and secondary metabolites, difference between primary and secondary metabolites.	
	3.2 Grandma’s pouch: Following plants have to be studied with respect to botanical source, part of the plant used, active constituents present and medicinal uses: <i>Oscimum sanctum</i> , <i>Justicia adhatoda</i> (<i>Adathoda vasica</i>), <i>Zinziber officinale</i> , <i>Curcuma longa</i> , <i>Santalum album</i> , <i>Aloe vera</i> .	

References:

1	Glover, BJ (2000) Differentiation in plant epidermal cells. J. Exp. Bot. 51(344):497-505.
2	Plant Tissue Systems: Dermal, Ground, and Vascular (http://www.plantphys.net/article.php?ch=1&id=19)
3	Taiz, L, Zeiger, E (2002) Plant Physiology, 3rd edition, Chapter 24: The control and flowering, pp. 560-565.
4	Barbhuiya, A.R., Sahoo, U.K. and K. Upadhyaya (2016). Plant diversity in the indigenous home gardens in the Eastern Himalayan region of Mizoram, northeast India. Econ. Bot., 70 (2), pp. 115-131
5	Huai, H. and A. Hamilton (2009). Characteristics and functions of traditional homegardens: a review. Front. Biol. China, 4 (2) (2009), pp. 151-157

Course Code and Title: S108BOP (MAJOR): PRACTICAL II BOTANY

Level: 4.5	Credits: 02	Number of Lectures: 60	Semester-II
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Instructions:

- All the observations and readings after calculation should be written with proper units in conclusion.
- After completing all the required number of experiments in the semester and recording them in journal, student will have to get their journal certified and Produce the certified journal at the time of practical examination.
- While evaluating practical, weightage should be given to sketch diagram, observations, tabular representation, experimental skills and procedure, graph, calculation and result.
- Skill of doing the experiments and understanding botanical concepts should be more important.

Learning Outcome: On successful completion of this course students will be able to:

- Identify and classify angiospermic plants on basis of general characters and principles of taxonomy
- Understand basic terminology regarding plant body.
- Evaluate economic importance of gymnosperm & angiospermic plants.
- Justify different stages in the life cycle of *Nephrolepis* and *Cycas*.
- Understand photosynthetic steps and why plants are important for mankind.
- Explain the type of tissues with their differentiation on basis of functions.
- Describe importance of primary and secondary metabolites for living things.
- Explore ethnomedicinal plants of their area.
- Explain Occurrence, structure, reproduction of *Nostoc*, *Spirogyra*, *Rhizopus*, *Aspergillus* and *Riccia*
- Identify and classify Algae, Fungi and bryophytes on basis of general characters and principles of taxonomy
- Differentiate modes of nutrition in fungi
- Evaluate economic importance of algae, fungi and bryophytes
- Understand the differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics.

Note: Exemption of two experiments from section A and /or B may be given if student carries out any one of the following activity.

- Collect the information of at least five botanist with their work or any three events on botany, report that in journal.
- Execute a mini project to the satisfaction of teacher in-charge of practical.
- Participate in a study botanical tour or field visit & submit a study tour report.

For practical examinations, the learner will be examined in two experiments (one from each group).

- Each experiment will be of three lecture hours' duration.
- A Minimum 4 from each group and in all minimum 8 experiments must be reported in journal.

- All the skill experiments are required to be completed compulsorily. Students are required to report all these experiments in the journal. Evaluation in viva voce will be based on regular experiments and skill experiments. A learner will be allowed to appear for the semester and practical examination only if he submits a certified journal of Botany having a certificate that the learner has completed the practical course of Botany Semester II as per the minimum requirements.

