Curriculum for B.Sc. (Honours) Session : 2024-2025

Department of Botany Faculty of Biological Sciences

# Outcome-based Education (OBE) Curriculum for Bachelor of Science (Honors) in Botany

## Session : 2024-2025

### Examination

B.Sc. (Honours) First Year : First & Second Semester, 2025
B.Sc. (Honours) Second Year: First & Second Semester, 2026
B.Sc. (Honours) Third Year : First & Second Semester, 2027
B.Sc. (Honours) Fourth Year: First & Second Semester, 2028

**Department of Botany**
**Faculty of Biological Sciences**
**University of Rajshahi**
**Rajshahi 6205, Bangladesh**

# Outcome-Based Education (OBE) Curriculum for
## Bachelor of Science (Honors) in Botany
## Session: 2024-2025

**Examination:**

**B.Sc. (Honors) First Year : First & Second Semester, 2025**
**B.Sc. (Honors) Second Year : First & Second Semester, 2026**
**B.Sc. (Honors) Third Year : First & Second Semester, 2027**
**B.Sc. (Honors) Fourth Year : First & Second Semester, 2028**

**Department of Botany**
**Faculty of Biological Sciences**
**University of Rajshahi**
**Rajshahi 6205, Bangladesh**

# Content

# Academic Calendar

| Years | Class begins | Class ends | Exam begins | Result/ Remarks |
|---|---|---|---|---|
| First Year : First Semester | | | | |
| First Year : Second Semester | | | | |
| Second Year : First Semester | | | | |
| Second Year : Second Semester | | | | |
| Third Year : First Semester | | | | |
| Third Year : Second Semester | | | | |
| Fourth Year : First Semester | | | | |
| Fourth Year : Second Semester | | | | |

# Class Routine

| Periods / Days | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| **Sunday** | | | | | | | | |
| **Monday** | | | | | | | | |
| **Tuesday** | | | | | | | | |
| **Wednesday** | | | | | | | | |
| **Thursday** | | | | | | | | |

# Assignments

| Course Tutor | Course Title | Deadline |
|---|---|---|
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |
| | | |

# Personal Notes

**Name:**

**Class Roll No.:**

**Registration No.:**

**Student ID:**

**Batch No.:**

**Society Membership ID:**

**National ID:**

**Blood Group:**

**Emergency Contact:**

**Next to Kin:**

**Residential Address:**

**Others:**

# 1. Overview of the University of Rajshahi

On the recommendation of Sadler Commission formed on the 6th July 1917, Rajshahi town was considered as valuable place for the establishment of a university in the North Bengal. After partition in 1947 a movement started in favour for the establishment of a university at Rajshahi in accordance with the recommendation made by the Sadler Commission. Madar-Bux, a distinguished lawyer of Rajshahi and Dr. Itrat Hossain Zuberi, a scholar of English literature and Principal of Rajshahi College made the draft of a university and organized a movement to implement this. And in 1950, a strong committee consisted of 64 members was formed with a view to the demand for the establishment of the university to the government. University of Rajshahi being the second oldest and largest University in Bangladesh is the highest seat of learning in the Northern region of the country. Rajshahi University act 1953 (East Bengal Act XV of 1953) was passed by the East Pakistan provincial assembly on March 31, 1953 (Exhibit: p.1-3). The assent of the then Governor to establish a University at Rajshahi was first published in the Dhaka Gazette. Extraordinary dated 16th June 1951 and consequently the University started functioning. "Bara Kuthi", 18th century`s Dutch trading house was made the administration building. Dr. Itrat Hossain Zuberi was the first Vice-Chancellor to the University. Its normal academic activities began in 1954 (session 1953-54). The number of student was 161 at its inception stage. During the early days of inception classes were held at Rajshahi Government College.

In 1961, the University moved to its present campus. The present campus of the university is at Motihar on 753 acres of land acquired for the purpose and the construction of new buildings and structures started in 1958. Presently, the 59 departments are organized into 13 faculties: Faculty of Arts (12 Departments), Faculty of Law (2 Departments), Faculty of Science (9 Departments), Faculty of Business Studies (6 Departments), Faculty of Social Science (10 Departments), Faculty of Agriculture (2 Departments), Faculty of Biological Sciences (6 Departments),Faculty of Geoscience (2 Departments), Faculty of Engineering (5 Departments), Faculty of Fine Arts (3 Departments), Faculty of Veterinary & Animal Sciences (1 Department), Faculty of Fisheries (1 Department), Faculty of Medical Science (8 affiliated Medical Colleges)

The six institutes of the university are those of Bangladesh Studies, Biological Sciences, Education and Research, Environmental Science and Business Administration and English and Other Languages meant for higher education and research. With more than 37,176 students, more than 1215 academic staff, nearly 734 officers and 1896 supporting staffs are currently at work. It is one of the largest universities in Bangladesh. The university has 17 residential halls for students, 6 for female and 11for male students; and 1 dormitory for research fellows and international students. Degrees offered by the university include Bachelors (Honors) and Masters in different disciplines as well as MPhil, PhD, Diplomas and Certificates.

The central library of the university, the second largest library of the country has a collection of 350,000 books and journals of 2000 titles. In addition, there are libraries in all institutes, student's halls and almost on all departments. The university has a relatively well-managed Computer Centre (ICT) that provides internet and e-mail services throughout the university. The university has a good record of performances in sports and cultural activities. The physical education department of the university has a 25,000-seated stadium, 2 gymnasiums, 1 swimming pool, 4 football grounds, 1 hockey ground, 4 tennis courts, 2 basketball courts, 1 Taikondo training setup and a squash court. The transport pool of the university launched in 1967 has a fleet of vehicles (61) for transporting students, teachers and staffs staying outside the campus.

## 2. Vision of the University

To pursue enlightenment and creativity for production world-class human resources to cater for the needs of changing time.

## 3. Mission of the University (MU)

| | |
|---|---|
| **MU1** | To ensure a world-class curriculum with talented academicians and conducive academic and research environment for generation and dissemination of knowledge. |
| **MU2** | To maintain international standards in education with focus on both knowledge and skills, and humanitarian and ethical values to meet the needs of the society and state. |
| **MU3** | To develop strategic partnerships with leading national and international universities, and organizations for academic as well as research collaborations. |

## 4. Name of the Program Offering Entity

Department of Botany, University of Rajshahi

## 5. Department of Botany: At a glance

Botany is the scientific study of all aspects of plant sciences, from biomolecules to ecosystems. It provides an integrated view of all biological levels from gene (biomolecules) to higher plant groups. Botany is a multidisciplinary subject by nature and involves the study of microbes, their genetics, utility; lower and higher plant groups - their morphology and physiological attributes, exploring present and future prospects. It also covers the study of surrounding environment of those organisms, their role in the dynamics of the environment and the way to sustainable conservation. As a result, Botany appears as a combination of various disciplines such as Genetics, Physiology, Ecology, Taxonomy, Microbiology, Mycology, Phycology and Limnology, Cell biology, Cytogenetics, Plant-people's relations, Plant Breeding,

Plant Biotechnology, Climate change and its impact on plants, Biodiversity conservation, etc. The course curriculum has been arranged consistently from the beginners to higher levels considering that the loads remain optimum and do not exert extra pressure on students. The scientific achievements of this subject have been disseminating to the outreach people for economic outcomes as well as it also accommodates the people's knowledge for further research and development. Since its inception, this Department has significant role in the human resource development through its curricula and extra-curricular activities and by generating knowledge and contributes in environmental conservation, food security, sustainable development and ultimately in the reduction of poverty.

## 6. Vision of the Entity

To become a center of excellence in the plant science learning for quality education and research to produce skilled and competent human resources who adapt swiftly to the challenges of the 21st century.

## 7. Mission of the Entity (ME)

| | |
|---|---|
| **ME1** | To provide high quality education through adoption of comprehensive programs with a regular updating curriculum for requirements of contemporary job markets. |
| **ME2** | To facilitate teaching learning environment and infrastructure of the entity by producing competent and high level professionals equipped with modern technology, and to contribute to the socio-economic development of the country for making a prosperous nation in globalized environment. |
| **ME3** | To organize training research collaboration, workshop, seminar, conference for improving teaching quality and research. |
| **ME4** | To develop the entity as a leading centre of plant sciences in the country in terms of knowledge generation, graduate recruitment, innovation and outreach the innovation to the respective stakeholders |

### 8. Objectives of the Entity (OE)

| | |
|---|---|
| **OE1** | To provide professional graduate in the field of plant sciences and the multidisciplinary areas according to the requirements of contemporary job markets |
| **OE2** | To disseminate botanical knowledge in the diversified field of agriculture, industry, medical sciences and academia to ensure its effective application |
| **OE3** | To publish leading professional journals to contribute the theoretical development and application of plant sciences addressing substantive problems through scholarly research |
| **OE4** | To deliver adequate, relevant and advanced knowledge of plant sciences for facilitating research, planning and decision making process of the government and the community for achieving Sustainable Development Goals (SDGs) of Bangladesh |

## 9. Name of the Degree

Bachelor of Science (Honors) Degree in Botany

## 10. Description of the Degree

The B.Sc. (Honors) Degree in Botany consists of major (Botany) and minor courses from relevant discipline. Different courses of the major and minor altogether carry 4000 marks the total being 160 credits (40 units). The courses are distributed over four years ($8^{th}$ semesters). There are theoretical, practical and viva-voce examinations at the end of each semester. A research project/internship in the $4^{th}$ year $2^{nd}$ semester of B.Sc. (Honors) is also compulsory in which students are oriented and motivated to conduct research in postgraduate level (M.S./M.Phil./Ph.D.). Each course carries 2 credits (50 marks). The theoretical examination of each course is of 3 hours duration (50 marks). There are continuous assessments in each semester. A student shall acquire minimum 128 credits for successfully completing the Undergraduate Program.

## 11. Graduate attributes (Based on need assessment)

| |
|---|
| 1. **Scholars:** Our graduates are expected to have broad knowledge on plant science discipline and will be expertise. |
| 2. **Problem solvers:** With an adequate knowledge of disciplinary expertise and problem domain, our graduates will be in a position to formalize any problem and solve that in a methodical way. |
| 3. **Innovators:** Our graduates are expected to be critical thinkers, creative designers and efficient makers, and will be capable of developing unique and sustainable technology. |
| 4. **Leaders:** Graduates of our department will be trained up to take personal responsibilities and to work with a team. They will be confident, inclusive inspiring and influential through various extra-curricular activities of our department. |
| 5. **Global Citizens:** Graduate of our department will be produced to meet the challenges locally and globally. They will be aware about global issues and act with integrity sensitivity and fluency across cultures and perspectives, and are committed to the betterment of the society as whole. |

## 12. Program Educational Objectives (PEOs)

| | |
|---|---|
| **PEO 1** | Make the students to be aware about conservation and sustainable use of plants, application of different plants in various industries, agriculture and other related fields to make the country self-sufficient. |
| **PEO 2** | Enrich the students with the latest developments in the field of environmental science, microbiology, biotechnology, information and communication technology, bioinformatics, bio-prospecting and other related field of research and development. |
| **PEO 3** | Develop skill in practical works including- conducting experiments, operation of advanced equipments and laboratory techniques along with collection and interpretation of biological materials and data. |
| **PEO 4** | Provide skilled scientists, medics, academicians and entrepreneurs to mitigate national and global demand. |
| **PEO 5** | Understand and appreciate the role of biology in social issues such as environment and biological resources, biodiversity, ethics, human health and diseases, and to give the awareness to the public to protect the planet from all kinds of exploitation. |

## 13. Program Learning Outcomes (PLOs)

At the end of this undergraduate program, the students will be able to:

| | |
|---|---|
| **PLO 1** | Understand microbes to plant forms, diversity, classification, cellular mechanisms, heredity, environmental relationship, molecular biology, biotechnology and other plant related fields. |
| **PLO 2** | Know all aspects of plant sciences from biomolecules to ecosystem by studying microbes, lower to higher plant groups, their attributes and interaction with environments, and the way to explore present and future prospects for sustainable development. |
| **PLO 3** | Assimilate knowledge and ideas, construct and test hypothesis; carry out practical work in the field and laboratory, analyze data using appropriate statistical methods and computer packages; use of ICT to communicate of scientific ideas, effective report writing, design documentation, presentation and career planning. |
| **PLO 4** | Create, select, and apply appropriate techniques, resources, and modern instruments and equipment related to plant science with an understanding of the application and limitations. |
| **PLO 5** | Apply the contextual knowledge to assess plants and its importance for society, health, biosafety and the consequent responsibilities. |
| **PLO 6** | Demonstrate the knowledge for legal and ethical principles, bioethics and environmental issues. |
| **PLO 7** | Apply the knowledge to develop skilled and competent human resources to adapt the challenges globally. |

## 14. Mapping Mission of the university with PEOs

| **Program Educational Objectives (PEOs)** | **Mission of the University (MU)** | | |
|---|---|---|---|
| | **MU 1** | **MU 2** | **MU 3** |
| PEO 1 | 3 | 2 | 2 |
| PEO 2 | 3 | 3 | 2 |
| PEO 3 | 2 | 3 | 2 |
| PEO 4 | 3 | 3 | 2 |
| PEO 5 | 3 | 2 | 2 |

3 - High, 2 – Medium, 1 - Low

## 15. Mapping PEOs with PLOs

| **Program Educational Objectives (PEOs)** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| PEO 1 | 3 | 3 | 2 | 2 | 2 | 3 | 3 |
| PEO 2 | 2 | 3 | 1 | 3 | 2 | 3 | 2 |
| PEO 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| PEO 4 | 1 | 3 | 2 | 1 | 3 | 3 | 2 |
| PEO 5 | 3 | 2 | 3 | 3 | 2 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

## 16. Mapping courses with PLOs

| Courses | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| **First Year: First Semester** | | | | | | | |
| **Major** | | | | | | | |
| BBOT 1101 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| BBOT 1102 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| BBOT 1103 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| BBOT 1104 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| **GEd** | | | | | | | |
| BBOT 1105 | 3 | 2 | 3 | 2 | 2 | 2 | 3 |
| BBOT 1106 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| BBOT 1107 | 2 | 3 | 3 | 3 | 2 | 2 | 3 |
| **Practical** | | | | | | | |
| BBOT 1108 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| BBOT 1109 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| BBOT 1110 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| BBOT 1111 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| BBOT 1112 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| **Field work/Excursion** | | | | | | | |
| BBOT 1113 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Non-credit** | | | | | | | |
| BBOT 1114 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| **First Year: Second Semester** | | | | | | | |
| **Major** | | | | | | | |
| BBOT 1201 | 3 | 2 | 3 | 3 | 2 | 2 | 3 |
| BBOT 1202 | 3 | 3 | 2 | 3 | 2 | 2 | 2 |
| BBOT 1203 | 3 | 2 | 3 | 3 | 2 | 2 | 3 |
| BBOT 1204 | 3 | 3 | 3 | 3 | 3 | 2 | 2 |
| **GEd** | | | | | | | |
| BBOT 1205 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| BBOT 1206 | 2 | 3 | 2 | 3 | 3 | 2 | 3 |
| **Practical** | | | | | | | |
| BBOT 1207 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| BBOT 1208 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| BBOT 1209 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| BBOT 1210 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| BBOT 1211 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |
| **Viva-voce** | | | | | | | |
| BBOT 1212 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Field work/Excursion** | | | | | | | |
| BBOT 1213 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Second Year: First Semester** | | | | | | | |
| **Major** | | | | | | | |
| BBOT 2101 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| BBOT 2102 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |
| BBOT 2103 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| **GEd** | | | | | | | |
| BBOT 2104 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| BBOT 2105 | 3 | 2 | 2 | 2 | 3 | 2 | 2 |
| BBOT 2106 | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| **Practical** | | | | | | | |
| BBOT 2107 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BBOT 2108 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| BBOT 2109 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| BBOT 2110 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| **Field work/Excursion** | | | | | | | |
| BBOT 2111 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Second Year: Second Semester** | | | | | | | |
| **Major** | | | | | | | |
| BBOT 2201 | 3 | 3 | 2 | 2 | 2 | 2 | 3 |
| BBOT 2202 | 3 | 2 | 2 | 2 | 2 | 2 | 3 |
| BBOT 2203 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| **GEd** | | | | | | | |
| BBOT 2204 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| BBOT 2205 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| BBOT 2206 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| **Practical** | | | | | | | |
| BBOT 2207 | 2 | 3 | 2 | 3 | 2 | 3 | 3 |
| BBOT 2208 | 2 | 3 | 3 | 2 | 3 | 2 | 3 |
| BBOT 2209 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| BBOT 2210 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| BBOT 2211 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| **Viva-voce** | | | | | | | |
| BBOT 2212 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Field work/Excursion** | | | | | | | |
| BBOT 2213 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Third Year: First Semester** | | | | | | | |
| **Major** | | | | | | | |
| BBOT 3101 | 3 | 2 | 2 | 2 | 3 | 2 | 3 |
| BBOT 3102 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| BBOT 3103 | 2 | 3 | 2 | 3 | 2 | 2 | 3 |
| BBOT 3104 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |
| BBOT 3105 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| **GEd** | | | | | | | |
| BBOT 3106 | 3 | 3 | 3 | 2 | 2 | 2 | 3 |
| BBOT 3107 | 3 | 2 | 3 | 3 | 2 | 2 | 3 |
| **Practical** | | | | | | | |
| BBOT 3108 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| BBOT 3109 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| BBOT 3110 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| BBOT 3111 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |
| **Field work/Excursion** | | | | | | | |
| BBOT 3112 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Third Year: Second Semester** | | | | | | | |
| **Major** | | | | | | | |
| BBOT 3201 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| BBOT 3202 | 3 | 3 | 3 | 2 | 3 | 3 | 3 |
| BBOT 3203 | 2 | 2 | 3 | 2 | 3 | 3 | 3 |
| BBOT 3204 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |
| BBOT 3205 | 3 | 2 | 3 | 2 | 3 | 3 | 2 |
| **GEd** | | | | | | | |
| BBOT 3206 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| BBOT 3207 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| **Practical** | | | | | | | |
| BBOT 3208 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| BBOT 3209 | 2 | 3 | 2 | 3 | 2 | 3 | 3 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BBOT 3210 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| BBOT 3211 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| BBOT 3212 | 2 | 3 | 2 | 3 | 2 | 3 | 3 |
| **Viva-voce** | | | | | | | |
| BBOT 3213 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Field work/Excursion** | | | | | | | |
| BBOT 3214 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Fourth Year: First Semester** | | | | | | | |
| **Major** | | | | | | | |
| BBOT 4101 | 3 | 3 | 2 | 3 | 3 | 2 | 3 |
| BBOT 4102 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| BBOT 4103 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| BBOT 4104 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |
| BBOT 4105 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| BBOT 4106 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| **GEd** | | | | | | | |
| BBOT 4107 | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| **Practical** | | | | | | | |
| BBOT 4108 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| BBOT 4109 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| BBOT 4110 | 2 | 3 | 2 | 3 | 3 | 3 | 3 |
| BBOT 4111 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| BBOT 4112 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| BBOT 4113 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| **Fourth Year: Second Semester** | | | | | | | |
| **Major** | | | | | | | |
| BBOT 4201 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| BBOT 4202 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| BBOT 4203 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| BBOT 4204 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| BBOT 4205 | 2 | 3 | 3 | 2 | 3 | 2 | 3 |
| BBOT 4206 | 2 | 2 | 2 | 3 | 2 | 3 | 3 |
| **Practical** | | | | | | | |
| BBOT 4207 | 3 | 3 | 2 | 3 | 2 | 3 | 3 |
| BBOT 4208 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| BBOT 4209 | 2 | 3 | 2 | 3 | 3 | 2 | 3 |
| BBOT 4210 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| BBOT 4211 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |
| BBOT 4212 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |
| **Viva-voce** | | | | | | | |
| BBOT 4213 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| **Research Project/Internship** | | | | | | | |
| BBOT 4214 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

# List of Present Teachers of the Department of Botany

## Chairman: Professor Dr. Mohammad Shahidul Alam

| Sl | Name of Teachers | Designation | Field of Specialization | Email & Contact No. |
|---|---|---|---|---|
| 1. | Dr. Mohammad Shahidul Alam | Professor | Mycology; Plant Pathology | sarubot61@gmail.com 01715138818 |
| 2. | Dr. Sabrina Naz | Professor | Aquatic Diversity; Conservation Limnology | drsabrina_naz@ru.ac.bd 01715178196 |
| 3. | Dr. Md. Zahangir Alam | Professor | Plant Physiology | zabotbd@ru.ac.bd 01798298832 |
| 4. | Dr. Most. Ferdousi Begum | Professor | Microbiology | ferdrita@yahoo.com 01712122968 |
| 5. | Dr. Lipika Ghosh | Professor | Fern Biology | lipika_ru@yahoo.com 01716389838 |
| 6. | Dr. Gour Pada Ghosh | Professor | Ethnobotany; Climate Change and Plant Adaptation | ghosh.g.p@ru.ac.bd 01716055860 |
| 7. | Dr. Farzana Ashrafi Neela | Professor | Microbiology | nfarzanaashrafi@yahoo.com 01732465793 |
| 8. | Dr. A.H.M. Mahbubur Rahman | Professor | Plant Taxonomy; Biosystematics | drrahmanahmm@ru.ac.bd 01714657224 |
| 9. | Dr. Mst. Ferdowsi Mahal | Professor | Plant Pathology; Seed Science and Technology | mini_mahal@ru.ac.bd 01717769370 |
| 10. | Dr. M. A. K. Azad | Professor | Plant Tissue Culture; Proteomics | azad@ru.ac.bd 01746077255 |
| 11. | Dr. Shamima Nasrin Sima | Professor | Plant Anatomy | sima_bot2006@yahoo.com 01711274531 |
| 12. | Dr. Rubaiyat Sharmin Sultana | Professor | Plant Anatomy; Wood Science | sultanaru@yahoo.com 01715795813 |
| 13. | Dr. Ahmed Imtiaj | Professor | Mycology, Pathology, Mushroom Biology | aimtiajbot@ru.ac.bd 01714118546 |
| 14. | Dr. Md. Sarwar Parvez | Professor | Genetics; Plant Biotechnology | sarwarparvez@yahoo.com 01712192477 |
| 15. | Dr. F M Ali Haydar | Professor | Plant Breeding; Biometrical Genetics | fmalihaydar@gmail.com 01711238081 |
| 16. | Dr. Md. Nasiruddin | Professor | Biotechnology; Plant Breeding and Genetics | mnuddin@ru.ac.bd 01719417225 |
| 17. | Dr. Md. Rezaul Karim (Study Leave) | Professor | Biotechnology, Molecular Biology; Bioinformatics | mrkarimbot@ru.ac.bd/ 01714461267 |
| 18. | Dr. Md. Hasanur Rahman | Professor | Plant Ecology; Environmental Management | hasanur7@yahoo.com 01746108338 |
| 19. | Dr. Uthpal Krishna Roy | Associate Professor | Cell Biology; Plant Stress Biology; Plant Diversity | roy.uthpalbt@ru.ac.bd 01717450897 |
| 20. | Dr. Ahmad Humayan Kabir (Study Leave) | Associate Professor | Molecular Plant Stress Physiology; Phytoremediation | ahmad.kabir@ru.ac.bd 01717134836 |
| 21. | Dr. Umme Qulsum | Associate Professor | Molecular Biology; Bioinformatics | qulsum@ru.ac.bd 01308145565 |
| 22. | Dr. Md. Mostafizur Rahman | Associate Professor | Molecular Plant Stress Physiology | muradbt@ru.ac.bd 01717450964 |
| 23. | Dr. Saika Kabir Nitu | Associate Professor | Plant Ecology | nitu.saikakabir@gmail.com 01712272336 |
| 24. | Dr. Rony Rani | Associate Professor | Plant Taxonomy | ronyranibot@gmail.com 01916536428 |
| 25. | Md. Mamunur Rashid Sarkar | Associate Professor | Cell Biology; Cytogenteics | mrsarkar_bot@ru.ac.bd 01710569271 |
| 26. | Md. Omar Faruq | Assistant Professor | Ethnobotany | omrfrq39@gmail.com 01670754455 |

# Curriculum for B.Sc. (Honors)
## Department of Botany, University of Rajshahi
## Session: 2024-2025

### Academic Schedule

| Each Semester (24 weeks) | Number of Weeks |
|---|---|
| Teaching | 14 |
| Preparatory leave | 2 |
| Examination period | 2-4 |
| Result publication | 2-4 |
| **Total** | **24** |

# First Year: First Semester

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (Major) | 200 | 2.0 | 8 |
| Theory (GEd) | 150 | 1.5 | 6 |
| Practical | 125 | 1.25 | 5 |
| Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| **Total** | **500** | **5.0** | **20** |
| English (Non-credit) | 50 | - | - |

| Course Code | Course Title | Marks | Units | Credits |
|---|---|---|---|---|
| **Theory (Major Courses)** | | | | |
| BBOT 1101 | General Microbiology | 50 | 0.50 | 2 |
| BBOT 1102 | Introductory Mycology | 50 | 0.50 | 2 |
| BBOT 1103 | Introductory Phycology | 50 | 0.50 | 2 |
| BBOT 1104 | Bryology | 50 | 0.50 | 2 |
| **Theory {General Education (GEd) Courses}** | | | | |
| BBOT 1105 | Biomolecules | 50 | 0.50 | 2 |
| BBOT 1106 | Animal Classification and Lower Animal Phyla | 50 | 0.50 | 2 |
| BBOT 1107 | Bangladesh Studies | 50 | 0.50 | 2 |
| **Practical** | | | | |
| BBOT 1108 | General Microbiology | 25 | 0.25 | 1 |
| BBOT 1109 | Introductory Mycology | 25 | 0.25 | 1 |
| BBOT 1110 | Introductory Phycology | 25 | 0.25 | 1 |
| BBOT 1111 | Bryology | 25 | 0.25 | 1 |
| BBOT 1112 | Zoology | 25 | 0.25 | 1 |
| **Field work/Excursion** | | | | |
| BBOT 1113 | Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| | **Total** | **500** | **5.0** | **20** |
| **Non-credit** | | | | |
| BBOT 1114 | English | 50 | - | - |

**Mark distribution Theory courses** (Major and GEd)

| Total Marks | Examination (70%) | Class Test / Class Assessment / Mid Term/Quiz (20%) | Attendance (10%) |
|---|---|---|---|
| e.g. 50 (2 credits) | 35 | 10 | 5 |

**Mark distribution Practical courses**

| Total Marks | Examination (60%) | Continuous Lab Assessment and/or Report (30%) | Attendance (10%) |
|---|---|---|---|
| e.g. 25 (1 credit) | 15 | 7.5 | 2.5 |

# First Year: Second Semester

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (Major) | 200 | 2.0 | 8 |
| Theory (GEd) | 100 | 1.0 | 4 |
| Practical | 125 | 1.25 | 5 |
| Viva-voce (Major) | 50 | 0.50 | 2 |
| Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| **Total** | **500** | **5.0** | **20** |

| Course Code | Course Title | Marks | Units | Credits |
|---|---|---|---|---|
| **Theory (Major Courses)** | | | | |
| BBOT 1201 | Basic Techniques in Microbiology | 50 | 0.50 | 2 |
| BBOT 1202 | Higher Fungi | 50 | 0.50 | 2 |
| BBOT 1203 | Pteridology | 50 | 0.50 | 2 |
| BBOT 1204 | Gymnosperm and Paleobotany | 50 | 0.50 | 2 |
| **Theory {General Education (GEd) Courses}** | | | | |
| BBOT 1205 | Metabolism and Nutrition | 50 | 0.50 | 2 |
| BBOT 1206 | Phyla Mollusca to Chordata and Applied Zoology | 50 | 0.50 | 2 |
| **Practical** | | | | |
| BBOT 1207 | Basic Techniques in Microbiology | 25 | 0.25 | 1 |
| BBOT 1208 | Higher Fungi | 25 | 0.25 | 1 |
| BBOT 1209 | Pteridology | 25 | 0.25 | 1 |
| BBOT 1210 | Gymnosperm and Paleobotany | 25 | 0.25 | 1 |
| BBOT 1211 | Biochemistry | 25 | 0.25 | 1 |
| **Viva-voce** | | | | |
| BBOT 1212 | Viva-voce (All major courses of First Year) | 50 | 0.50 | 2 |
| **Field work/Excursion** | | | | |
| BBOT 1213 | Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| | **Total** | **500** | **5.0** | **20** |

**Mark distribution Theory courses** (Major and GEd)

| Total Marks | Examination (70%) | Class Test / Class Assessment / Mid Term/Quiz (20%) | Attendance (10%) |
|---|---|---|---|
| e.g. 50 (2 credits) | 35 | 10 | 5 |

**Mark distribution Practical courses**

| Total Marks | Examination (60%) | Continuous Lab Assessment and/or Report (30%) | Attendance (10%) |
|---|---|---|---|
| e.g. 25 (1 credit) | 15 | 7.5 | 2.5 |

# Second Year: First Semester

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (Major) | 150 | 1.50 | 6 |
| Theory (GEd) | 150 | 1.50 | 6 |
| Practical | 100 | 1 | 4 |
| Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| **Total** | **425** | **4.25** | **17** |

| Course Code | Course Title | Marks | Units | Credits |
|---|---|---|---|---|
| **Theory (Major Courses)** | | | | |
| BBOT 2101 | Plant Taxonomy and Morphology | 50 | 0.50 | 2 |
| BBOT 2102 | Plant Physiology | 50 | 0.50 | 2 |
| BBOT 2103 | Cell Biology | 50 | 0.50 | 2 |
| **Theory {General Education (GEd) Courses}** | | | | |
| BBOT 2104 | Agronomy | 50 | 0.50 | 2 |
| BBOT 2105 | Social Psychology and Ethics | 50 | 0.50 | 2 |
| BBOT 2106 | Horticulture and Floriculture | 50 | 0.50 | 2 |
| **Practical** | | | | |
| BBOT 2107 | Plant Taxonomy and Morphology | 25 | 0.25 | 1 |
| BBOT 2108 | Plant Physiology | 25 | 0.25 | 1 |
| BBOT 2109 | Cell Biology | 25 | 0.25 | 1 |
| BBOT 2110 | Agronomy, Horticulture and Floriculture | 25 | 0.25 | 1 |
| **Field work/Excursion** | | | | |
| BBOT 2111 | Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| | **Total** | **425** | **4.25** | **17** |

**Mark distribution Theory courses** (Major and GEd)

| Total Marks | Examination (70%) | Class Test / Class Assessment / Mid Term/Quiz (20%) | Attendance (10%) |
|---|---|---|---|
| e.g. 50 (2 credits) | 35 | 10 | 5 |

**Mark distribution Practical courses**

| Total Marks | Examination (60%) | Continuous Lab Assessment and/or Report (30%) | Attendance (10%) |
|---|---|---|---|
| e.g. 25 (1 credit) | 15 | 7.5 | 2.5 |

# Second Year: Second Semester

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (Major) | 150 | 1.50 | 6 |
| Theory (GEd) | 150 | 1.50 | 6 |
| Practical | 125 | 1.25 | 5 |
| Viva-voce (Major) | 50 | 0.50 | 2 |
| Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| **Total** | **500** | **5.0** | **20** |

| Course Code | Course Title | Marks | Units | Credits |
|---|---|---|---|---|
| **Theory (Major Courses)** | | | | |
| BBOT 2201 | Plant Anatomy | 50 | 0.50 | 2 |
| BBOT 2202 | Plant Ecology | 50 | 0.50 | 2 |
| BBOT 2203 | Plant Biochemistry | 50 | 0.50 | 2 |
| **Theory {General Education (GEd) Courses}** | | | | |
| BBOT 2204 | Principles of Organic Farming | 50 | 0.50 | 2 |
| BBOT 2205 | ICT | 50 | 0.50 | 2 |
| BBOT 2206 | Data Processing | 50 | 0.50 | 2 |
| **Practical** | | | | |
| BBOT 2207 | Plant Anatomy | 25 | 0.25 | 1 |
| BBOT 2208 | Plant Ecology | 25 | 0.25 | 1 |
| BBOT 2209 | Plant Biochemistry | 25 | 0.25 | 1 |
| BBOT 2210 | Principles of Organic Farming | 25 | 0.25 | 1 |
| BBOT 2211 | ICT and Data Processing | 25 | 0.25 | 1 |
| **Viva-voce** | | | | |
| BBOT 2212 | Viva-voce (All major courses of Second Year) | 50 | 0.50 | 2 |
| **Field work/Excursion** | | | | |
| BBOT 2213 | Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| | **Total** | **500** | **5.0** | **20** |

**Mark distribution Theory courses** (Major and GEd)

| Total Marks | Examination (70%) | Class Test / Class Assessment / Mid Term/Quiz (20%) | Attendance (10%) |
|---|---|---|---|
| e.g. 50 (2 credits) | 35 | 10 | 5 |

**Mark distribution Practical courses**

| Total Marks | Examination (60%) | Continuous Lab Assessment and/or Report (30%) | Attendance (10%) |
|---|---|---|---|
| e.g. 25 (1 credit) | 15 | 7.5 | 2.5 |

# Third Year: First Semester

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (Major) | 250 | 2.50 | 10 |
| Theory (GEd) | 100 | 1.00 | 4 |
| Practical | 100 | 1.00 | 4 |
| Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| **Total** | **475** | **4.75** | 19 |

| Course Code | Course Title | Marks | Units | Credits |
|---|---|---|---|---|
| **Theory (Major Courses)** | | | | |
| BOTB 3101 | Ecosystem Dynamics | 50 | 0.50 | 2 |
| BBOT 3102 | Plant Diversity and Conservation | 50 | 0.50 | 2 |
| BBOT 3103 | Classical Genetics | 50 | 0.50 | 2 |
| BBOT 3104 | Systematics of Angiosperm | 50 | 0.50 | 2 |
| BBOT 3105 | Embryology of Angiosperm | 50 | 0.50 | 2 |
| **Theory {General Education (GEd) Courses}** | | | | |
| BBOT 3106 | Soil Science | 50 | 0.50 | 2 |
| BBOT 3107 | Forestry | 50 | 0.50 | 2 |
| **Practical** | | | | |
| BBOT 3108 | Ecosystem Dynamics | 25 | 0.25 | 1 |
| BBOT 3109 | Plant Diversity and Conservation | 25 | 0.25 | 1 |
| BBOT 3110 | Classical Genetics | 25 | 0.25 | 1 |
| BBOT 3111 | Systematics of Angiosperm | 25 | 0.25 | 1 |
| **Field work/Excursion** | | | | |
| BBOT 3112 | Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| | **Total** | **475** | **4.75** | **19** |

**Mark distribution Theory courses** (Major and GEd)

| Total Marks | Examination (70%) | Class Test / Class Assessment / Mid Term/Quiz (20%) | Attendance (10%) |
|---|---|---|---|
| e.g. 50 (2 credits) | 35 | 10 | 5 |

**Mark distribution Practical courses**

| Total Marks | Examination (60%) | Continuous Lab Assessment and/or Report (30%) | Attendance (10%) |
|---|---|---|---|
| e.g. 25 (1 credit) | 15 | 7.5 | 2.5 |

# Third Year: Second Semester

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (Major) | 250 | 2.50 | 10 |
| Theory (GEd) | 100 | 1.00 | 4 |
| Practical | 125 | 1.25 | 5 |
| Viva-voce (Major) | 50 | 0.50 | 2 |
| Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| **Total** | **550** | **5.50** | **22** |

| Course Code | Course Title | Marks | Units | Credits |
|---|---|---|---|---|
| **Theory (Major Courses)** | | | | |
| BBOT 3201 | Ethnobotany | 50 | 0.50 | 2 |
| BBOT 3202 | Introductory Plant Pathology | 50 | 0.50 | 2 |
| BBOT 3203 | Biostatistics | 50 | 0.50 | 2 |
| BBOT 3204 | Quantitative Genetics | 50 | 0.50 | 2 |
| BBOT 3205 | Introductory Molecular Genetics | 50 | 0.50 | 2 |
| **Theory {General Education (GEd) Courses}** | | | | |
| BBOT 3206 | Pharmacognosy | 50 | 0.50 | 2 |
| BBOT 3207 | Communication and Personal Skills | 50 | 0.50 | 2 |
| **Practical** | | | | |
| BBOT 3208 | Ethnobotany | 25 | 0.25 | 1 |
| BBOT 3209 | Introductory Plant Pathology | 25 | 0.25 | 1 |
| BBOT 3210 | Biostatistics | 25 | 0.25 | 1 |
| BBOT 3211 | Quantitative Genetics | 25 | 0.25 | 1 |
| BBOT 3212 | Introductory Molecular Genetics | 25 | 0.25 | 1 |
| **Viva-voce** | | | | |
| BBOT 3213 | Viva-voce (All major courses of Second Year) | 50 | 0.50 | 2 |
| **Field work/Excursion** | | | | |
| BBOT 3214 | Field work/Excursion (Major courses) | 25 | 0.25 | 1 |
| | **Total** | **550** | **5.50** | **22** |

