



ROYAL GLOBAL UNIVERSITY

— ♦ — GUWAHATI — ♦ —

ROYAL SCHOOL OF LIFE SCIENCES(RSLSC)

DEPARTMENT OF BOTANY

COURSE: B.Sc. BOTANY

JULY 2022

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Preamble

Over the past decades the higher education system of our country has undergone substantial structural and functional changes resulting in both quantitative and qualitative development of the beneficiaries. The upgradation of undergraduate programmes will play an extremely important role in promoting human as well as societal well-being and in developing India as envisioned in its Constitution - a democratic, just, socially conscious, cultured, and humane nation upholding liberty, equality, fraternity, and justice for all. A holistic and multidisciplinary education would aim to develop all capacities of human beings -intellectual, aesthetic, social, physical, emotional, and moral in an integrated manner. Such an education will help develop well-rounded individuals that possess. Such changes will further result in learning outcome based curriculum in order to maximize the benefits of the newly designed curriculum. The learning outcome based curriculum in general and in Botany in particular will definitely help the teachers of the discipline to visualize the curriculum more specifically in terms of the learning outcomes expected from the students at the end of the instructional process. It is pertinent to mention here that the purpose of education is to develop an integrated personality of the individual and the educational system provides all knowledge and skills to the learner for this.

The template as developed has the provision of ensuring the integrated personality of the students in terms of providing opportunity for exposure to the students towards core courses, discipline specific courses, generic elective courses, ability enhancement courses and skill enhancement courses with special focus on technical, communication and subject specific skills through practical and other innovative transactional modes to develop their employability skills. The template of learning outcome based framework has categorically mentioned very well defined expected outcomes for the programme like core competency, communication skills, critical thinking, affective skills, problem-solving, analytical, reasoning, research-skills, teamwork, digital literacy, moral and ethical awareness, leadership readiness and so on along with very specific learning course outcomes at the starting of each course. Therefore, this template on Learning Outcomes based Curriculum Framework (LOCF) for B.Sc. with Botany/ Botany Honours under The Assam Royal Global University will be more flexible, multi-disciplinary, holistic and will definitely be a landmark in the field of outcome based curriculum construction.

1.1 Introduction

The new course structure of BSc in Botany aims at a new and forward-looking Vision for India's Higher Education System. This curriculum framework for the bachelor-level program in Botany is developed keeping in view of the student centric learning pedagogy, which is entirely multidisciplinary outcome-oriented and curiosity-driven. To avoid rote -learning approach and foster imagination, the curriculum is more leaned towards self-discovery of concepts. The curriculum framework focuses on pragmatist approach whereby practical application of theoretical concepts is taught with substantial coverage of practical and field works. The platform aims at equipping the graduates with necessary skills for botany-related careers, careers with general graduate-level aptitude and for higher education in Botany and allied subjects. Augmented in this framework are graduate attributes including critical thinking, basic psychology, scientific reasoning, moral ethical reasoning and so on, qualification descriptors that are specific outcomes pertinent to the discipline of botany, learning outcomes for the two programmes these frameworks have been developed, learning outcomes for individual courses, pedagogical methods and assessment methods. Looking at all these new concepts and progress, the detailed syllabus of BSc (H) – Botany has been designed and decided to be implemented from the academic session 2022-23.

1.2 Approach to Curriculum Planning

While designing these frameworks, emphasis is given on the objectively measurable teaching-learning outcomes to ensure employability of the graduates. In line with recent trends in education section, these frameworks foster implementation of modern pedagogical tools and concepts such as flip-class, hybrid learning, MOOCs and other e-learning platforms. In addition, the framework pragmatic to the core; it is designed such a way to enable the learners implementing the concepts to address the real world problems. A major emphasis of these frameworks is that the curriculum focuses on issues pertinent to India and also of the west; for example, biodiversity and conservation of endemic and threatened species that are found in India, Indian climatological variables, Indian biodiversity and so on. Above all, these frameworks are holistic and aim to mould responsible Indian citizen who have adequate skills in reflective thinking, rational skepticism, scientific temper, digital literacy and so on such that they are equipped to fight immediate social issues apropos to Indian milieu, including corruption and inequity.

The fundamental premise underlying the learning outcomes-based approach to curriculum planning and development is that higher education qualifications such as a Bachelor's Degree (Hons) programmes are earned and awarded on the basis of (a) demonstrated achievement of outcomes (expressed in terms of knowledge, understanding, skills, attitudes and values) and (b) academic standards expected of graduates of a programme of study.

Learning outcomes-based frameworks in any subject must specify what graduates completing a particular programme of study are (a) expected to know, (b) understand and (c) be able to do at the end of their programme of study. To this extent, LOCF in Botany is committed to allowing for flexibility and innovation in (i) programme design and syllabi development by higher education institutions (HEIs), (ii) teaching-learning process, (iii) assessment of student learning levels, and (iv) periodic programme review within institutional parameters as well as LOCF guidelines, (v) generating framework(s) of agreed expected graduate attributes, qualification descriptors, programme learning outcomes and course learning outcomes. HEIs, on their turn, shall

address to the situations of their students by identifying relevant and common outcomes and by developing such outcomes that not only match the specific needs of the students but also expands their outlook and values.

1.2.1 Nature and Extent of Bachelor's Degree Programme in Botany (Honours)

A student pursuing 4 years undergraduate programme with research in a specific discipline shall be awarded an appropriate Degree in that discipline on completion of 8th Semester if he/she secures 180 Credits. An illustration of credits requirements in relation to the type of award is illustrated below:

| Sl. No. | YEAR | Mandatory Credits to be secured for the Award |
|---------|---|---|
| 1 | After successful completion of 1st Year | 48 |
| 2 | After successful completion of 1st and 2nd Years | 96 |
| 3 | After successful completion of 1st, 2nd, and 3rd Years | 148 |
| 4 | After successful completion of 1st, 2nd, 3rd, and 4th Years | 180 |

Bachelor's Degree (Honours) is a well-recognized, structured, and specialized graduate level qualification in tertiary, collegiate education. The contents of this degree are determined in terms of knowledge, understanding, qualification, skills, and values that a student intends to acquire to look for professional avenues or move to higher education at the postgraduate level.

Bachelor's Degree (Honours) programmes attract entrants from the secondary level or equivalent, often with subject knowledge that may or may not be directly relevant to the field of study/profession. Thus, BSc (Honours) Course in Botany aims to equip the students to qualify for joining a profession or to provide development opportunities in particular employment settings. Graduates are enabled to enter a variety of jobs or to continue academic study at a higher level.

1.2.2 Aims of Bachelor's Degree (Honours) Programme in Botany:

The overall objectives of the Learning Outcomes-based Curriculum Framework (LOCF) for B.Sc.- Honours degree in Botany are-

1. To impart the basic knowledge of Plant Sciences with theories, principles, processes, and studies of traditional and modern botany.
2. To impart more multi-disciplinary and holistic course curriculum.
3. To develop the learners providing research-based knowledge
4. To equip the students in solving the practical problems pertinent to India
5. To adopt recent pedagogical trends in education including e-learning, flipped class, hybrid learning and MOOCs
6. To mould responsible citizen for nation-building and transforming the country towards the future

7. To provide an environment that ensures cognitive development of students in a holistic manner. A dialogue about plants and its significance is fostered in this framework, rather than didactic monologues on mere theoretical aspects
8. To provide the latest subject matter, both theoretical as well as practical, such a way to foster their core competency and discovery learning. A botany graduate as envisioned in this framework would be sufficiently competent in the field to undertake further discipline-specific studies, as well as to begin domain-related employment.
9. To mould a responsible citizen who is aware of most basic domain-independent knowledge, including critical thinking and communication.
10. To enable the graduate prepare for national as well as international competitive examinations, especially UGC-CSIR NET and UPSC Civil Services Examination

1.3 Graduate Attributes

GA 1 Disciplinary knowledge and Understanding: Botany, as traditionally delimited epistemologically, is the broad discipline encompassing various subjects involved with the study of plants. Emphasis has been shifted to modern science at the cost of traditional botany. This shift is discussed at various forums. There is need to balance the traditional botany and upcoming modern computational and applied approach. In this view, adequate balance of topics is proposed displaying latest APG IV based phylogenetic systematics of plants covering higher plants, lower plants, aquatic (fresh and marine water) plants, nature/ field study, functional aspects of various cellular processes of plants, molecular genetics and modern tools i.e. tissue culture, genetic engineering and computational studies are required to be introduced at undergraduate level.

- a. BSc (Honours Programme in Botany at the Assam Royal Global University will provide basic knowledge of Plant Sciences, use of practical tools in the subject, problem solving capacity through research and concepts and knowledge of other courses relating to core areas of study.
- b. Along with the core papers, gives much more emphasis on broader coverage of generic electives. A student of BSc in Botany Programme can choose any discipline from a wide range of basket as his/her generic electives, which facilitate the student better understanding of the core courses. Moreover, a wide range of Skilled based papers are designed to improve the skill of the students.

GA 2 Communication Skills: Ability to express thoughts and ideas effectively in writing and orally is very essential for a student. The Assam Royal Global University at Undergraduate and PG level has made Communicative English compulsory for all students in all semesters. A student at UG level will study six papers of Communicative English as Ability Enhancement Compulsory Courses (AECC) with a view to improve communication skills of the students.

GA 3 Analytical ability: The students will be able to demonstrate the knowledge in understanding research and addressing practical problems. Application of various scientific methods to address different questions by formulating the hypothesis, data collection and critically analyse the data to decipher the degree to which their scientific work supports their hypothesis.

GA 4 Critical thinking: A student will be capable of using analytic thought to a body of knowledge and evaluate evidence, arguments, claims, beliefs based on empirical evidence. Faculty members organize

Group Discussion, Power Point presentation, Debate, Quiz, seminars, lecture series etc regularly to develop this quality among the students.

GA 5 Problem solving: this course is designed to develop capacity to extrapolate from what a student has learned and apply their competencies to solve different kinds of non-familiar problems and apply one's learning to real life situations in nature.

GA 6 Research-related skills: Botany is research-based subject. Students are asked prepare project report regularly which brings about the sense of inquiry and capability for asking relevant/appropriate questions. They can also develop the ability to recognise cause-and-effect relationships and can draw conclusions from data.

GA 7 Cooperation/Teamwork: Capable of working effectively in diverse teams in both classroom and field-based situations.

GA 8 Information/digital literacy: Capable of using computers in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources and use appropriate software for analysis of data.

GA 9 Moral and ethical awareness/reasoning: Capable of conducting their work with honesty and precision thus avoiding unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, and appreciating environmental and sustainability issues.

GA 10 Lifelong learning: Capable of self-paced and self-directed learning aimed at personal development, meeting

1.4 Program Learning Outcomes relating to BSc Botany (Honours) degree Programme in Botany:

The student graduating with the Degree B.Sc. (Honours) Botany should be able to acquire

PO 1: Knowledge of Botany : Students will acquire core competency in the subject Botany, and in allied subject areas.

- The student will be able to identify major groups of plants and compare the characteristics of lower (e.g. algae and fungi) and higher (angiosperms and gymnosperms) plants.
- Students will be able to use the evidence based comparative botany approach to explain the evolution of organism and understand the genetic diversity on the earth.
- The students will be able to explain various plant processes and functions, metabolism, concepts of gene, genome and how organism's function is influenced at the cell, tissue and organ level.
- Students will be able to understand adaptation, development and behaviour of different forms of life.
- The understanding of networked life on earth and tracing the energy pyramids through nutrient flow is expected from the students.
- Students will be able to demonstrate the experimental techniques and methods of their area of specialization in Botany.

PO 2: Critical Thinking and problem solving ability: An increased understanding of fundamental concepts and their applications of scientific principles is expected at the end of this course. Students will become critical thinker and acquire problem solving capabilities.

PO 3: Digitally equipped: Students will acquire digital skills and integrate the fundamental concepts with modern tools.

PO 4: Ethical and Psychological strengthening: Students will also strengthen their ethical and moral values and shall be able to deal with psychological weaknesses.

PO 5: Team Player: Students will learn team workmanship in order to serve efficiently institutions, industry and society.

PO 6: Independent Learner: Apart from the subject specific skills, generic skills, especially in botany, the program outcome would lead to gain knowledge and skills for further higher studies, competitive examinations and employment. Learning outcomes based curriculum would ensure equal academic standards across the country and broader picture of their competencies. The Bachelor program in Botany and Botany honours may be mono-disciplinary or multidisciplinary.

1.5 Programme specific Learning Outcomes

Programme Specific Outcomes (PSOs):

PSO1. A student completing the course is able to understand different specializations of Botany such as systematics, evolution, ecology, developmental biology, physiology, biochemistry, plant interactions with microbes and insects, morphology, anatomy, reproduction, genetics and molecular biology of various life-forms.

PSO2. The student completing the course is trained in various analytical techniques of plant biology, use of plants as industrial resources or as human livelihood support system and is well versed with the use of transgenic technologies for basic and applied research in plants.

PSO3. The student completing the course is able to identify various life forms of plants, design and execute experiments related to basic studies on evolution, ecology, developmental biology, physiology, biochemistry, plant interactions with microbes and insects, morphology, anatomy, reproduction, genetics, microbiology, molecular biology, recombinant DNA technology, proteomics and transgenic technology. Students are also familiarized with the use of bioinformatics tools and databases and in the application of statistics to biological data.

PSO4. The student completing the course is capable of executing short research projects incorporating various tools and techniques in any of the basic specializations of Plant Sciences under supervision.

1.6 Teaching Learning Process

Teaching and learning in this programme involve classroom lectures as well tutorials.

It allows-

- The tutorials allow a closer interaction between the students and the teacher as each student gets individual attention.
- Written assignments and projects submitted by students

- the project-based learning
- Group discussion
- Home assignments
- Quizzes and class tests
- PPT presentations, Seminars, interactive sessions
- Diversity survey
- Co-curricular activity etc.
- Industrial Tour or Field visit

1.7 Assessment Methods

| Methods | Weightage |
|--------------------------|------------------|
| Semester End Examination | 70% |
| Internal Assessment | 30% |
| Total | 100% |

1.8 SCHEME OF EVALUATION

I. Theory Papers (T):

- Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- Mid-term examination: 10%
- Attendance: 5%
- Semester End examination: 70%

II. Practical Papers (P):

- Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/performance) (any five).
- Attendance: 5%
- Semester End examination: 70 %

III. Combined Theory & Practical Papers (TP):

- Continuous Evaluation: 15% (Assignment. Class Test, Seminar, Lab Experiment, Copy and Viva: Any Three)
- Mid-term examination: 10%
- Attendance: 5%
- Semester End examination: 70 %

B.Sc. (HONOURS) BOTANY PROGRAMME STRUCTURE

1ST SEMESTER

| Sl.No. | Subject Code | Names of subjects | L | T | P | C | TCP |
|--|---------------------|--|-----------|----------|-----------|-----------|------------|
| CORE SUBJECTS | | | | | | | |
| 1 | BOT142C101 | MICROBIOLOGY, MYCOLOGY & PLANT PATHOLOGY | 4 | 0 | 0 | 4 | 4 |
| 2 | BOT142C102 | ALGAE, BRYOPHYTES, PTERIDOPHYTES | 4 | 0 | 0 | 4 | 4 |
| 3 | BOT142C113 | MICROBIOLOGY, MYCOLOGY & CRYPTOGAMS (PRACTICAL) | 0 | 0 | 8 | 4 | 8 |
| TOTAL CREDIT FOR CORE PAPERS | | | | | | 14 | 16 |
| SKILL ENHANCEMENT COURSE (SEC) | | | | | | | |
| 4 | BOT142S111 | PLANT PROPAGATION & NURSERY MANAGEMENT | 0 | 0 | 4 | 2 | 4 |
| ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) | | | | | | | |
| 5 | CEN982A101 | COMMUNICATIVE ENGLISH – I | 1 | 0 | 0 | 1 | 1 |
| 6 | BHS982A104 | BEHAVIORAL SCIENCE – I | 1 | 0 | 0 | 1 | 1 |
| VALUE ADDED COURSES (VAC) | | | | | | | |
| 7 | | ONE COURSE FROM A BASKET OF AVAILABLE COURSES TO BE SELECTED | 2 | 0 | 0 | 2 | 2 |
| GENERIC ELECTIVE | | | | | | | |
| 8 | BOT142G101 | GE1: BIODIVERSITY OF PLANTS | 2 | 0 | 2 | 3 | 4 |
| 9 | BOT142G102 | GE2: NURSERY & GARDENING | 2 | 0 | 2 | 3 | 4 |
| TOTAL CREDITS FOR THE SEMESTER | | | 17 | 0 | 14 | 24 | 32 |