A. EXTERNAL experiments	
1	Study of stages in the life cycle of <i>Nephrolepis</i> : Mounting of ramentum, hydathode, T.S. of rachis, T.S. of pinna of <i>Nephrolepis</i> passing through sorus.
2	<i>Cycas</i> : T.S of leaflet (<i>Cycas</i> pinna), <i>Cycas</i> : Megasporephyll, microsporephyll, coralloid root, microspore, L.S. of ovule of <i>Cycas</i> – all specimens to be shown.
3	Malvaceae
4	Amaryllidaceae
5	Primary structure of dicot and monocot root.
6	Primary structure of dicot and monocot stem.
7	Separation of chlorophyll pigments by paper chromatography.
8	Separation of amino acids by paper chromatography.
9	Effect of pH on Anthocyanin pigment (change in colour): black grapes/Purple cabbage
10	Test for tannins: tea powder, catechu.
B. INTERNAL experiments	
1	Stelar evolution with the help of permanent slides: Protostele: haplostele, actinostele, plectostele, mixed protostele, siphonostele: ectophloic, amphiphloic, dictyostele, eustele and atactostele.
2	Economic importance of Gymnosperms: <i>Pinus</i> (turpentine, wood, seeds)
3	Leaf morphology : as per theory
4	Types of inflorescence: as per theory
5	Study of dicot and monocot stomata.
6	Epidermal outgrowths: with the help of mountings Unicellular: <i>Gossypium</i> /Radish Multicellular: <i>Lantana</i> /Sunflower Glandular: <i>Drosera</i> and Stinging: <i>Urtica</i> – only identification with the help of permanent slides. Peltate: <i>Thespesia</i> Stellate: <i>Solanum</i> T-shaped: <i>Avicennia</i>
7	Identification of plants or plant parts for grandma's pouch as per theory.
8.	Botanical excursion

Note: Certified Journal is a must, to be eligible to appear for the semester end practical examination.

EXAMINATION PATTERN FOR MAJOR SUBJECTS

A) Continuous Internal Assessment (40 Marks):

Sr. No.	Particulars	Marks
1	One offline class test.	20
2	One assignment	10
3	Attendance in routine class/practical's.	05
4	Overall conduct as a responsible learner, mannerism and articulation and exhibit of leadership qualities in organizing related academic activities.	05

B) Semester End Examination (60 Marks):

Question Paper Pattern

1. These examinations shall be of **Two Hours** duration. Maximum marks **60**.
2. There shall be four questions of which first 3 questions are each of **16 marks**. Question 4 will be of 12 marks. Questions 1 will be based on **Unit-I**, Questions 2 will be based on **Unit-II**, **Questions 3** will be based on **Unit-III** and Question 4 will be based on entire syllabus with **Six short notes**.
3. All questions shall be compulsory with internal choice within the questions. But question 4 has internal choice of any **three out of six**.

Distribution of external 60 marks

Qn.	Sub-Qn	Particulars	Unit	Marks with options	Total Marks for qn
1	a,b,c,d	Answer the following (Attempt any two out of four)	I	32	16
2	a,b,c,d	Answer the following (Attempt any two out of four)	II	32	16
3	a,b,c,d	Answer the following (Attempt any two out of four)	III	32	16
4	a,b,c,d,e, f	Answer the following (2 on each Unit) (Attempt any three out of six)	I, II, III	24	12
		Total		120	60

Note: Out of 60 marks will be converted into **30** marks.

C) Semester End Practical Examination (50 marks):

Scheme of examination:

- There will be internal assessment for practical (20 marks).
- A candidate will be allowed to appear for the semester end practical examination only if the candidate submits a certified journal at the time of practical examination of the semester or a certificate from the Head of the Department/Institute to the effect that the candidate has completed the practical course of that semester of F.Y.B.Sc. Botany as per the minimum requirement.
- The practical examination will be conducted in **SINGLE SESSIONS** of two hours.
- The learners will be evaluated based on the experiments performed during the examination.
- The questions on slips for the same should be framed in such a way that candidate will be able to complete the task and should be evaluated for the skill and understanding of Botany.

Distribution of marks in practical examination

Sr. No.	Particulars	Marks (50marks)
1	Experiments external	30
2	Experiments internal	20
	Total Marks	50

Course Code and Title: S109BOT (MINOR): PLANT DIVERSITY II

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-II
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Learning Objectives:

- To know the basics of vascular cryptogams.
- To understand the plant diversity with special reference to phanerogams diversity.
- To give knowledge of identification of angiosperms and gymnosperms.
- To understand the scope of the cryptogams diversity with special reference Algae,
- Fungi, Bryophytes

Learning Outcomes:

After Completing the course, Student will be able to

- Explain occurrence, structure, reproduction of *Nephrolepis* and *Cycas*.
- Identify and classify angiospermic plants on basis of general characters and principles of taxonomy
- Understand basic terminology regarding plant body.
- Evaluate economic importance of gymnosperm & angiospermic plants.
- Justify different stages in the life cycle of *Nephrolepis* and *Cycas*.