**Mark distribution Theory courses** (Major and GEd)

| Total Marks | Examination (70%) | Class Test / Class Assessment / Mid Term/Quiz (20%) | Attendance (10%) |
|---|---|---|---|
| e.g. 50 (2 credits) | 35 | 10 | 5 |

**Mark distribution Practical courses**

| Total Marks | Examination (60%) | Continuous Lab Assessment and/or Report (30%) | Attendance (10%) |
|---|---|---|---|
| e.g. 25 (1 credit) | 15 | 7.5 | 2.5 |

# Fourth Year: First Semester

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (Major) | 300 | 3.00 | 12 |
| Theory (GEd) | 50 | 0.50 | 2 |
| Practical | 150 | 1.50 | 6 |
| **Total** | **500** | **5.00** | **20** |

| Course Code | Course Title | Marks | Units | Credits |
|---|---|---|---|---|
| **Theory (Major Courses)** | | | | |
| BBOT 4101 | Plant Disease Management | 50 | 0.50 | 2 |
| BBOT 4102 | Plant Breeding | 50 | 0.50 | 2 |
| BBOT 4103 | Recombinant DNA Technology | 50 | 0.50 | 2 |
| BBOT 4104 | Plant Tissue Culture | 50 | 0.50 | 2 |
| BBOT 4105 | Limnology | 50 | 0.50 | 2 |
| BBOT 4106 | Industrial Botany | 50 | 0.50 | 2 |
| **Theory {General Education (GEd) Course}** | | | | |
| BBOT 4107 | Research Methodology | 50 | 0.50 | 2 |
| **Practical** | | | | |
| BBOT 4108 | Plant Disease Management | 25 | 0.25 | 1 |
| BBOT 4109 | Plant Breeding | 25 | 0.25 | 1 |
| BBOT 4110 | Recombinant DNA Technology | 25 | 0.25 | 1 |
| BBOT 4111 | Plant Tissue Culture | 25 | 0.25 | 1 |
| BBOT 4112 | Limnology | 25 | 0.25 | 1 |
| BBOT 4113 | Industrial Botany | 25 | 0.25 | 1 |
| | **Total** | **500** | **5.00** | **20** |

**Mark distribution Theory courses** (Major and GEd)

| Total Marks | Examination (70%) | Class Test / Class Assessment / Mid Term/Quiz (20%) | Attendance (10%) |
|---|---|---|---|
| e.g. 50 (2 credits) | 35 | 10 | 5 |

**Mark distribution Practical courses**

| Total Marks | Examination (60%) | Continuous Lab Assessment and/or Report (30%) | Attendance (10%) |
|---|---|---|---|
| e.g. 25 (1 credit) | 15 | 7.5 | 2.5 |

# Fourth Year: Second Semester

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (Major) | 300 | 3.00 | 12 |
| Practical | 150 | 1.50 | 6 |
| Viva-voce (Major) | 50 | 0.50 | 2 |
| Research Project/Internship | 50 | 0.50 | 2 |
| **Total** | **550** | **5.50** | **22** |

| Course Code | Course Title | Marks | Units | Credits |
|---|---|---|---|---|
| **Theory (Major Courses)** | | | | |
| BBOT 4201 | Bioprospecting | 50 | 0.50 | 2 |
| BBOT 4202 | Bioinformatics | 50 | 0.50 | 2 |
| BBOT 4203 | Climate Change and Plant Adaptation | 50 | 0.50 | 2 |
| BBOT 4204 | Physiology of Crop Plants | 50 | 0.50 | 2 |
| BBOT 4205 | Cytogenetics | 50 | 0.50 | 2 |
| BBOT 4206 | Biotechnology | 50 | 0.50 | 2 |
| **Practical** | | | | |
| BBOT 4207 | Bioprospecting | 25 | 0.25 | 1 |
| BBOT 4208 | Bioinformatics | 25 | 0.25 | 1 |
| BBOT 4209 | Climate Change and Plant Adaptation | 25 | 0.25 | 1 |
| BBOT 4210 | Physiology of Crop Plants | 25 | 0.25 | 1 |
| BBOT 4211 | Cytogenetics | 25 | 0.25 | 1 |
| BBOT 4212 | Biotechnology | 25 | 0.25 | 1 |
| **Viva-voce** | | | | |
| BBOT 4213 | Viva-voce (All major courses of Fourth Year) | 50 | 0.50 | 2 |
| **Research Project/Internship** | | | | |
| BBOT 4214 | Research Project/Internship | 50 | 0.50 | 2 |
| | **Total** | **550** | **5.50** | **22** |

**Mark distribution Theory courses** (Major)

| Total Marks | Examination (70%) | Class Test / Class Assessment / Mid Term/Quiz (20%) | Attendance (10%) |
|---|---|---|---|
| e.g. 50 (2 credits) | 35 | 10 | 5 |

**Mark distribution Practical courses**

| Total Marks | Examination (60%) | Continuous Lab Assessment and/or Report (30%) | Attendance (10%) |
|---|---|---|---|
| e.g. 25 (1 credit) | 15 | 7.5 | 2.5 |

| Year and Semester | First Year | | Second Year | | Third Year | | Fourth Year | | Total |
|---|---|---|---|---|---|---|---|---|---|
| | First Semester | Second Semester | First Semester | Second Semester | First Semester | Second Semester | First Semester | Second Semester | |
| Marks | 500 | 500 | 425 | 500 | 475 | 550 | 500 | 550 | 4000 |
| Units | 5.00 | 5.00 | 4.25 | 5.00 | 4.75 | 5.50 | 5.00 | 5.50 | 40 |
| Credits | 20 | 20 | 17 | 20 | 19 | 22 | 20 | 22 | 160 |

# Curriculum
# For First Year: First Semester

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1101 | | |
| **Course Title** | : General Microbiology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Microbiology is one of the most significant branches of biology specially the need for it has increased after the Covid-19 pandemic. This course aims to provide students with an introduction to the subject of Microbiology and presents ways in which fundamental principles are put into practice and the special skills and techniques needed for identifying microbes.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | learn the historical backgrounds of microbiology and its application in different sectors for human wellbeing; | R |
| CLO 2 | acquire knowledge on the comparative characteristics of different groups of microorganisms and their position in the living world; | U |
| CLO 3 | explain the detail structure, reproduction and classification of cellular and acellular microorganisms such as virus, viroids and prions; | E |
| CLO 4 | apply infectious diseases and their control measurement related knowledge in practical life. | Ap |

R-remember; U-Understanding; Ap-Apply; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| CLO 2 | 3 | 3 | 3 | 2 | 2 | 2 | 2 |
| CLO 3 | 3 | 3 | 2 | 2 | 2 | 2 | 3 |
| CLO 4 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Historical development and scope of microbiology** | **7** | |
| 1.1 | Basic concept, Discovery of microbial world, spontaneous generation vs biogenesis | 2 | 1 |
| 1.2 | Germ theory of disease, pasteurization, principles of | 2 | 1 |

| | | | |
|---|---|---|---|
| | vaccination and Koch's postulates | | |
| 1.3 | Contribution of Leeuwenhoek, Edward Jenner, Alexander Fleming, Louis Pasteur and Robert Koch | 2 | 1 |
| 1.4 | Scope of microbiology: in medical science, agriculture, food and dairy industry, environment and pollution control | 1 | 1 |
| **2.0** | **Classification of microorganisms** | **6** | |
| 2.1 | Introduction to major groups of microorganisms- bacteria, archaea, algae, fungi, protozoa and viruses | 2 | 2 |
| 2.2 | Five kingdom system (R.H. Whittaker, 1969) - criteria for classification, general characteristics of each kingdom, merits and demerits of the system | 2 | 2 |
| 2.3 | Three domain system (Carl Woes, 1990) - General characters of each domain and merits and demerits of the system | 2 | 2 |
| **3.0** | **Viroid and Prion** | **2** | |
| 3.1 | Viroid- Discovery, characteristics and structure, replication and economic importance | 1 | 3 |
| 3.2 | Prion- Discovery, characteristics and structure, replication and economic importance | 1 | 3 |
| **4.0** | **Viruses** | **5** | |
| 4.1 | Discovery, biological status of viruses and general morphology | 1 | 3 |
| 4.2 | Physical and chemical structure of TMV and SARS-COV-2 | 2 | 3 |
| 4.3 | Replication- lytic cycle and lysogenic cycle | 2 | 3 |
| **5.0** | **Archaea** | **1** | |
| 5.1 | Introduction, general characteristics, types, and importance | 1 | 3 |
| **6.0** | **Bacteria** | **7** | |
| 6.1 | Introduction, characteristics, external structure: surface appendages- flagella and pilli; surface adherents- capsule and slime layer | 2 | 3 |
| 6.2 | Structure and function of cell wall- Gram positive bacteria and Gram-negative bacteria; plasma membrane | 2 | 3 |
| 6.3 | Cytoplasm and organelles; special structures- endospore and stalk | 1 | 3 |
| 6.4 | Reproduction: binary fission, genetic recombination- conjugation, transformation and transduction | 2 | 3 |
| **7.0** | **Bacterial and viral diseases in human** | **3** | |
| 7.1 | Bacterial diseases: Tuberculosis, typhoid, Cholera and tetanus | 2 | 4 |
| 7.2 | Viral diseases: Dengue and Influenza | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Alcamo, I.E. 1996. Fundamentals of Microbiology (5th ed.). Addison Wesley Longman, Inc.
2. Dube, H.C.A. 1994. Text Book of Fungi, Bacteria and Viruses. Vikas Publ. Ltd. India.
3. Hawker, L.E. and Linton, A.H. 1972. Microorganisms: Function, Form and Environment. Edward Arnold Publ. London.
4. Pelczer, M.J., Chau, E.C.S and Krieg, N.R. 1993. Microbiology (5th ed.). Tata McGraw-Hill Com. India.
5. Prescott, S.O. and Dunn, C.G. 1959. Industrial Microbiology (3rd ed.). McGraw-Hill, Inc., USA.
6. Stainer, R.Y., Doudoroff, M., and Adelberg, E.A. 1957. The Microbial World. Prentice-Hall, Inc. USA.
7. Tortora, G.J., Funke, B.R. and Case, C.L. 2004. Microbiology an Introduction (8th ed.). Pearson Education Pvt. Ltd. India.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1102 | | |
| **Course Title** | : Introductory Mycology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Introductory Mycology will help students to know regarding fungal taxonomy, reproduction, life cycle and their habitat. This course is also significant to agriculture, pharmaceuticals, industry, food production and environmental studies as decomposers of organic material and pollutants in recycling nutrients and maintaining global carbon cycle.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to : | Cognitive Level |
|---|---|---|
| CLO 1 | define and understand fungal characteristics of different classes and habitats with reproduction systems and life cycle; | U |
| CLO 2 | describe mycological mode of function, pattern of classifications, environmental and nutritional factors, as well as relationship of fungi with agriculture, crop plants and human/animal; | U |
| CLO 3 | learn how to collect, isolate, identify different fungi, and myco-products. | E |

U-Understanding; E –Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| CLO 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 |
| CLO 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 |

Note: 3 - High, 2 - Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction to fungi** | **16** | |
| 1.1 | History of Mycology | 1 | 1 |
| 1.2 | Introduction to kingdom fungi and fungal-like organisms (myxomycetes) | 3 | 1 |
| 1.3 | Habit, Habitat, Growth, Development and Nutrition | 2 | 1,2 |
| 1.4 | Range of vegetative structures of fungi | 2 | 1,2 |
| 1.5 | The reproduction systems of fungi | 2 | 1,2 |
| 1.6 | Taxonomic nomenclature and various systems of fungal classification | 5 | 1,2 |

| | | | |
|---|---|---|---|
| 1.7 | Scope and importance of fungi to mankind | 1 | 1 |
| **2.0** | **Introduction to lower fungi** | **17** | |
| 2.1 | Introduction to lower fungi | 2 | 1 |
| 2.2 | Classification of the lower fungi with key orders | 4 | 1 |
| 2.3 | Chytridiomycetes with particular emphasis on *Synchytrium endobioticum* | 2 | 1,2,3 |
| 2.4 | Oomycetes with special emphasis on *Phytophthora, Saprolegnia, Peronospora, Pythium, Achlya*and *Albugo* | 6 | 1,2,3 |
| 2.5 | Zygomycetes with special emphasis on *Mucor* and *Rhizopus* | 3 | 1,2,3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Alexopoulos, C.J. 1962. Introductory Mycology. John. Wiley & Sons, Inc. N.Y. and London.
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2007. Introductory Mycology (4th Edition). Wiley India Pvt. Ltd.
3. Dube, H.C. 1990. An Introduction to Fungi (2nd Edition). Vikas Publishing House Pvt. Ltd., New Delhi-110014, India.
4. Mehotra, R.S. and Aneija, K.R. 1990. An Introduction to Mycology (1st Edition). New Age International Publishers, New Delhi, India.
5. Sharma, O.P.1989. Text Book of Fungi. Tara McGraw-Hill Pub. Comp. Ltd., New Delhi-110008, India.
6. Vashishta, B.R. 1990. Fungi, Botany for Degree Students (9th Edition). Chand & Company Ltd., New Delhi-110055, India.
7. Webster, J. and Weber, R. 2007. Introduction to Fungi. Cambridge University Press, The Edinburgh Building, Cambridge CB2 8RU, UK.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1103 | | |
| **Course Title** | : Introductory Phycology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Phycology branch of biological science that tells us how chlorophyllous thallophytes the algae are characterized. It includes studying the prokaryotic and eukaryotic forms of algae growing in terrestrial and aquatic habitats. Algae are an important part of aquatic ecosystems and are vital for life on the Earth. A course on algae in Botany will help students understand their role in the environment and their potential uses. Algae forms symbiotic association with lichen and pteridophytes which are unique examples of plant science. It also deals with the applications of algae in different sectors (algalization, food, industry, and aquaculture).

**Course Learning Outcomes (CLO)**

| **CLO No.** | **Expected Course Outcomes** Upon completion of this course, the students will be able to : | **Cognitive Level** |
|---|---|---|
| CLO 1 | learn the trends of algal and lichen classification; | R |
| CLO 2 | acquire basic knowledge on the significance and potentiality of algae and lichen; | U,E |
| CLO 3 | identify algae and lichens, analyze the similarities and dissimilarities between different taxa; | Ap |
| CLO 4 | enable them to exploit different areas (environmental, industry, food, and aquaculture) of life from above mentioned perspective; | Ap,E |
| CLO 5 | apply the skills related to algal biodiversity in conservatiom. | Ap |

R-Remember; U-Understanding; Ap-Apply; E-Evaluate

**Mapping CLOs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 2 | 2 | 3 | 3 | 2 | 3 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| CLO 4 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| CLO 5 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 - Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| **Module** | **Course Contents** | **Credit hrs** | **CLOs** |
|---|---|---|---|
| **1.0** | **Introduction to phycology** | **2** | |
| 1.1 | Definition, history | 1 | 1 |
| 1.2 | Scope | 1 | 1 |

| | | | |
|---|---|---|---|
| **2.0** | **Habit and habitat** | **2** | |
| 2.1 | Habit, habitat diversity; fresh water and marine water algal habitat; | 1 | 2 |
| 2.2 | Terrestrial and sub-aerial algal habitat; unusual habitat of algae | 1 | 2 |
| **3.0** | **Classification of algae** | **2** | |
| 3.1 | Trends of algal classification | 1 | 1 |
| 3.2 | Modern classification of algae | 1 | 1 |
| **4.0** | **Structure of algae** | **5** | |
| 4.1 | Thallus organization and range | 2 | 2 |
| 4.2 | Cell wall; types of chloroplasts, function, and types of flagella | 3 | 1 |
| **5.0** | **Reproduction of algae** | **2** | |
| 5.1 | Vegetative Reproduction | 1 | 1 |
| 5.2 | Asexual and Sexual Reproduction | 1 | 1 |
| **6.0** | **General aspects and significance of the following classes of algae** | **14** | |
| 6.1 | Cyanophyceae: *Oscillatoria* | 2 | 1,2 |
| 6.2 | Chlorophyceae: *Oedogonium* | 2 | 2 |
| 6.3 | Charophyceae: *Chara* | 2 | 2 |
| 6.4 | Euglenophyceae: *Euglena* | 2 | 1,2 |
| 6.5 | Bacillariophyceae*: Navicula* | 2 | 2 |
| 26.6 | Phaeophyceae: *Ectocarpus* | 2 | 2 |
| 6.7 | Rhodophyceae: *Batrachospermum* | 2 | 1,2 |
| **7.0** | **Algae as symbiont** | **2** | |
| 7.1 | Lichen | 1 | 2,3 |
| 7.2 | Pteridophyte: *Azolla* | 1 | 2,3 |
| **8.0** | **Ecological importance of algae** | **1** | |
| 8.1 | Algae as primary producer, water bloom | 1 | 1 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Fogg, G.E. 1974. Biology of Blue-Green Algae. Academic Press-London and New York.
2. Kumar, H.D. 1989. Algal Cell Biology. Affiliated East-West Press Pvt. Ltd. New Delhi, India.
3. Lee, R.E. 2008. Phycology.
4. Prescott, G.W. 1969. The Algae-A Review. Nelson Publ.
5. Round, E.F. 1985. The Ecology of Algae. Cambridge Univ. Press. UK.
6. Singh, R.N. 1961. Role of Blue Green Algae in Nitrogen Economy of Indian Agriculture. ICAR. New Delhi, India.
7. Smith, G.M. 1971. Cryptogamic Botany Algae and Fungi. Vol.1. ($2^{nd}$ed.) Tata Mc Graw-Hill, New Delhi.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1104 | | |
| **Course Title** | : Bryology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course deals with a group of primitive plants known as bryophytes. It includes their habit and habitat, structure, reproduction, function and relationship of the important members of each class. Bryophytes are important to study for many reasons, including their role in the environment, their potential medicinal uses, source as food, and their economic value.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | Understand the unique and general features of bryophytes; | U |
| CLO 2 | Identify the external morphology, internal structure and reproduction of different types of bryophytes; | An |
| CLO 3 | Examine the possible applications of bryology; | Ap |
| CLO 4 | Predict the economic significance of bryophytes. | E |

U-Understanding; Ap-Apply; An-Analyze; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 3 | 2 | 2 | 2 | 2 |
| CLO 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| CLO 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CLO 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**COURSE CONTENT, TEACHING AND ASSESSMENT STRATEGY**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.** | **General Study of Bryophytes** | **10** | |
| 1.1 | Introduction, Distribution and morphology | 2 | 1 |
| 1.2 | Origin of alternation of generation | 2 | 1 |
| 1.3 | Reproduction | 1 | 1 |
| 1.4 | Salient features of bryophytes | 1 | 1 |
| 1.5 | Resemblances and differences of bryophytes with algae and pteridophytes | 1 | 1 |
| 1.6 | Classification | 1 | 1 |
| 1.7 | Evolution of gametophyte and sporophyte among bryophytes | 2 | 2 |

| | | | |
|---|---|---|---|
| **2.** | **Type / Group Study of Bryophytes** | **14** | |
| 2.1 | **Hepaticopsida** | 1 | 1 |
| 2.2 | Morphology, anatomy, reproduction, and life cycle of *Riccia* | 3 | 2 |
| 2.3 | Morphology, anatomy, reproduction, and life cycle of *Marchantia* | 3 | 2 |
| 2.4 | **Anthocerotopsida** | 1 | 2 |
| 2.5 | Morphology, anatomy, reproduction, and life cycle of *Anthoceros* | 2 | 2 |
| 2.6 | **Bryopsida** | 1 | 2 |
| 2.7 | Distribution, habitat and habit of Musci or Mosses, morphology, reproduction, embryo development, comparison between liverworts and mosses, classification | 3 | 2 |
| **3.** | **Conservation of bryophytes** | **3** | |
| 3.1 | Levels of threats and the need for conservation | 1 | 3 |
| 3.2 | Conservation strategies | 1 | 3 |
| 3.3 | Restoration | 1 | 3 |
| **4.** | **Economic importance of bryophytes** | **3** | |
| 4.1 | Biological and ecological importance of bryophytes | 1 | 4 |
| 4.2 | Importance as household, medicine, fine arts, construction, horticulture, food and shelter. | 2 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Glime, J.M. 2006. Bryophyte Ecology. Vol. I. Published online at http://bryoecol.mtu.edu/
2. Smith, G.M. 1938. Crytogramic Botany Vol. II. Bryophytes and pteridophytes. Mc Graw Hill Book Company, London.
3. Vanderpoorten, A. and Goffinet, B. 2009. Introduction to Bryophytes. Cambridge University Press, NY.
4. Vashishta, B.R., Sinha, A.K., Kumar, A. 2018. Botany for Degree Students: Part III: Bryophytes. S. Chand & Com. Ltd. New Delhi.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1105 | | |
| **Course Title** | : Biomolecules | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course explores the chemistry and biological significance of key organic molecules. It connects biochemistry to biology, medicine, agriculture, and disease, covering carbohydrates, lipids, proteins, nucleic acids, and enzymes. Topics include their structure, classification, properties, and roles in biological processes, emphasizing fundamental concepts like optical activity, base-pairing rules, enzyme kinetics, and macromolecular interactions, preparing students for diverse scientific and industrial applications.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | Define, classify and understand the source and structure of different biomolecules and their metabolism in living organisms. | R |
| CLO 2 | Describe the functions, metabolism and importance of biomolecules, nomenclature of enzymes and co-enzymes, transport of substances into the cells. | U |
| CLO 3 | Estimate and purify different biomolecules from different types of biological sources**.** | An, Ap, C |

R- Remember; U-Understanding; Ap-Apply; An-Analyze; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 2 | 3 | 1 | 3 | 2 | 2 | 1 |
| CLO 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 |

Note: 3 - High, 2 – Me3dium, 3 – Low

**COURSE CONTENT, TEACHING AND ASSESSMENT STRATEGY**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Biochemistry:** Introduction, scopes and prospects, relationship with biology, chemistry, agriculture, medicine and diseases | 4 | |
| **2.0** | **Carbohydrates:** Definition, occurrence, biological importance and classification, Structure, biological importance, optical and chemical properties of monosaccharides, disaccharides and polysaccharides | 6 | 1,2 |

| | | | |
|---|---|---|---|
| **3.0** | **Lipids:** Definition, classification, chemical properties and biological importance, classification of fatty acids, essential and non-essential fatty acids; fatty and oils and their characteristics; rancidity of fats and oils | 4 | 1,2 |
| **4.0** | **Amino acids and proteins:** Definition, source, physical, chemical and optical properties of naturally occurring amino acids, classification and structure of naturally occurring amino acids, Essential and non-essential amino acids, peptide bonds, oligopeptides and polypeptides, Identification of N-terminal and C-terminal residue of peptide, Introduction, classification, primary, secondary, tertiary and quaternary structure of proteins, denaturation and renaturation of proteins | 8 | 1 |
| **5.0** | **Nucleic acids:** General structure of nucleosides and nucleotides, chemistry of DNA and RNA, Base pair rule, double helical structure, types and functions of DNA and RNA, denaturation and renaturation of nucleic acids | 4 | 1,2 |
| **6.0** | **Enzymes:** Definition, classification, nomenclature and functions, factors affecting enzyme-catalyzed reactions | 4 | 1,2 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Deb, A.C. 1995. Fundamentals of Biochemistry. New Central Book Agency. 21/1, C.I.T. Road, Kolkata - 700014, India.
2. Harvey, R.A., and Ferrier, D.R. 2011. Lippincott's Illustrated Reviews: Biochemistry (5th edt). Lippincott Williams & Wilkins. 351 West Camden Street, Baltimore, MD 21201, USA.
3. Jain, J.L., Jain, S. and Jain, N. 2022. Fundamentals of Biochemistry (7th Edition). S. Chand & Company Ltd. 7361, Ram Nagar, New Delhi - 110055, India.
4. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. 2003. Harper's Illustrated Biochemistry (26th Edition). McGraw-Hill Medical. 1221 Avenue of the Americas, New York, NY 10020, USA.
5. Nelson, D.L. and Cox, M.M. 2008. Lehninger Principles of Biochemistry (5th edn). W.H. Freeman and Company. 41 Madison Avenue, New York, NY 10010, USA.
6. Sathyanarayan, U. and Chakrapani, U. 2007. Biochemistry. Books and Allied (P) Ltd., (3rd edt), Kolkata.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1106 | | |
| **Course Title** | : Animal Classification and Lower Animal Phyla | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | : Selected Teachers from the dept. of Zoology | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course provides foundational knowledge of the diversity, organization, and evolutionary relationships of animals. It explores classification systems, body forms, embryonic development, and phylum-level taxonomy. Students learn diagnostic features of key phyla and representative species like Paramecium and Ascaris, enabling understanding of animal morphology, physiology, and their ecological and biological significance in evolutionary contexts.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | define different terminologies relevant to Zoology. | R |
| CLO 2 | describe determinate and indeterminate cleavage, protostomia and deuterostomia, morphometrics and meristics, polyp and medusa, roundworm and flatworm, neanthes and heteroneanthes, morphological characteristics of the representative animals. | U |
| CLO 3 | apply skills to mention systematic position, distribution, habit and habitats of the animal. | Ap |

R-Remember; U-Understanding; Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 1 | 3 | 2 | 2 | 3 | 3 | 3 |
| CLO 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 |
| CLO 3 | 3 | 2 | 3 | 3 | 3 | 2 | 1 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Bases of animal classification** | **14** | |
| 1.1 | Body forms (sexual, developmental and polymorphic), symmetry, orientation, metamerism, tagmatization. | 6 | 1,2 |
| 1.2 | Appendages, (flagella, cilia, antennae, styles, podia, fins, wings and limbs). | 3 | 1,2 |
| 1.3 | Germinal layers; Coelom. | 1 | 1 |

| | | | |
|---|---|---|---|
| 1.4 | Embryogeny (radial, spiral, determinate and indeterminate cleavages). | 2 | 1,2 |
| 1.5 | Protostomia and Deuterostomia; morphometrics and meristics | 2 | 1 |
| **2.0** | **Classification of Animals** | **6** | |
| 2.1 | Number of kingdoms; classification up to phyla. | 2 | 1 |
| 2.2 | Different taxa and Linnaean hierarchy and nomenclature on the basis of organization, symmetry and phylogeny. | 4 | 2,3 |
| **3.0** | **Diagnostic and special features of each phylum and salient features and brief morphological description of the following representative animals/groups:** | **10** | |
| 3.1 | The Protozoan Phyla:(The animal-like Phylum of Protista) *Paramecium* | 2 | 2,3 |
| 3.2 | The Metazoan Phyla: Phylum - Porifera: *Scypha* | 2 | 2,3 |
| 3.3 | Eumetazoa | | |
| 3.3.1 | Phylum - Cnidaria: *Obelia*<br>Phylum - Platyhelminthes: *Fasciola, Taenia* | 3 | 2,3 |
| 3.3.2 | Phylum - Nematoda: *Ascaris*<br>Phylum - Annelida: *Neanthes* | 3 | 2,3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Amin, M. 1999. Aumerudondi Pranibidha. Shahitya Prakash, Dhaka, Bangladesh.
2. Jordan, E.L., and Varma, P.S. 2005. Invertebrate Zoology. S. Chand & Company Ltd. 7361, Ram Nagar, New Delhi - 110055, India. ISBN: 978-8121909853.
3. Kabir, S.M.H. 2001. Sadharan Pranibidha. Kabir Publications, Dhaka, Bangladesh.
4. Muttalib, M.A., and Aurongojeb, M. 2005. Metajoyans. Bangladesh Book House, Dhaka, Bangladesh.
5. Qyum, M.A., and et al., 1996. Protozoology. Dhaka University Press, Dhaka, Bangladesh.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1107 | | |
| **Course Title** | : Bangladesh Studies | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | | | |
| **Credit Value** | : 2 | **Credit hours/week**: 12 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course explores the history, geography, and culture of Bangladesh. It covers the Liberation War, the role of Bangabandhu Sheikh Mujibur Rahman, and how the nation was built after independence. Students learn about the Constitution, laws, economy, education, politics, and challenges like governance and foreign policy, gaining a clear picture of Bangladesh's past, present, and future.

**Course Learning Outcome (CLOs)**

| CLO no. | Expected Course Learning Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | know the history, constitution, culture and heritage of Bangladesh; | R |
| CLO 2 | recognize in-depth knowledge on the major political events that shaped Bangladesh as an independent sovereign state; | U |
| CLO 3 | apply their understanding on education, politics, economy and social development of Bangladesh; | Ap |
| CLO 4 | analyze and apply the foreign policies of Bangladesh and relationship with international communities. | An |

R- Remember; U-Understanding; Ap-Apply; An-Analyze

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 2 | 1 | 1 | 3 | 3 |
| CLO 2 | 3 | 3 | 3 | 3 | 1 | 2 | 3 |
| CLO 3 | 1 | 3 | 3 | 3 | 2 | 3 | 3 |
| CLO 4 | 1 | 2 | 3 | 3 | 3 | 2 | 3 |

Note: 3 - High, 2 - Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLO |
|---|---|---|---|
| **1.0** | **Background of the emergence of Bangladesh** | **8** | |
| 1.1 | Prehistory of Bangladesh | 3 | 1 |
| 1.2 | Liberation War 1971 | | 1 |
| 1.3 | The founding father Bangabandhu Sheikh Mujibur Rahman | 3 | 2 |
| 1.4 | Nation-building after independence | 2 | 2 |
| **2.0** | **Constitution of Bangladesh** | **3** | |
| 2.1 | Constitution | 1 | 1 |
| 2.2 | Constitutional amendments | 1 | 1 |
| 2.3 | Different laws related to biology and biodiversity | 1 | 1 |

| | | | |
|---|---|---|---|
| **3.0** | **Geographical feature** | **3** | |
| 3.1 | Geography | 1 | 3 |
| 3.2 | Environmental challenges | 2 | 3 |
| **4.0** | **Different societies and their cultures** | **3** | |
| **5.0** | **Economy** | **3** | **3** |
| 5.1 | Internal and external trade | 2 | 3 |
| 5.2 | Some major socio-economic issues | 1 | 3 |
| **6.0** | **Education** | **2** | 3 |
| **7.0** | **Government and Politics** | **4** | 3 |
| 7.1 | Issues of governance | 2 | 3 |
| 7.2 | Good governance | 1 | 3 |
| 7.3 | Politics and political parties | 1 | 2 |
| **8.0** | **Foreign Policy:** realities and challenges | **4** | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Halim, M.A. 2010. Constitution, Constitutional Law and Politics: Bangladesh Perspective, Chapter VII: Amendment of the Constitution of Bengladesh, CCB Foundation, Dhaka-1000
2. Huq, M.S. 1995. Bangladesh in International Politics. The University Press Limited, Dhaka-1000, Bangladesh.
3. Islam, M.J. and Hamid, S.S. 2017. Alleviating Corruption in Bangladesh: An Agenda for Good Governance, in Dr. Mizanur Rahman (ed.) Human Rights and Corruption, Empowerment through Law of the People (ELCOP), Dhaka-1205.
4. Jahan, R. 2005. Bangladesh Politics: Problems and Issues, Chapter-6: Bangladesh in 1972: Nation-Building in a New State, the University Press Limited, Dhaka-1000, Bangladesh.
5. Muhith, A.M.A. 1999. Bangladesh in the Twenty-First Century: Towards an Industrial Society, Chapter-5: The State of Bangladesh Economy, the University Press Limited, Dhaka-1000, Bangladesh
6. Rashid, H.U. 2012. Bangladesh Foreign Policy: Realities, Priorities and Challenges, 2nd Edition, Chapter-3: Bangladesh Foreign Policy, Academic Press and Publishers Library, Dhaka-1209, Bangladesh.
7. Rashid, K.B.S. 2008. Bangladesh: Resources and Environmental Profile, Chapter-6: Environmental Hazards, A H Development Publishing House, New Market, Dhaka-1205

# Practical Courses

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1108 | | |
| **Course Title** | : General Microbiology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **General Microbiology** |
| 1.1 | Introduction of pioneer scientists in microbiology |
| 1.2 | Microscopy: operation of compound microscope |
| 1.3 | Stain and Staining: simple staining technique |
| 1.4 | Study of infectious diseases |
| 1.5 | Study of commercial microbial products |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1109 | | |
| **Course Title** | : Introduction to Mycology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Introduction to Mycology** |
| 1.1 | Techniques for preparing temporary slides of fungal specimens for microscopic examinations |
| 1.2 | Detailed morphological studies: non-mycelial and mycelial vegetative bodies of the fungi; fungal tissue (prosenchyma and pseudoparenchyma); special somatic structures (selerotia, stroma, rhizomorphs, haustoria); asexual spores (arthrospores, blastospores, chlamydospores, sporangiospores, and conidiospores); sexual spores (oospores and zygospores) |
| 1.3 | Laboratory studies of the locally available members of fungi under Phycomycetes |
| 1.4 | Study the air and soil-borne fungi |
| 1.5 | Preparation of different culture media |
| 1.6 | Collection and preservation of fungi from various sources |
| 1.7 | Practical note book contain description, labeled diagrams and identifying characters of the studied fungal genera |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1110 | | |
| **Course Title** | : Introductory Phycology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Introductory Phycology** |
| 1.1 | Collection of algae from various habitats |
| 1.2 | Common techniques of algae preservation |
| 1.3 | Study of planktonic, terrestrial and sub-aerial algae in the University area |
| 1.4 | Study of the genera covered in the theory along with commonly found algal genera in Rajshahi |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1111 | | |
| **Course Title** | : Bryology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Bryology** |
| 1.1 | Students will conduct field trips (both local and long) and report on them |
| 1.2 | Students will collect bryophytes and study their morphology |
| 1.3 | Students will study the internal structure and reproductive organs of some plant species in the following groups of bryophytes: *Riccia*, *Marchantia*, *Anthoceros*, and moss |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1112 | | |
| **Course Title** | : Zoology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Zoology** |
| 1.1 | Identification of animals |
| 1.2 | Bones and histological slides |
| 1.3 | Dissection of invertebrate and vertebrate animals |
| 1.4 | Class records |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1113 | | |
| **Course Title** | : Field work/Excursion (Major courses) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | : Respective examination committee | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1114 | | |
| **Course Title** | : English | | |
| **Course Type** | : Non Credit | | |
| **Year/Semester** | : First Year First Semester | | |
| **Course Teacher** | | | |
| **Credit Value** | : Non Credit | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The rationale for an English course is a statement that explains the course's education; goals and values. Proficiency in English is important globally. It helps student to develop confidence and competence to meet the demands of social life and employment. The communicative inequality produced by the dominance of English between, in particular, native-speaking scientists/ academics and non-native scientists, the latter experiencing relative disadvantage, it is sometimes claimed, when it comes to placing their work in high prestige international journals. Considering the above issues the English has been included as a four year integrated course in botany.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | more confident to use English as a medium of communications; | R |
| CLO 2 | better equipped to understand learners and how to support their learning in English for biological sciences; | U |
| CLO 3 | apply their knowledge and skills in English as a Medium of Instruction. | Ap, C |

R-Remember; U-Understanding; Ap-Apply; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO1 | PLO2 | PLO3 | PLO4 | PLO5 | PLO6 | PLO7 |
| CLO1 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CLO2 | 3 | 3 | 1 | 3 | 2 | 1 | 2 |
| CLO3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Elementary Grammar** | **7** | |
| 1.1 | use of articles, tenses/ right form of verbs, appropriate prepositions, voice changes, Antonym and Synonym, changes of speeches (narration) | | 1,4 |
| **2** | **Reading** | **3** | |
| 2.1 | Textual reading; making deduction and drawing logical conclusion from reading | 1 | 1,3 |

| | | | |
|---|---|---|---|
| 2.2 | Seen passage, Answering questions from statement | 1 | 2 |
| 2.3 | Reading for others; thinking in English | 1 | 2 |
| **3.** | **Writing** | **6** | |
| 3.1 | Preparing flow chart with proper sequence by the help the statement | 1 | 3 |
| 3.2 | Interpreting graph or chart and make conclusive remark | 1 | 3 |
| 3.3 | Writing a informal and formal e-mail | 1 | 2 |
| 3.4 | CV writing with cover letter | 1 | 3 |
| 3.5 | Writing reports (explaining numerical result, table and data); Arranging subjects in a sequences | 2 | 3 |
| **4.** | **Speaking** | **6** | |
| 4.1 | English language as a tool for communication | 1 | 1 |
| 4.2 | Understand and practice different techniques of communication | 1 | 1 |
| 4.3 | Familiarize with spoken English | 1 | 1 |
| 4.4 | Involved in conversations | 1 | 3 |
| 4.5 | Tips for amplifying students 'conversation skills | 1 | 3 |
| 4.6 | Find out the barriers of conversation and overcome the barriers | 1 | 3 |
| **5.** | **Interview** | **4** | |
| 5.1 | Understand and practice interview etiquettes | 1 | 1 |
| 5.2 | Improving your interview skill | 2 | 3 |
| 5.3 | Mock interview | 1 | 3 |
| 6. | **Presentation** | **4** | |
| 6.1 | Oral and poster presentation | 2 | 3 |
| 6.2 | Planning and arranging and improving quality of presentation | 2 | 3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Goyal, S.K. 2006. Technical English. R. Lall Book Depot.
2. Kim, A. Son, Y.D. and Sohn, S.Y. 2009. Conjoint analysis of enhanhanced English as a medium of instruction for college students. Expert Systems with Applications. 36(6) 10197-10203.
3. Kim, S.K. and Sohn, S.Y. 2009. System to evaluate English as a medium of Instruction in Korean Universities. Expert Systems with Applications 36(9):11626-11632.
4. Kumar, S., and Lata, P. 2017. Communication Skills in English. Oxford University Press.
5. Murphy, R. 2012. English Grammar in Use (4th ed.). Cambridge University Press.
6. Swan, M. 2005. Practical English Usage (3rd ed.). Oxford University Press.
7. Wren, P., and Martin, H. 2005. High School English Grammar & Composition. S. Chand & Company Ltd.

