Appendix- B

AC –

Item No. –

As per NEP 2020

**S. R. D. S. P. Mandal’s**

**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-III and Sem-IV

Reference GR dated 16th May 2023 for Credit structure

**S. R. D. S. P. Mandal’s**

**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 | * 1. Certificate  1. Diploma   5.5 Advance Diploma  6.0 Research Degree |
|  | Pattern | Semester Pattern |
|  | Status | New |
|  | To Be Implemented from the academic year | * 1. Certificate 2023-2024  1. Diploma 2024-2025   5.5 Advance Diploma 2025-2026  6.0 Research Degree 2026-2027 |

**Preamble**

Shri Pancham Khemaraj Mahavidyalaya, Sawantwadi (Autonomous) is committed to the implementation of various measures that align with the guidelines established by the University Grants Commission (UGC) in order to promote excellence, efficacy, and equity in the higher education system. To attain these objectives, diligent attempts are undertaken to guarantee superior educational standards through the implementation of various measures aimed at improving the teaching-learning process, assessment and evaluation methodologies, and the comprehensive development of students.

The B.Sc. Botany program is a four-year program with a progressive and innovative curriculum that prepares students for the challenges that higher education will provide in the future. The first semester of F.Y. B.Sc. Botany at S. P. K. Mahavidyalaya, Sawantwadi (Autonomous) has a curriculum that transcends traditional academic boundaries, developed by the Board of Studies in Botany at S. P. K. Mahavidyalaya, Sawantwadi (Autonomous) in response to the rapid advancements in science and technology and the evolving approaches in various domains of Botany and related subjects. In order to guarantee that students receive an education that equips them for the opportunities and challenges of the twenty-first century, the syllabus has been linked with the NEP 2020 principles. 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 postgraduate degree in Botany provides students with the requisite knowledge and abilities need for a wide array of rewarding professional trajectories. Postgraduates in the discipline of Botany are presented with a wide range of prospects across several domains, encompassing urban planning, pedagogy, environmental science, plant sciences, organic agriculture, nursery management, and entrepreneurship. The disciplines encompassed include mushroom cultivation, medicinal plant cultivation, floriculture, horticulture, propagation methods, and plant tissue culture method, among others. During the course of their three-year academic program, students delve into the profound importance of plants in the existence of all living organisms on our planet. Students acquire the necessary knowledge and skills to establish various agencies involved in the production of pickles, jam, jelly, medicinal plants, fruit processing, vegetable processing, organic products, organic fertilizers, and pesticides. Additionally, they gain the ability to develop knowledge in the production of natural remedies for a wide range of diseases. They acquired expertise in the identification and advancement of numerous novel medicinal compounds that are currently employed in the pharmaceutical, herbal cosmetics, and other ingredient-based sectors.

A comprehensive, up-to-date education that prepares pupils to thrive in today's fast-paced, globally interconnected world is assured by revising Botany curricula to meet the requirements of NEP 2020. As a result, students are better prepared to succeed academically and professionally in today's dynamic world and to make meaningful contributions to society as a whole.

**Aims and Objective**

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

**Program Outcomes**

After Completing the Programme, Students will be able to,

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| --- | --- | --- |
| PO1 | Demonstrate comprehensive knowledge and grasp of science that form a component of an undergraduate plan of study. | Disciplinary knowledge |
| PO2 | Exhibit the ability to read and write critically, listen intently, use appropriate media, confidently express oneself, communicate scientific knowledge, concepts, and ideas both orally and in writing, and explain difficult material to a variety of audiences. | Communication Skills |
| PO3 | Apply analytical thinking to a corpus of information; identify relevant presumptions or implications; study and evaluate arguments, evidence, claims, and opinions in light of empirical evidence. Develop logical arguments. Analyze theories, policies, and practices critically while using a scientific approach to information collection. | Critical thinking |
| PO4 | Extrapolate from what one has learned and apply their competencies to solve other types of non-familiar challenges, rather than duplicating curricular core knowledge; and apply one’s learning to real world scenarios. | Problem solving |
| PO5 | Evaluate the dependability and relevance of evidence; uncover logical errors and holes in the arguments of others; evaluate and synthesise data from a range of sources; draw valid results and back them with facts and examples, and addressing opposing perspectives. | 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 successfully and respectfully with multiple teams; create cooperative or coordinated group effort; operate as a group or team in the interests of a common cause; and work efficiently as a team member. | Cooperation/Team work |
| PO8 | Analyse, interpret and derive conclusions from Quantitative/Qualitative data; and critically assess ideas, evidence and experiences from a open-minded and reasoned perspective. | Scientific reasoning |
| PO9 | Examine and evaluate one's own sensitivity to life experiences, as well as one's own and society's reflexivity. | Reflective thinking |
| PO10 | Use ICT in a variety of learning scenarios; exhibit, access, evaluate, and apply a variety of relevant information sources; and analyze data using appropriate tools. | Information/digital  literacy |
| PO11 | Work autonomously, identify the resources needed for a project, and see it through to completion. | Self-directed learning |
| PO12 | Maintain comprehension of other cultures' values and beliefs, as well as a global worldview. Participate in a multicultural culture and engage politely with different groups. | Multicultural competence |
| PO13 | Adopt moral and ethical values in your life, take a position on moral matters and give reasons from multiple angles, and incorporate morality into all you do.Recognize moral issues, refrain from unethical behavior such as fabricating, falsifying, or misrepresenting that plagiarism has occurred, respect intellectual property rights, and recognize environmental and sustainability issues; and act impartially, objectively, and truthfully in all aspects of work. | Moral and ethical awareness/reasoning |
| PO14 | Map out the tasks that a team or organization must complete, establish direction, develop an inspiring vision, assemble a team to help achieve the vision, encourage and inspire team members to participate in that vision, and use management techniques to lead people effectively and efficiently. | Leadership readiness/qualities |
| PO15 | Acquire knowledge and skills, including 'learning how to learn', that are required for participating in learning activities throughout life through self-paced and self-directed learning aimed at personal development, meeting economic, social, and cultural objectives, and adapting to changing trades and workplace demands through knowledge/skill development/reskilling. | Lifelong learning |