Unit - I	PTERIDOPHYTES	10 Lectures
	1.1 General characters of pteridophytes.	
	1.2 Structure life cycle, systematic position and alternation of generations in <i>Nephrolepis</i> .	
	1.3 Stellar evolution.	
Unit – II	GYMNOSPERMS	10 Lectures
	2.1 General characters of Gymnosperm. Structure life cycle systematic position and alternation of generations in <i>Cycas</i> .	
	2.2 Economic importance of Gymnosperms.	
Unit – III	ANGIOSPERMS	10 Lectures
	3.1 LEAF MORPHOLOGY: typical leaf, simple leaf and types of compound leaves, venation, phyllotaxy, types of stipules,	
	3.2 Inflorescence: types of Racemose and Cymose	
	3.3 Special type of inflorescence: Cyathium, Verticillaster, Hypanthodium.	
	3.4 Study of following families: Malvaceae, Amaryllidaceae.	

References:

1	Kato, M. 1983. Classification of major groups of pteridophytes. J. Fac. Sci. Univ. Tokyo III, 13: 263–283.
2	Bentham, G., Hooker, J.D. 1862–1883. Genera Plantarum, 3 vols. London: various publishers.
3	Eames, A. J. 1936. Morphology of vascular plants. Lower groups. New York London: MacGraw-Hill.
4	Fitzpatrick, H. M. 1929. Coniferae: keys to the genera and species, with economic notes. Sci. Proc. R. Dublin Soc. II, 19: 189–260.
5	Bentham, G., Hooker, J. D. 1880. Genera Plantarum 3, 1. Gymnospermae. London: L. Reeve, pp. 417–447.
6	Corner, E.J.H. 1976. The seeds of dicotyledons, 2 vols. Cambridge: Cambridge University Press.

Course Code and Title: S110BOT (MINOR): FORM AND FUNCTION II

Level: 4.5	Credits: 02	Number of Lectures: 30	Semester-II
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Learning Objectives:

- To know the basics of plant physiology.
- To understand the medicinal importance of plants and traditional remedies of human related diseases.
- To give knowledge of plant tissue system.

Learning Outcomes:

On successful completion of this course students will be able to:

- Understand photosynthetic steps and why plants are important for mankind.
- Explain the type of tissues with their differentiation on basis of functions.
- Describe importance of primary and secondary metabolites for living things.
- Explore ethnomedicinal plants of their area.

Unit - I	ANATOMY	10 Lectures
	1.1 Simple tissues, complex tissues.	
	1.2 Primary structure of dicot and monocot root, stem and leaf.	
	1.3 Epidermal tissue system: types of hair, monocot and dicot stomata.	
Unit – II	PHYSIOLOGY	10 Lectures
	2.1 Photosynthesis: Light reactions, photolysis of water.	
	2.2 Photophosphorylation (cyclic and non cyclic).	
	2.3 Carbon fixation phase (C3, C4 and CAM pathways).	
Unit – III	MEDICINAL BOTANY	10 Lectures
	3.1 Concept of primary and secondary metabolites, difference between primary and secondary metabolites.	
	3.2 Grandma’s pouch: Following plants have to be studied with respect to botanical source, part of the plant used, active constituents present and medicinal uses: <i>Oscimum sanctum</i> , <i>Adathoda vasica</i> , <i>Zinziber officinale</i> , <i>Curcuma longa</i> , <i>Santalum album</i> , <i>Aloe vera</i> .	

References:

1	Glover, BJ (2000) Differentiation in plant epidermal cells. J. Exp. Bot. 51(344):497-505.
2	Plant Tissue Systems: Dermal, Ground, and Vascular (http://www.plantphys.net/article.php?ch=1&id=19)
3	Taiz, L, Zeiger, E (2002) Plant Physiology, 3rd edition, Chapter 24: The control and flowering, pp. 560-565.
4	Barbhuiya, A.R., Sahoo, U.K. and K. Upadhyaya (2016). Plant diversity in the indigenous home gardens in the Eastern Himalayan region of Mizoram, northeast India. Econ. Bot., 70 (2), pp. 115-131
5	Huai, H. and A. Hamilton (2009). Characteristics and functions of traditional homegardens: a review. Front. Biol. China, 4 (2) (2009), pp. 151-157

Course Code and Title: S111BOP (MINOR): PRACTICAL II BOTANY

Level: 4.5	Credits: 02	Number of Lectures: 60	Semester-II
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Learning Outcome: On successful completion of this course students will be able to:

- Identify and classify angiospermic plants on basis of general characters and principles of taxonomy.
- Understand basic terminology regarding plant body.
- Evaluate economic importance of gymnosperm & angiospermic plants.
- Understand photosynthetic steps and why plants are important for mankind.
- Explain the type of tissues with their differentiation on basis of functions.
- Explore ethnomedicinal plants of their area.