# Curriculum
# For First Year: Second Semester

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1201 | | |
| **Course Title** | : Basic Techniques in Microbiology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course is design to develop laboratory skills and to know about safety rules and laboratory practices. It includes microscope and microscopy, culture media preparation, cultivation, isolation and preservation, microbial growth measurement, microbiological analysis of food, milk and water samples and finally identification of microorganisms in clinical pathology and public health sector.

**Course Learning Outcomes (CLOs)**

| CLOs No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | understand about the laboratory equipment, techniques and safety rules; | U |
| CLO 2 | develop skill for handling microscope, preparing different culture media and preservation techniques of microorganisms; | C |
| CLO 3 | evaluate microbial growth in culture system and analyze microorganisms in various samples as soil, air, water and food; | E |
| CLO 4 | apply the technical knowledge for identification of microorganisms in clinical pathology, research institutes and public health sector. | A |

U-Understanding; Ap-Apply; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 2 | 3 | 2 | 2 | 3 |
| CLO 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 |
| CLO 4 | 2 | 3 | 3 | 3 | 2 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Microbiology laboratory and safety** | **3** | |
| 1.1 | Introduction to common equipment and materials | 1 | 1 |
| 1.2 | Safety rules and Good Microbiological Laboratory Practices (GMLP) | 1 | 1 |
| 1.3 | Biosafety | 1 | 1 |
| **2.0** | **Microscope and microscopy** | **5** | |

| | | | |
|---|---|---|---|
| 2.1 | Introduction, magnification, resolving power, numerical aperture | 1 | 2 |
| 2.2 | Optical microscope: Principles, applications and light pathway of bright field, dark field and phase contrast microscope | 2 | 2 |
| 2.3 | Electron microscope: TEM and SEM | 2 | 2 |
| **3.0** | **Sterilization and aseptic techniques** | **4** | |
| 3.1 | Definition of sterilization, disinfection, sanitization and antiseptic; sterilization vs disinfection | 2 | 1 |
| 3.2 | Methods of sterilization: Physical method and chemical method | 1 | 1 |
| 3.3 | Types and uses of disinfectants; aseptic techniques | 1 | 1 |
| **4.0** | **Cultivation and preservation of microorganisms** | **4** | |
| 4.1 | Culture and media; types of media; composition and preparation of natural media, semi-synthetic and synthetic media; special media: selective, enrichment and differential media | 2 | 2 |
| 4.2 | Preservation: purposes of preservation, methods of culture preservation (short term and long term) and microorganisms culture collection center in the world | 2 | 2 |
| **5.0** | **Growth characteristics** | **4** | |
| 5.1 | Definition of growth, generation number, generation time and growth rate | 1 | 3 |
| 5.2 | Mathematical expressions of growth | 2 | 3 |
| 5.3 | Growth curve and phases of growth- lag phase, log phase, stationary phase and decline phase | 1 | 3 |
| **6.0** | **Methods of growth measurements** | **4** | |
| 6.1 | Direct microscopy: Petroff Hauser cell counter method | 2 | 3 |
| 6.2 | Dilution plate technique: serial dilution, plating and viable plate count. | 2 | 3 |
| **7.0** | **Identification of microorganisms** | **6** | |
| 7.1 | Morphological method: cultural and microscopic | 1 | 4 |
| 7.2 | Biochemical method: indole test, catalase test, oxidase test, methyl red test | 2 | 4 |
| 7.3 | Molecular method: DNA analysis and PCR | 3 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Alcamo, I.E. 1996. Fundamentals of Microbiology (5$^{th}$ed.). Addison Wesley Longman, Inc.
2. Brown, A., & Smith, H. (2014). Benson's Microbiological Applications, Laboratory Manual in General Microbiology, Short Version. McGraw-Hill Education.
3. Cappuccino, G. J., & Sherman, N. (2014). Microbiology: A Laboratory Manual Tenth Edition.
4. Dube, H.C.A. 1994. Text Book of Fungi, Bacteria and Viruses. Vikas Publ.Ltd. India.
5. Hawker, L.E. and Linton, A.H. 1972. Microorganisms: Function, Form and Environment. Edward Arnold Publ. London.
6. Pelczer, M.J., Chau, E.C.S and Krieg, N.R. 1993. Microbiology (5$^{th}$ed.). Tata McGraw-Hill Com. India.
7. Tortora, G.J., Funke, B.R. and Case, C.L. 2004. Microbiology an Introduction (8$^{th}$ed.). Pearson Education Pvt. Ltd. India.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1202 | | |
| **Course Title** | : Higher Fungi | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 2.5 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Higher Fungi will help students to know regarding fungal taxonomy, mode of reproduction, life cycle and their habitat. This course is also significant to agriculture, mushroom farming, mushroom bio-products, pharmaceuticals, alternatives medicine, industry, food production and environmental studies as decomposers of organic material and pollutants in recycling nutrients and maintaining global carbon cycle.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to : | Cognitive Level |
|---|---|---|
| CLO 1 | define and understand fungal characteristics of different classes and habitats with reproduction systems and life cycle; | U |
| CLO 2 | describe mycological mode of function, pattern of classifications, environmental and nutritional factors, as well as relationship of fungi with agriculture, crop plants and human/animal; | U |
| CLO 3 | collect, isolate, identify different fungi and use of myco-products. | Ap |

U-Understanding; Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |
| CLO 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 |
| CLO 3 | 1 | 2 | 3 | 2 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction to Ascomycetes** | **12** | |
| 1.1 | Studies of general characteristics and classification | 2 | 1 |
| 1.2 | Endomycetales with emphasis on the cell structure and the life cycle patterns of the members of Saccharomycetaceae | 2 | 2,3 |
| 1.3 | Eurotiales with emphasis on the imperfect and perfect stages of Aspergilli and Penicilli and their importance | 2 | 2,3 |
| 1.4 | Erysiphales: a discussion on the genera causes of powdery mildew diseases of crop plants and their separation on the basis of cleistothecial appendages | 2 | 2,3 |

| | | | |
|---|---|---|---|
| 1.5 | Meliolales: Common dark mildew fungi and their effect on host plants | 2 | 1,2 |
| 1.6 | Clavicipitales: Production of ergot by *Claviceps purpurea* on rye plant and its importance | 2 | 2,3 |
| **2.0** | **Introduction to Basidiomycetes** | **11** | |
| 2.1 | General characters and classification | 2 | 1 |
| 2.2 | Uredinales: Life cycle pattern, heteroecism and biological specialisation as found amongst the members of this group | 4 | 1,2 |
| 2.3 | Ustilaginales: Life cycle pattern, discussion on the important smut and bunt fungi and their manner of infecting host plants | 2 | 1,2 |
| 2.4 | Aphyllophorales: Morphological and anatomical details of the basidiocarps of agarics and boleti and their role as ectomycorrhizae; poisonous and edible mushrooms | 3 | 2,3 |
| **3.0** | **Introduction to Deuteromycetes** | **9** | |
| 3.1 | General characteristics and Classification | 3 | 1 |
| 3.2 | Pattern of reproduction, conidial ontogeny and their diversity | 2 | |
| 3.3 | The importance of the members of this group as plant pathogen | 4 | 2,3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 2007. Introductory Mycology (4th Edition). Wiley India Pvt. Ltd.
2. Dube, H.C. 1990. An Introduction to Fungi (2nd Edition). Vikas Publishing House Pvt. Ltd., New Delhi-110014, India.
3. Imtiaj, A. 2013. Mushroom Biology (In Bengali), Jatiya Grontha Prakashan, Dhaka, Bangladesh.
4. Mehotra, R.S. and Aneija, K.R. 1990. An Introduction to Mycology (1st Edition). New Age International Publishers, New Delhi, India.
5. Sharma, O.P.1989. Text Book of Fungi. Tara McGraw-Hill Pub. Comp. Ltd., New Delhi-110008, India.
6. Vashishta, B.R. 1990. Fungi, Botany for Degree Students (9th Edition). Chand & Company Ltd., New Delhi-110055, India.
7. Webster, J. and Weber, R. 2007. Introduction to Fungi. Cambridge University Press, The Edinburgh Building, Cambridge CB2 8RU, UK.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1203 | | |
| **Course Title** | : Pteridology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Pteridophytes were the first plants to grow on land and were the first vascular plants to evolve. Pteridology is that branch of plant sciences or biological sciences which deals with the evolutionary significance, morphology, anatomy, reproduction, economic importance and life cycle of pteridophytes. This course will provide theoretical and practical knowledge on biology and diversity of pteridophytes by which the learners will be able to distinguish those plants in their surroundings for future benefits in research area.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | understand the unique and general features of pteridophytes; | U |
| CLO 2 | identify the external morphology, internal structure and reproduction of different types of pteridophytes; | An |
| CLO 3 | examine the possible applications in pteridology; | Ap |
| CLO 4 | predict the economic significance of pteridophytes. | E |

U- Understanding; Ap- Apply; An- Analyze; E- Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 3 | 2 | 2 | 2 | 2 |
| CLO 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| CLO 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CLO 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Pteridophytes** | **5** | |
| 1.1 | Introduction | 1 | 1 |
| 1.2 | General characters | 1 | 1 |
| 1.3 | Life cycle; alternation of generation | 1 | 1 |
| 1.4 | Classification | 1 | 1 |
| 1.5 | Reproduction | 1 | 1 |
| **2.0** | **Type Study – Pteridophytes** | **25** | |

| | | | |
|---|---|---|---|
| 2.1 | Distribution of Psilophyta -*Psilotum*; Lycophyta- *Lycopodium, Selaginella* | 2 | 1 |
| 2.2 | Distribution of Sphenophyta- *Equisetum;* Pterophyta- *Pteris, Marsilea* | 2 | 1 |
| 2.3 | Morphology, anatomy, reproduction, and life cycle of *Psilotum* | 3 | 2 |
| 2.4 | Morphology, anatomy, reproduction, and life cycle of *Lycopodium* | 3 | 2 |
| 2.5 | Morphology, anatomy, reproduction, and life cycle of *Selaginella* | 3 | 2 |
| 2.6 | Morphology, anatomy, reproduction, and life cycle of *Equisetum* | 3 | 2 |
| 2.7 | Morphology, anatomy, reproduction, and life cycle of *Pteris* | 3 | 2 |
| 2.8 | Morphology, anatomy, reproduction, and life cycle of *Marsilea* | 3 | 2 |
| 2.9 | Stelar types in Pteridophytes | 1 | 2 |
| **3.0** | **Economic importance of Pteridophytes** | **2** | **4** |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Ashok, M. Bendre, and Dr. Ashok Kumar, 2009. A Text Book of Practical Botany. Rastogi Publications, Gangotri Shivaji Road, Meerut-250002, India.
2. Rashid, A. 1999. An Introduction to Pteridophyta. Vikash Publ. (2nded) House Pvt. Ltd. New Delhi.
3. Smith, GM. 1938. Crytogamic Botany Vol. II. Bryophytes and pteridophytes. Mc Graw Hill Book Company, London.
4. Sporne, K.R. 1970. The Morphology of pteridophytes(The structure of Ferns and Allied Plants). Hutchinson University Library, London.
5. Sundara Rajan, S. 1994. Introduction to Pteridophyta . New Age International Publishers Ltd., Wiley Eastern Ltd., New Delhi, Bangalore, Bombay, Calcutta, Guwahati, Hyderabad, Lacknow, Madras, Pune, London.
6. Tryon, R.M. and Tryon, H.N. 1982. Ferns and Allied Plants. Springer-Verlag, New York.
7. Vashishta, BR. 2005. Botany for Degree Students: Pteridophytes. S. Chand and Com. Ltd. New Delhi.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1204 | | |
| **Course Title** | : Gymnosperms and Paleobotany | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week:** 3 | **Total credit hours:** 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course covers the classification, characteristics, and economic importance of gymnosperms like Cycas, Pinus, and Ginkgo. It compares gymnosperms with pteridophytes and angiosperms, studying their evolutionary trends. The course also explores paleobotany, including fossil types, fossilization processes, and the study of ancient plants. Students learn about the geological time scale, fossil age determination, and the significance of fossils in areas like fuel exploration.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | classify gymnosperms and fossil; | R |
| CLO 2 | understand various topics of gymnosperms including phylogeny, evolution, seed habit, life cycle, paleobotany, fossil and geological time scale; | U, An |
| CLO 3 | examine the distribution, morphology, anatomy, reproduction and life cycle of gymnosperm; | Ap |
| CLO 4 | compare the gymnosperm with other plant groups. | E |

R-Remember; An-Analyze; U-Understanding; Ap-Apply; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 3 | 1 | 1 | 1 | 1 |
| CLO 2 | 3 | 3 | 3 | 3 | 3 | 1 | 1 |
| CLO 3 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| CLO 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Rationale of the course | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction, classification and importance of Gymnosperms** | **4** | |
| 1.1 | Introduction and general characteristics of Gymnosperms | 1 | 1 |
| 1.2 | Classification of Gymnosperms | 1 | 1 |
| 1.3 | Classification of Sporne (1965), Coulter and Chamberlain (1917) | 1 | 1 |
| | Economic importance of Gymnosperms | 1 | 3 |
| **2.0** | **Comparative accounts of gymnosperms with pteridophytes and angiosperms** | **2** | |
| 2.1 | Comparative study of gymnosperms with pteridophytes | 1 | 2 |
| 2.2 | Comparative accounts of gymnosperms with angiosperms | 1 | 2 |

| | | | |
|---|---|---|---|
| **3.0** | **Characteristic features, relationships and evolutionary tendencies of the major groups of gymnosperms** | **4** | |
| 3.1 | Characteristics of Cycadofilicales, Cycadales and Bennettitales | 1 | 2 |
| 3.2 | Characteristics of Coniferales and Ginkgoales | 1 | 2 |
| 3.3 | Characteristics of Cordaitales and Gnetales | 1 | 2 |
| 3.4 | Relationships and evolutionary tendencies of the major groups | 1 | 2 |
| **4.0** | **Types study- gymnosperms** | **7** | |
| 4.1 | Distribution of the living genera and species of gymnosperms Distribution of Cycadopsida – *Cycas*; Coniferopsida – *Pinus*; Gnetopsidae – *Gnetum* | 1 | 4 |
| 4.2 | Morphology and anatomy of stem, root, leaves of *Cycas* | 1 | 4 |
| 4.3 | Reproductive structures and reproduction and life cycle of *Cycas* | 1 | 4 |
| 4.4 | Morphology and anatomy of stem, root, leaves of *Pinus* | 1 | 4 |
| 4.5 | Reproductive structures and reproduction and life cycle of *Pinus* | 1 | 4 |
| 4.6 | Morphology and anatomy of stem, root, leaves of *Gingo biloba* | 1 | 4 |
| 4.7 | Reproductive structures and reproduction and life cycle of *Gingo biloba* | 1 | 4 |
| **5.0** | **Paleobotany-Fossils** | **6** | |
| 5.1 | Introduction to Paleobotany and its significance | 1 | 5 |
| 5.2 | Types of fossils, process and factor of fossilization | 1 | 1, 6 |
| 5.3 | Determining the age of fossils | 1 | 6 |
| 5.4 | Study of fossils gymnosperms *Lyginopteris* | 1 | 6 |
| 5.5 | Applied aspects of Paleobotany- exploration of fossil fuels | 1 | 6 |
| 5.6 | Implication and importance | 1 | 6 |
| **6** | **Geological time scale** | **2** | |
| 6.1 | Definition and divisions | 1 | 6 |
| 6.2 | Major evolutionary events in the fossils records | 1 | 6 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Coutler, J.M. and Chamberlain, C.J. 1958. Morphology of Gymnosperms. Central book depot. Allahabd.
2. Maarten, J.M., Christenhusz, James L Reveal, Aljos Farjon, Martin F Gardner, Robert R Mill, Mark W Chase, 2011. A new classification and linear sequence of extinct gymnosperms.Phytotaxa,19: 55 - 70.
3. Nasiruddin, M. and Islam, A.K.M.R. 2016. Gymnosperms and Paleobotany. Grantha Kutir, 26 Bangla Bazar, Dhaka-1100.
4. Sporne, K.R., 1967. The Morphology of Gymnosperms. Hutchinson and Co. Ltd. London.
5. Sreevastava, H.N, 1980. A Text Book of Gymnosperms. S Chand and Co. Ltd., New Delhi.
6. Vasishta, P.C. 1980. Gymnosperms. S Chand and Co., Ltd., New Delhi.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1205 | | |
| **Course Title** | : Metabolism and Nutrition | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credits:** 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course delves into the biochemical pathways sustaining life and their regulation. It explores carbohydrate metabolism, the TCA cycle, and energy dynamics alongside concepts of food, nutrients, and their classification. Emphasis is placed on vitamins, minerals, balanced diets, and dietary needs in various physiological states, equipping students with insights into health, nutrition, and metabolic processes.

**Course Learning Outcomes (CLO)**

| **Co No.** | **Expected Course Outcomes** Upon completion of this course, the students will be able to: | **Cognitive Level** |
|---|---|---|
| CLO 1 | Know the major pathways of intermediary metabolism of biomolecules, regulations and calculate the energetics of metabolic pathways and also the properties, functions and health effects of nutrients; | R |
| CLO 2 | Understand the properties, functions and health effects of nutrients; | U |
| CLO 3 | Plan meals for all populations, energy requirements for individual and describe the methods for assessing the nutritional status of a target group of population. | An, Ap, C |

R- Remember; U-Understanding; Ap-Apply; An-Analyze; C-Create

**Mapping CLOs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| CLO 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 |
| CLO 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| **Module** | **Course Contents** | **Credit hrs** | **CLOs** |
|---|---|---|---|
| **1.0** | **Intermediary metabolism:** Definition, catabolic, anabolic and amphibolic pathways, metabolic turnover, experimental approaches to intermediary metabolism | **5** | **1** |
| **2.0** | **Carbohydrate metabolism:** Glycolysis, Occurrence, glycolytic pathway, aerobic and anaerobic fate of pyruvate, regulation and energetic of glycolytic pathway, pentose phosphate pathway, glyoxalate pathway, Cori cycle, glycogenolysis, gluconeogenesis | **10** | |

| | | | |
|---|---|---|---|
| | and their regulations<br>**Tricarboxylic acid cycle:** Occurrence, cycle overview, amphibolic nature of the cycle, regulation and energetic of TCA cycle | | |
| **3.0** | **Food, Nutrition and Nutrients:** Basic concept on food, nutrition and nutrients, classification of food stuffs, classification of nutrients | **3** | **1** |
| **4.0** | **Vitamins:** Classification, co-enzyme activity and deficiency symptoms, dietary sources and requirement | **5** | **1, 2** |
| **5.0** | **Minerals and trace elements:** Occurrence and role on nutrition, daily requirements, deficiency symptoms, interrelation between vitamins and minerals | **4** | **1,2** |
| **6.0** | **Balanced diet:** Diet in altered physiological conditions, pregnant and lactating mothers and adult woman, growing children and adult man | **3** | **3** |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Deb, A.C. 1995. Fundamentals of Biochemistry. New Central Book Agency. 21/1, C.I.T. Road, Kolkata - 700014, India.
2. Harvey, R.A., and Ferrier, D.R. 2011. Lippincott's Illustrated Reviews: Biochemistry (5th edn). Lippincott Williams & Wilkins. 351 West Camden Street, Baltimore, MD 21201, USA.
3. Jain, J.L., Jain, S. and Jain, N. 2022. Fundamentals of Biochemistry (7th edn). S. Chand & Company Ltd. 7361, Ram Nagar, New Delhi - 110055, India.
4. Murray, R.K., Granner, D.K., Mayes, P.A. and Rodwell, V.W. 2003. Harper's Illustrated Biochemistry (26th Edn). McGraw-Hill Medical. 1221 Avenue of the Americas, New York, NY 10020, USA.
5. Nelson, D.L. and Cox, M.M. 2008. Lehninger Principles of Biochemistry (5th edn). W.H. Freeman and Company. 41 Madison Avenue, New York, NY 10010, USA.
6. Sathyanarayan, U. and Chakrapani, U. 2007. Biochemistry. Books and Allied (P) Ltd., 3rd Edition, Kolkata.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1206 | | |
| **Course Title** | : Phyla Mollusca to Chordata and Applied Zoology | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : Selected Teachers from the dept. of Zoology | | |
| **Credit Value** | : 2 | **Credit hours/week**: 12 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course explores key animal groups, focusing on their unique features, classification, and representative species like Pila, pigeon, and guinea pig. It highlights evolutionary and structural diversity. Applied Zoology introduces practical aspects like sericulture, apiculture, and lac culture, emphasizing their economic importance, applications, and relevance to sustainable livelihoods.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | define different terminologies relevant to Zoology; | R |
| CLO 2 | describe the characteristics of Mollusca, Uniramia and Biramia, Urochordata and Cephalochordata, compare different classes of Vertebrate, morphological characteristics of the representative animals; | U |
| CLO 3 | apply skills to mention systematic position, distribution, habit, habitats and importance of the animal. | Ap |

R-Remember; U-Understanding; Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CLO 2 | 1 | 3 | 2 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 3 | 1 | 3 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CO |
|---|---|---|---|
| **1.0** | **Diagnostic and special features of each phylum and salient features and brief morphological description of the following representative animals/groups:** | **30** | |
| 1.1 | Phylum - Mollusca: *Pila*, *Loligo*;<br>Phylum- Onychophora: *Peripatus* | 4 | 2,3 |
| 1.2 | Phylum - Uniramia: Honeybee;<br>Phylum - Crustacea: prawn. | 4 | 2,3 |
| 1.3 | Phylum - Hemichoradata: *Balanoglossus*;<br>Phylum - Echinodermata: *Asterias.* | 4 | 2,3 |
| 1.4 | Phylum - Chordata:<br>Sub-Phylum: Urochordata: *Ascidia*;<br>Sub-Phylum: Cephalochordata: *Branchiostoma.* | 4 | 2,3 |

| | | | |
|---|---|---|---|
| 1.5 | Sub-Phylum: Vertebrata:<br>Class-Chondrichthyes: Dogfish (Scoliodon);<br>Class- Osteichthyes: Major carp (*Labeo*);<br>Class- Reptilia: Lizard;<br>Class- Aves: pigeon;<br>Class- Mammalia: Guinea pig. | 8 | 2,3 |
| **2.0** | **Applied Zoology** | **6** | |
| 2.1 | Scope, limitation and importance of Sericulture, Apiculture and Lac culture | 6 | 3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Amin, M. 1999. Aumerudondi Pranibidha. Shahitya Prakash, Dhaka, Bangladesh.
2. Jordan, E.L. and Varma, P.S. 2005. Invertebrate Zoology. S. Chand & Company Ltd. 7361, Ram Nagar, New Delhi - 110055, India.
3. Kabir, S.M.H. 2001. Sadharan Pranibidha. Kabir Publications, Dhaka, Bangladesh.
4. Muttalib, M.A., and Aurongojeb, M. 2005. Metajoyans. Bangladesh Book House, Dhaka, Bangladesh.
5. Qyum, M.A. and al., et. 1996. Protozoology. Dhaka University Press, Dhaka, Bangladesh.


# Practical Courses

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1207 | | |
| **Course Title** | : Basic techniques in Microbiology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Basic techniques in Microbiology** |
| 1.1 | Sterilization: Operation of autoclave |
| 1.2 | Culture media preparation: Nutrient broth and nutrient agar |
| 1.3 | Isolation technique: Streak plate technique and pure culture |
| 1.4 | Stain and Staining: Gram staining technique |
| 1.5 | Viable count of bacteria by dilution plate method |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1208 | | |
| **Course Title** | : Higher Fungi | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Higher Fungi** |
| 1.1 | Detailed morphological studies: vegetative bodies of the fungi; Architecture of fruiting bodies and their tissues; asexual and sexual spores (ascospores and basidiospores) with spore print. |
| 1.2 | Laboratory studies of the locally available members of fungi under Ascomycetes, Basidiomycetes and Deuteromycetes. |
| 1.3 | Study the wood decay, white rot and brown rot fungi. |
| 1.4 | Collection and preservation of macro-fungi from various sources. |
| 1.5 | Preparation of substrates and methods of mushroom cultivation. |
| 1.6 | Practical note book contain description, labeled diagrams and identifying characters of the studied fungal genera. |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1209 | | |
| **Course Title** | : Pteridology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Pteridology** |
| 1.1 | Field trip and report on them |
| 1.2 | Collection of Pteridophytes and studies of their morphology |
| 1.3 | Studies on internal structure and reproductive organs of some plant species in the following groups of Pteridophytes: Equisetum, Selaginella, Pteris, Dryopteris and Morsilea |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1210 | | |
| **Course Title** | : Gymnosperms and Paleobotany | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Gymnosperms and Paleobotany** |
| 1.1 | Studies on external and internal features and reproductive structures of the prescribed gymnosperms |
| 1.2 | Studies on internal features of plant parts of living gymnosperms of Bangladesh |
| 1.3 | Study of TS of coralloid root |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1211 | | |
| **Course Title** | : Biochemistry | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Biochemistry** |
| 1.1 | Colour tests for carbohydrates and proteins |
| 1.2 | Titrimetric analysis |
| 1.3 | Estimation of vitamin C from supplied sample and biological sources by 2, 6, dichlorophenol indophenol |
| 1.4 | Chromatographic separation and identification of amino acids |
| 1.5 | Colorimetric estimation of protein and glucose |
| 1.6 | Isolation & purification of micro-organisms, growth of bacteria in solid and liquid media |
| 1.7 | Determination of saponification & iodine value of fats & oils |
| 1.8 | Determination of SGPT & SGOT activity in blood |
| 1.9 | Determination of creatinine in urine |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1212 | | |
| **Course Title** | : Viva-voce (All major courses of First Year) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : First Year Examination Committee | | |
| **Credit Value** | : 2 | **Credit hours/week**: | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 1213 | | |
| **Course Title** | : Field work/Excursion (Major courses) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : First Year Second Semester | | |
| **Course Teacher** | : Respective examination committee | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

# Curriculum
# For Second Year: First Semester

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2101 | | |
| **Course Title** | : Plant Taxonomy and Morphology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course focused plant description, identification, nomenclature, classification and diversity studies of flowering plants. It also highlighted morphology of angiosperms, principles of taxonomy, taxonomic characters, development of herbarium and botanical gardens and taxonomically and medicinally important selected angiosperm families. This knowledge is crucial for improving plant taxonomy and helpful for students about plant identification and conservation.

**Course Learning Outcomes (CO)**

| CLo No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | understand the plant morphology, terminologies as a foundation for plant recognition and identification; | U |
| CLO 2 | analyze the methods and principles of classification and nomenclature; | An |
| CLO 3 | plan field and lab based studies of angiosperm diversity; identify morphological specialities and writing short species descriptions and illustrations; | E |
| CLO 4 | identify members of the major angiosperm families by observing their diagnostic features and economic importance. | Ap |

U- Understanding; An- Analyze; E- Evaluation; Ap- Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 3 | 3 | 2 | 3 | 3 | 2 |
| CLO 2 | 2 | 2 | 2 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 1 | 2 | 3 | 3 | 3 |
| CLO 4 | 3 | 3 | 2 | 2 | 3 | 3 | 2 |

Note: 3 - High, 2 - Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLO |
|---|---|---|---|
| **1.0** | **Angiosperm Morphology** | **10** | |
| 1.1 | Root Morphology: Types and functions | 1 | 1 |
| 1.2 | Stem Morphology: Types and functions | 1 | 1 |
| 1.3 | Leaf Morphology: types, venation, phyllotaxy | 1 | 1 |
| 1.4 | Flower Morphology: Types and figures with examples | 1 | 1 |
| 1.5 | Floral parts, aestivation, placentations, floral diagram | 1 | 1 |

| | | | |
|---|---|---|---|
| | and floral formula | | |
| 1.6 | Inflorescence: racemose types – simple raceme, corymb, umbel, spike, spadix, head and catkin | 1 | 1 |
| 1.7 | Cymose types-simple cyme; monochasial – scorpoid and helicoids, dichasial and polychasial | 1 | 1 |
| 1.8 | Special type – cyathium, hypanthodium, verticillaster and panicle | 1 | 1 |
| 1.9 | Fruits: Types, simple fruits with figures and examples | 1 | 1 |
| 1.10 | Composite fruits with figures and examples | 1 | 1 |
| **2.0** | **Taxonomy: Principles of Plant Taxonomy** | **10** | |
| 2.1 | Aim and scope and significance of Taxonomy. Components and Phases of Taxonomy. Types of classification – artificial (brief account) | 1 | 2 |
| 2.2 | Natural: Bentham and Hooker (detailed account) | 1 | 2 |
| 2.3 | Phylogenetic classification: Englar and Prantl's System | 1 | 2 |
| 2.4 | Bessey's System | 1 | 2 |
| 2.5 | Hutchinson's System: Angiosperm phylogeny group system | 1 | 2 |
| 2.6 | ICBN/ICN, BAPT/IAPT, ICNCP | 1 | 2 |
| 2.7 | Binomial nomenclatures, author citation, conserve names. Principle of priority, valid publication, name changes | 1 | 2 |
| 2.8 | Taxonomic Characters: Different types and neglected morphological characters | 1 | 2 |
| 2.9 | Herbarium technique: importance of herbarium; preparation of herbarium and their preservation. Important of herbaria of the world | 1 | 3 |
| 2.10 | Botanical garden: role of botanical gardens in plant conservation and identification. Important botanical gardens of the world | 1 | 3 |
| **3.0** | **Detailed study of Families:** (Study the following families of Bentham and Hooker"s system with special reference to their vegetative and floral characters; special attention should be given to common and economically important plants within the families) | **10** | |
| 3.1 | Apocynaceae | 1 | 4 |
| 3.2 | Cucurbitaceae | 1 | 4 |
| 3.3 | Euphorbiaceae | 1 | 4 |
| 3.4 | Verbenaceae | 1 | 4 |
| 3.5 | Rutaceae | 1 | 4 |
| 3.6 | Solanaceae | 1 | 4 |
| 3.7 | Asteraceae | 1 | 4 |
| 3.8 | Arecaceae (Palmae) | 1 | 4 |
| 3.9 | Poaceae | 1 | 4 |
| 3.10 | Orchidaceae | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Bhattacharya, B. and Johri, B.M. 1998. Flowering Plants: Taxonomy and Phylogeny. Narosa Publishing House, New Delhi. India.
2. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, U.S.A.
3. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd Ltd, Edinburgh, London.
4. International Code of Botanical Nomenclature: Melbourne Code 2011. Australia.
5. Sivaranjan, V.V. and Robson, N.K.P. 1991. Introduction to the Principles of Plant Taxonomy (2nd ed.). Oxford & IBH Publishing Co. Pvt. Ltd. Calcutta, New Delhi.
6. Sharma, O.P. 2004. Plant Taxonomy. Tata MacGraw Hill Publihing Co. Ltd. New Delhi.
7. Subrahmanyam, N.S. 2004. Modern Plant Taxonomy. Vikas Publishing House (Pvt) Ltd. New Delhi, India.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2102 | | |
| **Course Title** | : Plant Physiology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Plant physiology is the study of plant processes, behavior and explores water transport, nutrient accumulation and transportation, phototropism, and other tropisms in plants. This knowledge is crucial for improving agricultural practices, enhancing crop yields, and addressing global challenges like food security, climate change, and environmental sustainability. This course equips students with the tools to make significant contributions to agricultural innovation, ecological sustainability, and biotechnological advancements.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to : | Cognitive Level |
|---|---|---|
| CLO 1 | describe the various physiological aspects in plants; | U |
| CLO 2 | learn about the importance of mineral nutrition in plants; | Ap |
| CLO 3 | evaluate the role of light and temperature on flowering and germination; | E |
| CLO 4 | discuss the basic aspects of photoperiodism; | U |
| CLO 5 | improve basic skills and techniques related to plant physiology. | C |

U- Understanding; Ap-Apply; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 2 | 2 | 1 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| CLO 4 | 2 | 3 | 2 | 3 | 2 | 2 | 2 |
| CLO 5 | 3 | 3 | 1 | 3 | 2 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Water relations** | **10** | |
| 1.1 | Plant water relations: Water potential - Concepts and Components | 2 | 1 |
| 1.2 | Absorption of water | 2 | 1 |
| 1.3 | Ascent of sap | 2 | 1 |
| 1.4 | Transpiration - types, mechanism, significance; | 2 | 1 |

| | | | |
|---|---|---|---|
| | antitranspirants; Guttation | | |
| 1.5 | Theories of stomatal movement (Starch-sugar, Proton-$K^+$ ion exchange) | 2 | 1 |
| **2.0** | **Mineral nutrition** | **6** | |
| 2.1 | Essentiality, Occurrence, availability, source and deficiency symptoms of micro and macro elements | 4 | 2 |
| 2.2 | Absorption of minerals | 2 | 2 |
| **3.0** | **Photoperiodism** | **4** | |
| 3.1 | Definition, types | 1 | 4 |
| 3.2 | Role of light, pigments and hormones | 2 | 4 |
| 3.3 | Application | 1 | 4 |
| **4.0** | **Vernalization** | **2** | |
| 4.1 | Definition and historical Background | 1 | 4 |
| 4.2 | Process and application of vernalization | 1 | 4 |
| **5.0** | **Plant movement** | **4** | |
| 5.1 | Definition, Types and Description of movements | 4 | 3 |
| **6.0** | **Germination and dormancy** | **4** | |
| 6.1 | Definition and types of germination | 1 | 1 |
| 6.2 | Definition and types of dormancy | 2 | 1 |
| 6.3 | Process of breaking dormancy | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Bhatla, S.C. and Lal M.A. 2018. Plant Physiology, Development and Metabolism. Springer Nature Singapore Pte Ltd. ISBN 978-981-13-2022-4
2. Duca, M. 2015. Plant Physiology. Springer International Publishing, ISBN 3319179098, 9783319179094.
3. Hopkins, W.G. and Huner, N.P.A. 2008. Introduction to Plant Physiology. John Willey and sons, Inc. USA. ISBN: 978-0-470-46142-6.
4. Jain, V.K. 2018. Fundamentals of Plant Physiology, S. Chand Publishing, India, ISBN 9352533348, 9789352533343.
5. Mukherji, S. and Ghosh, A.K. 2015. Plant Physiology. New Central Book Agency, India.
6. Taiz, L. and Zeiger, E. 2010. Plant Physiology (5th Edition). Sinauer Associates Publishers, Sunderland, Massachusetts, United States. ISBN-13: 978-0878938667.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2103 | | |
| **Course Title** | : Cell Biology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course provides foundational knowledge of cells, their structure, function, and processes. It covers the cell wall, membrane, organelles like mitochondria and chloroplasts, and mechanisms of energy transformation and autophagy. Students learn about cell division, the cell cycle, and advanced techniques like microscopy and cell culture, linking cellular functions to broader biological systems and research applications.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to : | Cognitive Level |
|---|---|---|
| CLO 1 | know the fundamental principles of cellular biology; | R |
| CLO 2 | develop in-depth understanding of cell structure and functions, cell signaling, cell and chromosomal movement; | U |
| CLO 3 | analyze the major cellular events with practical application; | An |
| CLO 4 | apply different techniques for studying cell structure, function, cell division and cell cycle. | Ap |