2ND SEMESTER

| Sl.No. | Subject Code | Names of subjects | L | T | P | C | TCP |
|--|---------------------|---|-----------|----------|-----------|-----------|------------|
| CORE SUBJECTS | | | | | | | |
| 1 | BOT142C201 | GYMNOSPERMS & ANGIOSPERMS | 4 | 0 | 0 | 4 | 4 |
| 2 | BOT142C202 | PLANT TAXONOMY & ANATOMY | 4 | 0 | 0 | 4 | 4 |
| 3 | BOT142C213 | GYMNOSPERMS, ANGIOSPERMS, PLANT TAXONOMY, & ANATOMY (PRACTICAL) | 0 | 0 | 8 | 4 | 8 |
| TOTAL CREDIT FOR CORE PAPERS | | | | | | 12 | 16 |
| SKILL ENHANCEMENT COURSE (SEC) | | | | | | | |
| 4 | BOT142S211 | PLANT PROPAGATION & NURSERY MANAGEMENT: HORTICULTURE | 0 | 0 | 4 | 2 | 4 |
| ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) | | | | | | | |
| 5 | CEN982A201 | COMMUNICATIVE ENGLISH - II | 1 | 0 | 0 | 1 | 1 |
| 6 | BHS982A204 | BEHAVIOURAL SCIENCE – II | 1 | 0 | 0 | 1 | 1 |
| VALUE ADDED COURSES (VAC) | | | | | | | |
| 7 | | ONE COURSE FROM A BASKET OF AVAILABLE COURSES TO BE SELECTED | 2 | 0 | 0 | 2 | 2 |
| GENERIC ELECTIVE | | | | | | | |
| 8 | BOT142G201 | GE-3: MUSHROOM CULTIVATION | 2 | 0 | 2 | 3 | 4 |
| 9 | BOT142G202 | GE-4: PLANT ECOLOGY & ECONOMIC BOTANY | 2 | 0 | 2 | 3 | 4 |
| TOTAL CREDITS FOR THE SEMESTER | | | 16 | 0 | 16 | 24 | 32 |

3RD SEMESTER

| SL.NO. | SUBJECT CODE | NAMES OF SUBJECTS | L | T | P | C | TCP |
|--|---------------------|--|-----------|----------|-----------|-----------|------------|
| CORE SUBJECTS | | | | | | | |
| 1 | BOT142C301 | CELL & MOLECULAR BIOLOGY | 4 | 0 | 0 | 4 | 4 |
| 2 | BOT142C312 | CELL, MOLECULAR BIOLOGY & ECONOMIC BOTANY (PRACTICAL) | 0 | 0 | 8 | 4 | 8 |
| TOTAL CREDIT FOR CORE PAPERS | | | | | | 8 | 12 |
| DISCIPLINE SPECIFIC ELECTIVE (DSE) | | | | | | | |
| 3 | BOT142D301 | ECONOMIC BOTANY | 4 | 0 | 0 | 4 | 4 |
| ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) | | | | | | | |
| 5 | CEN982A301 | COMMUNICATIVE ENGLISH - III | 1 | 0 | 0 | 1 | 1 |
| 6 | BHS982A304 | BEHAVIOURAL SCIENCE – III | 1 | 0 | 0 | 1 | 1 |
| INTERNSHIP | | | | | | | |
| 7 | | 4 WEEKS INTERNSHIP/ TRAINING/PROJECT AFTER 2ND SEM EXAM | 0 | 0 | 8 | 4 | 8 |
| GENERIC ELECTIVE | | | | | | | |
| 8 | BOT142G301 | GE-5: BOTANY IN RURAL COMMUNITIES | 2 | 0 | 2 | 3 | 4 |
| 9 | BOT142G102 | GE-6: NURSERY & GARDENING | 2 | 0 | 2 | 3 | 4 |
| TOTAL CREDITS FOR THE SEMESTER | | | 14 | 0 | 20 | 24 | 34 |

4TH SEMESTER

| SL.NO. | SUBJECT CODE | NAMES OF SUBJECTS | L | T | P | C | TCP |
|--|---------------------|---|-----------|----------|-----------|-----------|------------|
| CORE SUBJECTS | | | | | | | |
| 1 | BOT142C401 | PLANT PHYSIOLOGY & BIOCHEMISTRY | 4 | 0 | 0 | 4 | 4 |
| 2 | BOT142C412 | PLANT PHYSIOLOGY, BIOCHEMISTRY, & HERBARIUM TECHNIQUES(PRACTICAL) | 0 | 0 | 8 | 4 | 8 |
| TOTAL CREDIT FOR CORE PAPERS | | | | | | 8 | 12 |
| DISCIPLINE SPECIFIC ELECTIVE (DSE) | | | | | | | |
| 3 | BOT142D401 | PLANT IDENTIFICATION & HERBARIUM TECHNIQUES | 4 | 0 | 0 | 4 | 4 |
| SKILL ENHANCEMENT COURSE (SEC) | | | | | | | |
| 4 | BOT142S311 | FLORICULTURE I | 0 | 0 | 4 | 2 | 4 |
| ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) | | | | | | | |
| 5 | CEN982A301 | COMMUNICATIVE ENGLISH - III | 1 | 0 | 0 | 1 | 1 |
| 6 | BHS982A304 | BEHAVIOURAL SCIENCE – III | 1 | 0 | 0 | 1 | 1 |
| VALUE ADDED COURSES (VAC) | | | | | | | |
| 7 | | ONE COURSE FROM A BASKET OF AVAILABLE COURSES TO BE SELECTED | 2 | 0 | 0 | 2 | 2 |
| GENERIC ELECTIVE | | | | | | | |
| 8 | BOT142G401 | GE-7: ENVIRONMENTAL BIOTECHNOLOGY | 2 | 0 | 2 | 3 | 4 |
| 9 | BOT142G202 | GE-8: PLANT ECOLOGY & ECONOMIC BOTANY | 2 | 0 | 2 | 3 | 4 |
| TOTAL CREDITS FOR THE SEMESTER | | | 16 | 0 | 16 | 24 | 32 |

5TH SEMESTER

| SL.NO. | SUBJECT CODE | NAMES OF SUBJECTS | L | T | P | C | TCP |
|--|---------------------|---|-----------|----------|-----------|-----------|------------|
| CORE SUBJECTS | | | | | | | |
| 1 | BOT142C501 | GENETICS & PLANT BREEDING | 4 | 0 | 0 | 4 | 4 |
| 2 | BOT142C512 | GENETICS, PLANT BREEDING, BIOSTATISTICS, BIOINFORMATICS & APPLIED MICROBIOLOGY(PRACTICAL) | 0 | 0 | 8 | 4 | 8 |
| TOTAL CREDIT FOR CORE PAPERS | | | | | | 8 | 12 |
| DISCIPLINE SPECIFIC ELECTIVE (DSE) | | | | | | | |
| 3 | BOT142D501 | BIOSTATISTICS & BIOINFORMATICS | 4 | 0 | 0 | 4 | 4 |
| 4 | BOT142D502 | INDUSTRIAL & ENVIRONMENTAL MICROBIOLOGY | 4 | 0 | 0 | 4 | 4 |
| ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) | | | | | | | |
| 5 | CEN982A501 | COMMUNICATIVE ENGLISH – V | 1 | 0 | 0 | 1 | 1 |
| 6 | BHS982A504 | BEHAVIOURAL SCIENCE – V | 1 | 0 | 0 | 1 | 1 |
| VALUE ADDED COURSES (VAC) | | | | | | | |
| 7 | | ONE COURSE FROM A BASKET OF AVAILABLE COURSES TO BE SELECTED | 2 | 0 | 0 | 2 | 2 |
| INTERNSHIP | | | | | | | |
| 8 | | 6 WEEKS INTERNSHIP/IN- PLANT TRAINING/PROJECT AFTER 2 ND SEM EXAM | 0 | 0 | 12 | 6 | 12 |
| TOTAL CREDITS FOR THE SEMESTER | | | 16 | 0 | 20 | 26 | 36 |

6TH SEMESTER

| SL.NO. | SUBJECT CODE | NAMES OF SUBJECTS | L | T | P | C | TCP |
|--|--------------|--|-----------|----------|-----------|-----------|-----------|
| CORE SUBJECTS | | | | | | | |
| 1 | BOT142C601 | ECOLOGY & CONSERVATION BIOLOGY | 4 | 0 | 0 | 4 | 4 |
| 2 | BOT142C612 | ECOLOGY, AGRONOMY AND BIORESOURCE MANAGEMENT(PRACTICAL) | 0 | 0 | 8 | 4 | 8 |
| TOTAL CREDIT FOR CORE PAPERS | | | | | | 8 | 12 |
| DISCIPLINE SPECIFIC ELECTIVE (DSE) | | | | | | | |
| 3 | BOT142D601 | AGRONOMY & SUSTAINABLE DEVELOPMENT | 4 | 0 | 0 | 4 | 4 |
| 4 | BOT142D602 | BIORESOURCE MANAGEMENT | 4 | 0 | 0 | 4 | 4 |
| 5 | BOT142D603 | REPRODUCTIVE BIOLOGY OF PLANTS | 4 | 0 | 0 | 4 | 4 |
| TOTAL CREDIT FOR DSE PAPERS | | | 12 | 0 | 0 | 12 | 12 |
| SKILL ENHANCEMENT COURSE (SEC) | | | | | | | |
| 6 | BOT142S611 | FLORICULTURE II | 0 | 0 | 4 | 2 | 4 |
| ABILITY ENHANCEMENT COMPULSORY COURSES (AECC) | | | | | | | |
| 7 | CEN982A301 | COMMUNICATIVE ENGLISH – III | 1 | 0 | 0 | 1 | 1 |
| 8 | BHS982A304 | BEHAVIOURAL SCIENCE – III | 1 | 0 | 0 | 1 | 1 |
| VALUE ADDED COURSES (VAC) | | | | | | | |
| 9 | | ONE COURSE FROM A BASKET OF AVAILABLE COURSES TO BE SELECTED | 2 | 0 | 0 | 2 | 2 |
| TOTAL CREDITS FOR THE SEMESTER | | | 20 | 0 | 12 | 26 | 32 |

7TH SEMESTER

| SL.NO. | SUBJECT CODE | NAMES OF SUBJECTS | L | T | P | C | TCP |
|---|--------------|------------------------|---|---|----|----------|-----------|
| CORE SUBJECTS | | | | | | | |
| 1 | BOT142C701 | PLANT BIOTECHNOLOGY | 4 | 0 | 0 | 4 | 4 |
| TOTAL CREDITS FOR CORE PAPERS | | | | | | 4 | 4 |
| DISCIPLINE SPECIFIC ELECTIVE (DSE) | | | | | | | |
| 2 | BOT142D701 | RESEARCH METHODOLOGY | 4 | 0 | 0 | 4 | 4 |
| TOTAL CREDITS FOR DSE PAPERS | | | | | | 4 | 4 |
| RESEARCH | | | | | | | |
| 3 | BOT142C721 | PROJECT & DISSERTATION | 0 | 0 | 16 | 8 | 16 |
| TOTAL CREDITS FOR THE SEMESTER | | | | | | 8 | 24 |

8TH SEMESTER

| SL.NO. | SUBJECT CODE | NAMES OF SUBJECTS | L | T | P | C | TCP |
|---|--------------|-------------------------------|---|---|----|----------|------------|
| CORE SUBJECTS | | | | | | | |
| 1 | BOT142C801 | GENETIC ENGINEERING IN PLANTS | 4 | 0 | 0 | 4 | 4 |
| TOTAL CREDIT FOR CORE PAPERS | | | | | | 4 | 4 |
| RESEARCH | | | | | | | |
| 2 | BOT142C821 | PROJECT & DISSERTATION | 0 | 0 | 24 | 12 | 24 |
| TOTAL CREDITS FOR THE SEMESTER | | | | | | 4 | 28 |
| TOTAL CREDITS OF THE 4 YEAR COURSE | | | | | | | 180 |

Semester wise distribution of courses and credits:

| Semester | No. of Core papers and total credit of core papers | No. of DSE papers and total credit of DSE papers | Intern ship | No. of SEC papers and credit | Project work credit | No. of VAC papers and credit | No. Of AECC papers and credit | No. Of GE papers and credit | Total credit | |
|-----------------|---|---|--------------------|-------------------------------------|----------------------------|-------------------------------------|--------------------------------------|------------------------------------|---------------------|------------|
| 1 st | 3, 12 | 0 | 0 | 1,2 | 0 | 1,2 | 2,2 | 2, 6 | 24 | |
| 2 nd | 3,12 | 0 | 0 | 1,2 | 0 | 1,2 | 2,2 | 2, 6 | 24 | |
| 3 rd | 2,8 | 1, 4 | 4weeks, 4 | 0 | 0 | 0 | 2,2 | 2, 6 | 24 | |
| 4 th | 2,8 | 1, 4 | 0 | 1,2 | 0 | 1,2 | 2,2 | 2, 6 | 24 | |
| 5 th | 2,8 | 2, 8 | 6 weeks, 6 | 0 | 0 | 1,2 | 2,2 | 0 | 26 | |
| 6 th | 2,8 | 3, 12 | 0 | 1,2 | 0 | 1,2 | 2,2 | 0 | 31 | |
| 7 th | 1,4 | 1, 4 | 0 | 0 | 8 | 0 | 0 | 0 | 16 | |
| 8 th | 1,4 | 0 | 0 | 0 | 12 | 0 | 0 | 0 | 16 | |
| | | | | Total | | | | | | 180 |

DETAILED SYLLABUS OF 1ST SEMESTER

Paper I: MICROBIOLOGY, MYCOLOGY AND PHYTOPATHOLOGY,

Subject Code: BOT142C101, L-T-P-C: 4-0-0-4, Credit Units: 04

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Pre-requisite: Basic knowledge of biology and chemistry up to class 12

Course objective: To introduce and develop basic concepts to the world of microbes focusing on the diversity and fundamental biological processes of bacteria, viruses & algae.

Learning Outcomes: After the successful completion of the course the students will be able to:

CO1: To **describe** the physical dimensions, forms, functions and habitats of bacteria, Plant & animal viruses, the diversity of algae, the ecological role of Fungi and the biotechnological application of certain species of all the three groups – **BT 2**

CO2: To **distinguish** between the micro and macro forms of life and their value addition to the environment. - **BT 2**

CO3: To **illustrate** the differences between the antagonistic and beneficial roles of bacteria, viruses & Fungi in the plant kingdom. – **BT 3**

Detailed Syllabus

| Module | Course content | Lecture hours |
|----------|--|---------------|
| I | Introduction to microbial world: Introduction to microbial world, microbial nutrition, growth and metabolism. Viruses: Discovery, physiochemical and biological characteristics; classification (Baltimore), general structure with special reference to viroids and prions; replication (general account), DNA virus (T-phage), lytic and lysogenic cycle; RNA virus (TMV). Economic importance of viruses | 12 |

| | | |
|--------------|---|-----------|
| II | <p>Bacteria: Discovery, general characteristics, types-archaeobacteria, eubacteria, wall-less forms (mycoplasma and spheroplasts), cell structure, nutritional types, reproduction-vegetative, asexual and recombination (conjugation, transformation and transduction). Economic importance of bacteria</p> | 12 |
| III | <p>Introduction to fungi: Introduction to true fungi, Affinities with plants and animals; Cell wall composition; Nutrition; Classification.</p> <p>General account of Chytridiomycetes, Zygomycota, Ascomycota Basidiomycota and Oomycota: Heterokaryosis and parasexuality</p> <p>Allied Fungi:General characterises; Status of Slime molds, Classification; Occurrence; Types of plasmodia; Types of fruiting bodies.</p> <p>Symbiotic associations: Lichen – Occurrence; General characteristics; Growth forms and range of thallus organization. Mycorrhiza-Ectomycorrhiza, Endomycorrhiza and their significance.</p> | 12 |
| IV | <p>Applied Mycology: Role of fungi in biotechnology, Application of fungi in industries and Agriculture (Biofertilizers);</p> <p>Phytopathology: Terms and concepts; Symptomology and identification of plant diseases with reference to fungi, bacteria, and viruses. Host-Pathogen relationships; Disease cycle and role of environment in disease development; prevention and control of plant diseases, and role of quarantine.</p> <p>Type study of few important diseases (eg: Citrus canker, Tobacco Mosaic viruses, Early blight of potato, Black stem rust of wheat, White rust of crucifers, etc)</p> | 12 |
| Total | | 48 |

SUGGESTED READINGS:

TEXT BOOKS:

1. Dubey, R.C. and Maheshwari, D.K. (1999). A text book of Microbiology, S. Chand & Company Ltd., New Delhi, India
2. Pelczar, M.J. Microbiology. 2005. Tata McGraw-Hill Co, New Delhi
3. Tortora G.J., Funke B.R., Case C.L., Weber D and Bair W. Microbiology: An Introduction (13th Edition). 2018. Pearson Publisher.
4. Lee, R.E. Phycology. 2018. Cambridge University Press, Cambridge
5. Barsanti, L. and Gualtieri, P. (2014). Algae- Anatomy, Biochemistry and biotechnology- Taylor & Francis, New Delhi
6. Kumar, H.D. (1999). Introductory Phycology. East West Press Private Ltd., New Delhi.