A. EXTERNAL experiments	
1	Study of stages in the life cycle of <i>Nephrolepis</i> : Mounting of ramentum, hydathode, T.S. of rachis, T.S. of pinna of <i>Nephrolepis</i> passing through sorus.
2	<i>Cycas</i> : T.S of leaflet (<i>Cycas</i> pinna), <i>Cycas</i> : Megasporophyll, microsporophyll, coralloid root, microspore, L.S. of ovule of <i>Cycas</i> – all specimens to be shown.
3	Malvaceae
4	Amaryllidaceae
5	Primary structure of dicot and monocot root.
6	Primary structure of dicot and monocot stem.
7	Separation of chlorophyll pigments by strip paper chromatography.
8	Separation of amino acids by paper chromatography.
9	Change in colour because of change in pH: Anthocyanin: black grapes/Purple cabbage
10	Test for tannins: tea powder, catechu.
B. INTERNAL experiments	
1	Stelar evolution with the help of permanent slides: Protosteles: haplostele, actinosteles, plectosteles, mixed protosteles, siphonosteles: ectophloic, amphiphloic, dictyosteles, eusteles and atactosteles.
2	Economic importance of Gymnosperms: <i>Pinus</i> (turpentine, wood, seeds)
3	Leaf morphology : as per theory
4	Types of inflorescence: as per theory
5	Study of dicot and monocot stomata.
6	Epidermal outgrowths: with the help of mountings Unicellular: <i>Gossypium</i> /Radish Multicellular: <i>Lantana</i> /Sunflower Glandular: <i>Drosera</i> and Stinging: <i>Urtica</i> – only identification with the help of permanent slides. Peltate: <i>Thespesia</i> Stellate: <i>Erythrina</i> / <i>Sida acuta</i> / <i>Solanum</i> / <i>Helecteris</i> T-shaped: <i>Avicennia</i>
7	Identification of plants or plant parts for grandma's pouch as per theory.
8.	Botanical excursion

BOTOE02(GE/OE): ECONOMIC BOTANY

Level: 4.5	Credits: 02	Lectures: 30 L
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Learning Outcomes

- To explain the taxonomic diversity of useful plants.
- To understand the plant as a food source.
- To have Knowledge of plants and plant products which are used as human diet.
- To understand the medicinal importance of plants and traditional remedies of human related diseases.
- To acquire an increased awareness and appreciation of legumes and millets.

Unit - I	CEREALS	06 Lectures
	Botanical Name, Morphology, economic importance and varieties of Ragi (Nachani), Rice, Maize	
Unit – II	PULSES	06 Lectures
	Botanical Name, Morphology, economic importance and varieties of Pigeon pea, Chick pea, Soybean	
Unit – III	SPICES AND CONDIMENTS	06 Lectures
	Botanical Name, Morphology, economic importance of Black pepper, Nutmeg, <i>Cinnamomum</i>	
Unit – IV	MEDICINAL PLANTS	12 Lectures
	Botanical Name, part used and Medicinal uses of Sarpagandha, Tulsi, Kalmegh, Ashvagandha, Narkya, Gulvel,	

References:

1	Saxena, Rupali, (2015). Economic Botany of Angiosperms, Biogreen Books, New Delhi..
2	Singh, Sadhana, Economic Botany of Angiosperms 2015, Biogreen Books, New Delhi.
3	Kochhar, S.L. (2011). Economic Botany in the Tropics, MacMillan Publishers India Ltd., New Delhi. 4th edition.
4	Ethnobotany by S.K. Jain
5	Medicinal plants by Kirtikar and Basu

BOTOE03(GE/OE): FLORICULTURE

Level: 4.5	Credits: 02	Lectures: 60 L
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Learning Objectives:

- To inculcate the importance of studying floriculture and usage of floricultural crops.
- To equip the students with practical knowledge of different horticultural practices of floricultural crops.
- To familiarize the students with the floriculture-based industries at national and International level.
- To familiarize the students with the flowers and foliage crop used in flower arrangement.
- To give knowledge of different types of flower arrangement.
- To give knowledge of care and precautions taken during flower arrangement.
- To impart the basic skills in the field of floriculture.