R-Remember; U-Understanding; An- Analyze; Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 2 | 3 | 2 | 2 | 2 |
| CLO 2 | 2 | 2 | 2 | 3 | 3 | 2 | 2 |
| CLO 3 | 2 | 3 | 1 | 3 | 2 | 3 | 3 |
| CLO 4 | 2 | 3 | 1 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Cellular Prefatory** | **5** | |
| 1.1 | History | 2 | 1 |
| 1.2 | Cytology versus Cell Biology | 1 | 1 |
| 1.3 | Cell biology and other biological sciences | 2 | 1 |
| **2.0** | **Cell wall and Membrane** | **7** | |
| 2.1 | Ultra structure of cell wall | 2 | 2 |
| 2.2 | Structural models of cell membrane | 3 | 2 |
| 2.3 | Function of cell wall and cell membrane | 1 | 3 |
| 2.4 | Movement of substances across membrane (general account) | 1 | 2 |

| | | | |
|---|---|---|---|
| **3.0** | **Cellular Energy Transformation** | **6** | |
| 3.1 | Size, shape, number and structure of mitochondria and chloroplast | 3 | 2 |
| 3.2 | Role of mitochondria in oxidative phosphorylation | 2 | 3 |
| 3.3 | Role of chloroplast in photosynthesis | 1 | 2 |
| **4.0** | **Cellular Packaging** | **3** | |
| 4.1 | Ultra structure and function of endoplasmic reticulum, golgi apparatus and lysosomes | 1 | 2 |
| 4.2 | Structure and function of microtubule | 1 | 2 |
| 4.3 | Mechanism of autophagy | 1 | 2 |
| **5.0** | **Cellular Reproduction** | **7** | |
| 5.1 | The cell cycle process | 1 | 4 |
| 5.2 | Mechanism of mitotic and meiotic cell divisions and their significances | 3 | 4 |
| 5.3 | Chromosome pairing and crossing over | 2 | 2 |
| 5.4 | Cytokinesis and cell plate formation | 1 | 2 |
| **6.0** | **Cellular Techniques** | **2** | |
| 6.1 | Microscopy; cell fractionation; autoradiography | 1 | 4 |
| 6.2 | Cell culture; chromatography; electrophoresis | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Dalela, R.C. and Verma, S.R. 1996. A Text Book of Cytology, Jai Prakash Nath& Co. India
2. De Robertis, Nowinsk and Saez. 1963. Cell Biology. W.B. Saunders Company, Philadelphia and London.
3. Dowben, R. 1993. Cell Biology. Kalyani Publishers, India.
4. Gupta, M.L. and Jangir, M.L. 1998. Cell Biology. Agro Botanica, India.
5. Power, C.B. 1997. Cell Biology. Himalayan Publishers Home, India.
6. Swanson, C.P. 1965. Cytology and Cytogenetics. Macmillan & Co. Ltd., London.
7. Verma, P.S. and Agarwal, V.K. 1998. Cell Biology, Molecular Biology, Evolution and Ecology. S. Chand and Company Ltd., India.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2104 | | |
| **Course Title** | : Agronomy | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Agronomy is the science in agriculture that addresses the sustainable and maximum production of crops. This course is designed to equip learners with the knowledge of crop production, optimizing crop yields by managing soil conditions, tillage, fertilization, and other environmental factors aiming to improve productivity while minimizing costs. Combining theoretical and practical knowledge, the course empowers students to make decisions that benefit the agricultural sector, society, and the environment.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | understand the various agricultural aspects in crop plants; | U |
| CLO 2 | know different soils, seeds, crops, weeds, manures and fertilizers, irrigation system and herbicides; | R |
| CLO 3 | learn about the necessity of sustainable agriculture and solve problem related to agronomy; | E, C |
| CLO 4 | evaluate the application and importance of agronomic principles in crop management. | E, Ap |

R- Remember; U- Understanding, Ap- Apply; E- Evaluate; C- Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CLO 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CLO 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CLO 4 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Rationale of the course | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction** | **2** | |
| 1.1 | Definition and history | 1 | 1 |
| 1.2 | Principles and scope of agronomy | 1 | 1 |
| **2.0** | **Soil** | **4** | |
| 2.1 | Definition; components and texture | 1 | 1,2 |
| 2.2 | soil moisture; organic matter | 1 | 2,3 |
| 2.3 | organisms and fertility | 2 | 2,3 |
| **3.0** | **Seed** | **3** | |
| 3.1 | Definition; Types, structure and function | 1 | 2,3 |
| 3.2 | Classes of seed, seed purity | 1 | 2,3 |

| | | | |
|---|---|---|---|
| 3.3 | Seed dispersal and seed germination | 1 | 2,3 |
| **4.0** | **Crops** | **3** | |
| 4.1 | Classification of crops | 1 | 2,3 |
| 4.2 | Importance of agronomy crops | 1 | 2,4 |
| 4.3 | Cropping system | 1 | 3,4 |
| **5.0** | **Tillage** | **2** | |
| 5.1 | Definition and types | 1 | 1,2 |
| 5.2 | Importance | 1 | 2,4 |
| **6.0** | **Manures and fertilizers** | **3** | |
| 6.1 | Definition and differences | 1 | 1,2 |
| 6.2 | Classifications and application | 1 | 2,4 |
| 6.3 | Merits and demerits of manure and fertilizers | 1 | 2,3 |
| **7.0** | **Irrigation** | **4** | |
| 7.1 | Source of water | 1 | 1,2 |
| 7.2 | Types and applications | 2 | 2,4 |
| 7.3 | Importance | 1 | 2,3 |
| **8.0** | **Weeds** | **6** | |
| 8.1 | Definition and classification | 2 | 1,2 |
| 8.2 | Common weeds of agricultural field in Bangladesh | 2 | 3,4 |
| 8.3 | Effects of weeds on crops | 2 | 3 |
| **9.0** | **Herbicides** | **3** | |
| 9.1 | Definition and Classification. | 2 | 1,2 |
| 9.2 | Application. | 1 | 2,3,4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Balasubramaniyan, P. and Palaniappan, S.P., 2004. Principles and Practices of Agronomy Agrobios, Jodhpur, India.
2. Chandrasekaran, B., Annadurai, K. and Somasundaram, E. 2010. A Textbook of Agronomy. New Age International Publishers, New Delhi, India.
3. Das, P.C. 2000. Manures and fertilizers, Kalyani Publishers, New Delhi, India.
4. Gupta, O.P., 1998. Weed management- Principles and Practices. Agro Botanical Publishers, Bikaner.
5. Kirkham, M.B. (Editor). 2004. Water Use in Crop Production. Narosa Publishing House Pvt. Ltd. New Delhi, India.
6. Reddy, S.R., 1999. Principles of Agronomy. Kalyani Publishers, New Delhi, India.
7. Reddy, T.Y. and G.H.S. Reddi. 2004. Principles of Agronomy. Kalyani Publishers, New Delhi, India.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2105 | | |
| **Course Title** | : Social Psychology and Ethics | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course introduces students to the science of how our thoughts, feelings, and behaviors are influenced by the society we live in. Contents introduced here reveal important social phenomena, stimulating students' thinking about the basic processes and information underlying social behaviors, social ethics and values, social perception, social relations, attitudes, group processes, and leadership.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon successful completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | acuire knowledge on the nature and scope of social psychology and understand the effects of attitudes, group conformity and leadership styles in influencing social behaviors; | R |
| CLO 2 | understand how social perception and social relations can ensure a soothing state with enhanced psychological well-being; | U |
| CLO 3 | implement social values and ethics irrespective of the social influence under pressure while interacting with different stakeholders of the society. | An, Ap, C |

R-Remember; U-Understanding; An-Analyze; Ap-Apply; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| CLO 2 | 3 | 3 | 2 | 3 | 2 | 2 | 1 |
| CLO 3 | 3 | 2 | 3 | 1 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs. | CLOs |
|---|---|---|---|
| **1.0** | **Introducing Social Psychology** | **3** | |
| 1.1 | Subject matter of social psychology; social psychology & related fields | 1 | 1 |
| 1.2 | Brief history of social psychology | 1 | 1 |
| 1.3 | Research methods used in social psychology | 1 | 1 |
| **2.0** | **Social Perception** | **4** | |
| 2.1 | Socialization: self-concept, self-esteem, and self-presentation | 2 | 2 |
| 2.2 | Person perception: observation, attribution, integration, and confirmation biases | 2 | 2 |
| **3.0** | **Attitudes and Attitude Change** | **4** | |
| 3.1 | Formation of attitudes; Measurement of attitudes | 1 | 1, 2 |

| | | | |
|---|---|---|---|
| 3.2 | Processes of attitude change | 1 | 1, 2 |
| 3.3 | Theories of attitude change; Persuasive communications and attitude change | 2 | 1, 2 |
| **4.0** | **Group Processes** | **4** | |
| 4.1 | Fundamentals of groups, social facilitation, social loafing, group think, group conformity and obedience | 2 | 1, 2 |
| 4.2 | goals and plans in groups, cooperation and competition within and between groups | 2 | 1, 2 |
| **5.0** | **Social Relations** | **4** | |
| 5.1 | Prejudice: disliking others | 1 | 1,2,3 |
| 5.2 | Aggression: hurting others | 1 | 1,2,3 |
| 5.3 | Attraction and intimacy, Altruism, Conflict and peacemaking | 2 | 1,2,3 |
| **6.0** | **Leadership** | **3** | |
| 6.1 | Defining leadership; Traits, types, and approaches to leadership; Functions of leaders | 2 | 1, 2 |
| 6.2 | Leadership effectiveness | 1 | 1, 2 |
| **7.0** | **Ethics and Values in Social Psychology:** | **3** | |
| 7.1 | Institutional review boards, Informed consent, Debriefing, Ethics and consent online | 2 | 2, 3 |
| 7.2 | Values and science: ongoing debates and controversies | 1 | 2, 3 |
| **8.0** | **Social Psychology and the Law** | **3** | |
| 8.1 | Eyewitness testimony: perceiving the crime, storing the memory, identifying the culprit and testifying in the court | 2 | 2, 3 |
| 8.2 | Confessions: the psychology of lie detection, social influence under pressure, why innocent people confess | 1 | 2, 3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Aronson, E. & Wilson, T. D., & Sommers, S. R. (2019). Social Psychology (10thed.). New York: Pearson.
2. Baron, R.A., & Byrne, D. (1988). 'Social Psychology' Understanding Human Interaction (7thed.). Prentice Hall of India, New Delhi.
3. Kassin, S., Fein, S., & Markus, H. R. (2017). Social Psychology (10thed.). Wadsworth, Cengage learning.
4. Krech, D., Crutchfield, R. S., & Ballachey, E. L. (1962). Individual in society: A textbook of social psychology. McGraw-Hill.
5. Myers, D. G., & Twenge, J. M. (2016). Social Psychology (12thed.). McGraw-Hill Book Company. New York.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2106 | | |
| **Course Title** | : Horticulture and Floriculture | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Horticulture and floriculture courses are designed to equip students with the knowledge and skills needed to grow, manage, and utilize plants for food, aesthetics, and environmental sustainability. This course addresses key challenges and opportunities in food production, environmental sustainability, and economic development.

**Course Learning Outcomes (CLOs)**

| **CLO No.** | **Expected Course Outcomes**<br>Upon completion of this course, the students will be able to: | **Cognitive Level** |
|---|---|---|
| CLO1 | know the various terms of horticulture and floriculture; | R, U |
| CLO2 | understand field and nursery layout to cultivation, and management environmental factors, soil, fertilizer, irrigation and weeds for horticulture and floriculture crops; | E |
| CLO3 | apply some of the practical skills for plant propagation and improvement of horticulture and floriculture plants; | U, Ap |
| CLO4 | apply the knowledge to analyze and interpret the different practices of horticultural crop management; | Ap, An |
| CLO5 | create about various cultivation methods of horticulture and floricultural crops and apply this knowledge in commercial production. | C, Ap |

U- Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 3 | 2 | 2 | 2 | 2 | 1 | 2 |
| CLO 2 | 2 | 2 | 3 | 3 | 2 | 2 | 2 |
| CLO 3 | 1 | 2 | 2 | 2 | 2 | 2 | 2 |
| CLO 4 | 2 | 2 | 2 | 3 | 3 | 3 | 2 |
| CLO 5 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| | **Horticulture** | | |
| **1.0** | **Introduction** | **3** | |
| 1.1 | Definition, history, branches and importance of horticulture | 1 | 1 |
| 1.2 | Classification of horticultural crops | 1 | 1 |
| 1.3 | Role of horticultural crops in human nutrition | 1 | 1 |
| | | | |
| **2.0** | **Field and horticultural crops management** | **6** | |
| 2.1 | Soil and climatic for horticulture crops | 1 | 2 |
| 2.2 | Bed preparation of horticulture crops | 1 | 3 |
| 2.2 | Water requirements and irrigation methods for horticulture crops | 1 | 2,4 |
| 2.3 | Nutrient and weeds management for horticulture crops | 1 | 2,4 |
| 2.4 | Planting systems and transplanting of horticultural crops | 1 | 2 |
| 2.5 | Training and pruning | 1 | 3 |
| | | | |
| **3.0** | **Propagation techniques** | **3** | |
| 3.1 | Definition, types, advantages and importance of propagation | 1 | 1 |

| | | | |
|---|---|---|---|
| 3.3 | Layering, cutting, grafting and budding | 2 | 3 |
| | | | |
| **4.0** | **Cultivation of horticultural crops** | **2** | |
| 4.1 | Cultivation methods of Mango; Potato; Banana; Papaya | 2 | 5 |
| | | | |
| **5.0** | **Harvesting and post harvesting management of horticultural crops** | **1** | |
| 5.1 | Importance and harvest and post-harvest techniques of horticultural crops | 1 | 4 |
| | | | |
| | **Floriculture** | | |
| **1.0** | **Basic concepts of floriculture** | **3** | |
| 1.1 | Definition, background, types, scope and importance of floriculture | 1 | 1 |
| 1.2 | Classification of floricultural and landscape plants | 1 | 1 |
| 1.3 | Industrial importance of commercial flowers in Bangladesh and abroad | 1 | 1 |
| **2.0** | **Gardening and Landscaping** | **4** | |
| 2.1 | Principles and elements of landscape designs | 1 | 2 |
| 2.2 | Garden elements and designs | 1 | 2 |
| 2.3 | Layout structure and management of nursery | 1 | 2 |
| 2.4 | Gardening operations: soil laying, manuring, watering | 1 | 2 |
| **3.0** | **Protection of floriculture** | **3** | |
| 3.1 | Concept of protected cultivation | 1 | 1 |
| 3.2 | Types of protected structures and their components | 1 | 3 |
| 3.3 | Greenhouse operations techniques | 1 | 3 |
| | | | |
| **4.0** | **Commercial Floriculture** | **5** | |
| 4.1 | Definition, scope and importance of commercial floriculture | 1 | 1 |
| 4.2 | Production techniques of commercial flower crops like rose, marigold, chrysanthemum | 3 | 5 |
| 4.3 | Postharvest technology of cut flowers in respect of commercial flower crops | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Adams, C.R., Early, M.P. and Bamford, K.M. 2008. Principles of Horticulture (Fifth edition). Butterworth-Heinemann is an imprint of Elsevier Linacre House, Jordan Hill, Oxford OX2 8DP, UK
2. Edmond, J.B., Senn, T.L., Andrews, F.S., Halfacre, R.G. 1975. Fundamentals of Horticulture (4th Ed.).
3. Hartman, H.T. and Kester, D.E. 2017. Plant Propagation: Principle and Practices. ($5^{th}$ Ed.), Prentice Hall. Inc.
4. Trivedi, P.P. 2010. Home Gardening. Indian Council of Agricultural Research, India.
5. Uppal, S. 2018. Floriculturist (Protected Cultivation) National Council of Educational Research and Training.
6. Vasanthakumar, K. and Merga, B. 2017. A handbook on floriculture and landscaping. School of Plant Sciences, Haramaya University.


# Practical Courses

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2107 | | |
| **Course Title** | : Plant Taxonomy and Morphology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Taxonomy and Morphology** |
| 1.1 | Sterilization: Operation of autoclave |
| 1.2 | Culture media preparation: Nutrient broth and nutrient agar |
| 1.3 | Isolation technique: Streak plate technique and pure culture |
| 1.4 | Stain and Staining: Gram staining technique |
| 1.5 | Viable count of bacteria by dilution plate method |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2108 | | |
| **Course Title** | : Plant Physiology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Physiology** |
| 1.1 | Determination of osmotic potential of potato cell sap by the gravimetric method |
| 1.2 | Determination of water potential of *Rhoeo discolor* leaf by the incipient plasmolytic method |
| 1.3 | Determination of rate of transpiration per-unit under three environments by Ganong's potometer |
| 1.4 | Experiments to show that chlorophyll, $CO_2$ and light are essential for photosynthesis |
| 1.5 | Demonstration of aerobic and anaerobic respiration and heat is evolved during respiration |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2109 | | |
| **Course Title** | : Cell Biology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Cell Biology** |
| 1.1 | Preparation of prefixatives, fixatives, stains etc. used in cell biological studies |
| 1.2 | Study of somatic cell division and practice exercise |
| 1.3 | Study of meiotic system (usual and unusual) and practice exercise |
| 1.4 | Study of the models of different cell organelles |
| 1.5 | Study of different cell biological tools |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2110 | | |
| **Course Title** | : Agronomy, Horticulture and Floriculture | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : Relevant Course Teachers | | |
| **Credit Value** | : 1 | **Credit hours/week**: 3 | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Agronomy** |
| 1.1 | Identification of different organic and inorganic fertilizers |
| 1.2 | Identification of seeds of different crop plants |
| 1.3 | Identification of weeds of different crop fields |
| 1.4 | Demonstration of hand tools and tillage implement |
| 1.5 | Purity test of seeds |
| | |
| **2.0** | **Horticulture and Floriculture** |
| 2.1 | Study about Garden Tools and Implements |
| 2.2 | Identification of Horticultural Crops |
| 2.3 | Study about System of Planting |
| 2.4 | Study on Propagation by Cutting, Layering, Budding and Grafting |
| 2.5 | Study of Manures and Fertilizers Application |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2111 | | |
| **Course Title** | : Field work/Excursion (3 Major courses) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year First Semester | | |
| **Course Teacher** | : Respective examination committee | | |
| **Credit Value** | :1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

# Curriculum
# For Second Year: Second Semester

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2201 | | |
| **Course Title** | : Plant Anatomy | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours:** 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course explores the internal structure and organization of plants, focusing on cells, tissues, and organs. It provides foundational knowledge for understanding plant growth, function, and environmental interactions, crucial for agriculture, horticulture, and environmental science. By studying structural adaptations like xylem and phloem, students gain insights into improving crop yields, enhancing disease resistance, and supporting sustainable agriculture, biotechnology, and ecological research.

**Course Learning Outcomes (CLOs)**

| **CLO No.** | **Expected Course Outcomes**<br>Upon completion of this course, the students will be able to: | **Cognitive Level** |
|---|---|---|
| CLO 1 | understand the internal structure and organization of plants; | U |
| CLO 2 | describe cell, cell wall, tissue and tissue system, meristem, stomata, primary and secondary structure of stem and root; | E |
| CLO 3 | demonstrate a general familiarity with basic plant structure and organs; the detail structure of roots, stems and leaves of plants. | Ap, E |

U-Understanding; Ap-Apply, E-Evaluate

**Mapping CLOs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 3 | 3 | 2 | 2 | 1 | 1 | 1 |
| CLO 2 | 3 | 3 | 2 | 2 | 1 | 1 | 2 |
| CLO 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| **Module** | **Course Contents** | **Credit hrs** | **CLOs** |
|---|---|---|---|
| **1.0** | **Structure and composition of plant cell** | **10** | |
| 1.1 | Cell: Definition, cellular complexity in plants, origin, development, structure, shape, type and function | 3 | 1 |
| 1.2 | Cell wall: Origin, development, gross and ultra-structure, and different types of thickenings. The middle lamella-origin, development, structure and function. Sculpture, modifications and chemical nature of cell wall | 5 | 2 |
| 1.3 | Different types of cell wall thickening in treachery elements; extra cell wall thickening materials | 2 | 2 |

| | | | |
|---|---|---|---|
| **2.0** | **Organization of tissues** | **8** | |
| 2.1 | Tissue: Definition, classification, origin, development, structure and function | 2 | 2 |
| 2.2 | Tissue systems: Definition, classification, origin, development, structure and function | 2 | 2 |
| 2.3 | Meristems: Meristem and meristematic tissues, classification, origin, development and function | 2 | 2 |
| 2.4 | Stomata: Definition, origin, development, types, structure and function | 2 | 3 |
| **3.0** | **Plant body structure** | **12** | **2** |
| 3.1 | Primary and secondary structures: Roots and stems; Anomalous secondary growth in stems and roots | 7 | 3 |
| 3.2 | Transition: Root-stem transition in plants, transition of vegetative to reproductive meristem, basic development of reproductive meristem | 3 | 3 |
| 3.3 | Stele: Structure, types and evolution | 2 | 2 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Cutter, E.G. 1969. Plant Anatomy: Part l and Part ll, Edward Arnold Publ.UK.
2. Eames, A.J. and MacDaniels, L.H. 1947. An Introduction to Plant Anatomy: McGraw-Hill, NY.
3. Esau, K. 1953. Plant Anatomy: John Wiletsons, NY.
4. Fahn, A. 1967. Plant Anatomy: Pergamon Press, Oxford.
5. Johansen, D.A. 1940. Plant Microtechnique. McGraw-Hill, NY.
6. Vashista, P.C, 1984. Plant Anatomy. Pradeep publication, Jalandhar.
7. Wardlaw, C.W. 1968. Morphogenesis in Plants. Methwen Co. Ltd. UK.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2202 | | |
| **Course Title** | : Plant Ecology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The rationale for studying plant ecology is rooted in understanding the complex relationships between plants and their environment. Plant ecology provides insights into how plants interact with other organisms (such as animals, fungi, and microbes), how they respond to environmental factors, and how they contribute to ecosystem processes. It is essential for addressing the challenges related to biodiversity conservation, climate change, and sustainable land use. It provides a foundation for understanding how plants interact with the environment and how we can better manage and conserve plant life for future generations.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | understand the basic ecological principles and familiarize it; | U |
| CLO 2 | analyze different ecological processes and functions, interactions within plants and environments; | An |
| CLO 3 | apply knowledge to find out the present and future situation in terms of plant distribution, community structure and development, adaptation and succession in Bangladesh; | Ap |
| CLO 4 | create awareness on various ecological acts associated with human welfare. | C |

U- Understanding; Ap-Apply; An-Analyze; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 2 | 2 | 2 | 3 | 3 |
| CLO 2 | 3 | 2 | 3 | 1 | 1 | 1 | 1 |
| CLO 3 | 2 | 2 | 2 | 2 | 3 | 2 | 2 |
| CLO 4 | 2 | 3 | 3 | 2 | 2 | 3 | 2 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction** | **8** | |
| 1.1 | Definition and principles of ecology | 2 | 1 |
| 1.2 | Habitat, niche, biosphere, climatic factors, biotic factors, soil edaphic factors, topographic factors, | 6 | 1 |

| | | | |
|---|---|---|---|
| | ecotype, ecological indicators | | |
| **2.0** | **Autecology** | **3** | |
| 2.1 | Definition; ecological life history of species | 2 | 1 |
| 2.2 | Concept of population ecology | 1 | 1 |
| **3.0** | **Synecology or Community Ecology** | **5** | |
| 3.1 | Definition; community composition | 2 | 2 |
| 3.2 | Classification of community | 2 | 2 |
| 3.3 | Study of plant community structure. | 1 | 2 |
| **4.0** | **Bio-geochemical cycles** | **5** | |
| 4.1 | Concept and importance | 2 | 3 |
| 4.2 | Hydrologic cycle, Carbon cycle, Nitrogen cycle | 3 | 3 |
| 5.0 | **Plant adaptations** | **4** | |
| 5.1 | Introduction and ecological adaptations of plants. | 2 | 3 |
| 5.2 | Hydrophytic, xerophytic and mesophytic adaptations | 2 | 3 |
| **6.0** | **Phytogeography** | **5** | |
| 6.1 | Geographical distribution of plants in the world: types, nature and characteristics of vegetation | 2 | 1 |
| 6.2 | Vegetation of Bangladesh: Types, distribution, ecological conditions and floristic composition | 3 | 1 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Ashby, M. 1969. An Introduction to Plant Ecology. 2nd edition, Macmillan, New-Delhi, India.
2. Chandel, P.S. and Shukla, R.S. 2005. Ecology & Environments. Publisher: S Chand & company Ltd. New-Delhi, India.
3. Daubenmire, R.F. 1974. Plants and Environment. 3rd edition, John Wiley & Son's Inc. India.
4. Rahman M. Shamsur, 2005. Poribeshbigyan o udvidvugol, Abosarprokashoni, Dhaka.
5. Shukla R.S. and Chandel P.S. 2003. Plant Ecology and Soil Science. Publisher: S Chand & company Ltd. New-Delhi, India.
6. Shukla, R.S. and Chandel, P.S. 2001. Plant Ecology. Publisher: S Chand & company Ltd. New-Delhi, India.
7. Trivedi, PR and Raj, G. 1995. Environmental Ecology, Akash Publishing House New-Delhi. India.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2203 | | |
| **Course Title** | : Plant Biochemistry | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course is designed to know the chemical processes and compounds that occur within plants, focusing on vital aspects such as photosynthesis, respiration, nitrogen metabolism, lipid metabolism enzymes and hormones, all playing crucial roles in plant growth and development. Understanding plant biochemistry is essential or advancement in agriculture.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to | Cognitive Level |
|---|---|---|
| CLO 1 | describe the various biochemical aspects in plants; | U |
| CLO 2 | take students to higher levels of learning about assimilation of plants; | Ap |
| CLO 3 | discuss the basic aspects of plant metabolism; | U |
| CLO 4 | evaluate the role of enzymes in plant life; | E |
| CLO 5 | devise methods to improve basic skills and techniques related to plant biochemistry. | C |

U-Understanding; Ap-Apply; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 3 | 3 | 2 | 2 | 3 |
| CLO 2 | 3 | 2 | 3 | 2 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 |
| CLO 4 | 2 | 3 | 2 | 3 | 2 | 2 | 3 |
| CLO 5 | 3 | 3 | 2 | 3 | 2 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Enzymes** | **4** | |
| 1.1 | Definition, Nomenclature and properties | 1 | 4 |
| 1.2 | Classification with example | 2 | 4 |
| 1.3 | Mechanism of action | 1 | 4 |
| **2.0** | **Photosynthesis** | **7** | |
| 2.1 | Definition, Photosynthetic pigments, photo excitation | 1 | 3 |
| 2.2 | Photosystems – components and Organization | 1 | 2 |
| 2.3 | Cyclic and Non-cyclic photophosphorylation | 1 | 2 |
| 2.4 | Carbon assimilation pathways-C3 | 2 | 2 |

| | | | |
|---|---|---|---|
| 2.5 | C4 plants – kranz anatomy, CAM | 1 | 2 |
| 2.6 | Factors affecting photosynthesis –Blackmann's law of limiting factors | 1 | 2 |
| **3.0** | **Respiration** | **7** | |
| 3.1 | Definition, Glycolysis, Fermentation, Anaerobic and Aerobic respiration | 1 | 3 |
| 3.2 | Kreb'scycle | 1 | 3 |
| 3.3 | Mitochondrial electron transport system – components | 1 | 3 |
| 3.5 | Photorespiration | 2 | 3 |
| 3.6 | Direct respiration | 1 | 3 |
| 3.7 | RQ- significance, Factors affecting respiration | 1 | 3 |
| **4.0** | **Nitrogen metabolism** | **4** | |
| 4.1 | Source and availability of nitrogen | 1 | 3 |
| 4.2 | Physical nitrogen fixation | 1 | 3 |
| 4.3 | Biological nitrogen fixation | 1 | 3 |
| 4.4 | Amino acid and protein synthesis | 1 | 3 |
| **5.0** | **Lipids** | **5** | |
| 5.1 | Definition, General features and roles, and types of lipids | 1 | 3 |
| 5.2 | Fatty acids-saturated and unsaturated; fatty acid derivatives-fats and oils; compound lipids (brief study only) | 1 | 3 |
| 5.3 | Synthesis and Breakdown of fat | 2 | 3 |
| 5.4 | Energy balance of fat breakdown | 1 | 3 |
| **6.0** | **Plant growth and development** | **3** | |
| 6.1 | Plant hormones- Auxin – biosynthesis, physiological effect and practical application | 1 | 1 |
| 6.2 | Plant hormones- Cytokinin and Gibberlins- biosynthesis, physiological effect and practical application | 1 | 1 |
| 6.3 | Plant hormones- ABA & ethylene - biosynthesis, physiological effect and practical application | 1 | 1 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Hopkins, W. and Huner, N. 2008. Introduction to Plant Physiology. John Willey and sons, Inc. USA.
2. Jain, V.K. 2015. Plant Physiology. S Chand and Co. India.
3. Mukherji, S. and Ghosh, A.K. 2015. Plant Physiology. New Central Book Agency, India.
4. Taiz, L. and Zeiger, E. 2010. Plant Physiology. 5th edition. Sinauer Associates.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2204 | | |
| **Course Title** | : Principles of Organic Farming | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course is designed to provide students with the basic knowledge, skills and attitudes necessary for implementing and promoting organic agriculture activities and programs. Organic farming is important to study because it can help protect the environment, reduce exposure to harmful chemicals, and support local economies. It can also help improve soil health, reduce production costs, and sustain farmer livelihoods.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | learn various principles, scope, need and prospect of organic farming including the importance of sustainability, biodiversity and ecological balance; | U |
| CLO 2 | learn about marketing organic products, understanding consumer demand and the economic aspect of Organic farming; | E |
| CLO 3 | understand the forage production in organic farming systems and identify the key principles, practices underpinning the management, productivity, health and welfare; | An |
| CLO 4 | gain hands on experience through field work, farm visits or practical exercises to apply their knowledge in a real-world setting. | Ap |

U-Understanding; Ap-Apply; An-Analyze; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 2 | 2 | 3 | 2 | 3 |
| CLO 2 | 2 | 3 | 1 | 3 | 3 | 3 | 3 |
| CLO 3 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |
| CLO 4 | 1 | 3 | 1 | 3 | 1 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Principles of Organic Farming** | **4** | |
| 1.1 | Organic farming: definition, need, scope, principles, characteristics and relevance to modern agriculture | 1 | 1 |
| 1.2 | Different ecofriendly farming systems, biological farming, natural farming, regenerative agriculture, permaculture and | 1 | 1 |

| | | | |
|---|---|---|---|
| | biodynamic farming | | |
| 1.3 | Relevance of organic farming to Bangladesh, and global agriculture and future prospects- advantages - barriers | 1 | 1 |
| 1.4 | Social and Market aspects of Organic Farming | 1 | 1 |
| **2.0** | **Organic Fertilizers** | **5** | |
| 2.1 | Introduction; Need and Benefit of Organic Fertilizer, Preparation of Organic Fertilizer; Demonstration & land preparation | 1 | 4 |
| 2.2 | Name of plant Nutrients; Functions of Nutrients in plant growth and Development | 1 | 4 |
| 2.3 | Organic Manure: FYM/Rural compost, City compost, Oil cakes, Animal wastes, Vermi composts, etc; Characterization and Nutrients content of the above sources | 2 | 3 |
| 2.4 | Green Manure and Liquid Manure; Nutrient use in organic farming-scope and limitations; Nutrient management in organic farming | 1 | 3 |
| **3.0** | **Biological Disease Control** | **2** | |
| 3.1 | Fundamentals of insect, disease and weed management under organic mode of production-cultural-biological methods-non chemical pest & disease management | 1 | 4 |
| 3.2 | Botanicals- pyrethrum, neem seed kernel extract, neem seed powder, soluble neem formulations, neem oil | 1 | 4 |
| **4.0** | **Water and Soil Testing** | **4** | |
| 4.1 | Soil: Definition; Soil formation; Composition and characteristics; Types of soil according to composition | 1 | 4 |
| 4.2 | Acidic, Alkaline and Saline soils: How they affect Agriculture; Method of reclamation | 1 | 4 |
| 4.3 | Soil productivity: Meaning & Concept Difference between Soil Fertility and Productivity; Method of Increasing productivity and fertility | 1 | 4 |
| 4.4 | Water Sampling and Quality Control: Determining the Sample Size, choosing a Sample Method, How to Collect Water Samples, How to Transport Water Samples, How to Dilute a Water Sample, Ensuring Quality Control, WHO Guidelines for Physical Parameters | 1 | 4 |
| **5.0** | **Crop Management** | **4** | |
| 5.1 | Introduction, Plant Protection Measures: Integrated pest & disease managements. Organic pesticides, bio-pesticides. Inorganic pesticides, disadvantages of their use. Seed, seedling and soil Treatment measures. Feasibility of complete dependence on organic sources | 3 | 4 |
| 5.2 | Crop rotation: need and benefits; Harvesting and Post Harvesting Management | 1 | 4 |
| **6.0** | **Organic Farm Management** | **4** | |
| 6.1 | Preparation of seed bed & raising of seedlings: Wet seedbed, manuring, sowing broadcasting; Dry seed bed, bed size, | 2 | 3 |

| | | | |
|---|---|---|---|
| | manuring, soil treatment, actual sowing in line/broadcasting; weeding, watering, hardening of seedling, time requirement for seedling growth, uprooting seedlings | | |
| 6.2 | Physiological Diseases / Disorders: Identification, cause and effect ameliorating measures (soil/spray application Soil amelioration; Interaction | 1 | 3 |
| **7.0** | **Certification Process and Marketing** | **3** | |
| 7.1 | Inspection, certification, labelling, and accreditation procedures for organic products | 1 | 2 |
| 7.2 | Processing, economic consideration, and viability | 1 | 2 |
| 7.3 | Marketing and export potential of organic products; Role of organic farming in national economy | 1 | 2 |
| **8.0** | **Trade and Supply Chain Management** | **4** | |
| 8.1 | Good Harvesting Practices; Storage; Transportation; Supply Chain | 1 | 2 |
| 8.2 | Bio fertilizers and their method of use, Nitrogenous; Phosphatic; Potassic; Availability of Nutrients from above sources; Other Nitrogen contributing plants | 1 | 2 |
| 8.3 | Preparation of vermin compost: Pit construction; Raw materials; Availability of specific species of earth worm; Method of preparation; Quality improvement of finished vermin compost | 1 | 2 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

## References


1. Balasubramanian, R., Balakishnan, K. and Siva, S.K. 2013. Principles and Practices of Organic Farming. Satish Serial Publishing House.
2. Dongarjal, R.P. and Zade, S.B. 2019. Insect Ecology and Integrated Pest Management, Akinik Publications, New Delhi.
3. Dushyent, G. 2005. Organic farming- standards, accreditation, certification and inspection. Agrobios, India.
4. Palaniappan, S.P and Annadurai, K. 1999. Organic farming-Theory and Practice. Scientific publishers, Jodhpur, India.
5. Sathe, T.V. 2004. Vermiculture and Organic Farming. Daya Publishers.
6. Sharma, A.K. 2002. A Hand Book of Organic Farming. Agrobios, India.
7. Subha Rao, N.S. 2000, Soil Microbiology, Oxford & IBH Publishers, New Delhi

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2205 | | |
| **Course Title** | : ICT | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course introduces the fundamental concept of ICT, computer systems, networks and internet systems. The course also describes the importance and uses of ICT in different sectors including agricultural sectors.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | describe the term 'information and communication technology (ICT)' and can list reasons why people need ICT knowledge; | R |
| CLO 2 | categorize various types of input, output, and storage devices of a typical computer system; | U |
| CLO 3 | identify the key elements of network and communication system; | R |
| CLO 4 | explain about basic information system and its components. | U |