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

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| --- | --- |
| PSO1 | Describe the various tasks that plants do at the gene, cell, tissue, organ, and organism levels. |
| PSO2 | Sort and contrast the characteristics of different plant groups. Identify and categorize plants up to the class level using your understanding of plant morphology, anatomy, and other fundamental concepts from observation in the wild. |
| PSO3 | When addressing botany-related problems, apply scientific procedures by formulating testable hypotheses, gathering information to support these assumptions, and assessing the information to determine the extent to which the research supports the hypotheses. |
| PSO4 | Show mastery of the analytical and experimental techniques used in a variety of domains, as well as the most recent advancements 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** |
| **III**  **(Level 5.0)** | S201BOT (Major) | Plant diversity I | **Theory** | **2** |
| S202BOT (Major) | Form and Function I | **Theory** | **2** |
| S203BOT (Major) | Current Trends in Botany I | **Theory** |  |
| S204BOP (Major) | Practical I | **Practical** | **2** |
| S205BOT (Minor) | Plant diversity I | **Theory** | **2** |
| S206BOT (Minor) | Form and Function I | **Theory** | **2** |
| BOTVSC02 (VSC) | Experimental Botany-I | **Skill** | **2** |
| BOTVEC01(VEC) | Environmental Botany-I | **Voc. Skill** | **2** |
| BOTOE04(OE) | Mushroom cultivation | **Generic Elective** | **2** |
| **IV**  **(Level 5.0)** | S207BOT (Major) | Plant diversity II | **Theory** | **2** |
| S208BOT (Major) | Form and Function II | **Theory** | **2** |
| S209BOT (Major) | Current Trends in Botany II | **Theory** | **2** |
| S210BOP (Major) | Practical II | **Practical** | **2** |
| S211BOT (Minor) | Plant diversity II | **Theory** | **2** |
| S212BOT (Minor) | Form and Function II | **Theory** | **2** |
| BOTVSC03 (VSC) | Experimental Botany-II | **Practical** | **2** |
| BOTVEC02(VEC) | Environmental Botany II | **Skill Enh.** | **2** |
| BOTSEC04(SEC) | Botanical Decoration & Herbal Products | **Voc. Skill** | **2** |
| BOTOE05(OE) | Gardening | **Generic Ele.** | **2** |

## **MAJOR SUBJECTS**

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| --- | --- | --- | --- | --- | --- |
| Paper No. | Semester | Paper Code | Title of Paper | No of Credits | No of Lectures  In Hours |
| I | II | S201BOT (Major) | Plant diversity I | **2** | 30 |
| II | S202BOT (Major) | Form and Function I | **2** | 30 |
| III | S203BOT (Major) | Current Trends in Botany I | **2** | 30 |
| IV | S204BOP (Major) | Practical II | **2** | 60 |

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| **SEM -III** | | | |
| **Paper Code** | **Paper Title** | **Type** | **Credits** |
| S201BOT (Major) | Plant diversity I | **Theory** | **2** |
| S202BOT (Major) | Form and Function I | **Theory** | **2** |
| S203BOT (Major) | Current Trends in Botany I | **Theory** |  |
| S204BOP (Major) | Practical I | **Practical** | **2** |
| S205BOT (Minor) | Plant diversity I | **Theory** | **2** |
| S206BOT (Minor) | Form and Function I | **Theory** | **2** |
| BOTVSC02 (VSC) | Practical related to Minor | **Skill** | **2** |
| BOTVEC01(VEC) | Environmental Botany-I | **Voc. Skill** | **2** |
| BOTOE04(OE) | Mushroom cultivation | **Generic Elective** | **2** |

Committee for creation of Syllabus

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Sr. No.** | **Name** | **College Name** | **Designation** | **Signature** |
| 1. | Prof. (Dr.) Dethe 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](mailto: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](mailto: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](mailto:kashettiramesh@gmail.com) | Expert nominated by the VC |  |
| 8 | Dr. Naik Vinayak R. | Vardanjali Herbals, Goregaon (E), Mumbai  Mobile: 8928207443  Email: [drvinayaknaik01@gmail.com](mailto: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](mailto: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](mailto:pandurangghaware75@gmail.com) | Post Graduate Meritorius Alumni |  |

Letter Grades and Grade points

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| --- | --- | --- |
| **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≥ | 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: S201BOT (MAJOR): PLANT DIVERSITY I**

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| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-III** |

**Learning Objectives:**

* Students will learn that algae are classified into three categories: Red, Green, and Brown algae.
* Students will be able to differentiate between the different types of algae.
* Students will be able to understand the role algae plays in marine eco‐systems.
* 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 Phanerogams diversity with special reference .

**Learning Outcomes:**

After Completing the course, Student will be able to

* Explain occurrence, structure, reproduction of pheophyta members.
* Identify and classify Algae on basis of general characters and principles of taxonomy.
* Differentiate modes of nutrition in fungi
* Evaluate economic importance of brown algae.
* Justify the Phanerogams diversity.

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| **Unit - I Thallophyta (Algae) & Bryophyta 10 Lectures** | | |
|  | 1.1 General Characters of Division Phaeophyta: Distribution, Cell structure, range of thallus, Economic Importance.  Structure, life cycle and systematic position of *Sargassum.* |  |
| 1.2 General Account of Class Anthocerotae and Musci  Structure, life cycle and systematic position of   * *Anthoceros* * *Funaria* |
| **Unit – II Angiosperms 10 Lectures** | | |
|  | 2.1 Flower Morphology   * Parts of a flower, flower symmetry; * The accessory whorls : * Calyx types and modifications, * Corolla forms; * Aestivation |  |
| 2.2 With the help of Bentham and Hooker’s system of Classification for flowering plants study the vegetative, floral characters and economic importance of the following families:   * Leguminosae * Asterace * Amaranthaceae * Palmae |

**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 | Introductory Phycology by Kumar, H. D. 1988, Affiliated East-West Press Ltd., New York. |
| 4 | Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi. |

**Course Code and Title: S202BOT (MAJOR): FORM AND FUNCTION I**

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| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-III** |

**Learning Objectives:**

* To know the basics of genetics and cell biology.
* Knowledge of basic cytogenetic laboratory techniques necessary to prepare tissue samples or cytogenetic diagnosis.
* To understand the cell biology with special reference to ultrastructure and function of cell organelles.

**Learning Outcomes:**

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

* Explain the nature of chromosomal abnormalities in clinical syndromes associated with cytogenetic disorders.
* Explain the ultrastructure and function of Mitochondrion, Peroxisomes, Glyoxysomes and Ribosomes.
* Describe the basic principles of Cytogenetics.