REFERENCE BOOKS:

1. Wiley, J.M., Sherwood, L.M. and Woolverton C.J., Prescott. Microbiology. 2017. McGraw Hill International.
2. Madigan M.T., Martinko J.M., Bender K.S., Buckley D.H., Stahl D.A., Brock T. Brock Biology of Microorganisms (14th Edition). 2014. Pearson Publisher.
3. Harvey R.A. and Cornelissen C.N. Lippincott Illustrated Reviews: Microbiology (Lippincott Illustrated Reviews Series) Third, North American Edition. 2012. LWW; Third, North American edition.
4. Bold, H.C. and Wynne, M.J. (1978). Introduction to the algae. Prentice Hall of India Private Ltd., New Delhi.
5. Bux, F. and Chisti, Y. (2016). Algae Biotechnology: Products and Processes. Springer, International Pub. Switzerland.
6. Hoek, Van den, Mann, DG, Janes, H.M. (1995). Algae-An Introduction to Phycology, Cambridge University Press, New Delhi.

Paper II:ALGAE, BRYOPHYTES AND PTERIDOPHYTES

Subject Code: BOT142C102, L-T-P-C=4-0-0-4, Credit Units: 04

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Prerequisite: Basic knowledge of biology and chemistry up to class 12

Course objective: To introduce the students to the diversity and type study of Cryptogams, their economic importance, and their evolution to present times.

Learning Outcomes:After the successful completion of the course the students will be able to:

- CO1: The course shall **infer**the students with the understanding of the wide diversity of cryptogams, their economical, ecological & evolutionary variations and roles.**BT -2**
- CO2: The learners shall **develop** an understanding of the transition of early land plants from aquatic to terrestrial habitats.**BT-5**
- CO3: The students shall be able to **outline**the applications of phycology, bryology & pteridology.**BT -5**

Detailed Syllabus

| Module | Course content | Lecture hours |
|---------------|-----------------------|----------------------|
|---------------|-----------------------|----------------------|

| | | |
|--------------|---|-----------|
| I | <p>Major Groups of Algae I: Cyanophyta, Chlorophyta and Charophyta: General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Type study of <i>Nostoc, Volvox and Chara</i></p> <p>Major Groups of Algae II: Xanthophyta, Pheophyta and Rhodophyta: General characteristics; Occurrence; Range of thallus organization; Cell structure; Reproduction. Type study of <i>Vaucheria, Ectocarpus and Polysiphonia</i></p> | 16 |
| II | <p>Introduction to Archegoniates: Unifying features of archegoniates. Transition to land habit and its evolutionary significance. Alternation of generations.</p> <p>Bryophytes: Type Studies: Classification (up to family), morphology, anatomy and reproduction, evolutionary trends of <i>Riccia, Marchantia, Anthoceros, Sphagnum and Funaria (development stages not included)</i>. Ecological and economic importance of bryophytes</p> | 16 |
| III | <p>Pteridophytes: General characteristics; Classification; Early land plants (<i>Cooksonia</i> and <i>Rhynia</i>). Type Studies: Classification (up to family), morphology, anatomy and reproduction of <i>Psilotum, Selaginella, Equisetum, Marsilea</i> and <i>Pteris</i>.</p> | 6 |
| IV | <p>Apogamy, and apospory, heterospory and seed habit, telome theory, stelar evolution. Ecological and economic importance of pteridophytes.</p> | 10 |
| Total | | 48 |

Text Books:

1. Vashistha, P.C., Sinha, A.K., Kumar, A. (2010). Pteridophyta. S. Chand. Delhi, India.
2. Parihar, N.S. (1991). An introduction to Embryophyta: Vol. I. Bryophyta. Central Book Depot. Allahabad.
3. Raven, P.H., Johnson, G.B., Losos, J.B., Singer, S.R. (2005). Biology. Tata McGraw Hill, Delhi.
4. Vanderpoorten, A. & Goffinet, B. (2009) Introduction to Bryophytes. Cambridge University Press.

Reference books:

1. R.S. Chopra. Taxonomy of Indian mosses: an introduction. 2009. Publications & Information Directorate, CSIR, New Delhi.
2. A Manual Of Cryptogamic Botany: Adapted To The Requirements Of The Science And Art Department (Classic Reprint). 2018. Charlotte M. W. Ross. Forgotten Books Publisher.

Paper III: MICROBIOLOGY, MYCOLOGY, PHYTOPATHOLOGY & CRYPTOGRAMS(PRACTICAL)

Subject Code: BOT142C113, L-T-P-C=0-0-8-4, Credit Units: 04

SCHEME OF EVALUATION: Laboratory work (P)

- a. Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/performance) (any 5)
- b. Attendance: 5%
- c. Semester End examination: 70 %

Prerequisite: Basic knowledge of biology and chemistry up to class 12

Course objective: To introduce the students to the world of microbes by showing them live cultures and photographs and enable the students to have a hands-on experience of observing of bacteria, viruses, fungi, and cryptogams

Learning Outcomes: After the successful completion of the course the students will be able to:

- CO1: **Employ** practical knowledge of microns, fungi, as well as lower plants such as algae, bryophytes and pteridophytes. **BT - 3**
- CO2: **Discover** plant diseases bases on symptoms. **BT - 3**
- CO3: **Examine** cell structures under microscopes. **BT - 4**

Detailed Syllabus

| Module | Course content | Lecture hours |
|--------|---|---------------|
| I | <p>Microbiology:</p> <ol style="list-style-type: none">1. Electron micrographs/Models of viruses – T-Phage and TMV, Line drawings/ Photographs of Lytic and Lysogenic Cycle.2. Types of Bacteria to be observed from temporary/permanent slides/photographs.3. Electron micrographs of bacteria, binary fission, endospore, conjugation,4. Gram staining: Curd and root Nodule <p>Lichens:</p> <ol style="list-style-type: none">1. Study of growth forms of lichens (crustose, foliose and fruticose) on different substrates.2. Mycorrhizae: ectomycorrhiza and endomycorrhiza (Photographs) <p>Phytopathology:</p> <ol style="list-style-type: none">1. Herbarium specimens/ photographs of bacterial diseases, fungal diseases, viral disease in plants.2. Preparation and submission of disease album. | 12 |
| II | <p>Mycology:</p> <ol style="list-style-type: none">1. Introduction to the world of fungi (Unicellular, coenocytic/septate mycelium, ascocarps & basidiocarps).2. study of asexual stage from temporary mounts and sexual structures through permanent slides. Rhizopus/ Aspergillus/ Penicillium/ Alternaria | 12 |

| | | |
|--------------|--|-----------|
| | <p>3. Peziza: sectioning through ascocarp.</p> <p>4. Agaricus: Specimens of button stage and full grown mushroom; sectioning of gills of <i>Agaricus</i>, fairy rings and bioluminescent mushrooms to be shown.</p> | |
| III | <p>Algae:</p> <p>Study of vegetative and reproductive structures of <i>Nostoc</i>, <i>Chlamydomonas</i>, <i>Volvox</i>, <i>Oedogonium</i>, <i>Coleochaete</i>, <i>Chara</i>, <i>Vaucheria</i>, <i>Ectocarpus</i>, <i>Fucus</i> and <i>Polysiphonia</i>, temporary preparations and permanent slides (subject to availability, a minimum of 5 genera to be studied).</p> | 12 |
| IV | <p>Bryophytes:</p> <ol style="list-style-type: none"> 1. Study of <i>Riccia</i> & <i>Marchantia</i>- Morphology of thallus, vertical section of thallus through Gemma cup. 2. <i>Anthoceros</i>, <i>Sphagnum</i>, <i>Funaria</i> (as per availability) - Morphology of thallus, dissection of sporophyte (temporary slide), vertical section of thallus (permanent slide). temporary slides showing antheridial and archegonial heads, longitudinal section of capsule and protonema. <p>Pteridophytes:</p> <ol style="list-style-type: none"> 1. <i>Selaginella</i>- Morphology, whole mount of leaf with ligule, transverse section of stem, whole mount of strobilus, whole mount of microsporophyll and megasporophyll (temporary slides), longitudinal section of strobilus (permanent slide). 2. <i>Equisetum</i>- Morphology, transverse section of internode, longitudinal section of strobilus, transverse section of strobilus, whole mount of sporangiophore, whole mount of spores (wet and dry) (temporary slide), transverse section of rhizome (permanent slide). 3. <i>Pteris</i>- Morphology, transverse section of rachis, vertical section of sporophyll, wholemount of sporangium, whole mount of spores (temporary slides), transverse section of rhizome, whole mount of prothallus with sex organs and young sporophyte (permanent slide). | 12 |
| Total | | 48 |

Text books:

1. Santra S. Practical Botany Vol.1 and 2. 2015. NCBA Publisher.
2. Bendre and Kumar. Practical Botany Vol.1 and 2. 2018. Rastogi Publications.
3. Internet : <https://www.biodiversitylibrary.org/item/90703#page/3/mode/1up>.
4. Pandey.B.P. Modern Practical Botany Vol. 1, 2, 3. 2011. S.Chand Publication.

AECC - 1

| |
|--|
| AECC-1/Subject Name: Communicative English- I: Developing Oral Communication and Listening Skills |
| Subject Code: CEN982A101 |
| L-T-P-C – 1-0-0-1 |
| Credit Units: 1 |
| Scheme of Evaluation: Theory + Viva-Voce + Extempore Speech Continuous Evaluation: 30 Marks Semester End Examination: Component A – Written Examination = 30 Marks Component B +C – Viva-Voce + Extempore speech = 40 Marks |

Course Objective:

The objective of the course is to introduce students to oral communication skills in English by engaging them to meaningful discussion and interactive activities.

Course Outcomes: On completion of this course students will be expected to -

- CO1: Have a knowledge of Communication process, verbal, and non-verbal communication
- CO2: Improve the skill of listening processes
- CO3: Develop a life skill on oral group communication- group discussion leadership skills, team management.
- CO4: Have a basic idea of language styles – oral and written communication.

Detailed Syllabus:

| Modules | Course Content | Lecture hours |
|----------------|--|----------------------|
| I | Basics of Communication- Introduction Communication - definition – meaning – elements - basics of communication - communication process - importance of communication Components of Communication Types/forms of Communication (Oral-written, Formal-Informal (Grapevine), Interpersonal-Intrapersonal, Mass- Group, Verbal-Non Verbal External communication, Organizational Communication- Upward, Downward, horizontal, Diagonal) Non-verbal Communication - Introduction; Body language- Personal | 4 |

| | | |
|--------------|---|-----------|
| | Appearance, Postures, Gestures, Eye Contact, Facial expressions Paralinguistic Features-Rate, Pause, Volume, Pitch/Intonation/ Voice/modulation Proxemics , Haptics, Artifactics, Chronemics | |
| II | The Listening Process Types of Listening – Superficial, Appreciative, Focused, Evaluative, Attentive, Emphatic, Listening with a Purpose , Barriers to Communication, Barriers to Listening | 4 |
| III | Focus on Oral Group Communication Nature of group communication, Characteristics of successful Group Communication Selection of group discussion-subject knowledge, leadership skills, team management Group Discussion Strategies | 4 |
| IV | Language Styles- Oral and Written Communication Technical Style, ABC of technical communication- accuracy, using exact words and phrases, brevity, clarity, Objectivity of Technical Writing - Impersonal language, Objectivity in professional speaking. | 4 |
| TOTAL | | 16 |

Textbooks:

Rizvi, M. Ashraf. (2008). *Effective Technical Communication* (11 reprint). New Delhi: Tata McGraw Hill.

Reference Books:

- Koneru, Aruna.(2017) *Professional Communication*. New Delhi: Tata McGraw Hill ISBN-13: 978-0070660021
- Hair, Dan O., Rubenstein, Hannah and Stewart, Rob. (2015).A *Pocket Guide to Public Speaking*. (5th edition). St. Martin's. ISBN-13:978-145767040

AECC – 2

| |
|---|
| AECC-2/Subject Name: Behavioural Science – I |
| Subject Code: BHS982A102 |
| L-T-P-C – 1-0-0-1 |

| |
|--|
| Credit Units: 1 |
| Scheme of Evaluation: Theory + Viva-Voce + Extempore Speech |
| Continuous Evaluation: 30 Marks |
| Semester End Examination: Component A – Written Examination = 30 Marks Component B +C – Viva-Voce + Extempore speech = 40 Marks |

Course objectives: To increase one’s ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations

Course Outcomes: On completion of this course students will be expected to -

- CO1:** Understand self-identity and identity crisis
- CO2:** Understand self-esteem.
- CO3:** Have in depth knowledge of foundation of individual behaviour.
- CO4:** Develop a life skill on Time management
- CO5:** Have an idea on barriers of communication.

| Modules | CourseContents | Lecture hours |
|----------------|--|----------------------|
| I | Understanding Self Understanding of Self, what is self? Components of Self-self-identity, Identity crisis, Definition self-confidence, self-image, Johari Window, Self Esteem, High and Low Self-esteem, Erikson's model. | 4 |
| II | Foundations of individual behavior Personality- structure, determinants, personality traits, Perception- Perceptual Process, Attribution, Errors in perception, Stereotyping, Racial Profiling, Learning- Theories of learning. | 4 |
| III | Managing self Time management: Introduction-the 80:20, sense of time management, Three secrets of time management, Effective scheduling, Stress management, effects of stress, kinds of stress-sources of stress, Signs of stress, Stress management tips. | 4 |
| IV | Behaviour and communication. Behaviour as a barrier to Communication, ways to overcome the barriers, Non-verbal communication-body language (voluntary and involuntary body language) forms of body language, Interpreting body language | 4 |
| Total | | 16 |

Text books

- Soft skills by Dr.K.Alex, S.Chand.
- Organisationalbehaviour by S.P Robbins, Judge , Vohra 18th Ed.

DETAILED SYLLABUS FOR GENERIC ELECTIVE 1

1st Semester

PAPER GE 1:BIODIVERSITY IN PLANTS

SUBJECT CODE: BOT142G101, CREDIT UNITS: 2+0+1=3

SCHEME OF EVALUATION: Combined Theory & and laboratory work (TP):

- a.Continuous Evaluation: 15% (Assignment. Class Test, Seminar, Lab Experiment, Copy and Viva: Any Three)
 b.Mid-term examination: 10%
 c.Attendance: 5%
 d.Semester End examination: 70 %

Course objective: Develop an understanding of the various groups of Plant kingdom and Acquire knowledge about the evolution from lower plants to higher plants in the Plant kingdom.

Learning Outcomes:After the successful completion of the course the students will be able to:

- CO1: **Recognize** various plant groups of plants from primitive to highly evolved. **BT 1**
 CO2: **Infer** foundation for further studies in Botany.**BT 2**

Prerequisite: Basic knowledge of biology of class XII.

| Module/ Experiment | Topic and Course content | Lecture hours |
|-----------------------|---|------------------|
| Theory | | |
| I | Microbes: Discovery, general characteristics and economic importance of viruses and bacteria. | 6 |
| II | Algae: General characteristics, range of thallus organization, reproduction, ecological and economic importance of algae. Fungi: General characteristics, range of thallus organization, reproduction, ecological and economic importance of fungi. General account and significance of symbiotic associations: Lichens and Mycorrhiza. | 6 |
| III | Archegoniates: Unifying features, Bryohytes: General characteristics, range of thallus organization, reproduction, ecological and economic importance, adaptation to land habit. Pteridophytes: General characteristics, ecological and economic importance. | 6 |
| IV | Gymnosperms: General characteristics, ecological and economic importance. Angiosperms: General characteristics, ecological and economic importance | 6 |
| Total | | 24 |
| Practical | | |
| 1 | Study of preservation of botanical specimens, different instruments used in a | 1 |

| | | |
|--------------|--|-----------|
| | laboratory and Microscopy and different sections of plant material and preparation of microscope slides. | |
| 2 | Study of different staining procedures (single, double and Gram staining), Preparation of Gram stain and other important stains used in laboratory studies | 1 |
| 3 | Study of different types of bacteria through photographs and permanent slides | 1 |
| 4 | Study of various structures of <i>Nostoc</i> and <i>Fucus</i> through temporary preparations and permanent slides | 1 |
| 5 | Study of various structures of <i>Rhizopus</i> and <i>Agaricus</i> through temporary preparations and permanent slides | 2 |
| 6 | Study of various growth forms of lichen and different types of mycorrhiza through photographs | 1 |
| 7 | Study of various structures of <i>Marchantia</i> through temporary preparations and permanent slides | 1 |
| 8 | Study of various structures of <i>Selaginella</i> and <i>Equisetum</i> through temporary preparations and permanent slides | 1 |
| 9 | Study of various structures of <i>Cycas</i> and <i>Pinus</i> through temporary preparations and permanent slides | 2 |
| 10 | Study of floral structures of <i>Hibiscus</i> sp. and <i>Tagetes</i> sp. (Marigold). | 1 |
| Total | | 12 |

Text Books:

1. Ghosh, Bhattacharyya and Hait. A textbook of Botany , Vol 1-4. 2015.NCBA Publishers
2. B. P. Pandey . Botany for Degree students – Biodiversity. 2010. S. Chand Publishers.