R- Remember; U-Understanding; Ap-Apply; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 3 | 2 | 2 | 3 | 2 | 1 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| CLO 4 | 3 | 3 | 2 | 2 | 3 | 3 | 2 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLO |
|---|---|---|---|
| **1.0** | **Concepts of ICT** | **5** | |
| 1.1 | Data, Information and Knowledge, Data processing cycle, Definition of IT, Definition of CT, Convergence of IT & CT, Importance of ICT**,** ICT Architecture | 2 | 1, |
| 1.2 | Progress of ICT adoption, Components of ICT, Role of ICT in present era, ICT and Economic Development | 2 | 1 |
| 1.3 | Impact of ICT on social life, Ethics of ICT usages, ICT Act and Policy | 1 | 1 |
| **2.0** | **Computer Hardware** | **5** | |
| 2.1 | Input Devices, Alternative methods of inputs, Devices for the hand, Optical Input devices, and Audio-Visual | 1 | 2 |

| | | | |
|---|---|---|---|
| | input devices | | |
| 2.2 | Monitors and its types, Comparison parameters of monitors, Video controller, PC Projectors, Sound system | 1 | 2 |
| 2.3 | Overview of printers, Dot Matrix Printers, Inkjet Printer, Laser printers, Snapshot printers, Other high quality printers | 1 | 2 |
| 2.4 | Types of storage devices, Optical storage devices- all related, Magnetic storage devices-all related | 1 | 2 |
| 2.5 | Hardware configurations of a Computers, Types of computers: Micro, mini, mainframe computers, Motherboard and its applications in computers | 1 | 2 |
| **3.0** | **Computer Software** | **5** | |
| 3.1 | Software and its activities in computers, Software classification: System software, application software, Categories of application software: Horizontal and vertical. Operating system-examples | 2 | 2 |
| 3.2 | Personal Application software-Document preparation software, Spreadsheet, Data management, Presentation software, and computer aided software | 1 | 2 |
| | Groupware software: communication tools, conferencing tools, collaborative management tools, Social computing tools, multimedia software, middleware and enterprise software | 1 | 2 |
| 3.3 | Databases, data processing and analysis software, photo editing software, scientific literature resources for biological research | 1 | 2 |
| **4.0** | **Computer Networks** | **2** | |
| 4.1 | Networks?– Examples, Computer networks, Hardware components of networks, Types of networks-complex, peer-to-peer, client server based | 1 | 3 |
| 4.2 | Uses of computer networks, Popular networks-11 categories: Illustration, advantages, functions, features, disadvantages | 1 | 3 |
| **5.0** | **Communication Systems** | **4** | |
| 5.1 | Communication model, Application, Basic elements of communication system, communication channels | 2 | 3 |
| 5.2 | WiFi, Bluetooth, Wireless LAN, MAN, Line of Sight, Adhoc network, Cellular Communication, Optical communication | 2 | |
| **6.0** | **Internet** | **4** | |
| 6.1 | Internet, Intranet, extranet, WWW, Web browser | 2 | 3 |
| 6.2 | Logical Address, IP address, Domain name, Zone name. DNS | 2 | 3 |
| **7.0** | **Information System** | **5** | |

| | | | |
|---|---|---|---|
| 7.1 | Basic Information System, Components of Information System | 2 | 4 |
| 7.2 | Transaction Processing System, Management Information System | 2 | 4 |
| 7.3 | Information Security, Multimedia | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Balagurusamy, E. 2018. Fundamentals of Computers (6th Edition). Tata McGraw-Hill Education. 7 West, Madhavan, New Delhi-110 001, India.
2. Norton, P. 2010. Introduction to Computers (7th Edition). McGraw-Hill Education. 1221 Avenue of the Americas, New York, NY 10020, USA.
3. Rajaraman, V. 2009. Fundamentals of Computers (5th Edition). Prentice-Hall of India Pvt. Ltd. 482, F.I.E., Patparganj, Delhi-110092, India.
4. Turban, E., Rainer, R. K., and Potter, R. E. 2005. Introduction to Information Technology. John Wiley & Sons, Inc. 111 River Street, Hoboken, NJ 07030, USA.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2206 | | |
| **Course Title** | : Data Processing | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This is an introductory course for statistics practitioners. It emphasizes on preliminary concepts, data processing, exploratory data analysis, statistical tools and techniques for data summarizing.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | understand the data structure and data frame; Explain the relationship among a set of variables; | U |
| CLO 2 | clean and prepare data before modeling and analysis; | Ap |
| CLO 3 | create various types of graphs for visualization of the nature of data; | Ap |
| CLO 4 | measure the central tendency and dispersion of a data set to evaluate the characteristics of the data; | E |
| CLO 5 | apply the statistical tests of hypotheses for different characteristics and Analyze the lifetime data. | Ap |

R- Remember; U-Understanding; Ap-Apply; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 2 | 2 | 3 | 3 | 2 | 1 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| CLO 4 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| CLO 5 | 3 | 2 | 1 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Data Structures and Data Frames** | **4** | |
| 1.1 | Variables and Observations | 1 | 1 |
| 1.2 | Sequences, List, Set | 1 | 1 |
| 1.3 | Multidimensional Array Object, Spreadsheet, Gathering Data into Data frames | 2 | 1 |
| **2.0** | **Data Cleaning and Preparation** | **4** | |
| 2.1 | Handling Missing Data, Data Transformation | 1 | 2 |
| 2.2 | Detecting and Filtering Outliers, Computing Indicator/Dummy Variables | 1 | 2 |
| 2.3 | String Manipulation, Handling Categorical Data | 1 | 2 |
| 2.4 | Accuracy and Precision of Data | 1 | 2 |

| | | | |
|---|---|---|---|
| **3.0** | **Plotting and Visualization of Data** | **4** | |
| 3.1 | Bar chart, Line chart, Histograms | 2 | 3 |
| 3.2 | Scatter plot, Stacked plot, Box plot, Pie Charts | 1 | 3 |
| 3.3 | Creation of Multiple Graphs | 1 | 3 |
| **4.0** | **Measures of Central Tendency and Dispersion** | **5** | |
| 4.1 | Mean, Median, Mode and Quantiles, Quantile–Quantile Plots (QQ-Plots) | 2 | 4 |
| 4.2 | Range and Interquartile Range, Absolute Deviation, | 1 | 4 |
| 4.3 | Variance, Standard Deviation, and Coefficient of Variation | 2 | 4 |
| **5.0** | **Hypothesis Testing** | **5** | |
| 5.1 | Experimental Design, and Inference | 1 | 5 |
| 5.2 | Test Statistic, Type I and Type II Errors, Interpretation of p-value | 1 | 5 |
| 5.3 | One- and Two-Sample Tests | 1 | 5 |
| 5.4 | Differences Among Multiple Samples | 1 | 5 |
| 5.5 | Differences Among Observed and Expected Values | 1 | 5 |
| **6.0** | **Correlation and Regression Model** | **5** | |
| 6.1 | Correlation, Linear Regression Model, Nonlinear Regression Model | 1 | 1 |
| 6.2 | Analysis of Variance | 1 | 1 |
| 6.3 | Logistic Regression | 1 | 1 |
| 6.4 | Generalized linear model | 1 | 1 |
| 6.5 | Model selection, Model diagnosis | 1 | 1 |
| **7.0** | **Biostatistics** | **3** | |
| 7.1 | Various Functions for Lifetime Data, Nonparametric Estimation of Survival Function | 1 | 5 |
| 7.2 | Lifetime Distributions | 1 | 5 |
| 7.3 | Censored Data, Parametric Estimation of Distribution Parameters and Survival Function. | 1 | 5 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Everitt, B.S. and Hothorn, I. 2010. A Handbook of Statistical Analyses Using R, Taylor & Francis Croup.
2. Hartvigsen, G. 2021. A Primer in Biological Data Analysis and Visualization Using R, Columbia University Press New York.
3. Heumann, C. and Shalabh, M.S. 2016. Introduction to Statistics and Data Analysis, Springer.
4. McKinney, W. 2022. Python for Data Analysis, Wesley McKinney.
5. Ortutay, C. and Ortutay, Z. 2017. Molecular Data Analysis Using R, John Wiley & Sons.
6. Pekar S. and Brabec M. 2016. Modern Analysis of Biological Data: Generalized Linear Models in R. Masaryk University Press, Brno.

# Practical Courses

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2207 | | |
| **Course Title** | : Plant Anatomy | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Anatomy** |
| 1.1 | Study of different types of plant cell |
| 1.2 | Microtomy and permanent slide preparation |
| 1.3 | Studies on the organization of shoot and root apex |
| 1.4 | Studies on the primary and secondary structures of leaves, stems, and roots |
| 1.5 | Studies on the anomalous secondary structures in stems and roots: *Dracaena*, *Bougainvillea*, *Boerhaavia*, *Tinospora*, etc. |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2208 | | |
| **Course Title** | : Plant Ecology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Ecology** |
| 1.1 | Ecological adaptations in xerophytes, hydrophytes, epiphytes , halophytes with comments and their niches |
| 1.2 | Survey of plant communities by a) list, b) count and c) point quadrates, d) line and e) belt transects |
| 1.3 | Calculation of some quantitative characters (both analytic and synthetic) of species /communities from the collected data |
| 1.4 | Preparation of a) frequency histogram, b) valence histogram, c) phytograph with ecological comments |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2209 | | |
| **Course Title** | : Plant Biochemistry | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Biochemistry** |
| 1.1 | Separation of photosynthetic pigments by paper chromatography |
| 1.2 | Experiments on enzymes |
| 1.3 | Qualitative determination of different carbohydrates |
| 1.4 | Demonstration of Fluorpen 100 and soil-plant analyses development (SPAD)meter for studying different photosynthetic parameters |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2210 | | |
| **Course Title** | : Principles of Organic Farming | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Principles of Organic Farming** |
| 1.1 | Visit to Organic farm to study the various components, identification and utilization of Organic products. |
| 1.2 | Preparation of Organic Compost-Over ground compost, Pit compost, Liquid compost, Vermi compost, Preparation of enriched farm yard manure |
| 1.3 | Weed control through organic way |
| 1.4 | Soil analysis: pH determination |
| 1.5 | Seed bed preparation, seed selection and seedling preparation |
| 1.6 | Study of post-harvest management in organic farming |
| 1.7 | Study of quality parameters of organic produce |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2211 | | |
| **Course Title** | : ICT and Data Processing | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **ICT** |
| 1.1 | Introduction to Hardware's |
| 1.2 | Operating system |
| 1.3 | Word processing using Microsoft Word |
| 1.4 | Spreadsheet using Microsoft Excel |
| 1.5 | Database using Microsoft Access |
| 1.6 | Internet Communication (Browsing, searching, emailing and video/voice/text messaging) |
| | |
| **2.0** | **Data Processing** |
| 2.1 | Construction of Data Sheet or Data Frame with different types of variables |
| 2.2 | Construction of Bar chart, Line chart, Histograms, Scatter plot, Box plot, and Pie Chart |
| 2.3 | Measures of central tendency and dispersion and their interpretation |
| 2.4 | Testing the differences among multiple samples and differences between observed and expected values |
| 2.5 | Fitting regression models, use and interpretation of the fitted models |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2212 | | |
| **Course Title** | : Viva (All major courses of second year) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : Respective Examination Committee | | |
| **Credit Value** | : 2 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 50 | | |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 2213 | | |
| **Course Title** | : Field work/Excursion (3 Major courses) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Second Year Second Semester | | |
| **Course Teacher** | : Respective examination committee | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

# Curriculum
# For Third Year: First Semester

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3101 | | |
| **Course Title** | : Ecosystem Dynamics | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The study of ecosystem dynamics lies to understand how ecosystems work, how they are impacted by environmental and human-induced changes, and how we can maintain their health and sustainability. This knowledge is critical for addressing global challenges such as biodiversity loss, climate change, and resource depletion. Furthermore, it is essential for the learners to accommodate them for the development of strategies that ensure a balanced relationship between humans and the natural environment.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to : | Cognitive Level |
|---|---|---|
| CLO 1 | understand the basic ecosystem principles and its dynamics; | U |
| CLO 2 | analyse different ecosystem processes and functions, interactions between biotic and abiotic components for life functioning; | An |
| CLO 3 | apply knowledge to find out the ecosystem-based adaptation and conservation of ecosystem; | Ap |
| CLO 4 | create awareness on various ecological processes associated with human welfare. | C |

U- Understanding; Ap-Apply; An-Analyze; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 3 | 2 | 2 | 2 | 3 |
| CLO 2 | 3 | 2 | 2 | 2 | 3 | 2 | 3 |
| CLO 3 | 1 | 2 | 1 | 1 | 3 | 2 | 3 |
| CLO 4 | 2 | 2 | 2 | 2 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Fundamentals of ecosystem** | **8** | |
| 1.1 | Concept and components of ecosystem | 2 | 1,2 |
| 1.2 | Types and examples of ecosystem | 4 | |
| 1.3 | Trophic relations; Food chain & food web | 2 | |

| | | | |
|---|---|---|---|
| **2.0** | **Structural and functional attributes of ecosystem** | **6** | |
| 2.1 | Structure and function of ecosystem; Ecological pyramid; Pyramid of numbers; Pyramid of biomass; Pyramid of energy | 6 | 2 |
| **3.0** | **Ecological energetics** | **8** | |
| 3.1 | Energy, energy flow in ecosystem; Laws of thermodynamics in ecosystem; Energy and productivity concept | 8 | 2,3 |
| **4.0** | **Community dynamics** | **3** | |
| 4.1 | Concepts, characteristics, Temporal and spatial dynamics, climax | 3 | 2,3 |
| 4.2 | Plant Succession: Definition, causes of succession, kinds of succession, hydrosere and xerosere | | |
| **5.0** | **Ecosystem services** | **3** | |
| 5.1 | Concepts, types, importance, valuation | 3 | 2,3 |
| **6.0** | **Ecosystem conservation** | **2** | 4 |
| 6.1 | Ecosystem conservation for life sustainability | 2 | 3,4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Ambasht, R.S. 2004. Modern Trends in Ecology and Environment. Publisher: Satish Kumar Jain for CBC Publishers and Distributors. New-Delhi, India.
2. Ambasht, R.S. and Ambasht, N.K.2004. A Text book of Plant Ecology. Publisher: Satish Kumar Jain for CBC Publishers and Distributors. New-Delhi, India.
3. Ashby, M. 1969. An Introduction to Plant Ecology. 2nd edition, Macmillan, New-Delhi, India.
4. Chandel, P.S. and Shukla, R.S. 2005. Ecology & Environments. Publisher: S Chand & company Ltd. New-Delhi, India.
5. Shukla R.S. and Chandel P.S. 2014. A Text book of Plant Ecology. Publisher: S Chand & company Ltd. New-Delhi, India.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3102 | | |
| **Course Title** | : Plant Diversity and Conservation | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | :50 | | |

**Rationale of the course**

The Plant Biodiversity and Conservation course is essential to gain a comprehensive understanding of plant diversity, its ecological significance, and conservation challenges. This course will equip students with the knowledge to recognize the critical role plants play in ecosystems, human livelihoods, and climate resilience. By exploring various plant species and their interactions, students will be empowered to contribute to sustainable environmental practices, biodiversity conservation, and the development of strategies to protect plant life in a rapidly changing world.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | know the values and importance of biodiversity, their causes of creation, types, conservation and destruction; | R |
| CLO 2 | describe the mitigation process of biodiversity loss and successful restoration of threatened species through conservation techniques; | U |
| CLO 3 | analyze the interaction between the flora and different environmental factors; | An |
| CLO 4 | apply knowledge to reduce pollution for sustainable management in plant communities. | Ap |

R-Remember; U-Understanding; An-Analyze; Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 2 | 2 | 3 | 3 | 2 |
| CLO 2 | 3 | 3 | 2 | 3 | 2 | 2 | 2 |
| CLO 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| CLO 4 | 2 | 2 | 2 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Biodiversity** | **5** | |
| 1.1 | Basic concepts, values and importance, scope of the study | 1 | 1 |
| 1.2 | Causes of biodiversity creation: cytological, genetical and environmental | 1 | 1 |

| | | | |
|---|---|---|---|
| 1.3 | Types of biodiversity, biodiversity through time and biodiversity rising | 2 | 1 |
| 1.4 | Ecology and evolution of biodiversity | 1 | 2,3 |
| **2.0** | **Diversity in plant kingdom** | **3** | |
| 2.1 | Variation in plant morphology, structure and function | 1 | 1 |
| 2.2 | Plant utilities and their importance | 1 | 1 |
| 2.3 | Comparison of biodiversities in major plant groups | 1 | 2 |
| **3.0** | **Biodiversity destruction and crisis** | **4** | |
| 3.1 | Definitions, types and causes of biodiversity destruction | 1 | 1 |
| 3.2 | Concepts on deforestation, global warming and pollution and their effects | 1 | 1 |
| 3.3 | Pressure of human population on plant diversity and its effects | 1 | 2 |
| 3.4 | Mitigation processes of diversity destructions and sustainable use of plant resources | 1 | 2,3 |
| **4.0** | **Biodiversity conservation** | **6** | |
| 4.1 | Concepts and principles of biodiversity conservation, its types and importance | 1 | 1 |
| 4.2 | IUCN: programs, actions and commissions | 1 | 1 |
| 4.3 | Protected areas of Bangladesh: accounts and importance, exploitation of protected areas and its effects on natural environments, protected area managements | 2 | 1,2 |
| 4.4 | Measurement of biodiversity: Simpson's and Shannon's indices, and Cartagena protocol | 2 | 3,4 |
| **5.0** | **Crop genetic resources** | **5** | |
| 5.1 | Definition, types and importance of crop genetic resources | 1 | 1 |
| 5.2 | Erosion of genetic resources, monocultural practices and its danger | 2 | 1 |
| 5.3 | Uses of crop genetic resources in agriculture and its economic aspects | 2 | 3,4 |
| **6.0** | **Ecological aspects of plant diversity** | **7** | |
| 6.1 | Ecology of biodiversity: concepts on ecosystem, community, assemblage, habitat and biomes | 1 | 1 |
| 6.2 | Interaction between the flora and its environment, plant diversities in different biomes | 2 | 2,3 |
| 6.3 | Factors influencing the distribution and abundance of different plant species and plant adaptation in different environments | 2 | 2,3 |
| 6.4 | Centers of plant diversity: continental hot spots, large islands and oceanic islands, centers of genetic diversity: mega gene center | 2 | 1 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Briggs, D. and Walters, S.M. 1997. Plant Variation and Evolution. Cambridge University Press: 3rd Editon.
2. Dobzhensky, T. 1970. Genetics of the Evolutionary Process. Columbia University Press.
3. Mettler, L.E. and Greger, T.G. Population Genetics and Evolution.
4. Paul, N.K. and Sarker, A.M. 2000. Biodiversity (In Bengali). Eureka, Rajshahi.
5. Wilson, E.O. and Bossert, W.H. 1971. A Premier of Population Biology. Sinauer.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3103 | | |
| **Course Title** | : Classical Genetics | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: **30** |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course introduces classical genetics by covering foundational concepts like Mendel's laws, genetic terminology, and inheritance patterns. It explores deviations from Mendelism, linkage, crossing over, sex-linked traits, and extra-chromosomal inheritance. Emphasizing genetic diversity, trait expression, and heredity, the course equips students with knowledge essential for understanding genetic mechanisms, problem-solving, and applications in medicine, agriculture, and biotechnology.

**Course Learning Outcomes (CLOs)**

| **CLO No.** | **Expected Course Outcomes**<br>Upon completion of this course, the students will be able to: | **Cognitive Level** |
|---|---|---|
| CLO 1 | help students to acquire knowledge on the fundamental principles of heredity and inheritance; | U |
| CLO 2 | explore various topics of Mendelian genetics, chromosomal basis of heredity, gene interactions, multiple alleles, polygene and linked gene inheritance; | U |
| CLO 3 | apply different techniques, tools and equipment used in genetic research; | Ap |
| CLO 4 | conduct relevant experiments in the field of classical genetics, analyze and interpret results and to make inferences. | E |

U-Understanding; Ap-Apply; E-Evalute

**Mapping CLOs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 2 | 3 | 3 | 2 | 1 | 3 | 3 |
| CLO 2 | 1 | 2 | 2 | 3 | 2 | 1 | 3 |
| CLO 3 | 3 | 2 | 1 | 2 | 3 | 2 | 3 |
| CLO 4 | 3 | 3 | 2 | 3 | 3 | 3 | 2 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| **Module** | **Course Contents** | **Credit hrs** | **CLOs** |
|---|---|---|---|
| **1.0** | **Introduction to genetics** | **4** | |
| 1.1 | Science, history, areas and importance of genetics | 2 | 1 |
| 1.2 | General terminology used in genetics- gene**,** homozygous and heterozygous, dominant and recessive gene, genotypic and phenotypic variation,heredity, test cross and back cross | 2 | 1 |

| | | | |
|---|---|---|---|
| **2.0** | **Mendelian inheritance** | **5** | |
| 2.1 | Biography of Mendel, his experiments on pea plants | 1 | 1 |
| 2.2 | Law of segregation: monohybrid cross, back cross and test cross, problems related | 2 | 1,2 |
| 2.3 | Law of independent assortment: dihybrid cross in pea plant, back cross and test cross, problems related | 2 | 1,2 |
| **3.0** | **Deviations from Mendelism** | **7** | |
| 3.1 | Incomplete dominance, co-dominance, lethal gene | 1 | 1,2,3 |
| 3.2 | Silent alleles, pleiotropy, polygenic inheritance | 1 | 1,2,3 |
| 3.3 | Multiple allele: definition, characteristics and inheritance | 3 | 1,2,3 |
| 3.4 | Epistasis: definition, different types of epistasis with their ratio | 2 | 1,2,3 |
| **4.0** | **Linkage and Crossing Over** | **4** | |
| 4.1 | Definition, linked gene, linkage group and kinds of linkage | 1 | 1 |
| 4.2 | Definition and significance of crossing over | 1 | 1 |
| 4.3 | Development linkage map and its importance | 2 | 3 |
| **5.0** | **Sex linked, sex limited and sex influenced trait** | **4** | |
| 5.1 | Definition, sex chromosomes and autosomes | 1 | 1,3 |
| 5.2 | Sex linked inheritance: X and Y chromosome linked | 1 | 1,3 |
| 5.3 | Inheritance of sex limited trait | 1 | 1,2,3 |
| 5.4 | Inheritance of sex influenced traits | 1 | 1,2,3 |
| **6.0** | **Extra-chromosomal inheritance** | **6** | |
| 6.1 | Definition, different types of extra-chromosomal inheritance | 1 | 1 |
| 6.2 | Cytoplasmic inheritance: mitochondrial, chloroplast | 3 | 2,3 |
| 6.3 | Maternal inheritance, cris-cross inheritance, uniparental inheritance | 2 | 2,3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Sinnot, E.W., Dunn, L.C. and Dobzhansky, T. 1985. Principles of Genetics. McGraw-Hill Book Co. Inc. New York, London.
2. Stint, G.S. 1971. Molecular Genetics. An Introductory Narrative. W. H. Freeman and Co. San Francisco.
3. Strickberger, M.W. 1996. Genetics. Macmillan Publishing Co. Inc. New York, London.
4. Suzuki, D.T., Griffiths, Anthony J.F., Miller, Jeffrey H., Lewontin, Richard C. 1989. An Introduction to genetic analysis. 4th Edition W.H. Freeman.
5. Whitehouse, H.L.K. 1973. Towards an Understanding of the Mechanism of Heredity. Edward Arnold. England.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3104 | | |
| **Course Title** | : Systematics of Angiosperms | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week:** 3 | **Total credit hours**: 30 (minimum) |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course highlighted the study of plant origin, diversity as well as their identification, nomenclature, classification and evolution. It also reveals the study of genetic lineage and variations among taxa, origin and evidences of plants, taxonomy and consrvation, Red data book, detailed study and phylogenetic importance of selected families, molecular and numerical approches. This knowledge is crucial for improving systematics of angiosperms and helpful for students about plant identification and conservation.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | understand the fundamental values of plant systematics and gather knowledge on classification and phylogenetic relationship of plant taxa. | U |
| CLO 2 | analyze the methods and principles of classification and nomenclature. | An |
| CLO 3 | plan desk, lab and field based studies of angiosperm diversity, identifying morphological specialties and writing short species descriptions and illustrations. | C |
| CLO 4 | identify members of the major angiosperm families by observing their diagnostic features and phylogenetic importance. | An |

U-Understanding; An-Analyze; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 3 | 2 | 2 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| CLO 4 | 3 | 3 | 2 | 2 | 3 | 3 | 2 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Origin and evidences of Plant Systematics** | **6** | |
| 1.1 | Phylogeny, different theories regarding origin of angiosperms | 1 | 1,2 |

| | | | |
|---|---|---|---|
| 1.2 | Ranalian and Englerian Schools. Origin of monocots | 1 | 1,2 |
| 1.3 | Morphology, Anatomy and Cytology | 1 | 1 |
| 1.4 | Photochemistry and Serotaxonomy | 1 | 2,3 |
| 1.5 | Breeding System: Types and describe. Role of breeding system in plant systematics | 1 | 1,2 |
| 1.6 | Isolation: Types and describe. Role of isolation in the origin of new species | 1 | 1 |
| | | | |
| **2.0** | **Taxonomy: Principles of Plant Taxonomy** | **12** | |
| 2.1 | Aim and Scope and significance of plant systematics. Relation to taxonomy and systematics | 1 | 2,3 |
| 2.2 | Developmental phases of plant classificatory system-prior to Darwin. Pre-Darwinian and post-Darwinian classification | 1 | 2 |
| 2.3 | Phylogenetic classification: Cronquist system | 1 | 2 |
| 2.4 | Takhtajan System | 1 | 2 |
| 2.5 | APGIII system and APGIV system | 1 | 2 |
| 2.6 | History of botanical exploration in Indo-Bangladesh sub-continent. Plant taxonomic research in Bangladesh | 1 | 2 |
| 2.7 | Population and environment: causes and speciation | 1 | 2 |
| 2.8 | Ecotype concept. Californian transect experiment | 1 | 2 |
| 2.9 | Methods of biosystematic studies. Biosystematics categories | 1 | 2 |
| 2.10 | Taxonomy and conservation: *ex situ* and *in situ* conservation | 1 | 3 |
| 2.11 | Red Data Book and IUCN | 1 | 3 |
| 2.12 | Taxonomy in the service of man | 1 | 3 |
| | | | |
| **3.0** | **Detailed study of Families:** Study the following families with their phylogenetic importance | **5** | |
| 3.1 | Magnoliaceae | 1 | 4 |
| 3.2 | Nymphaeaceae | 1 | 4 |
| 3.3 | Asteraceae | 1 | 4 |
| 3.4 | Poaceae | 1 | 4 |
| 3.5 | Orchidaceae | 1 | 4 |
| | | | |
| **4.0** | **Molecular and Numerical Systematics** | **7** | |
| 4.1 | Numerical taxonomy: principles, application. Construction of groups, merits and demerits of numerical taxonomy | 1 | 4 |
| 4.2 | Taxonomic Database concept. List of biodiversity data bases up to 2016 | 1 | 4 |
| 4.3 | Molecular Phylogenetics: Introduction and History, techniques and applications. Theoretical background, limitations of molecular systematics | 1 | 4 |
| 4.4 | Molecular Evolution: Introduction and principles of molecular evolution, the driving forces of evolution | 1 | 4 |

| | | | |
|---|---|---|---|
| 4.5 | History of sciences, genome evolution | 1 | 4 |
| 4.6 | Molecular Marker: Concept; types; application | 1 | 4 |
| 4.7 | Concept of molecular clock, primer and phylogenetic tree | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Bhattacharya, B. and Johri, B.M. 1998. Flowering Plants: Taxonomy and Phylogeny. Narosa Publishing House, New Delhi. India.
2. Cronquist, A. 1981. An Integrated System of Classification of Flowering Plants. Columbia University Press, U.S.A.
3. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd Ltd, Edinburgh, London.
4. Hillis, D.M. and Moritz, C. 1996. Molecular Systematics. 2nd ed. Sinauer Associates Incorporated. USA.
5. Radford, A.E. 1974. Vascular Plants Systematics. Harper and Row Publishers. New York.
6. Sharma, O.P. 2004. Plant Taxonomy. Tata MacGraw Hill Publihing Co. Ltd. New Delhi.
7. Soltis, P.S., Soltis, D.E. and Doyle, J.J. 1992. Molecular Systematics of Plants. Chapman & Hall, New York.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3105 | | |
| **Course Title** | : Embryology of Angiosperms | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course examines embryo development in flowering plants, focusing on fertilization, seed formation, and organ development. Essential for careers in plant biology, agriculture, and biotechnology, it supports advancements in crop breeding, seed development, and sustainable farming. The course also explores evolutionary biology and applications like plant tissue culture, equipping students with knowledge to innovate in agriculture, conservation, and plant sciences.

**Course Outcomes (CLO)**

| **CLO No.** | **Expected course outcomes**<br>Upon completion of this course, the students will be able to: | **Cognitive level** |
|---|---|---|
| CLO 1 | classify and understand the types of floral organs, embryo structure and function; | U |
| CLO 2 | explain Some techniques of experimental embryology, such as production of haploid and diploid embryo through apomixes or parthenogenesis; | U |
| CLO 3 | assess Embryology of angiosperms is not only embryonic development but also the formation of the generative sphere. Embryology is developed on the knowledge of embryo formation and growth; | E |
| CLO 4 | distinguish embryo types and different evolutionary process, controlled pollination and fertilization have proved of great significance in genetics and plant breeding. | E |

U-Understanding; E-Evaluate

**Mapping COs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 3 | 3 | 2 | 3 | 3 | 2 | 2 |
| CLO 2 | 3 | 3 | 3 | 3 | 2 | 3 | 2 |
| CLO 3 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| CLO 4 | 2 | 3 | 3 | 3 | 2 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| **Module** | **Course contents** | **Credit hrs** | **CLOs** |
|---|---|---|---|
| **1.0** | **Introduction** | **2** | **2** |
| 1.1 | Definition and historical background of Embryology; | 2 | |

| | | | |
|---|---|---|---|
| | Experimental embryology | | |
| **2.0** | **Microsporangium and male gametophyte** | **5** | |
| 2.1 | Microsporangium: Structure and development of Anther | 2 | 3 |
| 2.2 | Microsporogenesis and Dehiscence of Anther | 1 | 3 |
| 2.3 | Structure of pollen | 1 | 3 |
| 2.4 | Development of male gametophyte | 1 | 3 |
| **3.0** | **Megasporangium and female gametophyte** | **4** | **3** |
| 3.1 | Megasporangium; Types of ovule. | 2 | 3 |
| 3.2 | Megasporogenesis- Female gametophyte. | 1 | 3 |
| 3.3 | Structure of a typical embryo sac; Types of embryo sac | 1 | 3 |
| **4.0** | **Embryo** | **4** | |
| 4.1 | Classification of embryo. | | 3,4 |
| 4.2 | Embryo development in monocotyledonous plants | | |
| 4.3 | Embryo development in dicotyledonous plants | | |
| **5.0** | **Fertilization and embryogenesis** | **3** | **3,4** |
| 5.1 | Definition, mechanism | 2 | 3,4 |
| 5.2 | Double fertilization | 1 | 3,4 |
| **6.0** | **Seed and fruit development** | **5** | |
| 6.1 | Flower structure, Pollination | 2 | 1 |
| 6.2 | Seed development; seed dispersal; seed dormancy | 1 | 1 |
| 6.3 | Fruit wall and pericarp, dry fruit wall, fleshy fruit wall | 1 | 1 |
| 6.4 | Relation of fertilization with seed and fruit development | 1 | 1 |
| **7.0** | **Endosperm** | **3** | |
| 7.1 | Types and morphology of endosperm | 2 | 2 |
| 7.2 | Types of haustorial structures associated with endosperm and embryo sac | 1 | 2 |
| **8.0** | **Apomixis** | **4** | |
| 8.1 | Types and Process of apomixis | 2 | 2 |
| 8.2 | Development of apomictic plant and applications | 2 | **2** |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Batygina, T.B 2009. Embryology of Flowering Plants: Terminology and Concepts, Vol. 3 Reproductive Systems. CRC Press.
2. Bhojwani, S.S. and Bhatnagar S.P. 2014. The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi.
3. Johri B.M. 1984. Embryology of Angiosperms. Springer-Verlag Berlin Heidelberg New York.
4. Maheshwari, P. 1950. An Introduction to the Embryology of Angiosperms. McGraw-Hill, New York.
5. Nair, P.K.K. 1970. Pollen Morphology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi.
6. Raghavan, V. 1997. Molecular Embryology of flowering Plants. Cambridge University Press, Cambridge, England.
7. Sharma, H.P. 2009. Plant Embryology: Classical and Experimental. Narosa Publishing House Pvt. Ltd., New Delhi.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3106 | | |
| **Course Title** | : Soil Science | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course is design to know the concepts of soil composition, formation, structure, particles and texture and classification; soil organisms, soil fertility and organic matter, soil water; and agro-ecological condition of Bangladesh and helps to develop skill on soil water potential measurement and biofertilizer production.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | understand soil composition, functions and formation; | U |
| CLO 2 | explain physical and chemical properties of soil, soli particles, soil texture and classification; | An |
| CLO 3 | interpret general soil types and agro-ecology in Bangladesh; | E |
| CLO 4 | develop knowledge on organic matter and humus formation and analyze soil water regimes and their importance; | E, An |
| CLO 5 | explain soil nutrients and nutrients deficiency in plant, biological nitrogen fixing agents and apply the knowledge of BGA production. | An, Ap |

U-Understanding; An-Analyze; E-Evaluate, Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 3 | 1 | 2 | 1 | 2 |
| CLO 2 | 3 | 3 | 3 | 2 | 2 | 1 | 3 |
| CLO 3 | 2 | 2 | 2 | 3 | 2 | 2 | 3 |
| CLO 4 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| CLO 5 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Soil genesis** | **4** | |
| 1.1 | Definition of soil and component of soil | 1 | 1 |
| 1.2 | Soil forming factors and processes (laterization, podzolization and calcification) | 2 | 1 |
| 1.3 | Soil profile: horizons, regolith, monolith, eluviation and illuviation | 1 | 1 |

| | | | |
|---|---|---|---|
| **2.0** | **Soil properties** | **4** | |
| 2.2 | Concept, soil texture, structure, particle density, bulk density and soil porosity | 2 | 2 |
| | Soil pH and Ion exchange in soil | 1 | 2 |
| | Soil organisms and their importance | 1 | 2 |
| **3.0** | **Soil particles and Texture** | **4** | |
| 3.1 | Soil Particles- Definition, Clarification and prophesies, comparative characteristic of send silt and clay | 2 | 2 |
| 3.2 | Soil Texture- Definition, methods of determination soil; Textural classes by USDA | 2 | 2 |
| **4.0** | **Soils of Bangladesh** | **4** | |
| 4.1 | Agro-Ecological Zones (AEZ) Concept and criteria for AEZ classification; principles of AEZ | 2 | 3 |
| 4.2 | Short description of AEZs- location, extent and crops grown, land types, and present land use | 2 | 3 |
| **5.0** | **Organic matter** | **4** | |
| 5.1 | Concept of organic matter, sources and composition of soil organic matter. C/N ratio and significance of C/N ratio | 2 | 4 |
| 5.3 | Humus formation process- modem theory, and causes of organic matter development, effects of organic matter on soil properties | 2 | 4 |
| **6.0** | **Soil water** | **3** | |
| 6.1 | Definition, importance, classification of soil water and constant | 1 | 4 |
| 6.2 | Soil water potential- concept, methods of measurement and unit of expression | 2 | 4 |
| **7.0** | **Soil fertility and Plant nutrients** | **3** | |
| 7.1 | Soil fertility and Plant nutrients- Criteria for essentiality, available forms and source | 1 | 5 |
| 7.2 | Macro and micronutrients, and their functions in plants | 2 | 5 |
| **8.0** | **Biological Nitrogen Fixation (BNF)** | **4** | |
| 8.1 | Definition of BNF and agents of BNF. Symbiotic $N_2$ fixation: Legume- *Rhizobium* symbiosis; Azolla-Anabaena symbiosis; Non- symbiotic $N_2$ fixation- *Azotobacter, Azospirillum,* Cyanobacterea | 2 | 5 |
| 8.2 | Blue-green algae (BGA)- importance and methods of production. Factors affecting Azolla and BGA growth | 2 | 5 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Brady, N.C. and Weil, R.R. 2006. The Nature and Properties of Soils. Thirteen edition Pearson Education Pvt. Ltd. New Delhi, India.
2. Brammer, H. 1996.The Geography of the Soils of Bangladesh. University Press Ltd., Dhaka, Bangladesh.
3. Foth H.D. 1991. Fundamentals of Soil Science. 8th edition, Willey and Black, USA.
4. Klute, A. 1986. Methods of Soil Analysis, Part 1, Amer. Soc. Agron., Madison, Inc. Pub., Wis., USA.
5. Miller, R.W. and Donahue, R.L. 1990. Soils- An Introduction to Soils and Plant Growth. Prentice Hall Inc. USA.
6. Subba Rao, N.S. (2002). Soil Microbiology. Oxford and IBH Publ Co. Ltd., New Delhi.
7. Subba Rao, N.S. 1982. Biofertilizers, In: Advances in Agricultural Microbiology (Ed. Subba Rao. N.S.). Oxford and IBH Publ. Co., New Delhi.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3107 | | |
| **Course Title** | : Forestry | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Forest ecosystems have been placed at the center of the contentious and global concerns for their carbon sequestration, biodiversity conservation, economic importance, etc. A broad segment of human society relies on forest for their sustenance and employment of huge number of population. This course is designed to provide an overview of the issues regarding forestry like forest ecology, forest product extraction processes, agroforestry and standard forest management practices and policies. These are convincing enough to include forestry as a general education course in the curriculum of botany.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to : | Cognitive Level |
|---|---|---|
| CLO 1 | define forest and forestry, understand its importance to human beings; | R, U |
| CLO 2 | describe natural and artificial regeneration of forest and classify forest; | U, An |
| CLO 3 | understand forest ecology and evaluate forest productivity system and niche-based management practices of forests; | U, E |
| CLO 4 | identify the threats to forest and can develop sustainable standard forest management system. | An, Ap |

R-Remember; U-Understanding; Ap-Apply; An- Analyze; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 2 | 3 | 2 | 2 | 2 | 2 |
| CLO 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 |
| CLO 3 | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| CLO 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Forestry – an Introduction** | **4** | 1,2 |
| 1.1 | Definition and basic terms related to forestry | 1 | |
| 1.2 | Characteristics of forests; importance of forest to humans | 1 | |
| 1.3 | Classification of forests with species composition | 1 | |
| 1.4 | Salient features of Bangladesh forests | 1 | |
| **2.0** | **Forest formation** | **3** | 2,3 |

| | | | |
|---|---|---|---|
| 2.1 | Natural regeneration- Natural regeneration from seeds, vegetative parts, coppicing, pollarding, root suckers; mode of regeneration | 1 | |
| 2.2 | Artificial regeneration – objectives, choices between natural and artificial regeneration of preliminary and essential consideration of artificial regeneration (AR). | 2 | |
| **3.0** | **Tending operations** | **2** | 2, 3 |
| 3.1 | Weeding, cleaning, thinning, mechanical and ordinary crown and advanced thinning | 1 | |
| 3.2 | Crown classification of trees | | |
| **4.** | **Forest mensuration** | **2** | 2,3 |
| 4.1 | Objectives, diameter measurement, instruments used in diameter measurement | 2 | |
| **5.0** | **Silviculture** | **3** | 2,3 |
| 5.1 | Definition and objectives of silviculture | 1 | |
| 5.2 | Tree nursery practices– seed collection, seed pre-treatment, seed bed preparation and sowing | 1 | |
| 5.3 | Planning and layout of forest plantation, choice of species, methods of plantation and after care | 1 | |
| **6.0** | **Agroforestry** | **4** | 2,3 |
| 6.1 | Definition, importance and classification of agroforestry system | 1 | |
| 6.2 | Criteria of selection of trees in agroforestry | 1 | |
| 6.3 | Different agroforestry system prevalent in Bangladesh | 1 | |
| 6.4 | Traditional agroforestry systems in different agro-ecological zones/ ecosystems | 1 | |
| **7.0** | **Forest Ecology** | **5** | 3 |
| 7.1 | Different ecological cycles (Hydrologic, nitrogen, carbon cycle, etc.) | 1 | |
| 7.2 | Animals in forest | 1 | |
| 7.3 | Forest ecosystem and its components. Different niches and tropic levels of a forest ecosystem | 1 | |
| 7.4 | Productivity of forest | 1 | |
| 7.5 | How trees grow? Fueling the growth, tree physiology– photosynthesis and water | 1 | |
| **8.0** | **Maturation of forest trees** | **2** | 3 |
| 8.1 | Tree stem formation; form factors; form quotient; Forest production chain | 1 | |
| 8.2 | Measurement of volume felled and standing trees; age determination; annual rings; complete the cycle of regeneration | 1 | |
| **9.0** | **Human interaction with forest** | **3** | 3 |
| 9.1 | Forest extraction perspective | 1 | |

| | | | |
|---|---|---|---|
| 9.2 | Forest products: Wood product, paper pulp, residues, chemicals | 1 | |
| 9.3 | Non-timber forest products (NTFP): Useable edible fruits/plants; fibre bio-fuel $O_2$; Carbon; biodiversities; wildlife habitat; recreation, etc. | 1 | |
| **10.** | **Threats to forest** | **2** | 3,4 |
| 10.1 | Deforestation; forest fire; climate change; wind break; natural calamities and others | 2 | |
| **11.** | **Forest management** | | 3,4 |
| 11.1 | Sustainable forest management practice; Principles of sustainable forest management Standards (SFMS) | 3 | |
| 11.2 | National policies and international initiatives | | |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Anderson, D.A. and Smith, W.A. 1976. Forest and Forestry. Interstate Printers and publishers Inc.
2. Cubbage, F. W., O'Laughlin, J. and Bullock, C.S. 1993. Forest Resource policy. John Wiley and Sons NY.
3. Donald, L.G. Pete, B. and Jack, P.S. 2013. Introduction Forestry and natural Resources. Elsevier New York.
4. Glew, L., Hudson M.D. and Osborne P.E. 2010. Evaluating the effectiveness of community- based conservation in northern Kenya: a report on nature conservancy. Centre for Environmental Sciences. Southhampton, UK.
5. Green, S.B. 1908. Priciples of American forestry. John Wiley and Sons, New York.
6. Pancel, L. and Kohl, M. 2016. Tropical Forest Handbook (2nd edition). Spriger- Verlag, Berlin.
7. Sophei, H. James. M., Stephen, B. Neil, J. and Ruth, B. 2005. Sustainable Forestry Handbook; A Practical Guide for Tropical Forest Managers on Implementing New Standard. Earthscan London.