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| **Unit - I CELL BIOLOGY 10 Lectures** | | |
|  | Ultra Structure and functions of the following cell organelles:   * Mitochondrion(membranes, cristae, F1 particles and matrix) * Peroxisomes and Glyoxysomes * Ribosomes (prokaryotic, eukaryotic and subunits)   Cell Division and its significance   * Cell Cycle, structure of Interphase Nucleus (nuclear envelop, chromatin network, nucleolus and nucleoplasm) * Mitosis & Meiosis * Nucleic Acids: Types, structure and functions of DNA and RNA |  |
| **Unit – II Cytogenetics 10 Lectures** | | |
|  | 2.1 **Variation in Chromosome Number** Origin and production, morphological and cytological features, applications in crop improvement and evolution of Aneuploids and Euploids (Monoploids, Autopolyploids and allopolyploids) |  |
| 2.2 **Extranuclear Genetics**  Organelle heredity-   * Chloroplast determines heredity -Plastid transmission in *Mirabilis jalapa*, * Streptomycin resistance in Chlamydomonas. * Mitochondrion determined heredity- petite colonies in yeast |

**References:**

|  |  |
| --- | --- |
| 1 | Cell Biology by C.B. Powar. |
| 2 | Cell Biology by De Robertis. |
| 3 | Genetics by Russel. Wesley Longman inc publishers. ( 5th edition). |

**Course Code and Title: S203BOT (MAJOR): CURRENT TRENDS IN PLANT SCIENCES I**

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| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-III** |

**Learning Objectives:**

* Know Phytochemistry of these drugs.
* Discuss phytopharmacology of these drugs.
* Have knowledge about pharmaceutical adjuvants of plant origin.
* Understand concept of Ethanopharmacognosy, Ethanomedicine.
* To know the basics of genetics and cell biology.
* To understand the cell biology with special reference to ultrastructure and function of cell organelles.

**Learning Outcomes:**

* Identify and isolate and characterize the active constituents against advanced diseases from
* plants.
* Practice principles of Ayurveda and utilize in herbal medicine.
* Apply pharmacovigilance in herbal therapy and establish authentic standards.
* Students will demonstrate their ability to model and predict population stability or change using equations associated with evolutionary theory.
* Students will exhibit proficiency in assessing the influence of structural or component alterations on a biological system and/or the interconnections among systems.

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| **Unit - I Pharmacognosy and Phytochemistry 10 Lectures** | | |
|  | 1.1 Introduction to pharmacopoeia  1.2 Study of secondary metabolites (sources, properties and uses, with suitable example of plant for each category) with reference to   * Alkaloids, * Glycosides, * Tannins, * Volatile oils * Gums and resins |  |
| **Unit II Forestry and Economic Botany 10 Lectures** | | |
|  | 2.1 Forestry: Outline of types of forest in India   * Forestry: Agro-forestry, Urban forestry, organic farming, Sacred Groves   2.2 Economic Botany:   * Types of fibers: Jute and cotton, * Current trends in Fiber industries * Spices and condiments: Saffron, black pepper and cardamom |  |

**References:**

|  |
| --- |
| 1. Bruneton Jean, Pharmacognosy : Phytochemistry Medicinal Plants, Lavoisier Publishing 2. Ayurvedic Pharmacopoeia Of India 3. Herbal Pharmacopeia 1-2 (IDMA) 4. The Wealth Of India, Raw Materials (All Volumes) Council Of Scientific And Industrial Research (CSIR), New Delhi. 5. Who Monographs On Selected Medicinal Plants Vol-1-2 6. Ayurvedic Formulary of India, By Govt of India. 7. Molecular Biology: Robert Weaver 8. Molecular Cell Biology – Lodish 9. Molecular Biology - David Clark 10. The Encyclopedia Of Molecular Biology - By Creighton 11. Cell and Molecular Biology - Gerald Karp 12. Lewin's GENES XI 13. Essential Genes - Benjamin Lewin |

**Course Code and Title: S204BOP (MAJOR): PRACTICAL I BOTANY**

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| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 60** | **Semester-III** |

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

* Explain Occurrence, structure, reproduction of *Sargassum*
* Identify and classify algae and angiosperms on basis of general characters and principles of taxonomy.
* Evaluate economic importance of algae and angiospermic plants.
* Understand the differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast, Mendelian Genetics.

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| **A. EXTERNAL experiments** | |
| 1 | Study of stages in the life cycle of *Sargassum* from fresh/ preserved material and permanent slides. |
| 2 | Study of stages in the life cycle of *Anthoceros* and *Funaria* from fresh/ preserved material and permanent slides. |
| 3 | Study of one plant from each family prescribed for theory: morphological peculiarities and economic importance of the members of these families. |
| 4 | Chromatography: Separation of amino by circular paper chromatography. |
| 5 | Separation of Carotenoids by thin layer chromatography. |
| 6 | Estimation of DNA from plant material. |
| 7 | Estimation of RNA from plant material. |
| 8 | Study of *Phyllanthus amarus, Saraca asoka* and *Bacopa monieri* |
| **B. INTERNAL experiments** | |
| 1 | Economic importance in Phaeophyta |
| 2 | Study of plants for Phenols and Flavanoids. |
| 3 | Preparation of herbarium and wet preservation technique. |
| 4 | Study of inheritance pattern with reference to Plastid Inheritance. |
| 5 | Study of cytological consequences of chromosomal aberrations (Laggards, Chromosomal Bridge, Ring chromosome, Chromosomal ring) from permanent slides or photomicrographs |
| 6 | DNA sequencing- Sanger’s method |
| 7 | Determining the sequence of amino acids in the protein molecule synthesised from the given m-RNA strand (prokaryotic and eukaryotic) |
| 8 | Study of biodiversity (Visit to National Park/ Botanical Garden) |
| 9 | Sources of : Fibres & Paper  Spices & condiments |
| 10 | Preparation of herbal cosmetics (Face pack/ De-tanning cream) |

**Course Code and Title: S205BOT (MINOR): PLANT DIVERSITY I**

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| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-III** |

**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 Phanerogams diversity with special reference
* Know Phytochemistry of these drugs.
* Discuss phytopharmacology of these drugs.
* Have knowledge about pharmaceutical adjuvants of plant origin.