Reference Books:

1. Gangopadhyay A. Plant Biodiversity.2007. Gene-Tech Books.

DETAILED SYLLABUS FOR GENERIC ELECTIVE 2

PAPER GE 2:NURSERY AND GARDENING

SUBJECT CODE: BOT142G102, CREDIT UNITS: 2+0+1=3

SCHEME OF EVALUATION: Combined Theory & Practical Papers (TP):

- a.Continuous Evaluation: 15% (Assignment, Class Test, Seminar, Lab Experiment, Copy and Viva: Any Three)
- b.Mid-term examination: 10%
- c.Attendance: 5%
- d.Semester End examination: 70 %

Course objective: To enable the students about different branches of nursery and gardening, importance and scope of with reference to propagation techniques, canopy management, intercultural practices, diseases and disorders of nursery crops.

Learning Outcomes: After the successful completion of the course the students will be able to:

- CO1: **Recognize** various plant types and their propagation methods.**BT 1**
- CO2: **Produce** entrepreneurial aspects by studying various commercialization and economic benefits of plant propagation and cultivation.**BT 2**
- CO3: **Relate** various propagation and cultivation methods with the types of plant in different gardens.
BT 4

Prerequisite: Basic knowledge of biology of class XII.

Detailed Syllabus:

| Modules | Course content | Periods |
|----------------|--|----------------|
| I | Introduction to nursery techniques History and importance of nursery; role of Nursery; Guidelines for nursery raising; components of nursery; Layout and management of a good nursery, planting and layout of orchard, Types of nursery plant; nursery tools; Quality propagules production; selection of plants, | 6 |
| II | Propagation types, Seed extraction and storage of Nursery crops: Sexual and vegetative propagation, grafting, budding, Air-layering. Propagation media and micro propagation, establishment of commercial nurseries-its merits and demerits. Seed extraction and storage of nursery plants; soil management, of rootstocks, | 6 |
| III | Production and management of nursery crops: Production of nursery plant and gardening; Green house types; (Inter, mixed, multilayer) Types of chambers, poly house, net house, Advances of fruits and vegetables crops; Stress management of nursery crops and breeding of nursery crop),Bureau of Indian Standards (BIS-2008); | 6 |
| IV | An introduction to gardening: Brief history of gardening, choice and selection of plants for garden, soil, diseases and pests and its management; layout and designing of a gardening, types of landscaping garden; creative gardening | 6 |
| TOTAL | | 24 |

Practical (1 hours of practical per week)

1. To make an assessment of guidelines of nursery
2. Layout of nursery and propagation of nursery crop through hydroponics
3. Propagation of selected nursery crops suited to local condition
4. Grafting, budding and micro propagation of selected nursery crops
5. Raising rooting from cuttings in selected nursery crops
6. Projects based on theory course

Textbooks :

1. George Nicholson John Garrett J W H Trail (1851-1919):The Illustrated Dictionary of Gardening; A Practical and Scientific Encyclopaedia of Horticulture for Gardeners and Botanists, Nov 2018
2. R.R. Sharma and Hare Krishna (2019): A Text Book of Plant Propagation and Nursery Management (19) CBS Publisher & Distributors ISBN 9788181891983

References:

1. Kaushal K.Misra, Satish Chand, Navneet K. Misra: Plant Propagation,Biotech Books (2017), ISBN: 9788176223843
2. Allen M. Armitage's: Garden Perennials,Timber Press ©2000, ISBN: 0-88192-435-0

SEC/Subject Name: PLANT PROPAGATION & NURSERY MANAGEMENT

Subject Code: BOT142S111, L-T-P-C – 0-0-4-2, Credit Units:2

SCHEME OF EVALUATION: Practical Only (P)

- a.Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/performance) (any five).
- b.Attendance: 5%
- c.Semester End examination: 70 %

Course objective: To inculcate the importance of studying horticultural practices and usage of horticultural Crops and To impart the basic skills of entrepreneurship in the students specifically in the field of horticulture

Learning Outcomes: After the successful completion of the course the students will be able to:

- CO1: **Label** various practical application of different horticultural practices. **BT 1**
CO2: **Discover**with the horticulture based industries at national and international level.**BT 3**

| Module | Course content | Lecture hours |
|--------|---|---------------|
| I | Introduction: Concept, Objectives, Branches of Horticulture, Career opportunities in the horticulture. Garden Tools and their Implementation | 2 |

| | | |
|--------------|---|-----------|
| II | <p>Soil and its preparation: Physical texture and composition of soil, soil types, soil pH, preparation of beds and preparation of soil mixtures / garden soil.</p> <p>Fertilizers, Organic Manures and Substrates (preparations)</p> | 6 |
| III | <p>Potting, Repotting and Transplantation: Types of pots, Plants suitable for pot culture, Potting, Repotting and Transplantation.</p> <p>Pruning: Introduction, objectives; Types and season of pruning, special pruning techniques, differential pruning technique, pruning of flowering and fruit plants</p> | 8 |
| IV | <p>Training: Introduction, systems of pruning-leader and modified leader systems, training of plants requiring support of Structures, training of plants do not requiring support of Structure and training of ornamental plants.</p> | 8 |
| Total | | 24 |

DETAILED SYLLABUS OF 2ND SEMESTER

Paper I: GYMNOSPERMS & ANGIOSPERMS

Subject Code: BOT142C201, L-T-P-C=4-0-0-4, Credit Units: 04

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Prerequisite: Basic knowledge of biology of class XII.

Course objective: To introduce the students to the world of phanerogams and their evolutionary significance, their detailed taxonomy, and their life cycles.

Learning Outcomes: After the successful completion of the course the students will be able to:

CO1: **Identify** the phanerogams, their vegetative and reproductive structures and their importance. **BT 1**

CO2: **Explain** evolutionary lines in each group of gymnosperms and angiosperms. **BT 2**

CO3: **Relate** the differences and the affinities between the Gymnosperms & Angiosperms. **BT 3**

Detailed Syllabus

| Modules | Course content | Lecture hours |
|----------------|---|----------------------|
| I | Gymnosperms I: History and recent systems of classification of gymnosperms; origin and evolution of gymnosperms; affinities of gymnosperms with pteridophytes and angiosperms; distribution of gymnosperms in India; Ecological and economic importance of gymnosperms; Gymnosperms II: Gymnosperms: General characteristics. Classification (up to family). Morphology, anatomy and reproduction of affinities of living gymnosperms: Cycas, Pinus and Gnetum (Developmental details not to be included). | 12 |
| II | Angiosperms: General characteristics; Basal angiosperms and Magnoliids; Basal monocots; Petaloid monocots; Commelinids; Basal eudicots and Caryophyllids; Rosids; Asterids. Evolutionary trend in angiosperms plants. Ideas on the origin and evolution of roots, stem, leaf, stamen and carpel. Range of vegetative and reproductive structures and their modification in angiosperms. | 12 |
| III | Angiosperms Morphology (stems, roots, leaves & flowers, inflorescence): modifications and morphology of stems, roots, leaves and buds. Types of inflorescence, flowers, flower parts, fruits and type of placentations, definition and types of seeds. Palynology: pollen structure, pollen morphology; basic concepts of applied palynology. Role in taxonomic studies | 12 |

| | | |
|--------------|--|-----------|
| IV | <p>Origin and evolution of Plants: Origin and evolution of plants through Geological Time scale.</p> <p>Paleobotany- Paleobotanical records, plant fossils, Preservation of plant fossils - impressions, compressions, petrification's, moulds and casts, pith casts. Radiocarbon dating.</p> <p>Fossil taxa- Rhynia, Lepidodendron, Lepidocarpon, Lyginopteris and Cycadeoidea. Exploration of fossil fuels.</p> | 12 |
| Total | | 48 |

Text Books:

1. A.V.S.S.Sambamurty. A Textbook Of Bryophytes, Pteridophytes, Gymnosperms And Paleobotany. 2006. I.K. International Publishing House Pvt.Ltd.
2. C.J.Chamberlain. Gymnosperms: Structure And Evolution. 2009. Andesite Press.
3. W.N. Stewart and G.W. Rothwell. Paleobotany and the evolution of plants. 2010. Cambridge University Press.
4. J. M. Coulter, C.J.Chamberlain. Morphology Of Gymnosperms. 2016. Wentworth Publishers.
5. G. M. Smith. Cryptogamic botany. 1955. Mcgraw-hill (available online).

Reference Books:

1. A Manual Of Cryptogamic Botany: Adapted To The Requirements Of The Science And Art Department (Classic Reprint). 2018. Charlotte M. W. Ross. Forgotten Books Publisher.

Paper II: PLANT ANATOMY & TAXONOMY

Subject Code: BOT142C202, L-T-P-C=4-0-0-4, Credit Units:04

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Prerequisite: Basic knowledge of biology of class XII

Course objective: to introduce the students to the different tissue systems in angiosperms and how they function, their developmental theories of root and shoot development.

Learning Outcomes After the successful completion of the course the students will be able to:

- CO1: **Recognize** the various tissue organization of the plant body **BT 1**
- CO2: **Describe** the development and functions of various tissue systems inside the plant body. **BT 2**
- CO3: **Analyze** special types of anatomical adaptations in xerophytes and hydrophytes. **BT 4**

Detailed Syllabus

| Modules | Course content | Lecture hours |
|--------------|---|---------------|
| I | Introduction and organization of plant body: Tissues: Classification of tissues; Simple and complex tissues; Tissue system. Stem: Organization of shoot apex (Apical cell theory, Histogen theory, Tunica Corpus theory. Types of vascular bundles; Structure of dicot and monocot stem anatomy. Leaf: Structure of dicot and monocot leaf anatomy, Kranz anatomy. | 12 |
| II | Root: Organization of root apex (Apical cell theory, Histogen theory, Korper-Kappe theory); Quiescent centre; Root cap; Structure of dicot and monocot root; Endodermis, exodermis and origin of lateral root. Vascular Cambium: Structure, function and seasonal activity of cambium; Secondary growth in root and stem Wood: Axially and radially oriented elements; Types of rays and axial parenchyma; Sapwood and heartwood; Ring and diffuse porous wood. Adaptive anatomy: Hydrophytes and xerophytes. | 12 |
| III | Angiosperm Taxonomy: Aims of taxonomy, History of classification- Artificial, Natural (Bentham and Hooker), Phylogenetic (Englar&Prantl, Hutchinson, Takhtajan), APG system- a brief idea; Role of Morphology, anatomy, embryology, cytology, phytochemistry, and palynology in relation to taxonomy; Botanical Survey of India- Organization and activities, Botanical garden and its importance. | 12 |
| IV | Botanical nomenclature: Principles and rules (ICN); Typification, valid and effective publication, rejection of names, principle of priority and its limitations. Family studies: Affinities, phylogeny, economic importance and comparative studies of the following families: Magnoliaceae, Brassicaceae, Fabaceae, Malvaceae, Cucurbitaceae, Euphorbiaceae, Apiaceae, Rubiaceae, Solanaceae, Acanthaceae, Verbenaceae, Lamiaceae, Asteraceae. Arecaceae, Musaceae, Zingiberaceae, Orchidaceae, Poaceae. | 12 |
| Total | | 48 |

Text Book:

1. Evert, R.F.. Esau's Plant Anatomy: Meristems, Cells, and Tissues of the Plant Body: Their Structure, Function and Development. 2006. John Wiley and Sons, Inc.
2. Annie Ragland. Fundamentals Of Plant Anatomy And Microtechniques. 2016. Saras Publication.
3. Katherine Esau .Anatomy Of Seed Plants. 2006. Wiley Publications.

4. B.P.Pandey. Plant Anatomy. 2001. S.Chand Publication.
5. Singh, (2012). Plant Systematics: Theory and Practice Oxford & IBH Pvt. Ltd., New Delhi. 3rd edition.
6. Maheshwari, J.K. (1963). Flora of Delhi. CSIR, New Delhi.

Reference Books:

1. Charles B. Beck. An introduction to plant structure and development (plant anatomy for 21st century). (2nd edition). 2010. Cambridge University Press.
2. James D. Mauseth. Plant Anatomy. 2008. The Blackburn Press.
3. William Chase Stevens. Plant Anatomy From The Standpoint Of The Development And Functions Of The Tissues: And Handbook Of Micro-Technic. 2012. Wentworth Press.
4. Radford, A.E. (1986). Fundamentals of Plant Systematics. Harper and Row, New York.
5. Jeffrey, C. (1982). An Introduction to Plant Taxonomy. Cambridge University Press, Cambridge.
6. Judd, W.S., Campbell, C.S., Kellogg, E.A., Stevens, P.F. (2002). Plant Systematics-A Phylogenetic Approach. Sinauer Associates Inc., U.S.A. 2nd edition.

Paper III: GYMNOSPERMS, ANGIOSPERMS, PLANT TAXONOMY & ANATOMY (PRACTICAL)

Subject Code: BOT142C213, L-T-P-C= 0-0-12-6, Credit Units: 06

SCHEME OF EVALUATION: Practical (P)

- a. Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/performance) (any five).
- b. Attendance: 5%
- c. Semester End examination: 70 %

Prerequisite: Basic knowledge of biology of class XII.

Course objective: To impart practical knowledge on various group of archegoniates, have a clear concept on cellular structure of plants by microscopic observation, have a hands on experience on economically important plant parts used and do microchemical tests to observe the molecules present there

Learning Outcomes

- CO1: The course will help the students to gain practical knowledge of vascular plants.
- CO2: They will be equipped to identify various anatomical structures of plant body.
- CO3: They will be able to identify economic importance of various plants.

Detailed Syllabus

| Module | Course content | Lecture hours |
|--------|--|---------------|
| I | <p>Plant anatomy:</p> <ol style="list-style-type: none"> 1. Study of anatomical details through permanent slides/temporary stain mounts/macerations/museum specimens/microphotographs with the help of suitable examples. 2. Apical meristem of root, shoot and vascular cambium. Distribution and types of parenchyma, collenchyma and sclerenchyma. | 12 |

| | | |
|--------------|--|-----------|
| | <p>3. Xylem: Tracheary elements-tracheids, vessel elements; thickenings; perforation plates; xylem fibres.</p> <p>4. Wood: ring porous; diffuse porous; tyloses; heart- and sapwood.</p> <p>5. Phloem: Sieve tubes-sieve plates; companion cells; phloem fibres.</p> | |
| II | <p>7. Epidermal system: cell types, stomata types; trichomes: non-glandular and glandular.</p> <p>8. Root: monocot, dicot, secondary growth.</p> <p>9. Stem: monocot, dicot - primary and secondary growth; periderm; lenticels.</p> <p>10. Leaf: isobilateral, dorsiventral, C4 leaves (Kranz anatomy).</p> <p>11. Adaptive Anatomy: xerophytes, hydrophytes.</p> <p>12. Secretory tissues: cavities, lithocysts and laticifers.</p> | 12 |
| III | <p>Plant taxonomy:</p> <p>1. Study of vegetative and floral characters of the following families (Description, V.S. flower, section of ovary, floral diagram/s, floral formula/e and systematic position according to Bentham & Hooker's system of classification):</p> <ul style="list-style-type: none"> • Ranunculaceae –<i>Ranunculus/Delphinium</i> • Brassicaceae –<i>Brassica/Rorippa</i> • Apiaceae - <i>Coriandrum / Foeniculum</i> • Rubiaceae – <i>Ixora/Hedyotis</i> • Asteraceae - <i>Vernonia/Ageratum/ Eclipta/Mikania</i> • Solanaceae - <i>Solanum nigrum/Solanum indicum</i> • Lamiaceae - <i>Salvia/Ocimum</i> • Acanthaceae – <i>Justicia/Phlogocanthus</i> • Euphorbiaceae - <i>Euphorbia hirta/E.milii/E. pulcherrima</i> • Musaceae - <i>Musa</i> • Liliaceae - <i>Lilium/Allium</i> • Poaceae - <i>Triticum/Avena/Oryza</i> | 12 |
| IV | <p>2. Field visit (local) – Subject to grant of funds from the university.</p> <p>3. Mounting of a properly dried and pressed specimen of any wild plant with herbarium label (to be submitted in the record book).</p> | 12 |
| Total | | 48 |

1. Santra S. Practical Botany Vol.1 and 2. 2015. NCBA Publisher.
2. Bendre and Kumar. Practical Botany Vol.1 and 2. 2018. Rastogi Publications.
3. Internet : <https://www.biodiversitylibrary.org/item/90703#page/3/mode/1up>.
4. Pandey.B.P. Modern Practical Botany Vol. 1, 2, 3.2011.S.Chand Publication.