Learning Outcome:

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

- Understand plants used in floriculture.
- Knowledge of horticultural practices of floricultural crops.
- Knowledge of floriculture based industries.
- Knowledge flowers and foliage crop used in flower arrangement.
- Create different floral designs.
- Take care and precautions during flower arrangement.
- Develop entrepreneurship in floriculture.

PRACTICALS/ experiments	
1	Study of natural plant propagation methods (Seed, Rhizome, Bulb, Sucker, Runners). (01P)
2	Study of artificial plant propagation methods- Part I (Cutting and Grafting). (01P)
3	Study of artificial plant propagation methods- Part II (Air layering and Budding). (01P)
4	Study of flower and foliage plant used in flower arrangement (Cut flowers and loose flowers). (02P)
5	Study of different method of storage and packaging of flowering crop (02P)
6	Study of different materials used in flower arrangement (Floral foames, Vase, Floral pins). (01P)
7	Preparation of flower arrangement - Part I (Western type: Round, Symmetrical and Asymmetrical) (01P)
8	Preparation of flower arrangement - Part II (Western type: Hogarth, Cascade and Vertical). (01P)
9	Preparation of flower arrangement (Eastern type: Ikebana). (01P)
10	Preparation of garlands, bouquets and button holes. (01P)
11	Preparation of floral wheel and Rangoli. (01P)
12	Study of techniques of preparation of dry flower arrangement (02P)

References:

1	Armitage, Allan M (1993). Specialty cut flowers. The production of annuals, perennials, bulbs and woody plants for fresh and dried cut flowers. cabdirect.org.
2	Dole, John M; Wilkins, Harold F. (2004). Floriculture: Principles and Species (2nd ed.). Pearson.
3	Carpenter, W. J., & Rodriguez, R. C. (1971). Earlier Flowering of Geranium cv. Carefree Scarlet by High Intensity Supplemental Light Treatment1. HortScience, 6(3), 206-207
4	Griffith, L. P. (1998). Tropical Foliage Plants: A Grower's Guide. United States: Ball Pub.
5	Harisha, BN (Oct 2017). "An economic analysis of floriculture in India". <i>In Proceedings of the Sixth Middle East Conference on Global Business, Economics, Finance and Banking (ME17Dubai Conference)</i> : 6–8.

BOTSEC02(SEC): FRUIT PROCESSING

Level: 4.5	Credits: 02	Lectures: 60 L
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Learning Objectives:

- To learn the techniques of storage of Fruits.
- To understand importance of value addition Fruit products.
- To give knowledge of preparation of natural scented oils.
- To equip the students with practical knowledge Fruit processing.
- To give knowledge of Jam and Jelly preparation.
- To impart the basic skills in the field of Fruit processing.
- To give knowledge of care and precautions taken fruit processing.

Learning Outcome:

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

- Understand techniques of storage of Fruits.
- Get importance of value addition Fruit products.
- Get knowledge of preparation of natural scented oils.
- Get idea about the practical knowledge of Fruit processing.
- Get knowledge of preparation of Jam and Jelly.
- Develop entrepreneurship in Fruit processing
- Take care and precautions to setup Fruit processing industry.

PRACTICALS/ experiments	
1	Demonstration of fruit processing units. (01P)
2	Preparation of Jam. (01P)
3	Preparation of Tamarind syrup. (01P)
4	Preparation of Jelly. (01P)
5	Preparation of Aawla Supari , Sarbat (01P)
6	Preparation of Squash. (01P)
7	Preparation of Juice. (01P)
8	Preparation of Pickles. (01P)
9	Preparation of Muramba. (01P)
10	Preparation of Ketchup. (01P)
11	Preparation of Mango Papad and Jackfruit Papad. (01P)
12	Preparation of Potato Wafers and Banana Wafers. (01P)
13	Preparation of Gulkand. (01P)
14	Preparation of Kokam Aagal (01P)
15	Preparation of wine (Chiku / Jamun) (01P)

References:

1	Andress, E., and J. Harrison. So Easy to Preserve. 6th ed. Athens: University of Georgia Cooperative Extension Service, 2014.
2	https://nchfp.uga.edu/publications/publications_usda.html#gsc.tab=0 Agriculture Information Bulletin No. 539, 2015 revision, United States Department of Agriculture.
3	https://nchfp.uga.edu/how/can7_jam_jelly.html#gsc.tab=0 University of Minnesota Extension.
4	Patten, Marguerite (February 2001). Basic Basics: Jams, Preserves and Chutneys Handbook (2004 reprint ed.). Grub Street Books. ISBN 1-902304-72-1.
5	Isabel D. Wolf; William Schafer (1990). "Making Jams, Marmalades, Preserves, and Conserves". University of Minnesota extension school.