**Learning Outcomes:**

After Completing the course, Student will be able to

* Explain occurrence, structure, reproduction of pheophyta members.
* Identify and classify Algae on basis of general characters and principles of taxonomy.
* Differentiate modes of nutrition in fungi
* Evaluate economic importance of brown algae.
* Justify different stages in the life cycle of *Sargassum*.
* Understand concept of Ethanopharmacognosy, Ethanomedicine.

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| **Unit - I Thallophyta (Algae) & Bryophyta 10 Lectures** | | |
|  | 1.1 General Characters of Division Phaeophyta: Distribution, Cell structure, range of thallus, Economic Importance.  Structure, life cycle and systematic position of *Sargassum.* |  |
| 1.2 General Account of Class Anthocerotae and Musci  Structure, life cycle and systematic position of   * *Anthoceros* * *Funaria* |
|  | | |
| **Unit – II Angiosperms 10 Lectures** | | |
|  | 2.1 Flower Morphology   * Parts of a flower, flower symmetry; * The accessory whorls : * Calyx types and modifications, * Corolla forms; * Aestivation |  |
| 2.2 With the help of Bentham and Hooker’s system of Classification for flowering plants study the vegetative, floral characters and economic importance of the following families:   * Leguminosae * Asterace * Amaranthaceae * Palmae |
|  |

**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 | Introductory Phycology by Kumar, H. D. 1988, Affiliated East-West Press Ltd., New York. |
| 4 | Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi. |
| 5 | Bruneton Jean, Pharmacognosy : Phytochemistry Medicinal Plants, Lavoisier Publishing |
| 6 | Ayurvedic Pharmacopoeia Of India |
| 7 | Herbal Pharmacopeia 1-2 (IDMA) |

**Course Code and Title: S206BOT (MINOR): FORMS AND FUNCTION I**

|  |  |  |  |
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| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-III** |

**Learning Objectives:**

* To know the basics of genetics and cell biology.
* To understand the cell biology with special reference to ultrastructure and function of cell organelles.

**Learning Outcomes:**

* On successful completion of this course students will be able to:
* Define the Ecology, Ecosystem, multiple alleles
* Explain the ultrastructure and function of Mitochondrion, Peroxisomes, Glyoxysomes and Ribosomes.
* Describe the basic principles of Cytogenetics, .

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| **Unit - I CELL BIOLOGY 10 Lectures** | | |
|  | Ultra Structure and functions of the following cell organelles:   * Mitochondrion(membranes, cristae, F1 particles and matrix) * Peroxisomes and Glyoxysomes * Ribosomes (prokaryotic, eukaryotic and subunits)   Cell Division and its significance   * Cell Cycle, structure of Interphase Nucleus (nuclear envelop, chromatin network, nucleolus and nucleoplasm) * Mitosis & Meiosis * Differences between Mitosis and Meiosis   Nucleic Acids: Types, structure and functions of DNA and RNA |  |
| **Unit – II Cytogenetics 10 Lectures** | | |
|  | 2.1 **Variation in Chromosome Number** Origin and production, morphological and cytological features, applications in crop improvement and evolution of Aneuploids and Euploids (Monoploids, Autopolyploids and allopolyploids) |  |
| 2.2 **Extranuclear Genetics**  Organelle heredity-   * Chloroplast determines heredity -Plastid transmission in plants, Streptomycin resistance in Chlamydomonas. * Mitochondrion determined heredity- petite colonies in yeast |

**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 | Molecular Cell Biology – Lodish |
| 5 | Molecular Biology - David Clark |
| 6 | Cell and Molecular Biology - Gerald Karp |
| 7 | Lewin's GENES XI |
| 8 | Molecular Cell Biology – Lodish |

**Course Code and Title: BOTVSC02: EXPERIMENTAL I BOTANY**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 60** | **Semester-III** |

**Learning Outcomes:**

* Identify and isolate and characterize the active constituents against advanced diseases from

plants.

* Practice principles of Ayurveda and utilize in herbal medicine.
* Apply pharmacovigilance in herbal therapy and establish authentic standards.
* Students will demonstrate their ability to model and predict population stability or change using equations associated with evolutionary theory.
* Students will exhibit proficiency in assessing the influence of structural or component alterations on a biological system and/or the interconnections among systems.

|  |  |
| --- | --- |
| A. EXTERNAL experiments | |
| 1 | Study of *Phyllanthus amarus*. |
| 2 | Study of *Saraca asoka.* |
| 3 | Study of *Bacopa monieri.* |
| 4 | Preparation of herbal cosmetics (Face pack) |
| 5 | Estimation of crude fibre in cereals & their products |
| 6 | Visit to National Park/ Botanical Garden |
|  |  |
| B. INTERNAL experiments | |
| 1 | Sources of Fibers. |
| 2 | Sources of Paper |
| 3 | Sources of Spices & condiments |
| 4 | Nutraceutical value of mushroom/ wheat germ |
| 5 | Preparation of herbal cosmetics :De-tanning cream |

**BOTVEC01(VEC): ENVIRONMENTAL BOTANY I**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-III** |

**Learning Outcome:**

After completion of the program the students will be able to:

1. The students will acquire knowledge about the hazardous effects of different Environmental Pollutants and Relative Measures for their Control/Prevention.

2. Conservation and exploitation of biological diversity through crop management.

|  |  |  |
| --- | --- | --- |
| **Unit - I Environmental Factors and Pollutants 10 Lectures** | | |
|  | * Natural Resources: Nature and Conservation of the following: Energy, Water, -Mineral and Land Resources. Agriculture, Forestry, Range Land, Wild Life and Aquaculture. |  |
| **Unit III Biodiversity Conservation 10 Lectures** | | |
|  | * Biodiversity and Conservation: importance, reason of loss; In-situ and Ex-situ Conservation of Plants. |  |

**Books Recommended:**

1. Koziol, M.J. and Whatley, F.R. (2009). Gaseous Air Pollution and Plant Metabolism. Butterworths. U.K.

2. Goodstein, E.S. (2008). Economics and the Environment. Prentice Hall Publishers. New Jersey.

3. Agrawal, K.C. (2001). Environmental Biology, Agro Botanical Publishers, India.

4. Chhatwal, D.R., Mehra, M.C., Satake, M., Katyal, T., Katyal, M. and Nagahiro. T. (2001). Encyclopedia of Environmental Pollution and its Control. (6 Vols.), Anmol Publication, New Delhi, India.