AECC 3

| | |
|-----------------------------|---|
| AECC-3/Subject Name: | Communicative English- II: Conversation and Public Speaking |
|-----------------------------|---|

| |
|---|
| Subject Code: CEN982A201 |
| L-T-P-C – 1-0-0-1 |
| Credit Units: 1 |
| Scheme of Evaluation: Theory + Viva-Voce + Extempore Speech Continuous Evaluation: 30 Marks Semester End Examination: Component A = Written Examination = 30 Marks Component B + C = Viva-Voce + Extempore speech = 40 Marks |

Course Objective: The objective of the course is to give students a platform to enhance their speaking and conversational skills in English by engaging them in meaningful discussions and interactive activities.

Course Outcomes: On completion of this course students will be expected to -

- CO1: Improve speaking skill.
- CO2: Develop a life skill on conversation.
- CO3: Improve the skill of public speaking.

Detailed Syllabus:

| Modules | Course Content | Lecture hours |
|----------------|--|----------------------|
| I. | Speaking Skills Speaking – The Art of Speaking, Goals, Speaking Styles, The Speaking Process Importance of Oral Communication, Choosing the form of Communication, Principles & Guidelines of Successful Oral Communication, Barriers to Effective Oral Communication Three aspects of Oral Communication – Conversing, Listening and Body Language Intercultural Oral Communication | 4 |
| II. | Conversational Skills : Listening and Persuasive Speaking Conversation – Types of Conversation, Strategies for Effectiveness, Conversation Practice, Persuasive Functions in Conversation, Telephonic Conversation and Etiquette Dialogue Writing, Conversation Control | 4 |
| III. | Transactional Analysis The Role of Intonation , Strokes, Psychological Characteristics of Ego States (The Parent, The Adult, The Child), Structure and Aspects of Human Personality Analysing Transactions – Complementary Transactions, Crossed Transactions, Duplex or Ulterior Transactions, How to Identify the Ego States of Interacting Individuals, How to Manage Conversations, Structural Analysis, Certain Habits of Ineffective Conversationalists | 4 |

| | | |
|--------------|---|-----------|
| IV | Public Speaking | 4 |
| | Business Presentation and Speeches – Difference | |
| | Elements of a Good Speech – Planning, Occasion, Audience, Purpose, Thesis, Material | |
| | Organising and Outlining a Speech Outline, Types of Delivery | |
| | Guidelines for Delivery – Verbal Elements, Non-Verbal Elements, Vocal Elements, Visual Elements, Controlling Nervousness and Stage Fright | |
| TOTAL | | 16 |

Text/Reference Books:

- Mehra, Payal. (2012). *Business Communication for Managers*: Dorling Kindersley (India) Pvt. Ltd. Page 75 – 83. ISBN 978-81-317-5865-6
- Raman, Meenakshi and Singh, Prakash.(2012). *Business Communication* (2nd Edition): Oxford University Press. Page 123 – 165.ISBN-13:978-0-19-807705-03
- Raman, Meenakshi and Sharma, Sangeeta. (2011). *Technical Communication: Principles and Practice* (2nd Edition): Oxford University Press. Page 137 – 148 ISBN-13:978-0-19-806529-6
- Sengupta, Sailesh.(2011) *Business and Managerial Communication*. New Delhi : *PHI Learning Pvt. Ltd.* Page 136-153.ISBN-978-81-203-4435-8

AECC-4

| |
|--|
| AECC-4/Subject Name: Behavioural Science - II |
| Subject Code: BHS982A202 |
| L-T-P-C – 1-0-0-1 |
| Credit Units: 1 |
| Scheme of Evaluation: Theory + Viva-Voce + Extempore Speech Continuous Evaluation: 30 Marks Semester End Examination: Component A – Written Examination = 30 Marks Component B +C – Viva-Voce + Extempore speech = 40 Marks |

Course objectives: To increase one’s ability to draw conclusions and develop inferences about attitudes and behaviour, when confronted with different situations that are common in modern organizations

Course Outcomes: On completion of this course students will be expected to -

- CO1:** Understand culture and personality
- CO2:** Understand Value.
- CO3:** Demonstrate leadership.
- CO4:** Develop a life skill on motivation

| Module | Course Contents | Lecture hours |
|--------|---|---------------|
| I | Culture and Personality Relation Between Culture and Personality with Relevant Examples, Cultural Iceberg, Overview of Hofstede's Framework, Discussion of the four dimensions of Hofstede's Framework. | 4 |
| II | Attitudes and Values Attitude's definition: changing our own attitudes, Process of cognitive dissonance Types of Values, Value conflicts, Merging personal and Organisational values, changes of values with time, male & female values differences. | 4 |
| III | Leadership Definition of leadership, types of leadership, Leadership Continuum Transformational & transactional Leadership, Ethical Leadership. | 4 |
| IV | Motivation Definition of motivation with example, Theories of Motivation (Maslow & X and Y) Applications of motivation. | 4 |
| | | 16 |

Text books:

- Organizational Behaviour by Kavita Singh (Vikas publishers, 3rd Edition).
- Organisationalbehaviour by S.P Robbins, Judge , Vohra 18th Ed.

DETAILED SYLLABUS OF GENERIC ELECTIVE

PAPER GE 3: MUSHROOM CULTIVATION,

SUBJECT CODE: BOT142G201, CREDIT UNITS: 2+0+1=3

SCHEME OF EVALUATION: Combined Theory & Practical Papers (TP):

- a.Continuous Evaluation: 15% (Assignment. Class Test, Seminar, Lab Experiment, Copy and Viva: Any Three)
b.Mid-term examination: 10%
c.Attendance: 5%
d.Semester End examination: 70 %

Course objective: To Identify edible types in mushroom, Selection of appropriate cultivation sites, Designing and construction of Mushroom Farm, Packaging, storing and grading of Mushrooms.

Learning Outcomes: On completion of this course students will be expected to -

- CO1: **Identify** of prospects of Mushroom cultivation **BT 2**
 CO2: **Illustrate** cultivation of different types of edible Mushroom. **BT 3**
 CO3: **Outline** concepts on the methods of harvesting of Mushroom and methods of grading, packing and storing of Mushroom. **BT 4**

Prerequisite: Basic knowledge of biology of class XII.

Detailed syllabus

| Module/ Experiment | Topic/ Course content | Lecture hours |
|-----------------------|---|---------------|
| Theory | | |
| I | Introduction to Mushroom Cultivation, Its natural growth aspects and climatic requirement, Mushroom edible types, Appropriate Mushroom Cultivation sites | 08 |
| II | Designing and construction of Mushroom farm, Role of composting in Mushroom Cultivation and methods of composting, Types of Mushroom growing facilities and fixtures, Disease control and pest management | 08 |
| III | Harvesting packaging & grading and storage of Mushroom, Post harvest procedures. | 08 |
| IV | Value added products of Mushroom. | 08 |
| Practical | | |
| 1 | Project based on theory and local mushroom flora. | |
| Total | | 32 |

References:

Internet based latest information.

PAPER GE 4: PLANT ECOLOGY AND ECONOMIC BOTANY

SUBJECT CODE: BOT142G202, CREDIT UNITS: 2+0+1=3

SCHEME OF EVALUATION: Combined Theory & Practical Papers (TP):

- a. Continuous Evaluation: 15% (Assignment, Class Test, Seminar, Lab Experiment, Copy and Viva: Any Three)
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70 %

Course objective: To impart knowledge on interaction of plants with surrounding environments, on economic use of plants and their distribution

Learning Outcomes: On completion of this course students will be expected to –

- CO1: **Define** various plant interactions and ecological factors.**BT 1**
 CO2: **Describe** various application of plants for different economic uses.**BT 2**

Prerequisite: Basic knowledge of biology of class XII.

Detailed syllabus

| Module/ Experiment | Topic/ Course content | Lecture hours |
|-----------------------|--|------------------|
| Theory | | |
| I | Introduction and Ecological factors: Roles played by soil, water, light, temperature. Adaptations of hydrophytes and xerophytes. Ecosystem and Plant communities: Ecosystem introduction, concept, definition, energy flow, food chain and food webs, ecological pyramids, general account of biogeo-chemical cycles, Ecotone and edge effect, succession, processes, and types. Phytogeography: Principle biogeographical zones | 06 |
| II | Environmental pollution and Conservation: Environmental pollution with special reference to air and water pollution- causes, effects and control measures. Green-house effect. Types of <i>ex-situ</i> and <i>in-situ</i> conservation. | 06 |
| III | Origin of cultivated plants: Concept of centers of origin, their importance with reference to Vavilov’s work. Cereals and Legumes: Rice and Wheat-origin, morphology and uses, General account of legumes. | 06 |
| IV | Spices, Condiments and Beverages: General account with special reference to black pepper and ginger, Tea- morphology, processing and uses. Oils and Fats and Fiber-yielding Plants: General description of oils and fats. General description with special reference to Cotton- (botanical name, family, arts used, morphology and uses) | 06 |
| Practical | | |
| 1 | Determination of soil pH, soil moisture, bulk density. | 3 |
| 2 | Study of morphological adaptations of hydrophytes and xerophytes. | 3 |
| 3 | Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus (species to be listed). | 3 |
| 4 | Study of economically important plants through specimens, sections and micro-chemical tests- Rice, Pea, Mustard, Neem, Sugar cane | 3 |

Text Books:

1. Ghosh, Bhattacharryya and Hait. A textbook of Botany , Vol 1-4. 2015.NCBA Publishers
2. B. P. Pandey . Botany for Degree students – Biodiversity. 2010. S. Chand Publishers.

SEC/Subject Name: PLANT PROPAGATION & NURSERY MANAGEMENT: HORTICULTURE

Subject Code: BOT142S211

L-T-P-C – 0-0-4-2

Credit Units: 2

SCHEME OF EVALUATION: Practical (P)

- a. Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement /performance) (any five).
- b. Attendance: 5%
- c. Semester End examination: 70 %

Course objective To inculcate the importance of studying horticultural practices and usage of horticultural Crops and impart the basic skills of entrepreneurship in the students specifically in the field of horticulture.

Learning Outcomes: On completion of this course students will be expected to:

- CO1: define the scope and concept of the horticulture. BT 1
- CO2: **Discover** plant propagating media. BT 3
- CO3: **Analyse** sowing of seeds and plant cuttings in different media. BT 4
- CO4: **Identify** preparation of nursery seed beds. BT 4

Detailed syllabus:

| Module | Course content | Lecture hours |
|--------|---|---------------|
| I | Types of Horticultural Plants: Annuals, Perennials, climbers, shrubs and trees (at least two examples with morphology and horticultural use and applications from each type). Garden Tools and their Implementation | 2 |
| II | Plant Propagation: Classifications of plant propagation methods, Choice of propagation methods. Propagating Structures, Equipment's and Media. Sexual Propagation / Seed Propagation; Asexual Propagation / vegetative propagation; Micropropagation and ist methods | 6 |
| III | Nursery Management: Basics of nursery management: Propagules for different | 8 |

| | | |
|--------------|---|-----------|
| | horticultural crops, Technical Knowledge, Nursery Registration, Linkages, Finance, Hi-tech interventions, Marketing management, types of nursery, infrastructure and requirements Layout of a model nursery: Fencing, Roads and paths, Progeny block/Mother plant block, Irrigation system, Office cum store, Seed beds, Nursery beds, Propagation structures, Potting mixture and potting yard, Packing yard and Compost unit. | |
| IV | Nursery management practices: Mulching, Manuring, Irrigation, Hoeing and weeding, Removal of polythene strip, De-shooting, Staking, Single stemming, Uprooting and packing of plants, manures and fertilizer, Plant Protection; commercial importance | 8 |
| Total | | 24 |

TEXTBOOKS & REFERENCE BOOKS:

1. Rao KM (2005) Textbook of Horticulture. McMillan India Ltd, New Delhi.
2. Kaul GL (1989) Horticulture crop in India.
3. Andre G (1994) Application of Botany in Horticulture. Science Publishers, USA
4. Arora JS (2014) Introductory Ornamental Horticulture. Kalyani Publishers, New Delhi
5. Duryea ML (1984) Nursery cultural practices: Impacts on seedling quality. In forest nursery manual: Production of Bareroot seedlings. Duryea ML and Thomas, DL (eds.) MartinusNijhoff/Dr W. Junk publishers. The Hauge/Boston/Lancaster, for forest research laboratory, Oregon State University. Corvallis.
6. Aldhous JR (1972) Nursery practices [R]. Forestry Commission Bulletin No. 43. London: Page Bro Ltd. Pp. 184.

Project Report may be prepared on the following topics and likewise:

1. Study of Nursery Management.
2. Study of horticultural crops.
3. Case study on nursery.
4. Study of propagation of horticultural crops.
5. In vitro culture of horticultural crops.

DETAILED SYLLABUS OF 3rd SEMESTER

PAPER I: CELL BIOLOGY & MOLECULAR BIOLOGY

SUBJECT CODE: BOT142C301, L-T-P-C: 4-0-0-4, CREDIT UNITS: 04

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Pre-requisite: Basic knowledge of biology and chemistry up to class 12

Course objective: The present course has been devised to familiarize students with the structural and functional aspects of cell, the basic unit of life, and its different organelles. We aim to transmit the student how morphology, structure and function are connected. Also the course will familiarize students with the concept of molecular biology: understanding the process of replication, transcription and translation and learning how these are regulated

Learning Outcomes: On completion of this course students will be expected to –

CO1: **Describe** the components of cells and how cell organelles interact with each other to carry out the fundamental biological process. BT 1

CO2: **Express** significance of cell division for multicellular organism and the key events that happen during cell cycle. BT 2

CO3: **Discover** Central Dogma of life and understand the regulation of gene expression. BT 3

Detailed Syllabus:

| Module | Course content | Lecture hours |
|---------------|--|----------------------|
| I | Cell: Cell as a unit of structure and function; Origin of eukaryotic cell (Endosymbiotic theory); Structural organization of prokaryotic and eukaryotic cells. Cell organelles: Plasma membrane: structure and functions; Membrane transport: ion channels and pumps; Mitochondria: structure, and functions; Chloroplast: structure and organization of photosynthetic complexes; endoplasmic reticulum, rough and smooth; Nuclues: structure | 12 |
| II | Cell division: Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle checkpoints. Eukaryotic Genome Organization: Eukaryotic chromatin and chromosome: Changes in chromosomes with reference to centromeres and telomeres; Structure of nucleic acids: DNA and its A, B and Z conformations, RNA and its types: t-RNA, r-RNAs and mRNA | 12 |
| III | DNA replication: Machinery and mechanism in prokaryotes and eukaryotes; RNA transcription: Machinery and mechanism in prokaryotes and eukaryotes; RNA processing: concept of split gene, splicing ; RNA editing; Genetic code and exceptions to its universality. | 12 |
| IV | Translation: Machinery and mechanism (tRNA charging, initiation in prokaryotes and eukaryotes, elongation and termination); Regulation of gene expression in prokaryotes and eukaryotes: lac and tryptophan operon; regulation at transcriptional and | 12 |

| | | |
|--|---------------------------|-----------|
| | posttranscriptional level | |
| | TOTAL | 48 |

Textbooks:

1. Lodish, K.; Bretscher, A.; Berk, K.; Ploegh, S.,2013. Molecular cell biology, 7th Ed.
2. Garrett, R. H.; Grisham, C. M. Biochemistry. Saunders. Orlando (Fla.): Brooks/Cole, 2005.
3. Voet, D., Voet, J.G. and Pratt, C.W., 2016. Fundamentals of biochemistry: life at the molecular level. John Wiley & Sons. 6th Ed
4. Lewin, B. Genes IX. Nova York.,2007. Oxford University Press, Inc.
5. Alberts, B.; Johnson, A.; Lewis, J.; Raff, M.; Roberts, K.; Walter, P.,2008. Molecular biology of the cell. Garland science, 5th Ed.
6. Cooper, G.M. I Hausman, R.E.,2007. The Cell. A Molecular approach. Washington D.C. and Sunderland.

.References:

1. Karp, G., Iwasa, J. and Marshall, W., 2020. *Karp's Cell and Molecular Biology*. John Wiley & Sons.
2. Robertis, D., 1987. Cell and molecular biology.
3. Murray, K., Rodwell, V., Bender, D., Botham, K.M., Weil, P.A. and Kennelly, P.J., 2009. Harper's illustrated biochemistry. 28. *Citeseer, New York, United States*.