# Practical Courses

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3108 | | |
| **Course Title** | : Ecosystem Dynamics | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Ecosystem Dynamics** |
| 1.1 | Calculation of Phytodiversity Index |
| 1.2 | Pollution case studies local and national |
| 1.3 | Determination of pH of soil and water |
| 1.4 | Assessment of diversity, abundance and frequency of plant speciesby quadrat methods (grassland) |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3109 | | |
| **Course Title** | : Plant Diversity and Conservation | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Diversity and Conservation** |
| 1.1 | Studies on the biodiversity of local and national flora |
| 1.2 | Studies on the crop genetic resources used by the local farmers |
| 1.3 | Local surveys on medicinal plants diversities |
| 1.4 | Determination of biodiversity indices from collected information |
| 1.5 | Field trips to study the diversities of forests and natural vegetation |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3110 | | |
| **Course Title** | : Classical Genetics | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Classical Genetics** |
| 1.1 | Study of solving problems monohybrid and dihybrid crosses; modified ratios |
| 1.2 | Study of gene order and map distance using three point test crosses |
| 1.3 | Hybridization and progeny testing, genetic analysis and pedigree analysis |
| 1.4 | Determination of goodness of fit of ratio by $X^2$ method |
| 1.5 | Observation and analysis of variation: Qualitative & quantitative |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3111 | | |
| **Course Title** | : Systematics of Angiosperm | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Systematics of Angiosperm** |
| 1.1 | Identify the following inflorescence and fruits with reference to their morphological specialities: (a) Inflorescence - simple raceme, spike, corymb, head, simple cyme (b) cyathium, capitulum, verticillaster and hypanthodium |
| 1.2 | Root and stems: different types of modified root and stems |
| 1.3 | Different types of leaf structure |
| 1.4 | Fruits – simple – (fleshy) – berry drupe, pepo, hespiridium. Dry indehiscent – nut. Drydehiscent –legume, capsule (loculicidal). Aggregate |
| 1.5 | Preparation of floral formula and floral diagram from floral description (of families studied) |
| 1.6 | Identify the families mentioned in the syllabus by noting their vegetative and floral characters |
| 1.7 | Students must describe the floral parts, draw the L.S., floral diagram and write the floral formula of at least one flower from each family |
| 1.8 | Prepare herbarium of 50 plants with field notes |
| 1.9 | Field work: long and local excursion and field reports |
| 1.10 | Systematic position |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3112 | | |
| **Course Title** | : Field work/Excursion (major courses) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year First Semester | | |
| **Course Teacher** | : Respective Examination Committee | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

# Curriculum

# For Third Year: Second Semester

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3201 | | |
| **Course Title** | : Ethnobotany | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Ethnobotany is concerned with the interactions of people with plants. By using ethnobotanical knowledge, the chemical and genetic constituents of plants are being increasingly explored for human benefits. As it addresses resource users' knowledge, the incorporation of this knowledge into bio-prospecting and management of bio-recourses could bring about sustainable conservation of ecosystem. Ethnobotany also values the knowledge-base of local and indigenous people recognize their rights. After attaining the course, students will able to develop themselves to incorporate traditional botanical knowledge into development interface.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | know what ethnobotany is and recognize different terminologies of ethnobotany; | R |
| CLO 2 | understand the knowledge base of local people about plants and the extent of uses; | U |
| CLO 3 | analyze the traditional management practices of ecosystems; | Ap |
| CLO 4 | assess the contribution of ethnobotany in rural livelihood; | E |
| CLO 5 | evaluate the merit of that knowledge and could claim to protect those rights. | E |

R-Remember; U-Understanding; Ap-Apply; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |
| CLO 4 | 2 | 3 | 2 | 2 | 2 | 3 | 2 |
| CLO 5 | 3 | 2 | 2 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Basic concept of ethnobotany** | **4** | |
| 1.1 | Definition and terminologies used ethnobotany | 2 | 1 |

| | | | |
|---|---|---|---|
| 1.3 | Aim and objectives of ethnobotany | 1 | 2 |
| 1.4 | Branches and scope of ethnobotany | 1 | 1 |
| **2.0** | **Ethnobotany and traditional medicine** | **8** | |
| 2.1 | Historical background of traditional medicine | 2 | 2 |
| 2.2 | Medicinal plants and herbal medicine | 1 | 1,2 |
| 2.3 | Active chemical constituents within medicinal plants | 1 | 2 |
| 2.4 | Ten widely used medicinal plants with their active chemical constituents and ethnobotanical uses | 5 | 3,4 |
| **3.0** | **Ethnopharmacology** | **5** | |
| 3.1 | Definition, historical background, current and future perspectives | 2 | 1,2 |
| 3.2 | Ethnopharmacological approach: examples of drug discovery based on ethnopharmacological knowledge; process of modern drug development of ethnopharmacology | 3 | 3,4 |
| **4.0** | **Wild plants** | **4** | |
| 4.1 | Definition, sources and uses of wild plants | 2 | 1,3 |
| 4.2 | Distribution and dependency on wild plants of rural people of Bangladesh | 2 | 2,4 |
| **5.0** | **Traditional agriculture** | **4** | |
| 5.1 | Definition and nature of traditional agriculture | 1 | 1,2 |
| 5.2 | Agro-biodiversity feature of traditional agriculture | 1 | 2,3 |
| 5.3 | Role of traditional agriculture in environmental risk management and agriculture development | 2 | 4 |
| **6.0** | **Plant domestication** | **2** | |
| 6.1 | Definition and historical background | 1 | 1,2 |
| 6.2 | Domestication process of plants | 1 | 2 |
| **7.0** | **Ethnobotanical knowledge and intellectual property rights** | **3** | |
| 7.1 | Intellectual Property Rights (IPRs) and ethnobotanical knowledge | 2 | 2 |
| 7.2 | Justification of the use of IPRs | 1 | 3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Brush, S.B. and Stabinsky, D. 1996. Valuing Local Knowledge: Indigenous People and Intellectual Property Rights. Island Press, Washington DC.
2. Cotton, C.M. 1996. Ethnobotany: Principles and Applications. John Willey and Sons; Chichester, UK.
3. Ghani, A. 2003. Medicinal Plants of Bangladesh with Chemical Constituents and Uses (2nded.). Asiatic Society of Bangladesh.
4. Jain, S.K. 1981. Glirpses of Indian Ethnobotany. Oxford &IBH. New Delhi.
5. Martin, G.J. 1995. Ethnobotany: A Conservation Manual. Chapman and Hall, London.
6. Michael Heinrich and Anna K. Jäger, 2015, Ethnopharmacology. Chichster: Wiley Blackwell.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3202 | | |
| **Course Title** | : Introductory Plant Pathology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Plant pathology is a branch of botany which deals with plant pathogens and diseases. The diseases are caused by biotic and abiotic agencies. The study of the course ensure the diagnosis of plant diseases, host-pathogen interaction, their causative agents of unknown pathogens and different incitant causing plant disease of nationally and internationally economic crop plants.

**Course Learning Outcomes (CLOs)**

| CO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | know the history and significance of plant diseases; | U |
| CLO 2 | identify the different symptoms and causal agents of plant diseases; | E |
| CLO 3 | understand parasitism and stages of disease development; | AP |
| CLO 4 | acquire the knowledge of attacking and defence mechanisms of pathogens and plants. | R |

R -Remember; U-Understanding; Ap-Apply; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 2 | 1 | 1 | 3 | 2 |
| CLO 2 | 3 | 3 | 2 | 2 | 3 | 3 | 2 |
| CLO 3 | 2 | 2 | 3 | 3 | 3 | 3 | 3 |
| CLO 4 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Content | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **History of plant pathology** | **3** | |
| 1.1 | Definition, history of plant pathology and importance of plant pathology in modern agriculture | 1 | 1 |
| 1.2 | Plant disease and world crop production | 1 | 1 |
| 1.3 | Effects of changes in agricultural methods and human society on the development and spread of plant diseases | 1 | 1 |
| **2.0** | **Plant diseases concept and methods of studying diseases** | **7** | |
| 2.1 | Concepts of plant diseases | 1 | 2 |
| 2.2 | Classification of plant diseases | 1 | 2 |
| 2.3 | Methods of studying plant diseases in field conditions | 1 | 2 |
| 2.4 | Methods of studying plant disease in laboratory conditions | 1 | 2 |

| | | | |
|---|---|---|---|
| 2.5 | Isolation and purification pathogen in pure culture | 1 | 2 |
| 2.6 | Testify the Koch's rules in green house condition | 1 | 2 |
| 2.7 | Test of pathogenicity | 1 | 2 |
| **3.0** | **Plant diseases diagnosis and development** | **4** | |
| 3.1 | Symptoms and diagnosis of plant diseases | 1 | 3 |
| 3.2 | Stages of diseases development | 1 | 3 |
| 3.3 | Inoculation, penetration, infection, dissemination of pathogens | 1 | 3 |
| 3.4 | Disease cycle; over wintering and over summering of pathogens | 1 | 3 |
| **4.0** | **Host pathogen interaction** | **4** | |
| 4.1 | Mechanical force exerted by pathogens on host tissue | 1 | 3 |
| 4.2 | Chemical weapons of pathogens | 1 | 3 |
| 4.3 | Microbial toxins in plant disease | 1 | 3 |
| 4.4 | Growth regulators in plant disease | 1 | 3 |
| **5.0** | **Diseases of common plants** | **12** | |
| 5.1 | Rice: Brown spot, BLB and Tungro disease | 1 | 4 |
| 5.2 | Wheat: Black stem rust and Loose smut | 1 | 4 |
| 5.3 | Banana: Panama and Sigatoka diseases | 1 | 4 |
| 5.4 | Mango: Anthracnose and Fruit rot | 1 | 4 |
| 5.5 | Sugarcane: Red rot and Whip smut | 1 | 4 |
| 5.6 | Tomato: Wilt, Leaf curl and Mosaic | 1 | 4 |
| 5.7 | Tea: Red rust and Blister blight | 1 | 4 |
| 5.8 | Potato: Late blight, Early blight and Potato Spindle tuber disease | 2 | 4 |
| 5.9 | Jute: Stem rot and Anthracnose | 1 | 4 |
| 5.10 | Betel vine: Leaf blight and Foot-rot | 1 | 4 |
| 5.11 | Angiospermic Parasites: Loranthus and Dodder | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Agrios, G.N., 1997. Plant Pathology (4th Edition). Academic Press, San Diego, USA.
2. Manners, J.G., 1982. Principles of Plant Pathology. Cambridge University Press, London, UK.
3. Rangaswami, G. and Mahadevan, A. 2014. Diseases of Crop Plants in India (4th Edition). PHI Learning Private Limited, Delhi-110092, India.
4. Singh, R.P. 2010. Plant Pathology. Kalyani Publishers. New Delhi, India.
5. Singh, R.S., 1979. Introduction to the Principles of Plant Pathology (2nd Edition). Oxford and IBH Publishers, New Delhi, India.
6. Singh, R.S.1998. Plant Diseases (7th Edition). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India.
7. Strange, R.N., 2003. Introduction to Plant Pathology. John Wiley & Sons Ltd.,

Chichester, UK.

| | | | |
|---|---|---|---|
| **ourse Code** | : BBOT 3203 | | |
| **Course Title** | : Biostatistics | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week:** 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course teaches students how to collect, organize, and analyze biological data. It covers data types, sampling methods, and ways to present data visually. Students learn to calculate averages (mean, median) and variability (range, standard deviation), test hypotheses (t-test, ANOVA), and study relationships (correlation, regression). Experimental design ensures accurate research, making this course vital for biological studies.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | gain a solid understanding of core biostatistical concepts, including statistical terms, variables, and data types, essential for biological research. | U |
| CLO 2 | design biological experiments, systematically record data, and apply statistical methods to ensure scientific validity. This enables them to critically evaluate findings and support conclusions with statistical rigor and scientific integrity. | Ap, E |
| CLO 3 | acquire essential numerical skills for research, including hypothesis testing and variance analysis, enabling critical data analyze. These skills empower students to create valuable, data-driven contributions to the field of biological science. | An |

U- Understanding; Ap-Apply; E-Evaluate; An- Analyze

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 1 | 3 | 2 | 3 | 3 | 3 |
| CLO 2 | 3 | 2 | 3 | 2 | 2 | 3 | 3 |
| CLO 3 | 2 | 3 | 2 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction to Biostatistics** | **4** | |
| 1.1 | Definition, history, and importance in biological sciences | 1 | 1 |

| | | | |
|---|---|---|---|
| 1.2 | Variables: discrete and continuous variables | 1 | 1 |
| 1.3 | Data and data transformations | 1 | 1 |
| 1.4 | Population and sample; Sampling methods – random and non-random sampling | 1 | 1 |
| | | | |
| **2.0** | **Collection and Representation of data** | **5** | |
| 2.1 | Different methods for collecting data | 1 | 1 |
| 2.2 | Data representation techniques: tabular and graphical representation | 2 | 1,2 |
| 2.3 | Frequency distribution table and histogram | 2 | 3 |
| | | | |
| **3.0** | **Measurement of Central tendency and Dispersion** | **5** | |
| | Introduction to central tendency and dispersion; normal distribution | 1 | 1 |
| 3.1 | Measures of central tendency : mean; mode; median | 2 | 2,3 |
| 3.2 | Measures of dispersion : range; mean deviation, variance and standard deviation, standard error of mean | 2 | 2,3 |
| | | | |
| **4.0** | **Test of significance** | **3** | |
| 4.1 | Hypothesis testing; null hypothesis | 1 | 1 |
| 4.2 | t-test (comparison between two samples) | 2 | 2,3 |
| | | | |
| **5.0** | **Analysis of variance** | **5** | |
| 5.1 | Variance ratio test (F-test): comparison of three or more samples | 1 | 1 |
| 5.2 | One-way and two-way analysis of variance | 3 | 2 |
| | Multiple comparisons: least significant difference (LSD test) and Duncan's multiple range test (DMRT) | 1 | 3 |
| | | | |
| **6.0** | **Measurement of association** | **4** | |
| 6.1 | Correlation analysis; | 2 | 2 |
| 6.2 | Regression analysis | 1 | 2 |
| 6.3 | Path analysis | 1 | 2 |
| | | | |
| **7.0** | **Experimental design and analysis** | **4** | |
| 7.1 | Principles and significance of experimental design | 1 | 1 |
| 7.2 | Different types of experimental design: Completely randomized design (CRD), Randomized block design (RBD), Latin square design (LSD) and Split plot design | 3 | 2,3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Gomez, K.A and Gomez, A.A. 1976. Statistical Procedure for Agricultural research with emphasis on rice. The International Rice Research Institute.
2. Misra, B.N. and Misra, M.K. 1983. Introductory Practical Biostatistics. Naya Prokash, Calcutta, India.
3. Norman, T., Bailey, J. 2008. Statistical Methods in Biology. Cambridge.
4. Prasad, S. 2003. Elements of Biostatistics. Rastogi Publications, Meerut.
5. Robert, G.D., Steel and Torrie, J.H. 1981. Principles and procedure of Statistics (A biometrical approaeh). International student edition. McGraw-Hill International Book Company.
6. Snedecor, G.W. and Cochran, W.G. 1980. Statistical Methods. 7$^{th}$Edition, The Iowa State University Press, USA.
7. Zaman, S.M., Rahman, H.K. and Howlader, M. 1982. Simple Lessons from Biometry. Bangladesh Rice Research Institute, Joydebpur, Dhaka.

| | | | |
|---|---|---|---|
| **Course code** | : BBOT 3204 | | |
| **Course Title** | : Quantitative Genetics | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit value** | : 2 | Credit hours/week: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course explores how multiple genes influence traits, focusing on genetic models and factors like additive-dominance. It covers key concepts such as heritability, gene action, inbreeding, and outbreeding. Students learn about heterosis, inbreeding depression, and statistical methods like path coefficient analysis, correlation, and regression, helping to apply genetic principles in breeding, selection, and crop improvement.

**Course Learning Outcomes (CLOs)**

| **CLO no.** | **Expected Course Outcomes**<br>Upon completion of this course, the students will be able to: | **Cognitive level** |
|---|---|---|
| CLO 1 | be familiar with the basic knowledge of quantitative & qualitative inheritance, heredity and genetics; | U |
| CLO 2 | biological skills, data recording and statistical analysis to end up with scientific explanation and validity; | Ap |
| CLO 3 | Propose the required numerical skills necessary to carry out research. | E |

U-Understanding; Ap-Apply; E-Evaluate

**Mapping CLOs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 2 | 1 | 3 | 2 | 3 | 2 | 2 |
| CLO 2 | 1 | 2 | 3 | 2 | 2 | 2 | 3 |
| CLO 3 | 2 | 2 | 3 | 2 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| **Module** | **Course Contents** | **Credit hrs** | **CLOs** |
|---|---|---|---|
| **1.0** | **Introduction to quantitative genetics** | **4** | |
| 1.1 | Concept of quantitative genetics, multiple factor hypothesis | 4 | 1 |
| **2.0** | **Components of generation mean** | **4** | |
| 2.1 | Additive-dominance genetic model | 2 | 1, 2 |
| 2.2 | Scaling test | 2 | 2 |
| **3.0** | **Components of variation** | **6** | |
| 3.1 | Importance of heritability in selection | 1 | 1 |
| 3.2 | Partition of variance | 2 | 2 |
| 3.3 | Genotype-environment interaction and response of fitness to | 3 | 1, 2 |

| | | | |
|---|---|---|---|
| | selection | | |
| **4.0** | **Gene Action** | **3** | |
| 4.1 | Definition, concept, estimation and uses | 3 | 1, 2 |
| **5.0** | **Inbreeding and out breeding** | **3** | |
| 5.1 | Definition, concepts, approaches and application | 3 | 2, 3 |
| **6.0** | **Heterosis and Inbreeding depression** | **3** | |
| 6.1 | Concepts, estimation, application | 3 | 2, 3 |
| **7.0** | **Character association** | **7** | |
| 7.1 | Definition, characteristics, estimation and application of path coefficient analysis | 3 | 2, 3 |
| 7.2 | Correlation, regression and stability analysis | 4 | 2, 3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Acquaah, G. 2012. Principles of Plant Genetics and Breeding. Blackwell Publishing.
2. Allard, R.W. 1960. Principle of Plant Breeding. John Willey and Sons, New York.
3. Chahal, G.S. and Gosal, S.S. 2003. Principle and Procedure of Plant Breeding. Narosa Publishing. New Delhi, Kolkata.
4. Chaudhuri, H.K. 1966. Elementary Principles of Plant Breeding. Oxford &IBH Publishing Co. New Delhi, India.
5. Chaudhury, R.C. 1993. Introduction to Plant Breeding. Oxford & IBH Publishing Co. New Delhi, India.
6. Singh, B.D. 1983. Plant Breeding. Kalyani Publishers, New Delhi, India.
7. Sleper, D.A. and Poehlman, J.M. 2006. Breeding Field Crops. 1st ed. Blackwell Publishing.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3205 | | |
| **Course Title** | : Introductory Molecular Genetics | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course provides students with a fundamental understanding of the molecular mechanisms that underlie genetic processes. It covers DNA structure, gene expression, inheritance patterns, and genetic variations and also investigate concepts such as transcription, translation, gene regulation, and genetic engineering. The course prepares students to comprehend genetic research, biotechnology, and plant breeding, which are indispensable for the advancement of agriculture, conservation, and environmental science, by combining theoretical knowledge with practical applications.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | define relevant terminologies including central dogma of life, genes, split genes, transcription, mRNA splicing, translation, PCR, genomics etc., in molecular biology; | R |
| CLO 2 | describe the fundamental process in molecular genetics; | U |
| CLO 3 | conduct different experiments relevant to molecular genetics including DNA, RNA isolation, their quantification and detection, amplify target DNA/gene, interpret results. | Ap |

R- Remember; U-Understanding; Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 3 | 2 | 3 | 3 | 2 |
| CLO 2 | 2 | 3 | 2 | 1 | 2 | 3 | 1 |
| CLO 3 | 3 | 2 | 3 | 1 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction** | **9** | |
| 1.1 | Definition, history of the development of molecular genetics | 1 | 1 |
| 1.2 | Bridge between molecular genetics and classical genetics | 1 | 1 |
| 1.3 | DNA structure and function, DNA replication, RNA structures and functions | 2 | 1 |
| 1.4 | Gene structure and organization, prokaryotic and eukaryotic gene | 2 | 1,2 |

| | | | |
|---|---|---|---|
| 1.5 | Flow of genetic information: central dogma, Transcription and translation | 3 | 1,2 |
| **2.0** | **Basic Techniques of Molecular Genetics** | **7** | |
| 2.1 | Isolation and purification of DNA and RNA; Detection and quantification of nucleic acid | 2 | 3 |
| 2.2 | Agarose Gel Electrophoresis; nucleic acid blotting | 3 | 3 |
| 2.3 | Transformation of *E. coli.* | 1 | 3 |
| 2.4 | Polymerase Chain Reaction (PCR) | 1 | 3 |
| **3.0** | **Genome and genomics** | **4** | |
| 3.1 | Definition, different types of genomics, importance of genomics | 1 | 1 |
| 3.2 | Structural organization of prokaryotic, eukaryotic and organelle genomes | 3 | 2 |
| **4.0** | **DNA Sequencing** | **5** | |
| 4.1 | Definition, principle of DNA sequencing, importance | 2 | 2 |
| 4.2 | Methods of DNA sequencing | 3 | 3 |
| **5.0** | **Mutation** | **5** | |
| 5.1 | Definition causes and types. | 2 | 1 |
| 5.2 | Molecular basis of gene mutation, and site directed mutagenesis | 3 | 2 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Ahmed, J.U. 2002. Molecular Biology. Hasan Book House, Dhaka.
2. Dale, J.W. and Schanfz, M.V. 2002. From Gene to Genomics: Concept and Application of DNA Technology. John Wily and Sons.UK.
3. Griffiths, A.J.F., Miller, J.H., Suzuki O.T., Lewonfin, R.C.L. and Gilbart, W.M. 1998. An Introduction to Genetic Analysis. Freeman Company. USA.
4. Lesk, A.M. 2002. Introduction to Bioinformatics. Oxford University Press.
5. Primrose, S.B. and Twyman, R.M. 2003.Principle of Genome Analysis and Genomics. Black Well Publishing, UK.
6. Primrose, S.B., Twyman, R.M. and Old, R.W. 2001. Principles of Gene Manipulation. BlackWell Science Ltd. UK.

| | | | |
|---|---|---|---|
| **Course code** | : BBOT 3206 | | |
| **Course Title** | : Pharmacognosy | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit value** | : 2 | Credit hours/week: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Pharmacognosy studies natural products derived from plants, animals, and microorganisms, particularly their medicinal properties and applications. This course ensures the preservation and advancement of knowledge about natural medicinal resources, preparing students for careers in healthcare, research, and the pharmaceutical industry. It also contributes to developing safe, effective, and sustainable medicines for global health challenges.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | to recognize the primary knowledge of the general methods of extraction, isolation, purification, identity and assay of different chemical classes of bioactive natural compounds; | R |
| CLO 2 | understand the chemical classification, methods of extraction, isolation, physicochemical properties, tests for identity, assay and uses of selected natural compounds; | U |
| CLO 3 | apply and analyze the identification and separation techniques to evaluate the medicinally important metabolites and discover a novel drag from natural sources; | Ap, An |
| CLO 4 | create human resources to develop pharmaceutical science and technology in the field medicine industry. | C |

R- Remember; U- Understanding, Ap- Apply; An- Analyze; C- Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 2 | 1 | 1 | 2 | 1 |
| CLO 2 | 3 | 3 | 2 | 2 | 1 | 2 | 1 |
| CLO 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CLO 4 | 1 | 2 | 3 | 3 | 3 | 2 | 2 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course contents | Credit hrs. | COLs |
|---|---|---|---|
| **1.0** | **Introduction to Pharmacognosy** | **4** | 1 |
| 1.1 | History, Definition and Scope of Pharmacognosy | 1 | 1 |

| | | | |
|---|---|---|---|
| 1.2 | Alternative Systems of Medicines | 1 | 1 |
| 1.3 | Development and applications of Pharmacognosy. | 1 | 3 |
| 1.4 | Classification of Drugs of Natural Origin | 1 | 1 |
| | | | |
| **2.0** | **Sources of Drugs** | **2** | |
| 2.1 | Plants, Animals, Minerals Drug description. | 2 | 1 |
| | | | |
| **3.0** | **Cultivation, Collection, Production and Utilization of Herbal Drugs** | **4** | |
| 3.1 | Cultivation, Collection and Processing of Herbal Drugs | 2 | 2 |
| 3.2 | Utilization of Aromatic Plants and Derived Products | 1 | 3 |
| 3.3 | Role of Medicinal Plants on National Economy | 1 | 2 |
| | | | |
| **4.0** | **Analytical Pharmacognosy** | **6** | |
| 4.1 | Drug Adulteration | 2 | 1 |
| 4.2 | Evaluation of Crude Drugs | 2 | 3 |
| 4.3 | Biological Screening of Herbal Drugs | 2 | 3 |
| | | | |
| **5.0** | **Biogenesis of Phytopharmaceuticals** | **2** | |
| 5.1 | General Biosynthetic Pathways of Secondary Metabolites | 2 | 2 |
| | | | |
| **6.0** | **Pharmacognostical Study of Crude Drugs** | **4** | |
| 6.1 | Drugs Containing Alkaloids | 1 | 1,2 |
| 6.2 | Drugs Containing Glycosides | 1 | 1,2 |
| 6.3 | Drugs Containing Tannins | 1 | 1,2 |
| 6.4 | Enzymes and Protein Drugs | 1 | 1,2 |
| | | | |
| **7.0** | **Extraction, Isolation and Purification of Herbal Drugs** | **4** | |
| 7.1 | General Methods for Extraction, Isolation and Identification of Herbal Drugs | 2 | 2,3 |
| 7.2 | Isolation of Phytopharmaceuticals | 2 | 3 |
| | | | |
| **8.0** | **Pharmacobiotechnology** | **4** | |
| 8.1 | Introduction, Theory and Important Means in Biotechnology. | 1 | 1 |
| 8.2 | Biotechnology Vs Modern Pharmacy Practice | 1 | 3 |
| 8.3 | Biotechnology Based Pharmaceuticals for the Millennium | 1 | 4 |
| 7.4 | Biotechnology and Modern Drug Discovery | 1 | 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Ghani, G. 2023.Textbook of Phaamacognosy (2nd Edition). AFI Publication. Bangladesh.
2. Kar, A. 2001. Pharmacognosy and Pharmacobiotechnology (2nd Edition). Agrobios, India. New Age International (P) Ltd., Publishers. New delhi, India.
3. Kraemer, H. 1907. A Textbook of Botany and Phamacognosy (2nd Edition). Philadelphia and London, J.B. Lippincot Company.
4. McCreath, S.B. and Clement, Y.N. 2023. Pharmacognosy: Fundamentals, Applications and Strategies (2nd Edition). Academic Press.
5. Shah, B. and Seth, A.K. 2010. Textbook of Pharmacognosy and Phytochemistry (1st Edition). Elsevier, a division of Reed Elsevier India Private Limited. India.

| | | | |
|---|---|---|---|
| **Course code** | : BBOT 3207 | | |
| **Course Title** | : Communication and Personal Skills | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit value** | : 2 | Credit hours/week: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course focuses on learning important sets of skills that help one effectively and efficiently to communicate with his/her ideas or massages in simple ways and also on time. These learning processes are valuable to enhance one's personal productivity at work place which ultimately help to getting success to his / her career advancement. For that reason this course has been introduce in four year integrated curriculum in botany aiming to develop skilled man power concerning plant sciences.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to : | Cognitive Level |
|---|---|---|
| CLO 1 | familiarize the students with different types of skills; | R, U |
| CLO 2 | develop knowledge, skills and judgments around human communication that facilitate their ability to work collaboratively with each other; | U, An |
| CLO 3 | make the students aware of various kinds barriers of communication and helps to overcome those barriers; | U, E |
| CLO 4 | become more self-confident and strong determination which ultimately help them to build career in more productive wayat work place. | An, Ap |

R-Remember; U-Understanding; Ap-Apply; An- Analyze; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 2 | 2 | 3 | 2 | 2 | 2 |
| CLO 2 | 3 | 2 | 3 | 3 | 2 | 2 | 2 |
| CLO 3 | 2 | 2 | 3 | 3 | 3 | 2 | 3 |
| CLO 4 | 3 | 2 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course contents | Credit hrs. | CLOs |
|---|---|---|---|
| **1.0** | **Personal skills** | **2** | |
| 1.1 | Definition, types and importance skill enhancement | 2 | 1,2 |
| | | | |

| | | | |
|---|---|---|---|
| **2.0** | **Hard skills** | **11** | 1,2,3 |
| 2.1 | Definition, the hard skills need for students | 2 | |
| 2.2 | Examples of hard skills – (i) Language, (ii) Computer skills (Microsoft office compatible, programming language – C+, python, etc.) iii) Analytics (database management, data mining, statistical analysis – excel, SPSS, R, etc.) (iv) Network administration, Software handling, - e.g. AI in communication and plant sciences, (vi) Technical writing, (vii) Project management, (viii) Presentation skills | 7 | |
| 2.3 | Improvement and importance of hard skills | 2 | |
| | | | |
| **3.0** | **Soft skills** | **5** | **1,2, 3** |
| 3.1 | Definition, Hard skills vs soft skills- a comparative account | 1 | |
| 3.2 | Examples of Soft skills: (i) communication, (ii) Leadership, (iii) Teamwork, (iv) adaptability, (v) Creativity, (vi) Time management, (vii) Critical thinking, (Viii) Problem solving, (ix) Emotional intelligence, (x) Empathy, (xi) Social networking, (xii) Positive organizational culture, (xiii) Interview skill | 3 | |
| 3.3 | Communication skill : types, criteria and goals of communication and importance of communication skill | 1 | |
| | | | |
| **4.0** | **Skills for future** | **1** | 1,4 |
| | | | |
| **5.0** | **Attaining scientific seminar/ workshop/ symposium** | **4** | 2,3 |
| | | | |
| **6.0** | **Participation in community services** | **3** | 3 |
| 6.1 | Participation with any recognized volunteer services within their semester time* (e.g. BNCC/ Sondhany/ Red crescent/ Environmental conservation/ movement/ Disaster management services, etc.) | 3 | |
| | | | |
| **7.0** | **Organize at least one seminar / workshop** within the classroom or department (ending time of a semester)* | **4** | 3,4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, Participation Certificate of seminar/ workshop/ symposium and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Adler, R. and du Pré, A. and Rodman, G. 2018. Essential communication. Oxford University Press; 2nd edition.
2. Bhatnagat, N. and Bhatnagar, M. 2012. Effective communication and soft skills. Pearson Education India.
3. Black, M. 2023. Effective communication: Easy guide for understanding body language, having social intelligence and being more charismatic.
4. Kumar, S. and Lata, P. 2015. Communication skill. Oxford University Press; Second edition.
5. Mitra, B.K. 2016. Personality Development and soft skills. Oxford University Press; 2nd edition.
6. Ramesh, G. and Ramesh, M. 2014. The Ace of Soft Skills: Attitude, Communication and Etiquette for Success. Pearson College Div; 1st edition.
7. Robinson, J. 2012. Communication Miracles for Couples: Easy and Effective Tools to Create More Love and Less Conflict. Conari Press; 3rd edition.