5. Usher, M. (2001). Widllife Conservation Evaluation. Chapman and Hall.

6. Rao, D.N., Ahmad, K.J., Younas, and Singh, S.N. (2000). Perspectives in Environmental Botany (Vol. I,) Print House, Lucknow, India.

**BOTOE04(OE): MUSHROOM CULTIVATION**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-III** |

**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.
* Markets available for commercial production

|  |  |  |
| --- | --- | --- |
| **Unit - I Biology of Mushrooms 10 Lectures** | | |
|  | * Button, Straw& Oyster- General morphology, distinguishing characteristics, spore germination and life cycle. * Nutrient Profile of Mushroom: Pprotein, aminoacids, calorific values, carbohydrates , fats, vitamins & minerals. * Antiviral value, antibacterial effect, antifungal effect, anti-tumour effect, haematological value cardiovascular & renal effect, in therapeutic diets, adolescence, for aged persons & diabetes mellitus. |  |
| **Unit – II Compost & Composting 10 Lectures** | | |
|  | * Principles of composting, machinery required for compost making, materials for compost preparation. * Methods of Composting- Long method of composting (LMC) & Short method of composting (SMC). * Facilities required for spawn preparation, Preparation of spawn substrate, preparation of pure culture, media used in raising pure culture, culture maintenance, storage of spawn. |  |
| **Unit III Cultivation of Oyster Mushrooms 10 Lectures** | | |
|  | * Collection of raw materials, compost & composting, spawn & spawning, casing & case run, croping & crop management, picking & packing. * Visit to relevant Labs/Field Visits |  |

**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. |

## **EXAMINATION PATTERN FOR MAJOR SUBJECTS**

1. **Continuous Internal Assessment (20 Marks):**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks** |
| 1 | Class test / assignment / Seminar / Quiz | 20 |

## Semester End Examination (30 Marks):

Question Paper Pattern

* 1. These examinations shall be of **One Hours** duration. Maximum marks **30**.
  2. There shall be three questions of which first questions are of **10 marks MCQ**. Question 2 & 3 will be of 10 marks each. Questions 1 will be based on **Unit- I&II,** Questions 2 will be based on **Unit-I** and **Questions 3** will be based on **Unit-II**.
  3. All questions shall be compulsory with internal choice within the questions.

## **Distribution of external 30 marls**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Qn.** | **Sub-Qn** | **Particulars** | **Unit** | **Marks with options** | **Total Marks for qn** |
| **1** | **MCQ** | Answer the following  (Attempt **all**) | **I, II** | **10** | **10** |
| **2** | **a, b** | Answer the following  (Attempt **any one out of two**) | **I** | **20** | **10** |
| **4** | **a, b** | Answer the following (Attempt **any one out of two**) | **II** | **20** | **10** |
|  |  | **Total** |  | **50** | **30** |

1. **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 S.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** |

## **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)

1. **Continuous Internal Assessment (20 Marks):**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks** |
| 1 | Class test / assignment / Seminar / Quiz | 20 |

## 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**.

==========================SEM-III END=================================

**MAJOR SUBJECTS**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Paper No. | Semester | Paper Code | Title of Paper | No of Credits | No of Lectures  In Hours |
| I | II | S207BOT (Major) | Plant diversity II | **2** | 30 |
| II | S208BOT (Major) | Form and Function II | **2** | 30 |
| III | S209BOT (Major) | Current Trends in Botany II | **2** | 30 |
| IV | S210BOP (Major) | Practical II | **2** | 60 |

|  |  |  |  |
| --- | --- | --- | --- |
| **SEM -IV** | | | |
| S207BOT (Major) | Plant diversity II | **Theory** | **2** |
| S208BOT (Major) | Form and Function II | **Theory** | **2** |
| S209BOT (Major) | Current Trends in Botany II | **Theory** | **2** |
| S210BOP (Major) | Practical II | **Practical** | **2** |
| S211BOT (Minor) | Plant diversity II | **Theory** | **2** |
| S212BOT (Minor) | Form and Function II | **Theory** | **2** |
| BOTVSC03(VSC) | Practical related to Minor | **Practical** | **2** |
| BOTSEC04(SEC) | Botanical Decoration & Herbal Products | **Skill Enh.** | **2** |
| BOTVEC02(VEC) | Environmental Botany II | **VEC** | **2** |
| BOTOE05(GE/OE) | Gardening | **Generic Ele.** | **2** |

**Course Code and Title: S207BOT (MAJOR): PLANT DIVERSITY II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-IV** |

**Learning Objectives:**

* To know the basics of fungi and vascular plants.
* To understand the plant diversity with special reference to phanerogams diversity.
* To give knowledge of identification of gymnosperms.

**Learning Outcomes:**

After Completing the course, Student will be able to

* Explain occurrence, structure, reproduction of *Erysiphe* and *Xylaria*
* Identify and classify gymnosperms on basis of general characters and principles of taxonomy
* Understand basic terminology regarding plant diseases and their control measures.
* Understand basic importance of gymnosperms.

|  |  |  |
| --- | --- | --- |
| **Unit - I Thallophyta: Fungi, Plant Pathology and Lichens. 10 Lectures** | | |
|  | 1.1 General characters of Ascomycetae   * Structure, life cycle and systematic position of *Erysiphe* and *Xylaria*   1.2 Plant Pathology-   * Symptoms, causative organism, disease cycle and control measures of   Powdery mildew and Late blight of potato  1.3 Lichens-   * Classification, Structure and Economic Importance and Ecological Significance of Lichens. |  |
| **Unit II Gymnosperms**. **10 Lectures** | | |
|  | Salient features, classification up to orders (with examples of each) and  economic importance of Coniferophyta (Chamberlain’s system of  classification to be followed)   * Structure life cycle and systematic position of Pinus * Structure and systematic position of the form genus Cordaites |  |
|  | | |

**References:**

|  |  |
| --- | --- |
| 1 | College Botany Volume I and II by Gangulee, Das and Dutta. Central Education Enterprises. |
| 2 | Eames, A. J. 1936. Morphology of vascular plants. Lower groups. New York London: MacGraw-Hill. |
| 3 | Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill. |
| 4 | Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi. |
| 5 | "Pteridophytes, Gymnosperms and Palaeobotany" by V Kumaresan and Annie Ragland |
| 6 | "Diversity of Pteridophytes,Gymnosperms and Elementary Palaeobotany" by SATISH KUMAR |

**Course Code and Title: S208 BOT (MAJOR): FORM AND FUNCTION II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-IV** |

**Learning Objectives:**

* To know the basics of plant physiology and anatomy.
* To understand the important of plant tissue system.
* To give knowledge of plant metabolism.