Paper II: CELL, MOLECULAR BIOLOGY& ECONOMIC BOTANY(PRACTICAL)

Subject Code: BOT142C311, L-T-P-C: 0-0-8-4, Credit Units: 04

SCHEME OF EVALUATION: Practical (P)

- a.Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/performance) (any five).
- b.Attendance: 5%
- c.Semester End examination: 70 %

Pre-requisite: Basic knowledge of biology and chemistry up to class 12

Course objective: The course aims to teach to student the bases of basic research in cellular and molecular biology, introduce them to the preliminary bioinformatic tools that will help them reaching the correct conclusions from their experimental results.

Learning Outcomes: At the end of the course the student will be able to:

- CO1:**Reproduce** the different cell division techniques. BT 1
- CO2:**Demonstrate**molecular biology techniques like DNA isolation, spectrophotometric analysis PCR. BT 3
- CO3:By the application of bioinformatic tool students will be able to **illustrate and analyze** the experimental data. BT 4
- CO4:**Relate** about the economic and commercial importance of plants BT 5

Detailed Syllabus:

| Module | Course content | Lecture hours |
|--------|---|---------------|
| I | 1. Microscopy- Theoretical knowledge of Light and Electron microscope. 2. To identify the different types cells present in the leaf cross section. 3. Study of cell division – Mitosis in onion root tips (Squash method). 4. Study of cell division – Meiosis in <i>Rheo discolor</i> or <i>Allium Cepa</i> or any available material/flower buds (Smear method). | 12 |
| II | 1. Isolation of genomic DNA from a plant source. 2. Agarose gel electrophoresis. 3. Spectrophotometric estimation of the isolated DNA. 4. Polymerase Chain Reaction. 5. Agarose gel electrophoresis of the amplified product. | 12 |
| III | 1. Basic Aspects of Genome Annotation. 2. Primer designing 3. Blast analysis of nucleotide and protein sequences 4. Clustal W analysis 5. Prediction of ORFs and Genes | 12 |
| IV | 1. Study of economically important enlisted plants through specimens, sections and micro-chemical tests:Rice, Pea, Mustard, Neem, Sugar cane. 2. Preparation of economically important plants album | 12 |
| | | |

Textbooks:

1. Brown, T.A., 1998. Genetics: a molecular approach (No. Ed. 3). Chapman & Hall Ltd.
2. Wilson, K. and Walker, J. eds., 2010. Principles and techniques of biochemistry and molecular biology. Cambridge University Press..
3. Sambrook, J. and Russell, D.W., 2001. Molecular cloning: a laboratory manual. Cold Spring Scientific Publications.

DETAILED SYLLABUS OF GENERIC ELECTIVE

PAPER GE 5: BOTANY IN RURAL COMMUNITIES,

SUBJECT CODE: BOT142G301, CREDIT UNITS: 2+0+1=3

SCHEME OF EVALUATION: Combined Theory & Practical Papers (TP):

- a.Continuous Evaluation: 15% (Assignment, Class Test, Seminar, Lab Experiment, Copy and Viva: Any Three)
- b.Mid-term examination: 10%
- c.Attendance: 5%
- d.Semester End examination: 70 %

Course objective: To impart knowledge on rural areas use of plants and also basic concept of ethnobotany

Learning Outcomes: On completion of this course students will be expected to –:

- CO1: **Describe** various Traditional methods of Medical treatments in Rural Communities of IndiaBT
2
CO2: **Compute** the traditional knowledge of prominent tribes of Assam BT 3
CO3: **Infer** the applications of the ethnomedicine in modern pharmaceutical systems. BT 4

Prerequisite: Basic knowledge of biology of class XII

Detailed syllabus

| Module/ Experiment | Topic/ Course content | Lecture hours |
|----------------------------------|---|------------------|
| Theory | | |
| I | Basic concept of society, community and groups, Characteristics and of rural communities, Scope and Importance of botany in Rural Economy and Employment Generation, Importance in food and nutritional security, Ecotourism. | 08 |
| II | Ethnobotany in North -east India: Methods to study ethnobotany; Applications of Ethnobotany: National interacts, Palaeo-ethnobotany. | 08 |
| III | Ethnomedicine, ethnoecology, ethnic communities of NE India. Application of natural products to certain diseases - Jaundice, cardiac, infertility, diabetics, Blood pressure and skin diseases | 08 |
| IV | Herbs used by dominant communities of Assam- Bodo, Tiwa, Karbi, Garo and Rabha in their day to day life. | 08 |
| Practical | | |
| Project based on theory syllabus | | |

References:

Internet based latest research papers.

PAPER GE 6:NURSERY AND GARDENING

SUBJECT CODE: BOT142G102, CREDIT UNITS: 2+0+1=3

SCHEME OF EVALUATION: Combined Theory & Practical Papers (TP):

- a.Continuous Evaluation: 15% (Assignment, Class Test, Seminar, Lab Experiment, Copy and Viva: Any Three)
- b.Mid-term examination: 10%
- c.Attendance: 5%
- d.Semester End examination: 70 %

Course objective: To enable the students about different branches of nursery and gardening, importance and scope of with reference to propagation techniques, canopy management, intercultural practices, diseases and disorders of nursery crops.

Learning Outcomes: After the successful completion of the course the students will be able to:

- CO1: **Recognize** various plant types and their propagation methods.**BT 1**
- CO2: **Produce** entrepreneurial aspects by studying various commercialization and economic benefits of plant propagation and cultivation.**BT 2**
- CO3: **Relate** various propagation and cultivation methods with the types of plant in different gardens.
BT 4

Prerequisite: Basic knowledge of biology of class XII.

Detailed Syllabus:

| Module | Course content | Lecture hours |
|--------------|--|---------------|
| I | Introduction to nursery techniques History and importance of nursery; role of Nursery; Guidelines for nursery raising; components of nursery; Layout and management of a good nursery, planting and layout of orchard, Types of nursery plant; nursery tools; Quality propagules production; selection of plants, | 6 |
| II | Propagation types, Seed extraction and storage of Nursery crops: Sexual and vegetative propagation, grafting, budding, Air-layering. Propagation media and micro propagation, establishment of commercial nurseries-its merits and demerits. Seed extraction and storage of nursery plants; soil management, of rootstocks, | 6 |
| III | Production and management of nursery crops: Production of nursery plant and gardening; Green house types; (Inter, mixed, multilayer) Types of chambers, poly house, net house, Advances of fruits and vegetables crops; Stress management of nursery crops and breeding of nursery crop),Bureau of Indian Standards (BIS-2008); | 6 |
| IV | An introduction to gardening: Brief history of gardening, choice and selection of plants for garden, soil, diseases and pests and its management; layout and designing of a gardening, types of landscaping garden; creative gardening | 6 |
| TOTAL | | 24 |

Practical (1 hours of practical per week)

1. To make an assessment of guidelines of nursery
2. Layout of nursery and propagation of nursery crop through hydroponics
3. Propagation of selected nursery crops suited to local condition
4. Grafting, budding and micro propagation of selected nursery crops
5. Raising rooting from cuttings in selected nursery crops
6. Projects based on theory course

Textbooks :

1. George Nicholson John Garrett J W H Trail (1851-1919):The Illustrated Dictionary of Gardening; A Practical and Scientific Encyclopaedia of Horticulture for Gardeners and Botanists, Nov 2018
2. R.R. Sharma and Hare Krishna (2019): A Text Book of Plant Propagation and Nursery Management (19) CBS Publisher & Distributors ISBN 9788181891983

References:

1. Kaushal K.Misra, Satish Chand, Navneet K. Misra: Plant Propagation,Biotech Books (2017), ISBN: 9788176223843
 2. Allen M. Armitage's: Garden Perennials,Timber Press ©2000, ISBN: 0-88192-435-0
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DETAILED SYLLABUS OF 4th SEMESTER

Paper I: PLANT PHYSIOLOGY & BIOCHEMISTRY

Subject Code: BOT142C401, L-T-P-C=4-0-0-4, Credit Units:04

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Course objective: To acquaint the students with the various physiological processes inside the plant body and understand the important life processes of plants.

Learning Outcomes: On completion of this course students will be expected to –

CO1: **Describe** different physiological processes of plants on completion of this course. BT 2

CO2: **Discover** ideas on different factors effecting the physiological process. BT 3

CO3: **Distinguish** between various types of Biomolecules and their application in Plant sciences. BT 4

Prerequisite: Basic knowledge of biology of class XII.

Detailed Syllabus

| Module | Course content | Lecture hours |
|---------------|---|----------------------|
| I | <p><i>Plant water relations:</i> Water & solute potential; water absorption and water loss; translocation of solute, Phloem transport, Transpiration and factors affecting transpiration, mechanism of stomatal movement.</p> <p><i>Mineral Nutrition:</i> Criteria of essentiality, Macro & Micro elements- its deficiency symptoms and control measures.</p> | 12 |
| II | <p><i>Photosynthesis:</i> Light as a source of energy; photosystem I & II location and function; electron transport during light dependent phase of photosynthesis, Carbon fixation pathways- C₃, C₄ and CAM pathways; photorespiration</p> <p><i>Respiration:</i> Glycolysis and Krebs' cycle, mitochondrial electron transport chains and regulation of its operation, Oxidative phosphorylation.</p> | 16 |

| | | |
|------------|--|-----------|
| III | Biomolecules: Structures and classification of Carbohydrates, Proteins, and lipids Plant Growth Regulators: Types, biosynthesis and mechanism of action of auxins, gibberellins, cytokinins and abscisic acid. | 10 |
| IV | Nitrogen Metabolism: Nitrogen cycling in nature, Biological fixation of atmospheric nitrogen, Ammonia assimilation pathways, Protein synthesis . Lipid Metabolism – Synthesis and oxidation of fatty acids. | 10 |
| | <u>TOTAL</u> | 48 |

Text books:

1. Hopkins, W.G. and Huner, A. Introduction to Plant Physiology. 2008. John Wiley and Sons. U.S.A. 4th edition.
2. Taiz, L., Zeiger, E., Møller, I.M. and Murphy, A. Plant Physiology and Development. 2015. Sinauer Associates Inc. USA. 6th edition.
3. Dennis D. T., Turpin, D. H. Lefebvre D. D. and Layzell D. B. (eds) (1997). Plant Metabolism (Second Edition) Longman, Essex, England.
4. William G Hopkins, Norman P Huner. Introduction To Plant Physiology. 2009. Wiley.
5. Taiz, L., Zeiger, E., Moller, I.M. and Murphy, A (2015). Plant Physiology and Development. Sinauer Associates Inc. USA. 6th edition.

Reference Books

6. Buchanan B.B, Gruissem W. and Jones R. L. Biochemistry and Molecular Biology of Plants. 2000. American Society of Plant Physiologists, Maryland, USA.
7. Hopkins, W.G., Huner, N.P. Introduction to Plant Physiology. 2009. John Wiley & Sons, U.S.A. 4th Edition.
8. Bajracharya, D. Experiments in Plant Physiology- A Laboratory Manual. 1999. Narosa Publishing House, New Delhi.

Paper II: PLANT PHYSIOLOGY, BIOCHEMISTRY & HERBARIUM TECHNIQUES (PRACTICAL)

Subject Code: BOT142C412, L-T-P-C= 0-0-8-4, Credit Units: 04

SCHEME OF EVALUATION: Practical (P)

- a. Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/performance) (any five).
- b. Attendance: 5%
- c. Semester End examination: 70 %

Course objective: To impart practical knowledge on various physiological and metabolic processes of plants.

Learning Outcomes: at the end of the course the student will be:

CO1: **Interpret** the various processes of metabolism in plants. BT 3

CO2: **Examine & Test** different physiological processes of angiosperms through laboratory experiments. BT 3 & BT 4

Prerequisite: Basic knowledge of biology of class XII.

Detailed Syllabus

| Module | Course content | Lecture hours |
|---------------|---|----------------------|
| I | Determination of osmotic potential of plant cell sap by plasmolytic method. Determination of water potential of given tissue (potato tuber) by weight method. Study the induction of amylase activity in germinating barley grains. Demonstration of suction due to transpiration. Demonstration of fruit ripening/Rooting from cuttings. | 12 |
| II | Calculation of stomatal index and stomatal frequency from the two surfaces of leaves of a mesophyte and xerophyte. To calculate the area of an open stoma and percentage of leaf area open through stomata in a mesophyte and xerophyte (both surfaces). To study the phenomenon of seed germination (effect of light). To study the effect of different concentrations of IAA on Avena coleoptile elongation (IAA Bioassay). | 12 |
| III | Chemical separation of photosynthetic pigments. To demonstrate the rate of transpiration through Ganong's potometer To study the effect of light intensity on the rate of photosynthesis. Effect of carbon dioxide on the rate of photosynthesis. | 12 |
| IV | To demonstrate activity of Nitrate reductase in germinating leaves of different plant sources. Spot test- Cellulose, protein, fat, starch, Test for minerals- Ca, Mg, Na, K, P, Mn, Fe | 12 |

| | | |
|--------------|---|-----------|
| | Extraction of plant phenols and estimation of total phenols. Extraction of proteins from plant tissue. | |
| Total | | 48 |

Text Books:

1. Santra S. Practical Botany Vol.1 and 2. 2015. NCBA Publisher.
2. Bendre and Kumar. Practical Botany Vol.1 and 2. 2018. Rastogi Publications.
3. Pandey.B.P. Modern Practical Botany Vol. 1, 2, 3.2011. S.Chand Publication

DISCIPLINE SPECIFIC ELECTIVE

Paper I: PLANT IDENTIFICATION AND HERBARIUM TECHNIQUES

Subject Code: BOT142D401, L-T-P-C: 4-0-0-4, Credit Units: 04

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Course objective: To impart practical knowledge on various plant identification systems, their preservation and utilization.

Learning Outcomes: At the end of the course the student will be:

- CO1: **Identify, describe,** and practice different methods of plant identification systems BT 2 & 3
 CO2: **Categorised** different techniques used in preservation and utilize its knowledge in various field application. BT 4

Detailed Syllabus:

| Module | Course content | Lecture hours |
|---------------|--|----------------------|
| I | Plant identification: Introduction, ways of identification, importance of plant identification. Tools of identification: Expert determination, Herbarium, taxonomic literature (Floras, Manuals, Monographs, Icones, Journals, Supporting literature), taxonomic keys, interactive keys, visual keys, Computers in identification, molecular plant identification, How to identify Trees, Shrubs and herb plants; limitations of current identification methods. | 12 |

| | | |
|--------------|---|-----------|
| II | Plant nomenclature: History of organized nomenclature, International Code of Nomenclature (ICN)- ranks of taxa, publication of names, principle of priority, exceptions of principles of priority, valid publication, changes of names, rejection of names, name of hybrids, name of cultivated plants; Role of morphology in plant identification. | 12 |
| III | Herbarium: Introduction, definition, history, objective, herbarium sheet, types of herbaria, importance, major herbaria in the world and India. Herbarium techniques: Preparation for collection, field equipment, kinds of field works, what to collect, how to collect, field notebook, pressing, drying, poisoning, mounting, labelling, identification/determination, incorporation, maintenance. | 12 |
| IV | Techniques for special types of plants: Aquatic plants, cane, bamboo, succulents, rhizomatous plants, resinous plants, algae, wild mushrooms and bryophytes; Digital/virtual herbarium: Introduction, aims and objectives, importance and few important digital herbaria of India. | 12 |
| Total | | 48 |

Textbooks:

1. Simpson, M. G. 2006. Plant Systematics. Elsevier, Amsterdam
2. Rao and Jain 1976. A Handbook of Field and Herbarium methods
3. Singh, G. 2012. Plant Systematics- Theory and Practice. Oxford and IBH Publishing Co Pvt Ltd, New Delhi
4. Sharma and Sharma 2007. Taxonomy. Pragati Prakashan, Meerut

Reference Books:

1. Anderson, N. O., and J. D. Walker. 2003. Effectiveness of Web-based versus live plant identification tests. Horttechnology 13:199-205.
2. Dirr, M. A. 1998. Manual of Woody Landscape Plants: Their Identification, Ornamental Characteristics, Culture, Propagation and Uses. Stipes Publishing, Champaign, IL
3. Kahtz, A. W. 2000. Can computer assisted instruction be used by students for woody plant identification. Horttechnology 10:381-384.

DETAILED SYLLABUS OF GENERIC ELECTIVE

PAPER GE 7:ENVIRONMENTAL BIOTECHNOLOGY

SUBJECT CODE: BOT142G401, CREDIT UNITS: 3-0-0-3

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%

- c. Attendance: 5%
d. Semester End examination: 70%

Course objective : To impart knowledge on environmental technology and its application.