# Practical Courses

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3208 | | |
| **Course Title** | : Ethnobotany | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Ethnobotany** |
| 1.1 | Conduct field work to understand the extent of uses of plants by the local people, collection and submission of those plants/ plant products during examination and submit field report |
| 1.2 | Identify and describe the ethnobotanical uses of the items collected during field work |
| 1.3 | Collection of folk formularies of some common diseases (Skin disease, diabetes, dysentery, jaundice, etc.) from the people of assigned areas |
| 1.4 | Qualitative test of phytochemicals of medicinal plants (e.g. Carbohydrates, Flavonoids, Glycosides etc.) |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3209 | | |
| **Course Title** | : Introductory Plant Pathology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Introductory Plant Pathology** |
| 1.1 | Study of general symptoms, causal organisms of common plant diseases included in the theory course as well as interesting diseases occurring in the locality |
| 1.2 | Preparation of slides through free hand section or by other methods |
| 1.3 | Preparation and sterilization of culture media for fungal growth, isolation and purification technique |
| 1.4 | Preparation and application of different fungicides |
| 1.5 | Collection of diseased plant materials which to be submitted at the time of practical examination |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3210 | | |
| **Course Title** | : Biostatistics | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Biostatistics** |
| 1.1 | Collection of numerical data, tabulation and representation in Frequency distribution table, Line diagram, Bar diagram, Pie diagram, Histogram, Frequency curve |
| 1.2 | Problems related to central tendency and dispersion of data |
| 1.3 | Problems related to comparison between samples (t-test, F-test, LSD test, DMRT) |
| 1.4 | Problems related toassociation of Data (Correlation, regression and path analysis) |
| 1.5 | Lay out of different type of Experimental design and analysis (CRD, RBD and Latin square design) |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3211 | | |
| **Course Title** | : Quantitative Genetics | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Quantitative Genetics** |
| 1.1 | Study of solving problems monohybrid and dihybrid crosses; modified ratios |
| 1.2 | Study of gene order and map distance using three point test crosses |
| 1.3 | Hybridization and progeny testing, genetic analysis and pedigree analysis |
| 1.4 | Determination of goodness of fit of ratio by $X^2$ method |
| 1.5 | Observation and analysis of variation: Qualitative & quantitative |
| 1.6 | Pedigree analysis |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3212 | | |
| **Course Title** | : Introductory Molecular Genetics | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Introductory Molecular Genetics** |
| 1.1 | Preparation of different types of solutions used in molecular biology |
| 1.2 | Common techniques used in molecular biology: PCR, Southern, Northern and Western blotting, HPLC etc. |
| 1.3 | Isolation of DNA, RNAs and proteins from plant tissue/cells |
| 1.4 | Agarose and polyacrylamide gel electrophoresis of DNA and RNA, visualization and determination of the size of DNA/RNA fragments |
| 1.5 | cDNA synthesis and visualization |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3213 | | |
| **Course Title** | : Viva-voce (All major courses of Second Year) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : Respective Examination Committee | | |
| **Credit Value** | : 2 | **Credit hours/week**: | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 3214 | | |
| **Course Title** | : Field work/Excursion (Major courses) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Third Year Second Semester | | |
| **Course Teacher** | : Respective examination committee | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

# Curriculum

# For Fourth Year: First Semester

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4101 | | |
| **Course Title** | : Plant Disease Management | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Plant disease management also focused on the impact of environmental factors which develop epidemic condition on plants and measures the defence mechanisms with structural and biochemical way. This course also deals with disease forecasting and management protocol using regulatory, cultural, physical and chemical methods for eco-friendly disease management of plants.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | know elementary knowledge of environments, forecasting of plant diseases and pathogens; | U |
| CLO 2 | acquire the knowledge of attacking and defence mechanisms of pathogens and plants; | U |
| CLO 3 | to know the elementary knowledge regarding the avoidance of disease; | Ap |
| CLO 4 | apply skills to control and plant disease management, through resistance and others; | C, E |
| CLO 5 | analyze the factors and role of environment that cause plant diseases. | An |

Ap-Apply; An-Analyze; U-Understanding; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CLO 2 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CLO 3 | 3 | 3 | 3 | 3 | 2 | 2 | 2 |
| CLO 4 | 1 | 1 | 2 | 3 | 3 | 3 | 3 |
| CLO 5 | 1 | 1 | 3 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Content | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Effect of environmental factors on plant diseases** | **5** | |
| 1.1 | Effect of Temperature and moisture on plant disease | 1 | 1,5 |
| 1.2 | Effect of rainfall and humidity on plant disease | 1 | 1,5 |

| | | | |
|---|---|---|---|
| 1.3 | Effect of air current on plant disease | 1 | 1,5 |
| 1.4 | Effect of soil pH on plant disease | 1 | 1,5 |
| 1.5 | Effect of toxic soil minerals on plant disease | 1 | 1,5 |
| **2.0** | **Defence mechanism against pathogens** | **4** | |
| 2.1 | Structural defence mechanisms | 2 | 1,4 |
| 2.2 | Biochemical defence mechanisms | 2 | 1,4 |
| **3.0** | **Disease forecasting** | **2** | |
| 3.1 | General discussion of plant disease forecasting methods | 2 | 1,4 |
| **4.0** | **Diseases Management: Principles** | **5** | |
| 4.1 | Avoidance of the pathogens | 1 | 1,3 |
| 4.2 | Exclusion of the pathogens | 1 | 1,3 |
| 4.3 | Reduction or eradication of pathogen inoculum | 1 | 1,3,4 |
| 4.4 | Resistance (Immunity to pathogens) | 1 | 1,3 |
| 4.5 | Integrated approach | 1 | 1,3,4 |
| **5.0** | **Diseases Management: Regulatory methods** | **2** | |
| 5.1 | Quarantine | 1 | 1 |
| 5.2 | Seed certification | | 1,3,5 |
| 5.3 | Plant disease notification | 1 | 1,4 |
| 5.4 | Prevention of sale of diseased plants | | 1,3 |
| **6.0** | **Diseases Management: Cultural and Physical methods** | **9** | |
| 6.1 | Cultural practices that help reducing disease incidence by avoiding the contact between pathogen inoculum and the plant: Distance between plants, mixed cropping, depth of sowing, amount and timing of irrigation, quality and quantity of fertilizers, and deep ploughing during summer | 4 | 1,3,4 |
| 6.2 | Cultural practices that reduce or eradicate pathogen inoculum: Eradication of disease host, eradication of alternate hosts, wild hosts and weeds, drying and aging of seeds, seed cleaning, crop-rotation, sanitation | 4 | 1,3,5 |
| 6.3 | Physical methods: Heat treatment, refrigeration and radiation | 1 | 1,4,5 |
| 7.0 | **Diseases Management: Chemicals Treatment** | **3** | |
| 7.1 | Aim of chemical control, functions of anti-pathogen chemicals, classification of fungicides, desire character of anti-pathogen chemicals, dosage-response relationship, formulation of fungicides, application of fungicides, factors affecting efficacy of fungicides | 3 | 1,3,4,5 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Agrios, G.N., 1997. Plant Pathology (4th Edition). Academic Press, San Diego, USA.
2. Manners, J.G., 1982. Principles of Plant Pathology. Cambridge University Press, London, UK.
3. Rangaswami, G. and Mahadevan, A. 2014. Diseases of Crop Plants in India (4th Edition). PHI Learning Private Limited, Delhi-110092, India.
4. Singh, R.P. 2010. Plant Pathology. Kalyani Publishers. New Delhi, India.
5. Singh, R.S., 1979. Introduction to the Principles of Plant Pathology (2nd Edition). Oxford and IBH Publishers, New Delhi, India.
6. Singh, R.S.1998. Plant Diseases (7th Edition). Oxford & IBH Publishing Co. Pvt. Ltd. New Delhi, India.
7. Strange, R.N., 2003. Introduction to Plant Pathology. John Wiley & Sons Ltd., Chichester, UK.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4102 | | |
| **Course Title** | : Plant Breeding | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week:** 3 | **Total credit hours:** 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The rationale for the Plant Breeding course typically involves the fundamental genetic concepts that underlie plant breeding, with a particular emphasis on the processes of selection, variation, and inheritance. The course explores into modern biotechnological methods that improve plant development and breeding efficiency. Students acquire practical experience in experimental design, data analysis, and research methodologies, which ready them for careers in agriculture and research.

**Course Learning Outcomes (CLOs)**

| CLO no. | Expected Course Learning Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | explain the basics of plant breeding and pollination methods of plant; | R/U |
| CLO 2 | assess genetic basis of crop improvement; | U |
| CLO 3 | describe the various conventional and molecular methods or strategies for the genetic improvement of crops; | Ap |
| CLO 4 | apply skills to develop new crop varieties having improved traits. | C |

R-Remember; U- Understanding; Ap-Apply; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 1 | 3 | 3 | 2 | 3 | 3 |
| CLO 2 | 3 | 1 | 2 | 3 | 2 | 2 | 2 |
| CLO 3 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |
| CLO 4 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Basic topics** | **6** | |
| 1.1 | Definition, scope and goal of plant breeding | 2 | 1 |
| 1.2 | Genetic significance of pollination methods, incompatibility and male sterility and their utilization in crop improvement, apomixis and their use in plant breeding | 3 | 1 |

| | | | |
|---|---|---|---|
| 1.3 | System of pollination control and their role in breeding | 1 | 1 |
| **2.0** | **Genetic basis of crop improvement** | **6** | |
| 2.1 | Genetic consequences of hybridization | 1 | 2 |
| 2.2 | Quantitative inheritance, heritability, heterosis | 2 | 2 |
| 2.3 | Hybrid vigor, inbreeding depression and combining ability | 3 | 2 |
| **3.0** | **General Plant breeding methods** | **9** | |
| 3.1 | Introduction, domestication and selection | 2 | 3,4 |
| 3.2 | Hybridization-Definition; history; objectives; types; procedure | 2 | 3, 4 |
| 3.3 | Mass and pure line selection, pedigree and bulk method, single seed descent and backcross methods of selection | 3 | 3,4 |
| 3.4 | Development of hybrid-synthetics and composites | 2 | 3,4 |
| **4.0** | **Special plant breeding methods** | **10** | |
| 4.1 | Mutation breeding: Different approaches and mutagenic agents, space-breeding | 3 | 3, 4 |
| 4.2 | Somatic hybrid production, protoplast fusion | 2 | 3,4 |
| 4.3 | Marker assisted plant breeding | 2 | 3,4 |
| 4.4 | Polyploidy breeding: Induction and use of auto and allo-polyploidy in plant breeding | 3 | 3,4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Acquaah G. 2012. Principles of Plant Genetics and Breeding. Blackwell Publishing.
2. Allard R.W. 1960. Principle of Plant Breeding. John Willey and Sons, New York.
3. Chahal G.S. and Gosal S.S. 2003. Principle and Procedure of Plant Breeding. Narosa Publishing. New Delhi, Kolkata.
4. Chaudhury R.C. 1993. Introduction to Plant Breeding. Oxford & IBH Publishing Co. New Delhi, India.
5. Neal C. and Stewart JR. 2008. Plant Biotechnology and Genetics. A John wiley & sons, Inc., publication, New Jersey, Canada.
6. Singh B.D. 1983. Plant Breeding. Kalyani Publishers, New Delhi, India.
7. Sleper, D.A. and Poehlman J.M. 2006. Breeding Field Crops. 1st ed. Blackwell Publishing.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4103 | | |
| **Course Title** | : Recombinant DNA Technology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The course explores the most advanced methods employed in biotechnology and genetic manipulation. The principles and techniques of DNA isolation, cloning, gene expression, and genetic modification will be taught to students through the use of recombinant DNA technology. It looks into the tools and enzymes that are involved, including restriction endonucleases, ligases, and vectors, as well as their applications in gene therapy, diagnostics, and agriculture. This course develops critical thinking and helps students with the necessary skills to pursue careers in biotechnology and molecular biology.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | provide knowledge about genetic engineering, the basic principles of recombinant DNA technology, gene manipulation and genetic transformation ; | R |
| CLO 2 | understanding genetic engineering/gene manipulation, genetic transformation and their application to plant, animal and microbes improvement and their conservation; | U |
| CLO 3 | conduct different experiments relevant to cloning of genes, vector construction and interpret results. | Ap |

R- Remember; U-Understanding; Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 3 | 2 | 3 | 3 | 2 |
| CLO 2 | 3 | 3 | 3 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction** | **2** | |
| 1.1 | Concepts of Recombinant DNA technology | 1 | 1 |
| 1.2 | Importance, scope and opportunities, etc. | 1 | 1 |
| **2.0** | **Biological Tools of Recombinant DNA Technology** | **8** | |
| 2.1 | Different vectors | 1 | 1 |
| 2.2 | Different methods and mechanism of gene transfer | 2 | 2 |
| 2.3 | Application of virus and bacteria in recombinant DNA production | 1 | 3 |
| 2.4 | Competent cells, hosts for cloning and expression of recombinant DNA | 1 | 1,2 |
| 2.5 | Different enzymes involved in production of recombinant DNA. Restriction enzymes and their types, functions, naming | 3 | 1,2 |

| | | | |
|---|---|---|---|
| **3.0** | **Genetic Engineering** | **4** | |
| 3.1 | Definition of genetic engineering, steps and strategies of genetic engineering | 2 | 1,2 |
| 3.2 | Prospects and problems of genetic engineering. | 2 | 2 |
| **4.0** | **Cloning Vectors** | **8** | |
| 4.1 | Characteristics of good cloning vectors, types, structure of different cloning vectors | 3 | 1 |
| 4.2 | Synthesis and cloning of cDNA, Decapping of mRNA, isolation of full-length cDNA | 2 | 3 |
| 4.3 | 3´-RACE, 5´-RACE, formation of genomic DNA, preparation of vector DNA, recipient DNA, formation of hybrid DNA through genetic engineering | 3 | 3 |
| **5.0** | **Gene Library and Cloning of Foreign Gene** | **4** | |
| 5.1 | Construction of cDNA library, genomic library | 2 | 3 |
| 5.2 | Different approaches for finding the target gene from cDNA and gene libraries | 2 | 2 |
| **6.0** | **Creation of Transgenic Microbes, Plants and Animals through Genetic Engineering** | **4** | |
| 6.1 | Identification and isolation of nuclear, chloroplast and mitochondrial DNA | 2 | 2 |
| 6.2 | Preparation of selected DNA, gene transfer methods into host cells, expressing of the transfer genes | 2 | 3 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Ahmed, JU. 2002. Molecular Biology. Hasan Book House, Dhaka.
2. Dale, JW and Schanfz, MV. 2002. From Gene to Genomics: Concept and Application of DNA Technology. John Wily and Sons.UK.
3. Griffiths, AJF, Miller, JH, Suzuki OT, Lewonfin, RCL and Gilbart, WM. 1998. An Introduction to Genetic Analysis. Freeman Company. USA.
4. Lesk, AM. 2002. Introduction to Bioinformatics. Oxford University Press.
5. Primrose, SB and Twyman, RM 2003.Principle of Genome Analysis and Genomics. Black Well Publishing, UK.
6. Primrose, SB, Twyman, RM and Old, RW. 2001. Principles of Gene Manipulation. Black Well Science Ltd. UK.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4104 | | |
| **Course Title** | : Plant Tissue Culture | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course examines and discusses the principles, protocols and utilization of plant cell tissue culture systems. Plant tissue culture is need to study for many reasons, such as: large-scale plant production, disease eradication, plant improvement, plant conservation, development of stress tolerance genotype, transform plants with new genes.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | understand the history and current developments in the field of plant tissue culture; | U |
| CLO 2 | explain the methods involved in tissue culture and molecular techniques; | An |
| CLO 3 | apply skills to establish *in vitro* culture techniques in agricultural industry; | Ap |
| CLO 4 | predict social and ethical issues and concerns related to plant tissue culture and biotechnological processes, and advancements. | C |

U- Understanding; Ap-Apply; An-Analyze; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 3 | 3 | 3 | 3 | 3 |
| CLO 2 | 3 | 3 | 3 | 3 | 2 | 1 | 3 |
| CLO 3 | 2 | 3 | 3 | 3 | 3 | 3 | 3 |
| CLO 4 | 1 | 3 | 3 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Plant tissue culture** | **3** | |
| 1.1 | Introduction; history | 1 | 1 |
| 1.2 | Basic concepts of cell theory and cellular totipotency, differentiation, de-differentiation and re-differentiation | 2 | 1 |
| **2.0** | **Plant tissue culture requirements** | **8** | |
| 2.1 | Infrastructure and organization of a plant tissue culture laboratory, equipments | 1 | 2 |

| | | | |
|---|---|---|---|
| 2.2 | Tissue culture media and components | 1 | 2 |
| 2.3 | Preparation of media and role of plant growth regulators in tissue culture | 2 | 3 |
| 2.4 | Aseptic techniques and manipulation | 2 | 3 |
| 2.5 | Basis for plant tissue culture, factors affecting plant tissue culture | 2 | 2 |
| | | | |
| **3.0** | **Applications of plant tissue culture** | **19** | |
| 3.1 | Micropropagation methods: axillary shoot proliferation | 2 | 3 |
| 3.2 | Adventitious shoot regeneration | 1 | 3 |
| 3.3 | Direct and indirect shoot organogenesis, and somatic embryogenesis | 2 | 3 |
| 3.4 | Meristem culture and stages of micropropagation, hardening and transplantation | 2 | 3 |
| 3.5 | Advantages and disadvantages of micropropagation | 1 | 4 |
| 3.6 | Somaclonal variations and mutation breeding | 1 | 3 |
| 3.7 | Embryo culture, callus, and cell suspension culture | 2 | 3 |
| 3.8 | *In vitro* production of haploids–anther and pollen culture, uses of haploids | 3 | 3 |
| 3.9 | *In vitro* hybridization, production of artificial seeds, advantages and disadvantages | 1 | 3,4 |
| 3.10 | Production of drought and salt tolerant plants through cell/callus culture | 1 | 3 |
| 3.11 | Germplasm conservation | 1 | 3,4 |
| 3.12 | Secondary metabolites production, commercial application in agriculture | 2 | 3,4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Bhojwani, S.S. 1990. Plant Tissue Culture: Application and limitations. Elsevier Sci. Publ., Amsterdam, The Netherlands.
2. Bhojwani, S.S. and Razdan, M.K. 1993. Plant Tissue Culture: Theory and Practice. Elsevier Sci. Publ., Amsterdam, The Netherlands.
3. De, K.K. 1992. Plant Tissue Culture. New Central Book Agency, Calcutta.
4. Kirakosyan, Ara, Kaufman.and Peter, B. 2009. Recent Advances in Plant Biotechnology. Agritech Publ. NY, USA.
5. Razdan, M.K. 1993. An Introduction to Plant Tissue Culture. Oxford and IBH Publ. Co. Pvt. Ltd. New Delhi, India.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4105 | | |
| **Course Title** | : Limnology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Limnology is a multidisciplinary science that studies inland waters, including rivers, lakes, wetlands, and streams. It is related to Botany in that the course helps students understand the ecological demands of aquatic ecosystems. The course content will enable the students to identify water pollution and mitigate pollution applying different parameters.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | know the different theories and terminology of Limnology; | R, U |
| CLO 2 | understand the basic principles of Limnology; | U |
| CLO 3 | describe structure, function, aquatic biodiversity, and productivity of freshwater habitat to solve problems and formulate future projections; | U, Ap |
| CLO 4 | assess water pollution by using different parameters to mitigate water pollution. | E, Ap |

R-Remember; U-Understanding; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 2 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 3 | 2 | 3 | 3 | 2 | 3 | 3 |
| CLO 3 | 3 | 3 | 3 | 2 | 3 | 2 | 3 |
| CLO 4 | 3 | 3 | 2 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | Definition, Scope and history of Limnology. Difference between and Hydrobiology | **4** | 1 |
| **2.0** | Types of common hydrophytes, their adaptation and application | **4** | 2,3,4 |
| **3.0** | Global water share; water resource management | **3** | 1,2 |
| **4.0** | Aquatic ecosystem and energy relationship | **4** | 2,3 |

| | | | |
|---|---|---|---|
| **5.0** | Types of lakes; Trophic nature of lakes and ponds | **4** | 1,2 |
| **6.0** | Physical environment of inland water, source, flux and importance of light, temperature, density, colour, turbidity, TSS and TDS of water; water movement | **4** | 3,4 |
| **7.0** | Chemical environment of inland water, source, flux, and importance of electric conductivity, pH, alkalinities, hardness, DO, BOD, COD, $CO_2$, N, P, K, Si, and chlorosity of water | **4** | 3,4 |
| **8.0** | Types of organisms in inland water | **2** | 1,2 |
| **9.0** | Primary productivity and its measurement | **1** | 3,4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Cole, G.A. 1979. Text Book of Limnology. The Mosby Co. London,
2. Goldman, C.R. and Home, A.J. 1983. Limnology. McGraw-Hill. Book Co.
3. Khan, M.S. and Khatun, M. 1987. Aquatic Angiosperms of Bangladesh. Publ. by: Bangladesh National Herbarium & Bangladesh Agricultural Research Council.
4. Khondker, M. 1995. Limnology, Dhaka Univ. Publ.
5. Ruttner, R. 1963. Fundamentals of Limnology (Translated). Toronto Univ. Press. Canada.
6. Wetzel and Robert. G. 2001. Limnology; Academic Press, New York.
7. Zaman, M. and Naz, S. 2000. Shybal Bichitra. Srijon Publ. Rajshahi. Bangladesh.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4106 | | |
| **Course Title** | : Industrial Botany | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | Total credit hours: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Industrial botany is a complex branch of botany that studies the state of plants and plant communities under specific conditions of anthropogenic and technogenic impact. The tasks of industrial botany are constantly expanding and acquiring great social and economic significance. This subject address the socio-economic challenges related to plant sciences.

**Course Learning Outcomes (CLOs)**

| **CO No.** | **Expected Course Outcomes**<br>Upon completion of this course, the students will be able to: | **Cognitive Level** |
|---|---|---|
| CLO 1 | acquire knowledge about the importance of plants and their products; | U |
| CLO 2 | understand commercial value of plant and plant products; | U |
| CLO 3 | develop skill for processing of product from plant sources; | C |
| CLO 4 | apply the technical knowledge for developing industries. | Ap, E |

U- Understanding; Ap-Apply; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CLO 2 | 3 | 3 | 2 | 1 | 2 | 2 | 2 |
| CLO 3 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| CLO 4 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| **Module** | **Course Contents** | **Credit hrs** | **CLOs** |
|---|---|---|---|
| **1.0** | **The importance and nature of plant products** | **7** | |
| 1.1 | The importance of plants and plant products to mankind | 1 | 1 |
| 1.2 | Nature of plant products: reserve foods: carbohydrates, sugars, celluloses, fats and proteins; secretions and excretions: essential oils, tannins, resins, latexes, waxes, alkaloids, enzymes, vitamins and hormones | 3 | 1 |
| 1.3 | Chemistry of major plant products: hydrocarbons, alcohols, aldehydes, ketones, organic acids, esters, amines and amino acids | 3 | 1 |
| **2.0** | **Economically important plants** | **17** | |

| | | | |
|---|---|---|---|
| 2.1 | Classification of economically important plants | 1 | 1 |
| | Food plants: Cereals plant: *Oryza sativa*, legume plants: *Pisum sativum*: introduction, plant description, chemical properties, and importance | 2 | 1 |
| 2.2 | Beverage plants: *Camellia sinensis* and *Coffea arabica:* introduction, plant description, chemical properties and importance | 2 | 1 |
| 2.3 | Spices and herbs: *Cinnamomum*, *Vanilla* and *Crocus sativus*: introduction, plant description, chemical properties and importance | 2 | 1 |
| 2.4 | Fiber plants: *Gossypium arboretum* and *Corchorus capsularis*: plant description, chemical properties and importance | 2 | 1 |
| 2.5 | Latex plant: *Hevea brasiliensis*: introduction, plant description, chemical properties and importance | 2 | 1 |
| 2.6 | Medicinal plants: *Cinchona officinalis* and *Ephedra gerardiana*: introduction, plant description, chemical properties and importance | 2 | 1 |
| 2.7 | Fumitory and Masticatory plant: *Nicotiana tabacum* and *Cannabis sativa*: plant description, chemical properties and importance | 2 | 1 |
| 2.8 | Psychoactive plants: *Papaver somniferum and Atropa belladonna*: introduction, plant description, chemical properties and importance | 2 | 1 |
| 3.0 | **Plant products and processing** | **6** | 3,4 |
| 3.1 | Tea and coffee: types, and stages of processing | 2 | 3,4 |
| 3.2 | Rubber: types and processing of natural rubber | 2 | 3,4 |
| 3.3 | Tobacco: processing of tobacco from plant | 2 | 3,4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Ghani, A. 1998. Medicinal Plants of Bangladesh. Asiatic Society of Bangladesh. Dhaka.
2. Hill, A.F. 2000. Economic Botany. Tata McGraw-Hill Publishing Co. Ltd., India.
3. Kochhar, S.L. 2003. Economic Botany in the Tropics. MacMillan India Ltd.
4. Sane, H., Rahangdale, S. and Rahangdale, S. 2015. Industrial Botany-I. Vision Publication, India.
5. Upadhyay, S.K and Singh S.P. 2021. Bioprospecting of Plant Biodiversity for Industrial Molecules. John Wiley & Sons Ltd.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4107 | | |
| **Course Title** | : Research Methodology | | |
| **Course Type** | : GEd | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The Research Methodology course teaches how to plan and carry out research effectively. It covers picking a research topic, reviewing what others have studied, and identifying gaps to explore. You'll learn how to design your research, collect and analyze data, and follow ethical rules. The course also guides you in writing reports, research papers, and proposals, while understanding how to manage funds and share your findings.

**Course Learning Outcomes (CLO)**

| **CLO No.** | **Expected Course Outcomes**<br>Upon completion of this course, the students will be able to: | **Cognitive Level** |
|---|---|---|
| CLO 1 | demonstrate skills in information searching, selection, retrieval and interpretation; | R, U |
| CLO 2 | identify appropriate methods of quantitative and/or qualitative data collection as relevant to the research project undertaken; | U, An |
| CLO 3 | design and develop a structured research plan using cognitive skills and critical thinking; | U, Ap |
| CLO 4 | interpret, summarize and synthesize the academic & professional literature as well as acquire knowledge on ethics of research and article publication; | E, Ap |
| CLO 5 | apply the theoretical and practical research skills on methods of participation, data handling and research funds. | An, Ap |

R-Remember; U-Understanding; E-Evalute; An- Analyze; Ap-Apply

**Mapping CLOs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO 2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 2 | 3 | 3 | 3 | 2 | 1 | 2 |
| CLO 2 | 1 | 2 | 3 | 3 | 2 | 1 | 3 |
| CLO 3 | 2 | 2 | 3 | 3 | 2 | 1 | 3 |
| CLO 4 | 1 | 2 | 3 | 3 | 3 | 3 | 3 |
| CLO 5 | 1 | 1 | 3 | 3 | 2 | 1 | 3 |

Note: 3=High, 2=Medium, 1=Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Concepts and Approaches** | **3** | |
| 1.1 | Concept of a research and selecting a research topic | 1 | 1 |
| 1.2 | Nature, objectives, types, process, findings, importance and limitation of the research | 2 | 1 |
| **2.0** | **Literature Review** | **3** | |
| 2.1 | Review process of up-to-date available literatures related to the research using different search engines | 2 | 4 |
| 2.2 | Research gap consolidation; Advancing to fill up the gaps | 1 | 1 |
| **3.0** | **Research Design** | **4** | |
| 3.1 | Concepts, features of a good design and development of a research plan | 1 | 1 |
| 3.2 | Attributes of research; Proceeding with protocols, alternation/modification of protocols (if necessary) | 1 | 2 |
| 3.3 | Sampling strategy | 1 | 3 |
| 3.4 | Types of program design, survey and census | 1 | 3 |
| **4.0** | **Data Collection, Processing and Analysis** | **5** | |
| 4.1 | Primary data collection and selection of appropriate data | 1 | 2 |
| 4.2 | Data analysis, simulation, replication and interpretation | 1 | 5 |
| 4.3 | Problems, Choosing appropriate statistical methods/ apps, graphical representation and tabulation | 2 | 3 |
| 4.4 | Secondary data collection from other published or recognized sources, acknowledging the sources and meaningful interpretation and presentation | 1 | 2 |
| **5.0** | **Communication Guidelines** | **2** | |
| 5.1 | General principles and methods in people's participation | 1 | 1 |
| 5.2 | Concept of surveys; Questionnaire and schedule | 1 | 2 |
| **6.0** | **Research Ethics** | **3** | |
| 6.1 | Application of fundamental ethical principles to research activities respect autonomy, beneficence, non-beneficence and Justice | 2 | 4 |
| 6.2 | Data handling, Rules for collaborative research | 1 | 5 |
| **7.0** | **Writing research Paper** | **3** | |
| 7.1 | Title, authorship, abstract, keywords, introduction, developing conceptual model of the research, methodology, results, discussion, conclusion, acknowledgement and references, style and format | 2 | 4 |
| 7.2 | Keyword sequence importance (KSI) | 1 | 4 |

| | | | |
|---|---|---|---|
| **8.0** | **Publication Ethics** | **3** | |
| 8.1 | Authorship, Plagiarism | 1 | 4 |
| 8.2 | Rules of quotation and bibliography | 1 | 4 |
| 8.3 | Ethical issues on scientific papers writing | 1 | 4 |
| **9.0** | **Evaluation** | **2** | |
| 9.1 | Criteria to evaluate a report | 1 | 5 |
| 9.2 | Techniques of report evaluation | 1 | 5 |
| **10.0** | **Research proposal writing** | **3** | |
| 10.1 | Comprised of i) Title, ii) Introduction with background of the study/ Introduction encompassing the review of literatures, iii) Rational of the study, iv) Aim and objectives, v) Methodology including analytical procedures, vi) Time schedule by segments of the project (i.e. Granttchart) vii) Budget preparation and management, viii) Probable outcome and significance of the research, ix) Impact on society, x) Conclusion and xi) References | **2** | 5 |
| 10.2 | Fund collection and managing public research funds | 1 | 5 |

**Mapping CLOs with Teaching –Learning and Assessment Strategy**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Bright EW. Jr. 1991. An Introduction to Scientific Research. Dover Publications.
2. Creswell, J. W., & Creswell, J. D. 2017. Research design: Qualitative, quantitative, and mixed methods approaches. Sage publications.
3. Kamal U., Shamim M., Mahadhi H., Shahjahan M. and SM. Nurul A. 2023. A reference Book on keyword Sequence Importance (KSI): A Novel Method for Scientific Writing. Ahmadu Bello University Press Limited, Kaduna State, Nigeria.
4. Laake, P., Benestad, H. B., & Olsen, B. R. (Eds.). 2007. Research methodology in the medical and biological sciences. Academic Press.
5. Niglas, K. 2010. The multidimensional model of research methodology. SAGE handbook of mixed methods in social & behavioral research, 215-236.
6. Ranjit, K. 2011. Research methodology: A step-by-step guide for beginners. Sage publications.
7. Thomas, K. 1962. The structure of scientific revolutions. International Encyclopedia of Unified Science, 2(2).University of Chicago Press.

# Practical Courses

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4108 | | |
| **Course Title** | : Plant Disease Management | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Disease Management** |
| 1.1 | Study of general symptoms, causal organisms of common plant diseases included in the theory course as well as interesting diseases occurring in the locality |
| 1.2 | Preparation of slides through free hand section or by other methods |
| 1.3 | Preparation and sterilization of culture media for fungal growth, isolation and purification technique |
| 1.4 | Preparation and application of different fungicides |
| 1.5 | Collection of diseased plant materials which to be submitted at the time of practical examination |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4109 | | |
| **Course Title** | : Plant Breeding | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Breeding** |
| 1.1 | Hybridization technique: Emasculation, bagging and tagging; demonstration of hybridization technique in crop plants |
| 1.2 | Demonstration of field experiments: Data collection and data analysis in plant breeding; experimental design |
| 1.3 | Germplasm collection and preservation: Cereals, pulses, vegetables |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4110 | | |
| **Course Title** | : Recombinant DNA Technology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Recombinant DNA Technology** |
| 1.1 | Isolation of genomic DNA from transgenic plants and control plants: Objectives, principle, requirements and procedure, results |
| 1.2 | DNA quantification, estimation, detection by Gel electrophoresis: Objectives, principle, requirements and procedure, results, CTAB methods |
| 1.3 | Plasmid Isolation and different vector construction: Objectives, principle, requirements and procedure, results |
| 1.4 | Application of transgenic techniques for different crops: Transformation techniques |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4111 | | |
| **Course Title** | : Plant Tissue Culture | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Plant Tissue Culture** |
| 1.1 | Preparation of nutrient medium - Murashige and Skoog medium (Demonstration only) |
| 1.2 | Sterilization and inoculation of plant tissue in culture media |
| 1.3 | Establishing shoot tip, axillary bud cultures (Demonstration only) |
| 1.4 | Immobilization of whole cells or tissues in sodium alginate |
| 1.5 | Microscopic analysis of callus for cyto-differentiation, embryogenesis and organogenesis |
| 1.6 | Estimation of different growth parameters for evaluation of suitable media composition using proliferating shoot cultures |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4112 | | |
| **Course Title** | : Limnology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Limnology** |
| 1.1 | Demonstration about the collection of water sample for physicochemical and plankton estimation for local water bodies |
| 1.2 | Determination of DO, free $CO_2$, $CO_3$ and $HCO_3$ alkalinities of water |
| 1.3 | Study of the phytoplankton and zooplankton genera commonly found in Bangladesh |
| 1.4 | Practical notebook to contain description, labeled diagrams and identifying characters of the studied plankton genera |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4113 | | |
| **Course Title** | : Industrial Botany | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year First Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Industrial Botany** |
| 1.1 | Study and collection of plants and plant products having economic, social and aesthetic values should submit during the examination |
| 1.2 | Technique of manufacturing tea |
| 1.3 | Technique of manufacturing natural rubber |

# Curriculum

# For Fourth Year: Second Semester

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4201 | | |
| **Course Title** | : Bioprospecting | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course is design to know about the different aspects on exploration of plant resources for the process of discovery and commercialization as new drugs, application of biotechnological tools for crop improvement, value added food formulation and plant derived nanoparticle formulation; and also focus on Intellectual Property Rights (IPRs) related to policies and ethics regarding plant resource utilization in national and international context.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | acquire knowledge on different aspect of bioprospecting; | U |
| CLO 2 | develop skill for searching of potential phytochemicals for new drug development; | C |
| CLO 3 | evaluate nutritional status of plant products for formulation of value added foods and food supplements; | E |
| CLO 4 | apply biotechnological tools for crop improvement and technology for plant derived nanoparticle formulation; | Ap |
| CLO 5 | explain Intellectual Property Rights (IPRs) related to policies and ethics. | An, Ap |

U-Understanding; An-Analyze; E-Evaluate; Ap-Apply; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 2 | 2 | 2 | 2 | 2 |
| CLO 2 | 3 | 2 | 3 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 2 | 3 | 3 | 3 | 2 | 3 |
| CLO 4 | 2 | 3 | 3 | 2 | 3 | 3 | 3 |
| CLO 5 | 3 | 2 | 2 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Introduction to plant bioprospecting** | **3** | |
| 1.1 | Definition, aims of bioprospecting, advantages and disadvantages of bioprospecting | 1 | 1 |

| | | | |
|---|---|---|---|
| 1.2 | Phases of bioposecting, biorspecting derived resources and products | 1 | 1 |
| 1.3 | Implications of bio-prospecting for economic development | 1 | 4 |
| | | | |
| **2.0** | **Bio-prospecting of medicinal plants** | **5** | |
| 2.1 | Ethno-pharmacology and its scope of searching for drugs | 1 | 2 |
| 2.2 | Introduction of secondary metabolites in plant | 1 | 2 |
| 2.3 | Screening of secondary metabolites for medicine | 1 | 2 |
| 2.4 | Bio-technological approach of generating secondary metabolites (case study of *Ginseng*) | 1 | 2 |
| 2.4 | Agreement to collect biodiversity for pharmaceutical products (INBio-Merck) | 1 | 2 |
| | | | |
| **3.0** | **Nutraceuticals** | **5** | |
| 3.1 | Definition, criteria and benefits of nutraceuticals | 1 | 1 |
| 3.2 | Antioxidants: definition, food sources, and categories; antioxidants and free radicals, oxidative stress, antioxidants defense system, health benefits of antioxidants | 2 | 3 |
| 3.3 | Phytosterol: definition, sources, chemical classification and structure, absorption and metabolism of phytosterol, effects on cholesterol absorption, cardiovascular health and others | 2 | 3 |
| | | | |
| **4.0** | **Bio-prospecting and agro-biotechnology** | **7** | |
| 4.1 | Introduction, techniques used in agricultural biotechnology for crops improvement | 1 | 1 |
| 4.2 | agro-biotechnology for improved sapling production (case study of potato) | 2 | 4 |
| 4.3 | GM crop production (case study herbicide tolerant Canola) | 2 | 4 |
| | | | |
| **5.0** | **Plant mediated nanotechnology** | **5** | |
| 5.1 | Nanotechnology and plant sciences, green nanotechnology, plant derived nanoparticles | 2 | 1 |
| 5.2 | Herbal approach for developing nanoparticles: plant parts used to produce MNPs, nanoparticles synthesis from plant extracts | 2 | 5 |
| 5.3 | Commercial applications of biosynthesized nanoparticles | 1 | 5 |
| | | | |
| **6.0** | **Plant product policies and ethics** | **5** | |
| 6.1 | Ethical issues on patentability of plants and plant products | 1 | 5 |
| 6.2 | Intellectual Property Rights (IPRs) - Copyright, patents, trademarks, trade secrets, trade dress, geographical indications, plant variety rights | 1 | 5 |
| 6.3 | IPR law in Bangladesh, enforcement mechanisms of IPRs in Bangladesh | 1 | 5 |

| | | | |
|---|---|---|---|
| 6.4 | Trade Related Aspects of Intellectual Property Rights (TRIPs)- objectives, features and implementations in Bangladesh | 2 | 5 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Dubey, R.C. 1998. A text book of biotechnology. S. Chand & company LTD, New Delhi-110055, (India).
2. Finar, I.L. 1975. Organic Chemistry, Stereochemistry and the Chemistry of Natural Products, ELBS, Longman Singapore Publication (P) Ltd., Singapore, 5th edn.
3. Given DR and W Harris 1994.Techniques and Methods of Ethnobotany. Published by Commonwealth Secretariate, London.
4. Gupta, P.K. 1997. Elements of Biotechnology. Rastogi Publ., Meerut, India.
5. Harborne JB 1973. Phytochemical methods. Chapman and Hill, London \
6. Harborne, J.B. 1998. Phytochemical Methods-A guide to modern tecnique of plant analysis, 3rd edn, Champan& Hall, UK.
7. Secondary Plant products, 1980. Encyclopaedia of Plant Physiology-New Series Vol. 8, Springer-Verlag Berlin, Heidelberg, New York.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4202 | | |
| **Course Title** | : Bioinformatics | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Bioinformatics provides knowledge and skill to identify genes, proteins, determine their functions, establish evolutionary relationships and predict their conformation. However, this tool helps us to analyze vast amounts of biological data, identify new drug targets and develop personalized treatments.