**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.

|  |  |  |
| --- | --- | --- |
| **Unit - I ANATOMY 10 Lectures** | | |
|  | 1.1 Normal Secondary Growth in Dicotyledonous stem and root.  1.2 Secondary growth in Monocot stem – Dracaena.  1.3 Mechanical Tissue system   * Tissues providing mechanical strength and support and their disposition * I-girders in aerial and underground organs   1.4 Conducting tissue system :   * Xylem and its elements, * Phloem and its elements   1.5 Types of Vascular Bundles. |  |
| **Unit II : Plant Physiology and Plant Biochemistry** | | **10 Lectures** |
|  | **2.1 Respiration: Aerobic:** Glycolysis, TCA Cycle, ETS & Energetic of respiration; Anaerobic respiration.  **2.2 Photorespiration**  **2.3 Photoperiodism:** Phytochrome Response and Vernalization with reference to flowering in higher plants, Physico-chemical properties of phytochrome, Pr-Pfr interconversion, role of phytochrome in flowering of SDPs and LDPs;  **2.4 Vernalization** mechanisms and applications. |  |

**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 | Fundamentals of Plant Physiology by VK Jain |

**Course Code and Title: S209 BOT (MAJOR): CURRENT TRENDS IN PLANT SCIENCES II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-IV** |

**Learning Objectives:**

* Knowledge about Integrated Crop Management
* Identify and use basic tools, equipment & materials: Effectively identify, select & use the specified tools and equipment relevant to gardening works.
* Layout and design the Garden component: Area Measurement and planning for the layout and design of garden.
* Maintain the Garden: identify and select the tools for Pruning, training, trimming and develop healthy Garden.
* 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.
* Identify and use basic tools, equipment & materials: Effectively identify, select & use the specified tools and equipment relevant to gardening works.
* Prepare root stocks: Preparing root stocks for grafting, budding
* Layout and design the Garden component: Area Measurement and planning for the layout and design of garden.
* Maintain the Garden: identify and select the tools for Pruning, training, trimming and develop healthy Garden.

|  |  |  |
| --- | --- | --- |
| **UNIT I HORTICULTURE AND GARDENING 10 Lectures** | | |
|  | Introduction to Horticulture: Branches of Horticulture   * Gardening: * Locations in the garden- edges, hedges, lawn, flower beds, avenue, water garden (with names of two plants for eachcategory). * Types of gardens * Formal and informal gardens, * National Park: Sanjay Gandhi National Park. * Botanical Garden: Veer Mata JijabaiUdyan (Victoria Garden). |  |
| **UNIT II BIOSTATISTICS AND BIOINFORMATICS 10 LECTURES** | | |
|  | 2.1 Biostatistics:   * The chi square test. * Correlation – Calculation of coefficient of correlation.   2.2 Bioinformatics   * Information technology: History and tools of IT, Internet and its uses. * Introduction to Bioinformatics- goal, need, scope and limitation * Aims of Bioinformatics: Data organization, * Tools of Bioinformatics- tools for web search, Data retrieval tools- Entrez, BLAST * Bioinformatics programme in India. |  |

**References:**

|  |  |
| --- | --- |
| 1 | Biostatistical analysis by Jerrold Zar, 1974. |
| 2 | Principles of biostatistics by Marcello Pagano, 1993 |
| 3 | Biostatistics by P. N. Arora, 2010 |
| 4 | Introduction to Bioinformatics by Teresa Attwood, David Parry-Smith |
| 5 | Bioinformatics: A Biologist's Guide to Biocomputing and the Internet by Stuart M. Brown |
| 6 | Problems and Solutions in Biological Sequence Analysis by Mark Borodovsky and Svetlana Ekisheva |
| 7 | Handbook of Horticulture (Vol. I & II) | ICAR. |
| 8 | Handbook of Horticulture by Chadha K L |

**Course Code and Title: S210BOP (MAJOR): PRACTICAL II BOTANY**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 60** | **Semester-IV** |

**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 fungi, 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 *Erysiphe*.
* 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.
* Identify and classify 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 IVas per the minimum requirements.

|  |  |
| --- | --- |
| **A. EXTERNAL experiments** | |
| 1 | Study of stages in the life cycle of *Erysiphe* from fresh/ preserved material and permanent slides. |
| 2 | Study of stages in the life cycle of *Xylaria* from fresh/ preserved material and permanent slides |
| 3 | Study of stages in the life cycle of *Selaginella* from fresh/ preserved material and permanent slides. |
| 4 | Study of stages in the life cycle of *Pinus* from fresh/ preserved material and permanent slides. |
| 5 | Study of normal secondary growth in the stem and root of a Dicotyledonous plant |
| 6 | Study of conducting tissues- Xylem and phloem elements in Gymnosperms and Angiosperms as seen in LS and through maceration technique. |
| 7 | NR activity – in-vivo |
| 8 | Estimation of proteins by Lowry’s method (Prepare standard graph). |
| 9 | Study of vegetation by the list quadrat method. |
| 10 | Quantitative estimation of organic matter of the soil by Walkley and Blacks Rapid titration method. |
| 11 | Preparation of garden plans – formal and informal gardens |
| 12 | Seed sterilization, callus induction |
| 13 | Calculation of coefficient of correlation |
| 14 | Chi square test |
| **B. INTERNAL experiments** | |
| 1 | Study of Lichens (crustose, foliose, & fruiticose). |
| 2 | Study of fungal diseases as prescribed for theory. |
| 3 | Study of the form genus *Cordaites* with the help of permanent slide/ photomicrographs. |
| 4 | Growth rings, periderm, lenticels, tyloses, heart wood and sap wood |
| 5 | Study of different types of vascular bundles. |
| 6 | Study of the working of the following Ecological Instruments- Soil thermometer, Soil testing kit, Soil pH, Wind anemometer. |
| 7 | Mechanical analysis of soil by the sieve method & pH of soil. |
| 8. | Bioinformatics :-   * Web Search – Google, Entrez. * BLAST |
| 9. | Various sterilization techniques |
| 10. | Study of five examples of plants for each of the garden locations as prescribed for theory. |

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

## **EXAMINATION PATTERN FOR SUBJECTS**

## **EXAMINATION PATTERN FOR MAJOR SUBJECTS**

1. **Continuous Internal Assessment (20 Marks):**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks** |
| 1 | Class test / assignment / Seminar / Quiz | 20 |

## Semester End Examination (30 Marks):

Question Paper Pattern

* 1. These examinations shall be of **One Hours** duration. Maximum marks **30**.
  2. There shall be three questions of which first questions are of **10 marks MCQ**. Question 2 & 3 will be of 10 marks each. Questions 1 will be based on **Unit- I&II,** Questions 2 will be based on **Unit-I** and **Questions 3** will be based on **Unit-II**.
  3. All questions shall be compulsory with internal choice within the questions.