Learning Outcomes: On completion of this course students will be expected to –

- CO1: **Define** various applications of technology in the environment. BT 1
CO2: Describe various Natural & Renewable Resources in the Environment and their applications. BT 2
CO3: Distinguish between various types of Pollution, their causes, consequence and their mitigation measures. BT 4

Prerequisite: Basic knowledge of biology of class XII

Detailed syllabus

| Module/ Experiment | Topic/ Course content | Lecture hours |
|-----------------------|--|---------------|
| Theory | | |
| I | Introduction: Components of environment, atmosphere, lithosphere, hydrosphere, biosphere and anthroposystems, energy flow and ecosystem. Natural resources: Renewable and nonrenewable resources. | 08 |
| II | Concept of environmental technology, Impact of technology and growing population on environment, disasters management, acid rain and ozone depletion . Applications of Remote Sensing and Geographic Information System (GIS). | 08 |
| III | Technology to combat soil pollution: bioremediation, organic farming. Waste water treatment technologies. Management of solid waste. | 08 |
| IV | Conventional and non-conventional fuels, their environmental impacts, alternative energy sources, vehicular emission standards of fuel consumption, green buildings and rating systems. | 08 |

Text Books:

1. Nathanson J.A. Basic environmental technology. 2000. Standardsmedia.
2. [Daniel W. Gottlieb](#). Environmental Technology Resources Handbook. 2002. CRC Press.

PAPER GE 8: PLANT ECOLOGY AND ECONOMIC BOTANY

SUBJECT CODE: BOT142G202, CREDIT UNITS: 2+0+1=3

SCHEME OF EVALUATION: Combined Theory & Practical Papers (TP):

a. Continuous Evaluation: 15% (Assignment, Class Test, Seminar, Lab Experiment, Copy and Viva: Any Three)

b.Mid-term examination: 10%
 c.Attendance: 5%
 d.Semester End examination: 70 %

Course objective: To impart knowledge on interaction of plants with surrounding environments, on economic use of plants and their distribution

Learning Outcomes: On completion of this course students will be expected to –

- CO1: **Define** various plant interactions and ecological factors.**BT 1**
 CO2: **Describe** various application of plants for different economic uses.**BT 2**

Prerequisite: Basic knowledge of biology of class XII.

Detailed syllabus

| Module/ Experiment | Topic/ Course content | Lecture hours |
|-----------------------|--|------------------|
| Theory | | |
| I | Introduction and Ecological factors: Roles played by soil, water, light, temperature. Adaptations of hydrophytes and xerophytes. Ecosystem and Plant communities: Ecosystem introduction, concept, definition, energy flow, food chain and food webs, ecological pyramids, general account of biogeo-chemical cycles, Ecotone and edge effect, succession, processes, and types. Phytogeography: Principle biogeographical zones | 06 |
| II | Environmental pollution and Conservation: Environmental pollution with special reference to air and water pollution- causes, effects and control measures. Green-house effect. Types of <i>ex-situ</i> and <i>in-situ</i> conservation. | 06 |
| III | Origin of cultivated plants: Concept of centers of origin, their importance with reference to Vavilov’s work. Cereals and Legumes: Rice and Wheat-origin, morphology and uses, General account of legumes. | 06 |
| IV | Spices, Condiments and Beverages: General account with special reference to black pepper and ginger, Tea- morphology, processing and uses. Oils and Fats and Fiber-yielding Plants: General description of oils and fats. General description with special reference to Cotton- (botanical name, family, arts used, morphology and uses) | 06 |
| Practical | | |
| 1 | Determination of soil pH, soil moisture, bulk density. | 3 |
| 2 | Study of morphological adaptations of hydrophytes and xerophytes. | 3 |
| 3 | Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus (species to be listed). | 3 |

| | | |
|----------|---|----------|
| 4 | Study of economically important plants through specimens, sections and micro-chemical tests- Rice, Pea, Mustard, Neem, Sugar cane | 3 |
|----------|---|----------|

Text Books:

1. Ghosh, Bhattacharryya and Hait. A textbook of Botany , Vol 1-4. 2015.NCBA Publishers
2. B. P. Pandey . Botany for Degree students – Biodiversity. 2010. S. Chand Publishers.

SEC: FLORICULTURE I

SUBJECT CODE: BOT142S311, CREDIT UNITS L-T-P-C 0-0-4-2

SCHEME OF EVALUATION: Practical (P)

- a.Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/performance) (any five).
- b.Attendance: 5%
- c.Semester End examination: 70 %

Course objective: The student will learn the Techniques of floriculture its Economic importance of different plants used in floriculture and Commercial aspect of floriculture

Course Outcome: On completion of this course students will be expected to -

- CO1: Recognize**field based application on flower cultivation and marketing. BT 1
- CO2: Identify** gardening techniques for different flowers. BT 2

Prerequisite: Basic knowledge of biology of class XII.

Detailed Syllabus

| Module | Content | Lecture hours |
|---------------|---|----------------------|
| I | Importance and scope of floriculture and landscape gardening, Types of garden, garden elements, styles of gardening, famous gardens in India and abroad, Principles of gardening. | 3 |
| II | Ornamental plants, flowering annuals, herbaceous perennials, divine vines, shade and ornamental trees, ornamental bulbous and foliage plants, cacti and | 3 |

| | | |
|-------|--|----|
| | succulents, palms and cycads, ferns and selaginellas, cultivation of plants in pots, indoor gardening, Bonsai | |
| III | Methods of Propagation of flowers, sexual and vegetative methods of propagation, soil sterilization, seed sowing, pricking, planting and transplanting, shading, defoliation, wintering, mulching, topiary, role of plant growth regulators, maintenance of cut flowers | 3 |
| IV | Commercial floriculture, factors affecting flower production, production and packaging of cut flowers, flower arrangements, methods to prolong vase life, cultivation of important cut flowers (Carnations, Asters, Chrysanthemum, Dahlia, Gerbera, Gladiolus, Marigold, Rose, Liliun, Orchids). Mode of transportation and preservation of loose and cut flowers. | 3 |
| Total | | 12 |

Projects based on the syllabus such as:

1. Digital album of world famous gardens.
2. Development of gardens in RGU campus
3. Exhibition of floral arrangements of both fresh and dry flowers.

DETAILED SYLLABUS OF 5TH SEMESTER

PAPER I: CELL & MOLECULAR BIOLOGY

SUBJECT CODE: BOT142C501, L-T-P-C: 4-0-0-4, CREDIT UNITS: 04

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Pre-requisite: Basic knowledge of biology and chemistry up to class 12

Course objective: The present course has been devised to familiarize students with the structural and functional aspects of cell, the basic unit of life, and its different organelles. We aim to transmit the student how morphology, structure and function are connected. Also the course will familiarize students with the concept of molecular biology: understanding the process of replication, transcription and translation and learning how these are regulated

Learning Outcomes: On completion of this course students will be expected to –

| | | |
|------------|---|------------|
| CO1 | Describe the components of cells, their structural organization, and the origin of eukaryotic cells. | BT1 |
| CO2 | Explain the significance of cell division, the phases of the cell cycle, and the structural organization of chromosomes and nucleic acids. | BT2 |
| CO3 | Apply knowledge of DNA replication, RNA transcription, and RNA processing to understand these processes in prokaryotes and eukaryotes. | BT3 |
| CO4 | Analyse the processes of translation and the regulation of gene expression in prokaryotes and eukaryotes. | BT4 |

Detailed Syllabus:

| Module | Course content | Lecture hours |
|---------------|---|----------------------|
| I | Cell: Cell as a unit of structure and function; Origin of eukaryotic cell (Endosymbiotic theory); Structural organization of prokaryotic and eukaryotic cells. Cell organelles: Plasma membrane: structure and functions; Membrane transport: ion channels and pumps; Mitochondria: structure, and functions; Chloroplast: structure and organization of photosynthetic complexes; endoplasmic reticulum, rough and smooth; Nucleus structure | 12 |
| II | Cell division: Phases of eukaryotic cell cycle, mitosis and meiosis; Regulation of cell cycle checkpoints. Eukaryotic Genome Organization: Eukaryotic chromatin and chromosome: Changes in chromosomes with reference to centromeres and telomeres; | 12 |

| | | |
|------------|--|-----------|
| | Structure of nucleic acids: DNA and its A, B and Z conformations, RNA and its types: t-RNA, r-RNAs and mRNA | |
| III | DNA replication: Machinery and mechanism in prokaryotes and eukaryotes; RNA transcription: Machinery and mechanism in prokaryotes and eukaryotes; RNA processing: concept of split gene, splicing ; RNA editing; Genetic code and exceptions to its universality. | 12 |
| IV | Translation: Machinery and mechanism (tRNA charging, initiation in prokaryotes and eukaryotes, elongation and termination); Regulation of gene expression in prokaryotes and eukaryotes: lac and tryptophan operon; regulation at transcriptional and post-transcriptional level | 12 |
| | TOTAL | 48 |

Textbooks:

1. Lodish, K.; Bretscher, A.; Berk, K.; Ploegh, S., 2013. Molecular cell biology, 7th Ed.
2. Cooper, G.M. I Hausman, R.E., 2007. The Cell. A Molecular approach. Washington D.C. and Sunderland.

References:

1. Karp, G., Iwasa, J. and Marshall, W., 2020. *Karp's Cell and Molecular Biology*. John Wiley & Sons.
2. Robertis, D., 1987. Cell and molecular biology.
3. Murray, K., Rodwell, V., Bender, D., Botham, K.M., Weil, P.A. and Kennelly, P.J., 2009. Harper's illustrated biochemistry. 28. Citeseer, New York, United States. Garrett, R. H.; Grisham, C. M. Biochemistry. Saunders. Orlando (Fla.): Brooks/Cole, 2005.
4. Voet, D., Voet, J.G. and Pratt, C.W., 2016. Fundamentals of biochemistry: life at the molecular level. John Wiley & Sons. 6th Ed
5. Lewin, B. Genes IX. Nova York., 2007. Oxford University Press, Inc.
6. Alberts, B.; Johnson, A.; Lewis, J.; Raff, M.; Roberts, K.; Walter, P., 2008. Molecular biology of the cell. Garland science, 5th Ed.

Paper II: MOLECULAR BIOLOGY, BIOSTATISTICS, BIOINFORMATICS & APPLIED MICROBIOLOGY (PRACTICAL)

Subject Code: BOT142C512, L-T-P-C= 0-0-8-4, Credit Units: 04

SCHEME OF EVALUATION: Practical (P)

- a. Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/ performance) (any five).
- b. Attendance: 5%
- c. Semester End examination: 70%

Course objective: To impart practical knowledge on various principles of genetics, give a idea on different cytological techniques, special chromosomes, plant breeding, Biostatistics, Bioinformatics & Applied Microbiology

Learning Outcomes: At the end of the course the student will be able to:

| | | |
|------------|---|------------|
| CO1 | Identify different cytological techniques and plant breeding methods through laboratory experiments. | BT1 |
| CO2 | Understand fundamentals of working with genomic DNA and compute different biostatistical and informatics processes to analyse various data related to experiment. | BT2 |
| CO3 | Apply knowledge of biostatistics and bioinformatics in the analysis of experimental data. | BT3 |
| CO4 | Experiment with and analyse different applied microbiological techniques in the laboratory. | BT4 |

Prerequisite: Basic knowledge of biology of class XII.

Detailed Syllabus

| Module s | Course content | Peri ods |
|-----------------|--|-----------------|
| I | <ol style="list-style-type: none"> 1. Isolation of genomic DNA from a plant source. Agarose gel electrophoresis. 2. Spectrophotometric estimation of the isolated DNA. 3. Polymerase Chain Reaction. 4. Agarose gel electrophoresis of the amplified product. | 12 |
| II | <ol style="list-style-type: none"> 1. Statistical software packages and their importance in data analysis. 2. Exploration and presentation of data: (Scales of measurement, Tables, Graphs, Histograms, Box and Whisker plots, Frequency polygon, Scatter Plots). 3. Descriptive statistics: measures of central tendency, measures of dispersion, moments, Skewness and kurtosis | 12 |
| III | <ol style="list-style-type: none"> 1. Types of operating systems, concept of networking and remote login, 2. Data search (BLAST, ORF finder, Primer 3, protein motif and structure prediction tools, Vector NTI, DNASTAR). | 12 |
| IV | <ol style="list-style-type: none"> 1. Enumeration of air, water and soil microflora. 2. Industry visit. 3. Microbial examination and estimation of food and fermentation product | 12 |
| Total | | 48 |

DISCIPLINE SPECIFIC ELECTIVE

DSE I: BIOSTATISTICS AND BIOINFORMATICS**SUBJECT CODE: BOT142D401, CREDIT UNITS: L-T-P-C = 4-0-0-4****SCHEME OF EVALUATION: Theory (T)**

- Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- Mid-term examination: 10%
- Attendance: 5%
- Semester End examination: 70%

Course Objective: The course is designed to apply programming language to understand biological data.

Course Outcomes: By the end of the course the students will be able to:

| | | |
|------|--|-------------|
| CO1: | Outline and describe the basic concepts of Bioinformatics and its significance in Biological data analysis. | [BT1 & BT2] |
| CO2: | Compute and model out various bioinformatic too to decipher the structural organisation, structural properties and structure determination of biological macromolecules – DNA, Protein and Carbohydrates. | [BT3 & BT4] |
| CO3: | Interpret and demonstrate statistical reasoning skills accurately and contextually | [BT3] |
| CO4: | Apply statistical knowledge to design and conduct research studies and also Operate statistical software packages to conduct research studies. | BT3 & BT4] |

Detailed Syllabus:

| Module | Course content | Lecture hours |
|--------|--|---------------|
| I | Biostatistics: The scope of biostatistics; Classification of study design, Observational studies and Experimental studies. Exploration and presentation of data: (Scales of measurement, Tables, Graphs, Histograms, Box and Whisker plots, Frequency polygon, Scatter Plots). Descriptive statistics: measures of central tendency, measures of dispersion, moments, Skewness and kurtosis | 12 |
| II | Probability: Definition, random variable, Probability distribution (Binomial, Poisson, and Standard Normal Distribution), Hypothesis; Sampling methods. Chi Square test; test of goodness of fit. Analysis of variance (ANOVA): Variance and co-variance analyses; LSD, F-test; Correlation. | 12 |
| III | Databases in Bioinformatics: Biological Databases, Classification format of Biological Databases, Biological Database Retrieval System. Biological Sequence Databases: National Centre for Biotechnology Information (NCBI): Tools and Databases of NCBI, FASTA, Database Retrieval Tool, Sequence Submission to NCBI, Basic local alignment search tool (BLAST) | 12 |
| IV | Phylogenetic Analysis: Methods of Phylogeny, Software for Phylogenetic Analyses, Phylogenetic Prediction, rooted/uprooted trees, approaches for phylogenetic tree construction. | 12 |

| | | |
|-------|---|----|
| | Applications of Bioinformatics: in Drug Discovery, Drug design and Crop improvement. | |
| Total | | 48 |

Text Books:

1. Attwood T.K. and Parry-Smith D.J. 2007. Introduction to Bioinformatics, Pearson Education (Singapore) Pvt. Ltd.
2. David Edwards (Ed.) 2015. Plant Bioinformatics: Methods and Protocols, Humana Press, New Jersey, USA.
Kulas J.T. 2008. SPSS Essential: Managing and Analyzing Social Science Data. John Wiley & Sons, New York.

Reference Books:

1. Dwyer R. A. 2004. Genomic Perl: From Bioinformatics Basics to Working Code, Cambridge University Press, 1st South Asian Edition.
2. Rosenkrantz W.A. 2009. Introduction to Probability and Statistics for Science, Engineering and Finance. CRC Press, Boca Raton.

DSE II: INDUSTRIAL & ENVIRONMENTAL MICROBIOLOGY

SUBJECT CODE: BOT142D422, CREDIT UNITS: L-T-P-C = 4-0-0-4

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Pre-requisite: Basic knowledge of biology and chemistry up to class 12

Course Objectives: The course is designed to impart theoretical as well as practical knowledge on the diversity of microbes in the environment and their interaction in different areas. The course will also help the students understand the utilization of microorganisms in different categories of industries.