BOTIK01(IK): BOTANY IN AYURVEDA

Level: 4.5	Credits: 02	Lectures: 30 L
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Learning Objectives:

- To understand importance of Ayurveda and its principles.
- To know Ayurveda methods for collection and storage of crude drugs.
- To train students for identification of medicinal plant parts and their description.
- To make conscious and aware of natural resources and environment.
- To create awareness in students about healthy environment for the human beings.
- To give knowledge of biodiversity; ethics, human health and diseases.
- To train students for use of raw materials in Ayurveda formulations and drugs.

Learning Outcome:

- By the end of the course, students will be able to:
- Aware the importance of Ayurveda and its principles.
- Understand the Ayurveda methods for collection and storage of crude drugs.
- Understand the medicinal plant parts and their description.
- Conscious and aware of natural resources and environment.
- Identify plants and environment for the benefit of human beings,
- Conscious about biodiversity; ethics, human health and diseases.
- Use raw materials in Ayurveda formulations and drugs.

Course Content:

Unit - I	INTRODUCTION TO AYURVEDA	10 Lectures
	1.1 Definition, aim of Ayurveda, Brief description of Samhita and Ashtang.	
	1.2 Introduction to department of AYUSH, CCIM, CCRAS, RAV	
Unit – II	AYURVEDA AND INTEGRATED DISCIPLINE	10 Lectures
	2.1 Ancient Bhartiya Contribution in Environment & Health Ethnic Studies, Life Science in Plants, Anatomy, Physiology, Agriculture, Ecology and Environment.	
	2.2 Integrated Approach to Healthcare, Medicine, Microbiology, Surgery and Yoga.	
Unit – III	PLANTS IN AYURVEDA	10 Lectures
	3.1 Study on following dravyas with respect to Sanskrit name, Common name, Botanical name, Family, habit and parts used : Amalaki, Arjuna, Ashoka, Bhallataka, Bilva, Brahmi, Chandandravya, Chitraka, Daruharidra, Durva, Eranda, Gokshura, Guduchi, Nimba, Nirgudi, Punarnava, Shatavari, Tulsi, Lavangakeshara	

References:

1	S.K. Jain (Ed.) (1989): Methods and approaches in Ethno-botany. Society of ethnobotanists, Lucknow, India.
2	S.K. Jain, (1990): Contributions of Indian Ethno-botany. Scientific publishers, Jodhpur.
3	S. K. Jain (1995): Manual of Ethno botany, Scientific Publishers, Jodhpur.
4	Colton C.M. (1997): Ethno botany. Principles and applications. John Wiley and Sons, Chichester.
5	Rama Ro, N. and A. N. Henry (1996): The Ethno-botany of Eastern Ghats in Andhra Pradesh, India. Botanical Survey of India. Howrah.
6	Trivedi P. C., (2006): Medicinal Plants: Ethno-botanical Approach, Agrobios, India.
7	Purohit and V., (2008): Medicinal Plant Cultivation: A Scientific Approach, 2nd edn. Agrobios, India.
8	D. C. Pal. & Jain, S.K., (1998): Tribal Medicine. Naya Prakash Publishers, Calcutta.
9	Raychudhuri, S.P., (1991): (Ed.) Recent advances in Medicinal aromatic and spice crops.Vol.1, Today & Tomorrow's printers and publishers, New Delhi.

EXAMINATION PATTERN FOR OPEN ELECTIVE SUBJECTS

Scheme of examination:

- There will be internal assessment for OPEN ELECTIVE.
- A candidate will submit one assignments and one unit test carrying 10 Marks each.
- The learners will be evaluated based on the semester end theory examination.

Distribution of marks (50 marks)

A) Continuous Internal Assessment (20 Marks):

Sr. No.	Particulars	Marks
1	One assignment	10
2	One test	10

B) Semester End Examination (30 Marks):

Question Paper Pattern

1. These examinations shall be of **One Hours** duration. Maximum marks **30**.
2. There shall be two questions of which first question is of **20 marks**. Question 2 will be of 10 marks. Question **2** will be based on entire syllabus with **four short notes**.
3. All questions shall be compulsory with internal choice within the questions. But question **2** has internal choice of any **two out of four**.