## **Distribution of external 30 marls**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Qn.** | **Sub-Qn** | **Particulars** | **Unit** | **Marks with options** | **Total Marks for qn** |
| **1** | **MCQ** | Answer the following  (Attempt **all**) | **I, II** | **10** | **10** |
| **2** | **a, b** | Answer the following  (Attempt **any one out of two**) | **I** | **20** | **10** |
| **4** | **a, b** | Answer the following (Attempt **any one out of two**) | **II** | **20** | **10** |
|  |  | **Total** |  | **50** | **30** |

1. **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 S.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** |

## **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)

1. **Continuous Internal Assessment (20 Marks):**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks** |
| 1 | Class test / assignment / Seminar / Quiz | 20 |

## 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**.

**Course Code and Title: S211BOT (MINOR): PLANT DIVERSITY II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-IV** |

**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 Fungi.

**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*.

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| **Unit - I Thallophyta: Fungi, Plant Pathology and Lichens. 10 Lectures** | | |
|  | 1.1 General characters of Ascomycetae   * Structure, life cycle and systematic position of *Erysiphe* and *Xylaria*   1.2 Plant Pathology-   * Symptoms, causative organism, disease cycle and control measures of   Powdery mildew and Late blight of potato  1.3 Lichens-   * Classification, Structure and Economic Importance and Ecological Significance of Lichens. |  |
| **Unit II Gymnosperms**. **10 Lectures** | | |
|  | Salient features, classification up to orders (with examples of each) and  economic importance of Coniferophyta (Chamberlain’s system of  classification to be followed)   * Structure life cycle and systematic position of Pinus * Structure and systematic position of the form genus Cordaites |  |
|  | | |

**References:**

|  |  |
| --- | --- |
| 1 | College Botany Volume I and II by Gangulee, Das and Dutta. Central Education Enterprises. |
| 2 | "Pteridophytes, Gymnosperms and Palaeobotany" by V Kumaresan and Annie Ragland |
| 3 | "Diversity of Pteridophytes,Gymnosperms and Elementary Palaeobotany" by SATISH KUMAR |
| 4 | Kato, M. 1983. Classification of major groups of pteridophytes. J. Fac. Sci. Univ. Tokyo III, 13: 263–283. |
| 5 | Eames, A. J. 1936. Morphology of vascular plants. Lower groups. New York London: MacGraw-Hill. |
| 6 | Cryptogamic Botany Volume I and II by G M Smith, McGraw Hill. |
| 7 | Cryptogamic Botany Vol. I & II (2nd Edition) by Gilbert, M. S., Tata McGraw Hill Publishing Co., Ltd New Delhi. |
| 8 | Handbook of Horticulture (Vol. I & II) | ICAR. |
| 9 | Handbook of Horticulture by Chadha K L |

**Course Code and Title: S212 BOT (MINOR): FORM AND FUNCTION- II**

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| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-IV** |

**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.

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| **Unit - I ANATOMY 10 Lectures** | | |
|  | 1.1 Normal Secondary Growth in Dicotyledonous stem and root.  1.2 Secondary growth in Monocot stem – Dracaena.  1.3 Mechanical Tissue system   * Tissues providing mechanical strength and support and their disposition * I-girders in aerial and underground organs   1.4 Conducting tissue system :   * Xylem and its elements, * Phloem and its elements   1.5 Types of Vascular Bundles. |  |
| **Unit II : Plant Physiology and Plant Biochemistry** | | **10 Lectures** |
|  | **2.1 Respiration: Aerobic:** Glycolysis, TCA Cycle, ETS & Energetic of respiration; Anaerobic respiration.  **2.2 Photorespiration**  **2.3 Photoperiodism:** Phytochrome Response and Vernalization with reference to flowering in higher plants, Physico-chemical properties of phytochrome, Pr-Pfr interconversion, role of phytochrome in flowering of SDPs and LDPs;  **2.4 Vernalization** mechanisms and applications. |  |

**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 | Biostatistical analysis by Jerrold Zar, 1974. |
| 6 | Principles of biostatistics by Marcello Pagano, 1993 |
| 7 | Biostatistics by P. N. Arora, 2010 |
| 8 | Introduction to Bioinformatics by Teresa Attwood, David Parry-Smith |
| 9 | Bioinformatics: A Biologist's Guide to Biocomputing and the Internet by Stuart M. Brown |
| 10 | Problems and Solutions in Biological Sequence Analysis by Mark Borodovsky and Svetlana Ekisheva |
| 11 | Biostatistical analysis by Jerrold Zar, 1974. |
| 12 | Principles of biostatistics by Marcello Pagano, 1993 |

**Course Code and Title: BOTVSC03: EXPERIMENTAL BOTANY II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 60** | **Semester-IV** |

**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.
* 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.
* 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 IV as per the minimum requirements.

|  |
| --- |
| **A. EXTERNAL experiments** |
| **Horticulture 1 2 3 Biotechnology 4 5 6 7** |
| Preparation of garden plans – formal and informal gardens | |
| Study of five examples of plants for each of the garden locations as prescribed for theory | |
| Various sterilization techniques | |
| Seed sterilization, callus induction | |
| Chi square test | |
| Calculation of coefficient of correlation | |
| BLAST | |
| **B. INTERNAL experiments** |
| Bottle and dish garden preparation. | |
| Understand the differences, ultrastructure and function of Cell wall, plasma membrane, endoplasmic reticulum and chloroplast | |
| Preparation of Stock solutions, Preparation of MS medium. | |
| Regeneration of plantlet from callus. | |
| Identification of the cloning vectors – pBR322, pUC 18, Ti plasmid. | |
| Web Search – Google, Entrez. | |

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

## **EXAMINATION PATTERN FOR SUBJECTS**

1. **Continuous Internal Assessment (20 Marks):**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks** |
| 1 | Class test / assignment / Seminar / Quiz | 20 |

## Semester End Examination (30 Marks):

Question Paper Pattern

* 1. These examinations shall be of **One Hours** duration. Maximum marks **30**.
  2. There shall be three questions of which first questions are of **10 marks MCQ**. Question 2 & 3 will be of 10 marks each. Questions 1 will be based on **Unit- I&II,** Questions 2 will be based on **Unit-I** and **Questions 3** will be based on **Unit-II**.
  3. All questions shall be compulsory with internal choice within the questions.