Course Outcomes: By the end of the course the students shall be able to:

| | | |
|-------------|--|------------------------|
| CO1: | Identify different types of microorganisms found in the environment and recognize their contribution in eth environment. | [BT1 & BT2] |
| CO2: | Explain the application of microorganisms in various industries. | [BT3] |
| CO3: | Distinguish different diseases caused by microbes from different sources such as air, soil, and water. | [BT 4] |
| CO3: | Analyse methods of microbial growth control and the production of industrial products using microorganisms. | [BT 4] |

Detailed Syllabus:

| Modules | Topics / Course content | Periods |
|---------|-------------------------|---------|
|---------|-------------------------|---------|

| | | |
|--------------|---|-----------|
| I | Microbial diversity and its role in the environment. Aerobiology: assessment of air quality, airborne diseases and their control, enumeration of microbes from air. Soil Microbiology: soil microflora and their interactions, enumeration of microbes from soil. Bioinoculants and their application. | 12 |
| II | Water microbiology: ecosystems – fresh water and marine, zonations, eutrophication, water borne diseases and their control. Waste treatment – solid liquid, aerobic and anaerobic methods. | 12 |
| III | Food Microbiology: Food spoilage and food poisoning; fermented foods; methods of food preservation. Fermentations and its types- single, batch, continuous cultures | 12 |
| IV | Industrial Microbiology: Microorganisms growth in controlled environment; production of alcohol, organic acids, antibiotics, Biopolymers, biofuels, Biosurfactants; Bioconversion Processes; GEMs – Application and hazards. | 12 |
| Total | | 48 |

Text Book:

1. Whitaker and Stanbury. Principles of Fermentation Technology.
2. Casida. Industrial Microbiology. Tata McGraw Hill.
3. Adams and Moss. Food Microbiology. Cambridge.
4. Wiley, J.M., Sherwood, L.M. and Woolverton C.J., Prescott. Microbiology. 2017. McGraw Hill International.

Reference Books:

1. Brown A.E. and Smith H. Benson's Microbiological Applications: Laboratory Manual in General Microbiology.2016. McGraw-Hill Education.Madigan M.T., Martinko J.M., Bender K.S., Buckley D.H., Stahl D.A., Brock T. Brock Biology of Microorganisms (14th Edition). 2014. Pearson Publisher.
2. Frazier and Westhoff. Food Microbiology. Tata McGraw Hill.
3. Harvey R.A. and Cornelissen C.N. Lippincott Illustrated Reviews: Microbiology (Lippincott Illustrated Reviews Series) Third, North American Edition. 2012. LWW; Third, North American edition.
4. Pelczar, M.J. Microbiology. 2005.Tata McGraw-Hill Co, New Delhi
5. Tortora G.J., Funke B.R., Case C.L., Weber D and Bair W. Microbiology: An Introduction (13th Edition). 2018. Pearson Publisher.

DETAILED SYLLABUS OF 6TH SEMESTER

PAPER I: ECOLOGY & CONSERVATION BIOLOGY

SUBJECT CODE: BOT142C601, CREDIT UNITS: L-T-P-C = 4-0-0-4

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Course objective: To acquaint the students about environment and its conservation, plant interactions and various concepts on plant communities and community succession in a particular habitat.

Learning Outcomes: At the end of the course the student will be able to:

| | | |
|-----|--|-------------|
| CO1 | Identify how plants interact with their environment and understand patterns in ecosystem and knowledge across dimensions of ecological organization. | [BT 1] |
| CO2 | Describe the different aspects of community ecology and dynamics of population. | [BT 2] |
| CO3 | Apply knowledge to analyse the importance of biodiversity conservation, flagship species, and the aspects of human-wildlife conflict, wildlife trade, and related pandemics. | [BT3 & BT4] |
| CO4 | Analyse strategies for biodiversity conservation and evaluate case studies in biodiversity conservation. | [BT4] |

Detailed Syllabus:

| Module | Topics (if applicable) & Course Contents | Periods |
|---------------|---|----------------|
| I | Introduction to ecology: Biotic and abiotic factors and their interactions. Levels of organization, Laws of limiting factors, Ecotone and Edge effect, Ecological niche; Fundamental & Realized. | 12 |
| II | Ecosystem: Overview, Ecological balance; Ecological succession; concepts of ecological succession, general process of succession, types of succession. Ecosystem productivity: Food chains & food web, Ecological pyramids. Productivity and energy flow in an ecosystem. Biogeochemical cycling | 12 |

| | | |
|--------------|--|----|
| III | <p>Population ecology (Auto-ecology): Population characteristics, Population growth: exponential & logistic, Population regulation; density-dependent and independent, Population interactions: negative and positive interactions.</p> <p>Community ecology (Synecology): Characteristics of community, Community structure and composition, Intra & Inter specific competition, Lotka-voltera equation for prey-predator relationship.</p> | 12 |
| IV | <p>Biodiversity and its conservation: Hotspots of biodiversity, endemic species, global ecology and global change, strategies for biodiversity conservation, Protected areas and sacred groves, Endangered flagship species (with special reference to Northeast India); Best Environmental Practices (BEP); case studies in Biodiversity conservation</p> | 12 |
| TOTAL | | 48 |

Textbook:

1. Barrick, Barrett and Odum: Fundamentals of Ecology (Cengage Publication, 5th Edition, 2005)
2. P. D. Sharma : Ecology and Environment (Rastogi Publication, Edition: 13, 2017)

Reference Books:

1. A.R. Conklin: Field Sampling: Principles and Practices in Environmental Analysis (CRC Press, 2004)
2. Chapman & Reiss: Ecology: Principles and applications (Cambridge Univ. Press, 1992)
3. E. J. Kormondy Edward J: Concepts of Ecology (Pearson Education, 4th edition 2017)
4. Elizabeth Kolbert: The Sixth Extinction: An Unnatural History (Publisher: Henry Holt and Co., 2014)
5. Rachel Carson: Silent Spring, (Penguin UK; New Ed edition, 2000)
6. S. V. S. Rana: Essentials of Ecology and Environmental Science (5th Edition, 2013)
7. Turk and Turk: Environmental Science (4th ed. Saunders, 1993)

Paper II: ECOLOGY, AGRONOMY AND BIORESOURCE MANAGEMENT (PRACTICAL)

Subject Code: BOT142C612, L-T-P-C= 0-0-8-4, Credit Units: 04

SCHEME OF EVALUATION: Practical (P)

- a. Continuous evaluation: 25% (skill test, lab copy, practical viva, lab involvement/ performance) (any five).
- b. Attendance: 5%
- c. Semester End examination: 70%

Course objective: To impart practical knowledge on various principles of ecology, agronomy and bioresource management.

Learning Outcomes: At the end of the course the student will be able to:

| | | |
|------|---|-------------|
| CO 1 | Recall different ecological processes and interactions. | BT 2 |
| CO 2 | Classify and describe various ecosystem parameters related to diversity using different ecological tools. | BT 2 |
| CO 3 | Apply knowledge to analyse and measure the growth and yield of crops and the quality of compost and vermicompost. | BT 3 |
| CO4 | Analyze and model different conservation measures to mitigate the depletion of bioresources | BT 4 |

Prerequisite: Basic knowledge of biology of class XII.

Detailed Syllabus

| Modules | Course content | Periods |
|---------|--|---------|
| I | <ol style="list-style-type: none"> 1. Study of ecological adaptations – (morphological and anatomical) Hydrophytes, Xerophytes, Halophytes and Epiphytes (2 each). 2. Analysis of water samples for pH, Chloride, CO₂, Dissolved Oxygen and total hardness. 3. Determination of minimal quadrat size for the study of herbaceous vegetation in the college campus, by species area curve method (species to be listed) 4. Quantitative analysis of herbaceous vegetation in the college campus/ herbaceous vegetation for frequency, density and abundance and comparison with Raunkiaer's frequency distribution law. 5. Study of biotic interactions of the following: Stem parasite, Root parasite, Epiphytes, Predation (Insectivorous plants) | 12 |
| II | <ol style="list-style-type: none"> 1. Identification of seeds and crop plants at different growth stages. 2. Identification of different tillage implements. fertilizers and pesticides. 3. Study of agro-climatic zones of Northeast and India. 4. Operational tillage viz., primary, secondary, inter-tillage, sowing, harvesting, harvesting implements, Working with them. 5. Determination of purity and germination percentage of seed, Methods of seed germination. 6. Study of different methods of manures and fertilizer application and their application practice in important field crops. | 12 |
| III | <ol style="list-style-type: none"> 1. Study of quality analysis of compost and vermicompost. 2. Study of crop residue management and green manuring 3. Study of growth and yield contributing characters of any available crop. | 12 |
| IV | <ol style="list-style-type: none"> 1. Case studies on bioresources management and its conservation | 12 |

| | |
|--------------|-----------|
| Total | 48 |
|--------------|-----------|

Text Books:

1. Santra S. Practical Botany Vol.1 and 2. 2015. NCBA Publisher.
2. Bendre and Kumar. Practical Botany Vol.1 and 2. 2018. Rastogi Publications.
3. Internet : <https://www.biodiversitylibrary.org/item/90703#page/3/mode/1up>.
4. Pandey.B.P. Modern Practical Botany Vol. 1, 2, 3.2011. S.Chand Publication.

DSE I: AGRONOMY & SUSTAINABLE DEVELOPMENT

SUBJECT CODE: BOT142D601, CREDIT UNITS: L-T-P-C = 4-0-0-4

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Course Objective: The course is designed to inform the student about the various bioresources and its management.

Course Outcomes: By the end of the course the students will be able to:

| | | |
|-------|--|--------|
| CO1:. | Recognize and recall the fundamental concepts and definitions in agronomy, including the types and effects of tillage. | [BT 1] |
| CO2: | Explain and discuss the roles of organic and inorganic fertilizers, crop rotation, and weed management. | [BT 2] |
| CO3: | Apply knowledge of agronomy practices to improve crop production and sustainability. | [BT 3] |
| CO4: | Analyse the principles and goals of sustainable agriculture and evaluate different cropping systems and their impact on sustainability. | [BT 4] |

Detailed Syllabus:

| Module | Course content | Lecture hours |
|--------|---|---------------|
| I | Agronomy: definition, scope, role and relationship of Agronomy with other sciences. Tillage: definition and its types, tillage implements and factors affecting tillage, Effects of tillage on soil and crop growth. | 12 |
| II | Role of organic and inorganic fertilizers in crop production. Methods and time of application of manures, fertilizers and green manuring. Nutrient use efficiency in crops. | 12 |

| | | |
|-------|--|----|
| III | Crop rotation: definition, principles and advantages of crop rotation. Crop adaptation and its distribution. Weed management. Crop harvesting, signs of maturity in different field crops. Methods of threshing crops, Cleaning, Drying and Storage of field crops. | 12 |
| IV | Farming systems – Definition and types of Cropping systems, advantages and disadvantages of different cropping systems. Sustainable Agriculture: Introduction to sustainable agriculture. Definition, Principles, Goals, Problems and its importance in Agriculture, Sustainability Index and Conservation Agriculture. Organic crop production system Integrated Farming System , historical background, characteristics, objectives, components and its advantages. | 12 |
| Total | | 48 |

Text Books:

- 1) Chatterjee B.N. and Maiti S. Cropping systems Theory and Practice
- 2) Palanniappan S.P. Cropping Systems in Tropics – Principles and practices.

DSE II: BIORESOURCE MANAGEMENT

SUBJECT CODE: BOT142D602, CREDIT UNITS: L-T-P-C = 4-0-0-4

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Course Objective: The course is designed to inform the student about the various bioresources and its management.

Course Outcomes: By the end of the course the students will be able to:

| | | |
|------|--|--------|
| CO1: | Recognize various bioresources, its types, application and their management | [BT 1] |
| CO2: | Predict & Defend the available bioresources near them. | [BT 2] |
| CO3: | Apply knowledge to monitor and understand pattern of global biodiversity. | [BT 3] |
| CO4: | Relate various protection laws and Acts to conservation strategies and management Practices | [BT 4] |

Detailed Syllabus:

| Module | Course content | Lecture hours |
|--------|----------------|---------------|
|--------|----------------|---------------|

| | | |
|-------|---|----|
| I | Bioresource: Brief concept and sustainable use of bioresource; Bioresource management- Exploitation of bioresources and sustainable development. | 12 |
| II | Monitoring biodiversity: Methods for monitoring biodiversity trends. Mega biodiversity zones and global biodiversity hotspots; India as a mega diverse nation, Threats to biodiversity, species extinction; IUCN Red List Categories, Red data book. | 12 |
| III | Conservation programmes: Principles and strategies of biodiversity conservation; In situ and ex situ conservation strategies; Role of remote sensing and geographical information system in biodiversity studies, International efforts (IUCN, UNLP, WWF, NBPGR) for conserving Biodiversity. | 12 |
| IV | Bioresource management acts and policies: Indian Bioresources Information Network (IBIN), Forest Conservation Act 1981; Environment (protection) Act 1986; Ramsar Convention (Scope and Objective), Hazardous waste (Management and Handling) Rules 1989; Bio-Medical Waste (Management and Handling) Rules 1998; Environmental Impact Assessment (EIA) and Environmental Management Systems (EMS); National Biodiversity Action Plan; National Biodiversity Act 2002. | 12 |
| Total | | 48 |

Textbooks for Bioresources management:

1. Bioresources Conservation and Management: By Dr. Raju A.J. Solomon. Today and Tomorrow Printers and Publishers
2. Bioresources Conservation and Management: By Lingaraj Patro. Sonali Publications

Reference Books:

1. Bioresources and General and General Conservation. By Sing, M.P. & Soma Dey
2. Bioresource Technology: By G. Tripathi CBS Publisher and Distributors
3. Managing Natural Resources: Focus on Land and Water. By Misra, H.N. (Author), Harikesh, N. Misra (Editor)
4. Sustainable Bioresource Management: By Ratikanta Maiti et al.
5. Bioresource Management and Climate change. By Dr. Dilip Kumar, K.V. Rajendran, Srinivas Jahageerdar. Studium Press.

DSE III: REPRODUCTIVE BIOLOGY OF ANGIOSPERMS

SUBJECT CODE: BOT142D603, CREDIT UNITS: L-T-P-C = 4-0-0-4

SCHEME OF EVALUATION: Theory (T)

- a. Continuous evaluation: 15% (assignment, class test, practical viva, seminar, quiz (any three))
- b. Mid-term examination: 10%
- c. Attendance: 5%
- d. Semester End examination: 70%

Course Objective: The course is designed to inform the student about the various bioresources and its management.

Course Outcomes: By the end of the course the students will be able to:

| | | |
|------|---|--------|
| CO1: | Identify the stages of flower development, including the development of male and female gametophytes and the process of fertilization. | [BT 1] |
| CO2: | Explain the various incompatibilities and hybridization processes in plants. | [BT 2] |
| CO3: | Apply knowledge of pollination mechanisms and techniques to overcome self-incompatibility. | [BT 3] |
| CO4: | Compare various types of embryo development and seed types in plants. | [BT 4] |

Detailed Syllabus:

| Modules | Course content | Periods |
|--------------|--|-----------|
| I | Flower as a modified determinate shoot; ABC model of flower development. Development of Anther. Anther wall: Structure and functions, Microsporogenesis and Micro-gametogenesis; Pollen wall structure. Pollen viability. Abnormal features of pollens. | 12 |
| II | Ovule Structure, pollination, and double fertilization: Ovule Structure; Types; Special structures. Megasporogenesis and Mega-gametogenesis (details of <i>Polygonum</i> type). Organization and ultrastructure of mature embryo sac. Pollination Pollen pistil interaction. Double fertilization. | 12 |
| III | Self-incompatibility: Basic concepts (interspecific, intraspecific, homomorphic, heteromorphic). Methods to overcome self- incompatibility reactions. Intra-ovarian and in vitro pollination. Parasexual hybridization; Cybrids, in vitro fertilization. | 12 |
| IV | Embryo, Endosperm and Seed Structure and types: Development of dicot and monocot embryo and endosperm. Suspensor: structure and functions; Embryo-endosperm relationship, Nutrition of embryo. Unusual features embryo development in <i>Paeonia</i> . Seed structure, importance, and dispersal mechanisms. Polyembryony and apomixes. | 12 |
| Total | | 80 |

Text Book:

1. Bhojwani, S.S. and Bhatnagar, S.P. (2014). The Embryology of Angiosperms, Vikas Publishing House. Delhi. 5th edition.
2. Pandey B.P. Embryology of Angiosperm. 2017. Rastogi publication, Meerut.
3. Raghavan, V. Developmental Biology of Flowering plants. 2000. Springer, Netherlands.

Reference Book:

1. Haig D and Westoby M. Seed size, pollination costs and angiosperm success.1991. Springer-Verlag, Netherlands. (Research Paper).
2. Johri, B.M. Embryology of Angiosperms. 2015. Springer-Verlag, Netherlands.

3. Johri, B.M. Reproductive biology of Angiosperms. 2012. Springer-Verlag, Netherlands
4. Raghavan, V. Molecular embryology of flowering plants. 1997. Cambridge, University Press.
5. Shivanna, K.R. Pollen Biology and Biotechnology. 2003. Oxford and IBH Publishing Co. Pvt. Ltd. Delhi.
6. Went van J.L. Fertilization in Angiosperm plants. 1992. Springer-Verlag, Netherlands. (Research paper)