## **Distribution of external 30 marls**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Qn.** | **Sub-Qn** | **Particulars** | **Unit** | **Marks with options** | **Total Marks for qn** |
| **1** | **MCQ** | Answer the following  (Attempt **all**) | **I, II** | **10** | **10** |
| **2** | **a, b** | Answer the following  (Attempt **any one out of two**) | **I** | **20** | **10** |
| **4** | **a, b** | Answer the following (Attempt **any one out of two**) | **II** | **20** | **10** |
|  |  | **Total** |  | **50** | **30** |

**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 S.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** |

## **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)

1. **Continuous Internal Assessment (20 Marks):**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks** |
| 1 | Class test / assignment / Seminar / Quiz | 20 |

## 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**.

**BOTSEC04(SEC): BOTANICAL DECORATION& HERBAL PRODUCTS**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 60** | **Semester-IV** |

**Learning Objectives and Outcome:**

* To inculcate the importance of studying floriculture and usage of floricultural crops.
* To Get hands-on training in wet and dry preservation methods of plants.
* Acquire and perform the technique of screening antibacterial and antifungal activities of plant extracts.
* Create flower arrangements, vegetable & fruit carvings, bio-jewellery by acquiring botanical decoration skills.
* Formulate herbal cosmetics.
* Develop entrepreneurial skills by arranging exhibition cum sale of plant products, herbal cosmetics, bio-jewellery, etc.

|  |  |
| --- | --- |
| **PRACTCALS/ experiments** | |
| 1 | Preparation of garlands, bouquets and button holes. |
| 2 | Preparation of floral wheel and Rangoli. |
| 3 | Fruit carving tools |
| 4 | Vegetable carving. |
| 5 | Fruit carving. |
| 6 | Preparation of Biojewellery. |
| 7 | Preparation of Bio-gifts. |
| 8-15 | Preparation of herbal Products: Herbal Face Pack, Bath Oil, Herbal Shampoo, Herbal Lip Balm, Rose water, Floral Incense, and Kajal. |

**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". *In Proceedings of the Sixth Middle East Conference on Global Business, Economics, Finance and Banking (ME17Dubai Conference):* 6–8. |

**BOTVEC02(VEC): ENVIRONMENTAL BOTANY II**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-IV** |

**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.

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| --- | --- | --- |
| **Unit - I Ecosystem 15 Lectures** | | |
|  | Structure; energy flow trophic organisation; Food chains and food webs, Ecological pyramids production and productivity; Biogeochemical cycling; Cycling of carbon and nitrogen . |  |
| **Unit – II Biodiversity 15 Lectures** | | |
|  | Biodiversity: biotic communities, their characteristics. Importance of biodiversity, reason of loss, biodiversity hotspots in India. |  |

**References:**

|  |  |
| --- | --- |
| 1 | Environmental Biology by P S Verma and V K Agarwal. |
| 2 | Environmental Biology by Manoj Kr Sharma. |
| 3 | Energy and Environment by V K Ahluwalia. |
| 4 | Plant Conservation and Biodiversity by David and Alan |
| 5 | Biodiversity and Its Conservation in India by Sharad Singh Negi, Indus Publishing, 1993 |

**Course Code and Title: BOTOE05(OE) GARDENING**

|  |  |  |  |
| --- | --- | --- | --- |
| **Level: 5.0** | **Credits: 02** | **Number of Lectures: 30** | **Semester-IV** |

**Learning Outcome:**

After completion of the programme the students will be able to:

1. Familiarization with principles and practices of propagation for Horticultural Crops.

2. Study of introduction to propagation, cellular basis for propagation, sexual propagation, apomixis, polyembryony, chimeras. Principle factors influencing seed germination of horticultural crops, dormancy, hormonal regulation of germination and seedling growth.

3. Conservation and exploitation of biological diversity through crop management.

4. Establishment of models nurseries in rural areas for availability of quality planting materials.

5. Create job opportunities for the unemployed youths through teaching, research, training, extension etc., especially for the development of socially and economically depressed segment of society.

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| **Unit - I Fundamental of Gardening 10 Lectures** | | |
|  | * Horticulture- Branches, Importance and scope. * Vegetable gardens and kitchen garden. |  |
| **Unit II : Organic farming** | | **10 Lectures** |
|  | * Organic farming-Principles, importance and scope. * FYM and vermicompost. |  |
| **UNIT III Weed management. 10 Lectures** | | |
|  | * Weeds: Introduction, harmful and beneficial effects on horticultural crops. * Herbicides: advantages and limitation of herbicide in India. |  |

**References:**

|  |  |
| --- | --- |
| 1 | Kumar, N., 1990. Introduction to Horticulture. Rajyalakshmi publications, Nagarcoil, Tamilnadu |
| 2 | Prasad and Kumar, 2014. Principles of Horticulture 2ndEdn. Agrobios (India). |
| 3 | Gardner/Bardford/Hooker. J.R., 1957. Fundamentals of Fruit Production. Mac Graw Hill Book Co., New York. |
| 4 | Jitendra Singh, 2002. Basic Horticulture. Kalyani Publishers, Hyderabad. |
| 5 | Singh RS. 2013. Introduction to Principles of Plant Pathology.Oxford and IBH Pub.Co. |
| 6 | Gupta, O.P. 1984. Scientific Weed Management. Today and Tomorrow Printers and Publishers, New Delhi. |
| 7 | Gupta, O.P. 2015. Modern Weed Management. Agro Bios (India), Jodhpur. |
| 8 | Naidu, V.S.G.R., Handbook of Weed Identification. Directorate of Weed Research, Jabalpur. |

## **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)

1. **Continuous Internal Assessment (20 Marks):**

|  |  |  |
| --- | --- | --- |
| **Sr. No.** | **Particulars** | **Marks** |
| 1 | Class test / assignment / Seminar / Quiz | 20 |

## 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**.