**Course Learning Outcomes (CLO)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | know different terminologies of bioinformatics and molecular biology; | R |
| CLO 2 | gain a comprehensive knowledge about the different insights of bioinformatics; | U |
| CLO 3 | understand the various aspects of computer science to analyze biological databases; | U |
| CLO 4 | interpret the DNA and protein sequencing information using bioinformatics tools; | E |
| CLO 5 | apply bioinformatics tools to interpret biological functions. | Ap |

R- Remember; U-Understanding; Ap-Apply; E-Evaluate

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 3 | 3 | 3 | 2 | 3 | 3 |
| CLO 2 | 3 | 2 | 3 | 3 | 2 | 1 | 3 |
| CLO 3 | 3 | 2 | 3 | 3 | 3 | 1 | 3 |
| CLO 4 | 2 | 3 | 2 | 3 | 2 | 1 | 2 |
| CLO 5 | 3 | 2 | 1 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Basic Bioinformatics** | **14** | |
| 1.1 | Introduction to bioinformatics, Objectives and applications of bioinformatics | 3 | 1, 2 |
| 1.2 | Biological Databases: Types- primary, secondary and composite databases | 2 | 2, 3 |

| | | | |
|---|---|---|---|
| 1.3 | Nucleotide sequence databases: NCBI (GenBank), EMBL and DDBJ | 2 | 3 |
| 1.4 | Protein Sequence databases - SWISS-PROT, PIR | 2 | 3 |
| 1.5 | Protein structure database – PDB | 2 | 3 |
| 1.6 | Bibliographic database – PubMed | 2 | 3 |
| **2.0** | **Sequence Alignment and Molecular Phylogeny** | **11** | |
| 2.1 | BLAST, Blast2Go | 1 | 2, 4 |
| 2.2 | Sequence alignment –Scoring matrices, global and local alignment, Pair wise and multiple sequence alignment; Common softwares used in alignment–CLUSTALw, CLUSTAL Omega, CLUSTALx and MEGA | 5 | 4, 5 |
| 2.3 | Molecular phylogeny-homologs, orthologs and paralogs; Phylogenetic tree– rooted and unrooted tree, advantages of phylogenetic tree | 5 | 4, 5 |
| **3.0** | **Structure Predictions for Nucleic Acids and Proteins** | **5** | |
| 3.1 | Approaches for prediction of RNA secondary and tertiary structure; energy minimization and base covariance models | 2 | 4, 5 |
| 3.2 | Basic approaches for protein structure predictions, comparative modeling, fold recognition/'threading', and ab-initio prediction | 3 | 4, 5 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

## Books Recommended/webpage


1. Baxevanis, AD and Ouellette, BFF. 2001. Bioinformatics: A practical Guide to the Analysis of Genes and Proteins. Wiley Inter Science.
2. http://www.bioinformatics.nl/cgi-bin/primer3plus/primer3plus.cgi.
3. https://www.ebi.ac.uk/Tools/msa/clustalo/.
4. https://www.ncbi.nlm.nih.gov/.
5. Lesk, AM 2002. Introduction to Bioinformatics. Oxford University Press.
6. Primrose, SB and Twyman, RM, 2003. Principle of Genome Analysis and Genomics. Black Well Publishing, UK.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4203 | | |
| **Course Title** | : Climate Change and Plant Adaptation | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hour/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

Climate is the statistical description of the state of the climate system. The science of climate change involves the complex intersection of disciplines from meteorology to geo-chemistry and ecology. Biologists are also looking into the relations between changes in climate and responses of individuals, populations or communities in ecosystems. This course also addresses the international negotiations involved to mitigate the negative impacts focusing the world's roadmaps (e.g. the Paris Agreement) for tackling the climate change effect. Considering the above issues this course has been included in four year integrated course in botany.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | learn about the components climate and the complexities of global climate system; | R |
| CLO 2 | understand the causes of climate change and global warming; | U |
| CLO 3 | explain the observed changes in climate and its threats on physical and biological environment; and they will able to predict the future changes in the climate system; | Ap |
| CLO 4 | explore the adaptive feature of plants to accommodate with those changes; | E |
| CLO 5 | apply skills to formulate the mitigative process to reduce the negative impacts of climate change and act together with concerned stakeholders. | C |

R-Remember; U-Understanding; Ap-Apply; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 2 | 3 | 3 | 2 | 2 | 3 | 3 |
| CLO 2 | 2 | 2 | 3 | 3 | 2 | 2 | 3 |
| CLO 3 | 3 | 3 | 3 | 3 | 3 | 2 | 3 |
| CLO 4 | 2 | 3 | 2 | 2 | 3 | 3 | 2 |
| CLO 5 | 3 | 2 | 2 | 3 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Climate and Causes of climate change** | **5** | |
| 1.1 | Climate, climate components and climate change | 1 | 1,2 |
| 1.2 | Natural causes: Volcano eruption, solar variability, natural climate fluctuation, water vapour | 2 | 2 |
| 1.3 | Anthropogenic causes: Greenhouse gases, uses of CFC and aerosols agriculture and land uses pattern | 2 | 2 |
| **2.0** | **Greenhouse gases and climate change** | **2** | |
| 2.1 | Origin, types of greenhouse gases and climate change | 2 | 1,2 |
| **3.0** | **Observed changes in climate** | **4** | |
| 3.1 | Changes in atmospheric greenhouse gases | 1 | 2 |
| 3.2 | Changes in earth's surface temperature and precipitations | 1 | 2 |
| 3.3 | Changes in snow cover, sea level ice and glaciers | 1 | 2 |
| 3.4 | Changes in sea level rise and extreme climate events | 1 | 2 |
| **4.0** | **Impact of future climate change on physical environment** | **4** | |
| 4.1 | Future prediction at global level on temperature, precipitation, sea level rise, drought, glaciers/snow melt, extreme climate events | 4 | 3, 4 |
| **5.0** | **Climate change effect on Bangladesh** | **8** | |
| 5.1 | Physical environment: Temperature, rainfall, flood, drought, snow melt, sea level rise, cyclone and tornadoes | 4 | 3,4 |
| 5.2 | Biological environment: terrestrial ecosystem, coastal and marine ecosystem, biodiversity, agricultural productivity | 4 | 3,4 |
| **6.0** | **Mitigation** | **4** | |
| 6.1 | Reducing gas emission, changing energy use pattern, reducing deforestation, increase forestation, agriculture and land use pattern changes, carbon trapping, etc. | 4 | 4,5 |
| **7.0** | **Dealing with consequences** | **3** | |
| 7.1 | UN framework of climate change, national and international negotiations, carbon trapping and compensation | 3 | 3,4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Carter, T.R., Parry, M.L., Harasawa, H., Nishioka, S.1994. IPCC Technical Guidelines for Assessing Climate Change Impacts and Adaptation. University College, London, and Centre for Global Environmental Research, Tsukibajapan, pp. 1-59.
2. Intergovernmental Panel on Climate Change (IPCC) 2007. Climate change 2007: impact, adaptation and vulnerability. IPCC Secretariat: Geneva, Switzerland.
3. Intergovernmental Panel on Climate Change (IPCC) 2007. Fourth Assessment Report (AR4). The Reports from Working Groups. I, II and III are available at: http://www.ipcc.ch/.
4. Pender, J.S. 2008. What is climate change? And how it may affect Bangladesh. Briefing paper, Dhaka, Bangladesh: Church of Bangladesh Social Development Programme (CBSDP).
5. Roberts, J., Timmons and Bradley C. Parks, 2007. Climate of injustice: Global Inequality, North-South Politics, and Climate Policy. Cambridge: MIT Press.
6. Victor, D.G. and Cullenward,D. 2007. Making Carbon Markets Works. Scientific American.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4204 | | |
| **Course Title** | : Physiology of Crop Plants | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

This course is designed to know the factors that affect crop growth and development, such as microclimatic conditions: light, temperature, water, humidity, windfall, pollutants and nutrients, and the physiological mechanisms that plants use to adapt to their environment. Source-sink relationship, partitioning of metabolites, and growth and yield components.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive Level |
|---|---|---|
| CLO 1 | describe various climatic and microclimatic aspects on plants; | U |
| CLO 2 | identify the physiological factors that regulate growth and developmental processes of crop plants, and clearly define their roles; | Ap |
| CLO 3 | analyze growth patterns; | An |
| CLO 4 | evaluate the different strategies used by plants to acquire and utilize resources, and formulate a logical argument of their impact on crop productivity; | E |
| CLO 5 | recognize the significance of assimilate translocation and patterns of its partitioning in determining crop yield. | Ap |

U- Understanding; Ap-Apply; An-Analyze; E-Evaluate; C-Create

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 3 | 2 | 2 | 3 | 2 | 3 |
| CLO 2 | 3 | 3 | 2 | 3 | 3 | 3 | 3 |
| CLO 3 | 3 | 2 | 3 | 2 | 2 | 2 | 3 |
| CLO 4 | 3 | 3 | 3 | 3 | 2 | 3 | 3 |
| CLO 5 | 3 | 2 | 3 | 2 | 3 | 3 | 3 |

Note: 3 - High, 2 – Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Microclimate** | **6** | |
| 1.1 | Definition, energy relations of surfaces, energy budget | 2 | 1 |
| 1.2 | Light, temperature, humidity and windfall profile near a bare surface | 2 | 1 |
| 1.3 | Light, temperature, humidity and windfall profile within the | 2 | 1 |

| | | | |
|---|---|---|---|
| | vegetation | | |
| **2.0** | **Role of environmental factors on growth and productivity** | **6** | |
| 2.1 | Aerial environment (light, temperature, windfall, humidity, gases) | 3 | 6 |
| 2.2 | Soil environment (structure, texture, topography water and nutrition) | 3 | 6 |
| **3.0** | **Energy balance and gaseous exchange** | **6** | |
| 3.1 | Radiation and its impact on the diffusive resistance | 1 | 1 |
| 3.2 | Stomatal resistance | 1 | 1 |
| 3.3 | Stomatal movement | 1 | 1 |
| 3.4 | Photosynthesis, respiration and carbon economy | 2 | 1 |
| 3.5 | $C_3$ and $C_4$ adaptations and their ecological significance | 1 | 1 |
| **4.0** | **Growth and Development** | **6** | |
| 4.1 | Growth, development, differentiation, phenology | 1 | 2 |
| 4.2 | Vegetative growth: Generation of leaf surface, growth of a leaf, stem, root, swollen root and swollen stem | 3 | 2 |
| 4.4 | Classical and functional plant growth analysis techniques | 2 | 3 |
| **5.0** | **Physiological basis of crop yield** | **6** | |
| 5.1 | Dry matter production, translocation and partitioning | 1 | 5 |
| 5.2 | Source-sink relationship | 1 | 4 |
| 5.3 | Grain filling, yield capacity and yield assessment | 1 | 4 |
| 5.4 | Physiological basis of rice, wheat, sugarcane, potato and rapeseed yield | 3 | 5 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**

1. Bannister, P. 1976. Introduction to Physiological Plant Ecology. Black Well Scientific.
2. Charles-Edward, P.A. 1982. Physiologyical determinants of crop growth. Harcourt Brace.
3. Evans, L.T. 1975. Crop Physiology: Some Case histories. Cambridge University Press.
4. Landsberg, J.J. and Cutting, C.V. 1977. Environmental effects on crop physiology. London Academic Press.
5. Larcher, W. 1975. Physiological Plant Ecology. Springer-Verlag.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4205 | | |
| **Course Title** | : Cytogenetics | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | **:** 2 | **Credit hours/week :** 3 | **Total credit hours :** 30 |
| **Total Marks** | **:** 50 | | |

**Rationale of the course**

The course Cytogenetics explores the structure, function, and behavior of chromosomes. It covers their role in inheritance, genetic continuity, and variation, including chromosomal changes like deletions, duplications, and aneuploidy. Topics include Mendelian genetics, meiosis, crossing over, and sex determination. The course highlights the importance of chromosome studies in understanding genetics and improving crop breeding.

**Course Learning Outcomes (CLOs)**

| CLO No. | Expected Course Outcomes<br>Upon completion of this course, the students will be able to: | Cognitive level |
|---|---|---|
| CLO 1 | know the terminologies, fundamental principles and methods of cytogenetics; | R |
| CLO 2 | outline the concept and significance of linkage and crossing over, extra-nuclear inheritance and sex determination; | U |
| CLO 3 | discuss Mendelian and non-Mendelian pattern of inheritance; | R,U |
| CLO 4 | evaluate and analyze genetic importance, banding patterns, abnormalities of plant chromosomes; | E, An |
| CLO 5 | explain chromosomal variation, their meiotic behavior and cytogenetic consequences; | An, Ap |
| CLO 6 | apply skills using different methods and techniques in cytogenetic research. | Ap |

R-Remember; U-Understanding; An- Analyze; E-Evalute, Ap-Apply

**Mapping CLOs with PLOs**

| CLOs | Program Learning Outcomes (PLOs) | | | | | | |
|---|---|---|---|---|---|---|---|
| | PLO 1 | PLO 2 | PLO 3 | PLO 4 | PLO 5 | PLO 6 | PLO 7 |
| CLO 1 | 3 | 2 | 3 | 2 | 2 | 1 | 2 |
| CLO 2 | 3 | 2 | 2 | 2 | 3 | 3 | 1 |
| CLO 3 | 2 | 3 | 3 | 1 | 3 | 2 | 2 |
| CLO 4 | 2 | 3 | 3 | 3 | 3 | 2 | 3 |
| CLO 5 | 3 | 3 | 2 | 1 | 3 | 3 | 3 |
| CLO 6 | 1 | 3 | 2 | 3 | 3 | 2 | 3 |

Note: 3 - High, 2 - Medium, 1 - Low

**Course Content, Teaching and Assessment Strategy**

| Module | Course Contents | Credit hrs | CLOs |
|---|---|---|---|
| **1.0** | **Structure and Function of Chromosomes** | **4** | |
| 1.1 | Chemical composition, telomeres, centromeres and kinetochores | 1 | 1 |
| 1.2 | Nucleolar organizers; eu and heterochromatin | 1 | 1 |
| 1.3 | Unique and repetitive DNA | 1 | 1 |
| 1.4 | Chromosome strandedness | 1 | 1 |
| **2.0** | **Basis of Genetic Continuity and Transmission** | **6** | |
| 2.1 | Chromosome structure and number throughout the cell cycle | 3 | 2 |

| | | | |
|---|---|---|---|
| 2.2 | Chromosome banding – types and characteristics | 3 | 2 |
| **3.0** | **Basis of Heredity** | **6** | |
| 3.1 | Meiosis and Mendelian genetics | 2 | 3 |
| 3.2 | Chromosome theory of inheritance | 1 | 2 |
| 3.3 | Molecular mechanism of crossing over | 2 | 2 |
| 3.4 | Environmental and genetic factors affecting crossing over | 1 | 2 |
| **4.0** | **Variations in Chromosome Structure** | **7** | |
| 4.1 | Origin and adaptive significance of deletion, duplication, inversion and translocation | 4 | 5 |
| 4.2 | Isochromosome and sub terminal chromosome–their importance; ring chromosomes–origin and consequence | 2 | 5 |
| 4.3 | Whole arm translocation | 1 | 5 |
| **5.0** | **Changes in Chromosome Numbers** | **4** | |
| 5.1 | Aneuploidy (Monosomic, Nullisomic, Trisomic)–their origins, cytogenetic effects and use in crop breeding | 2 | 6 |
| 5.2 | Euploidy (Monoploid, Triploid, Tetraploid)– their origins, cytogenetic effects and use in crop breeding | 2 | 6 |
| **6.0** | **Sex Determination** | **3** | |
| 6.1 | Sex determination in plants | 1 | 2 |
| 6.2 | Chromosome theory and genic balance theory of sex determination | 1 | 2 |
| 6.3 | Environmental control of sex | 1 | 2 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4<br>CLO 5<br>CLO 6 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Garber, E.D. 1974. Cytogenetics. Tata McGraw-Hill Publishing Co. Ltd., India.
2. Gupta, P.K. 1999. Cytogenetics. Rastogi Publications, India.
3. Sharma, A. and Sumitra, S. 2002. Chromosome Botany. Science Publishers.
4. Shukla, R.S. and Chandel, P.S. 2001. Cytogenetics, Evolution and Plant Breeding. S. Chand and Co., India.
5. Sinha, U. and Sinha, S. 1995. Cytogenetics, Plant Breeding and Evolution. Vikas Publishing House, India.
6. Swanson, C.P., Merz, T. and Young, W.J. 1973. Cytogenetics. Prentice Hall of India.
7. Sybenga, J. 1972. General Cytogenetics. Elsevier.

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4106 | | |
| **Course Title** | : Biotechnology | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : | | |
| **Credit Value** | : 2 | **Credit hours/week**: 3 | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

**Rationale of the course**

The plant biotechnology course provides knowledge and skills essential for applying modern biotechnological tools to agriculture, medicine, and environmental sustainability. Students learn foundational concepts, including traditional and modern techniques like genetic engineering and tissue culture, as well as gene transfer methods. The course explores biotechnology's achievements, biofuel production, and biosafety principles, emphasizing innovation, sustainability, and safe practices for solving global challenges.

**Course Learning Outcomes (CLOs)**

| **CLO No.** | **Expected Course Outcomes** Upon completion of this course, the students will be able to: | **Cognitive Level** |
|---|---|---|
| CLO 1 | apply foundational biotechnological principles in practical settings; | U, Ap |
| CLO 2 | analyze various biotechnological methods, technologies, and their applications in different fields such as agriculture, medicine, environmental science, and industry; | Ap, An |
| CLO 3 | design, execute, and interpret results from biotechnological experiments, utilizing appropriate laboratory techniques, instrumentation, and data analysis methods; | Ap, An, C |
| CLO 4 | evaluate ethical and societal implications of biotechnological advancements, including genetic modification and biosecurity. | U, E |

U- Understanding; Ap-Apply; An-Analyze; C-Create

**Mapping CLOs with PLOs**

| **CLOs** | **Program Learning Outcomes (PLOs)** | | | | | | |
|---|---|---|---|---|---|---|---|
| | **PLO 1** | **PLO2** | **PLO 3** | **PLO 4** | **PLO 5** | **PLO 6** | **PLO 7** |
| CLO 1 | 1 | 2 | 1 | 3 | 1 | 2 | 2 |
| CLO 2 | 2 | 2 | 3 | 3 | 2 | 1 | 2 |
| CLO 3 | 1 | 2 | 3 | 3 | 2 | 1 | 2 |
| CLO 4 | 2 | 2 | 1 | 2 | 3 | 3 | 2 |

Note: 3 - High, 2 – Medium, 1 – Low

**Course Content, Teaching and Assessment Strategy**

| **Module** | **Course Contents** | **Credit hrs** | **CLOs** |
|---|---|---|---|
| 1.0 | **Introduction to biotechnology** | **7** | |
| 1.1 | Definition, historical background of plant biotechnology, | 2 | 1 |

| | | | |
|---|---|---|---|
| | traditional (old) biotechnology and modern biotechnology | | |
| 1.2 | Traditional (old) biotechnology: fermentation, mushroom production, breeding and selection, *in-vitro* culture, mutation breeding/ mutagenesis | 2 | 1, 2 |
| 1.3 | Modern biotechnology: recombinant DNA technology (genetic engineering), tissue culture, transgenic (GMO) | 2 | 1, 3 |
| 1.4 | Negative effect of biotechnology for environment | 1 | 1, 4 |
| 2.0 | **Gene transfer methods in plants** | **6** | |
| 2.1 | Gene transfer in biotechnology, benefits of gene transfer, vertical and horizontal gene transfer | 2 | 2, 3 |
| 2.2 | Different types of gene transfer method: direct and indirect | 1 | 2, 3 |
| 2.3 | Direct system: biolistics (particle or gene gun) | 1 | 2, 3 |
| 2.4 | Indirect system: Agrobacterium – mediated gene transformation | 1 | 2, 3 |
| 2.5 | Selection of transformants – using antibiotic resistance marker and reporter genes | 1 | 2, 3 |
| 3.0 | **Achievements of biotechnology** | **5** | |
| 3.1 | In Agriculture: nutritional value added plant (golden rice), insect/pest resistant plant (Bt cotton), herbicide-tolerant plant, bio-fertilizer, bio-pesticide | 2 | 1, 2 |
| 3.2 | In medicine: biopharmaceutical production (human peptide hormones, insulin, different types of antibiotics, and vaccines.), pharmacogenomics, genetic testing, gene therapy | 2 | 2, 3 |
| 3.3 | In environmental cleaning – microorganism for bioremediation- bacteria, fungi, algae, super bugs | 1 | 2, 3 |
| 4.0 | **Biological fuel generation** | **7** | |
| 4.1 | Introduction: definition, types, importance, role of biofuels in reducing greenhouse gas emissions and dependence on fossil fuels | 1 | 1, 3 |
| 4.2 | Sources of biomass: agricultural residues, energy crops, forestry residues, algae | 2 | 2, 3 |
| 4.3 | Biofuel production: - 1$^{st}$ generation, 2$^{nd}$ generation, 3$^{rd}$ generation | 1 | 2, 3 |
| 4.4 | Biofuel conversion processes: ethanol and methane from biomass, bio-gas production | 2 | 2, 3 |
| 4.5 | Economic and environmental considerations, advantages and disadvantages of biofuel | 1 | 3, 4 |
| 5.0 | **Biosafety** | **5** | |
| 5.1 | Fundamental principles of biosafety**:** introduction to biosafety, risk perception, biosafety levels | 1 | 1, 3 |
| 5.2 | Risk assessment: identifying hazards, assessing exposure risks, and implementing control measures | 2 | 1, 4 |
| 5.3 | Containment measures and laboratory practices: designing facilities, establishing protocols, and training personnel for safe handling of biological materials | 2 | 3, 4 |

**Mapping CLOs with the Teaching Learning and Assessment Strategies**

| CLOs | Teaching-Learning approach | Assessment strategy | Reinforcement assignment/Tasks |
|---|---|---|---|
| CLO 1<br>CLO 2<br>CLO 3<br>CLO 4 | Lectures, Multimedia projector, Participatory question-answer, Text books, Lecture notes, Group discussion, Online resources and Video documentation | Quiz, Assignment, Class test, Presentation, and Final exam | Feedback, Individual/Group discussion and Counseling |

**Books Recommended**


1. Chawla H. S. 2000. Introduction to Plant Biotechnology. CRC Press, Boca Raton, Florida, United States.
2. Giri, C.C. and Giri, A. 2007. Plant Biotechnology: Practical Manual. IK International Publishing House, New Delhi, Delhi
3. Kumaresan V. 2015. Applied Plant Biotechnology. Saras Publication, Nagercoil, India.
4. Nirmala C., Rajalakshmi G. and Karthick C. 2019. Plant Biotechnology. MJP Publishers. Chennai, India.
5. Singh P. 2016. Principles of Plant Biotechnology. Kalyani Publishers, Delhi, India.
6. Slater A., Nigel S. and Fowler M. 2008. Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press, Oxford, United Kingdom.
7. Umesha, S. 2019. Plant Biotechnology. CRC press, Boca Raton, Florida, USA.

# Practical Courses

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4207 | | |
| **Course Title** | : Bioprospecting | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Bioprospecting** |
| 1.1 | Introduction to bioprospecting derived plant products |
| 1.2 | Screening of seconday metabolites: Alkloid, Flavinoid, Tannin, Saponin |
| 1.3 | Demonstration for plant derived NPs formulation |
| 1.4 | Detection of categories of IPRs for bioprospecting products |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4208 | | |
| **Course Title** | : Bioinformatics | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Bioinformatics** |
| 1.1 | Retrieval of gene and genome sequences |
| 1.2 | Retrieval of RNA sequences |
| 1.3 | Retrieval of protein sequence |
| 1.4 | Sequence comparison (Pairwise and Multiple Sequence Alignment) and construction phylogenetic trees (Dendorgrams and Phenograms) |
| 1.5 | Gene structure |
| 1.6 | Primer design |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4209 | | |
| **Course Title** | : Climate Change and Plant Adaptation | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Climate Change and Plant Adaptation** |
| 1.1 | Visit to local area to understand the impact of climate changes on plants and ecosystem |
| 1.2 | Collect data on the changes those occur at individual and ecosystem level |
| 1.3 | Analyze collected data for presentation |
| 1.4 | $CO_2$ measurement from local air on a given time and presentation of the data |
| 1.5 | Calculation of rainfall data of a long time comment on the pattern of rainfall |
| 1.6 | Collect recorded data on low-tide and high-tide for a long time and comment on water level of the river |
| 1.7 | Collect recorded data on salinity level from tidal river and comment on the salinity level |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4210 | | |
| **Course Title** | : Physiology of Crop Plants | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Physiology of Crop Plants** |
| 1.1 | Preparation of various nutrient solution |
| 1.2 | Water culture experiments |
| 1.3 | Pot experiments on the different levels of water and nutrients on the growth of test crops |
| 1.4 | Determination of rates of stomatal and cuticular transpiration |
| 1.5 | Determination of relative leaf water content & time taken to close stomata |
| 1.6 | Quantitative determination of chlorophyll a, b and carotenoids by spectrophotometry |
| 1.7 | Quantitative analysis of growth of test crops by the classical technique of growth analysis |
| 1.8 | Germination and seedling growth of crop seeds under different environments |
| 1.9 | Effects of different hormones on crop plants |
| 1.10 | Allelopathic effects on crop plants |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4211 | | |
| **Course Title** | : Cytogenetics | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **5.0** | **Cytogenetics** |
| 5.1 | Study of nuclear phenotype |
| 5.2 | Study of usual and unusual meiotic system |
| 5.3 | Study of pollen grain mitosis |
| 5.4 | Karyotype analysis up to preparation of ideogram |
| 5.5 | Study of chromosome association and chiasma frequency |
| 5.6 | Sample comparisons measuring pollen grains |
| 5.7 | Methods for the induction of ploidy |
| 5.8 | Study of photomicrographs |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4112 | | |
| **Course Title** | : Biotechnology | | |
| **Course Type** | : Practical | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : Relevant Course Teacher | | |
| **Credit Value** | : 1 | **Credit hours/week**: | **Total credit hours**: |
| **Total Marks** | : 25 | | |

**Course Plan**

| Module | Course Contents |
|---|---|
| **1.0** | **Biotechnology** |
| 1.1 | Sterilization: principles & operations - Autoclave, Hot Air Oven, Filtration, Laminar Air Flow |
| 1.2 | Principles & operations of Incubators & Shakers, Centrifuge, pH meter, Colorimeter, Spectrophotometer |
| 1.3 | Studies of secondary metabolites in plants (phenolics, flavonoids, antioxidants) |
| 1.4 | Agrobacterium mediated transformation |
| 1.5 | Microscopic analysis of callus for cyto-differentiation, embryogenesis and organogenesis |

| | | | |
|---|---|---|---|
| **Course Code** | : BBOT 4213 | | |
| **Course Title** | : Viva (All major courses of Fourth Year) | | |
| **Course Type** | : Major | | |
| **Year/Semester** | : Fourth Year Second Semester | | |
| **Course Teacher** | : Respective Examination Committee | | |
| **Credit Value** | : 2 | **Credit hours/week**: | **Total credit hours**: 30 |
| **Total Marks** | : 50 | | |

| | |
|---|---|
| **Course Code** | : BBOT 4214 |
| **Course Title** | : Research Project/Internship |
| **Course Type** | : Major |
| **Year/Semester** | : Fourth Year Second Semester |
| **Course Teacher** | : Assigned Teacher |
| **Credit Value** | : 2 |
| **Total Marks** | : 50 |

Each student should conduct a project work or internship under the supervision of a teacher and submit the research paper/ report at the end of the academic year.

# FACULTY OF BIOLOGICAL SCIENCES
# University of Rajshahi

ORDINANCE FOR THE DEGREE OF BACHELOR OF SCIENCE (B.Sc.) WITH HONORS BOUNDED BY FOUR YEARS INTEGRATED SEMESTER SYSTEM IN THE DEPARTMENTS UNDER THE FACULTY OF BIOLOGICAL SCIENCES, THE UNIVERSITY OF RAJSHAHI, BANGLADESH.

**1. The Faculty of Biological Sciences shall consist of the following Departments:**

| | | | |
|---|---|---|---|
| a) | Psychology | d) | Genetic Engineering and Biotechnology |
| b) | Botany | e) | Clinical Psychology |
| c) | Zoology | f) | Microbiology |

Besides the new department(s) that may be established by the University from time to time and as assigned to the Faculty by the Academic Council.

**2.** The Faculty or Biological Sciences shall be constituted according to the Statutes, Ordinances and Regulations of the University governing the constitution of the Faculties.

**3.** There shall be a course of study of Bachelor of Science with Honors hereinafter referred to as **B.Sc. (Honors)** Degree.

**4. Subject code**

4.1 Psychology (PSY)
4.2 Botany (BOT)
4.3 Zoology (ZOOL)
4.4 Genetic Engineering and Biotechnology (GEB)
4.5 Clinical Psychology (CPSY)
4.6 Microbiology (MIC)

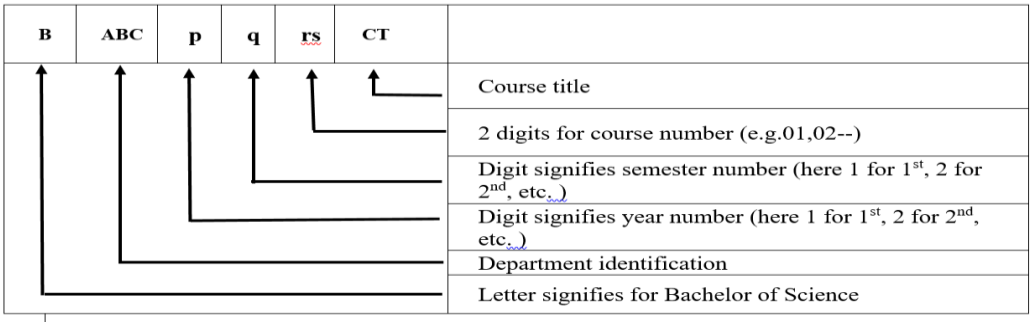
**5. Course Designation:** Each course is designated by a single letter identifying the course offering department followed by **B** for **Bachelor of Science** programme and other letter(s)/number(s) with the following criteria without any space between letters and numerals:

5.1 The following three letters correspond to the Department identification.

5.2 Next three digits correspond to the course number.

5.3 Next digit signifies Semester number.

5.4 The last two digits will be reserved for departmental use for the identification of different areas within a department (e.g. course title).



**6. Duration of the Course**

The programme of study for the degree of B.Sc. Honors shall be 8 Semesters (each semester consists of 6 months duration in one academic year) extended over a minimum period of four academic years and the degree shall be completed within a maximum period of six academic years from the date of his/her first admission. No student shall be allowed to stay for more than two times in 1st Semester to 7th Seventh Semester of the programme.

**7. Admission Requirements**

**7.1** Subject to the conditions laid down and conditions as set by the admission committee, students passing Higher Secondary Certificate (HSC) examination or an equivalent examination (twelve class/years education) of a recognized Board or equivalent institution may be admitted to the programme of study leading to the degree of B.Sc. Honors on recommendation of the academic committee of the department concerned.

**7.2** To be eligible for admission to B.Sc. Honors programme, as per rules of Rajshahi University Admission Committee.

**7.3** Admission of Foreign Students: Foreign Students will be admitted as per the 'Ordinance for Admission of Foreign Students' of the University of Rajshahi.

**8. Academic Schedule**

**8.1** Academic schedule for general notification shall be published before the start of the 1st Semester, on approval of the Departmental Academic Committee. The schedule may be prepared according to the following guidelines:

| **Each Semester (24 weeks)** | **Number of weeks** |
|---|---|
| Teaching | 14 |
| Preparatory Leave | 2 |
| Examination Period | 2-4 |
| Result Publication | 2-4 |
| Total: | 24 |

**8.2** Distribution of Course Marks, Units and Credit Points:

The marks shall be distributed as follows:

| **Semesters** | **Marks** | **Units** | **Credit Points** |
|---|---|---|---|
| 1st | 375-575 | 3.75-5.75 | 13-23 |
| 2nd | 375-525 | 3.75-5.25 | 13-19 |
| 3rd | 425-525 | 4.25-5.25 | 17-21 |
| 4th | 425-525 | 4.25-5.25 | 17-21 |
| 5th | 375-475 | 3.75-4.75 | 15-19 |
| 6th | 425-525 | 4.25-5.0 | 17-20 |
| 7th | 425-525 | 4.25-5.0 | 17-20 |
| 8th | 425-525 | 4.25-5.25 | 17-21 |
| **Total** | **4000** | **40.0** | **160** |

*100% = 70% examination, 20% Class assessment, 10% Class attendance

**8.3** Marks: The programme of study for the B.Sc. Honors degree shall carry a total of 3300- 4100 marks (33-41 units and 128-160 credits), 15-30% of which are for the related subjects and 30-40% for the practical, viva-voce, class assessment/ tutorial/ terminal/ home assignment/ field report/ excursion/ research project etc. The related courses shall have to be completed within the 4th Semester (in the first and second year) of the programme.

**8.4** Contact Hours: There shall be 30, 45 and 60 lecture hours (0.75 hours each) in an academic year for each theory course of 0.50. 0.75 and 1.00 unit, respectively and at least 30to 60 laboratory periods in an academic year for each practical course of 0.50 and 1.00 unit. For other fractions of a unit, proportionality should be applied. One laboratory period is equivalent to 3 (three) theoretical lecture periods.

**8.5** Examinations: The B.Sc. Honors examination shall be held semester-wise and shall consist of the (i) B.Sc. Honors 1st Semester to 8th Semester. A student, for obtaining the degree, shall have to pass all the examinations within 6 (six) academic years from the date of his/her first admission and shall not be allowed to stay more than 2 (two) times in each Semester (1st Semester to 7th Semester) of his/her Honors classes. The non-credit 'English' and 'Bangladesh studies' course shall have to be passed in 4 (four) academic years from the date of his/her admission.

**8.6** Marks distribution: The Semester-wise distribution of marks among the theory, practical, viva-voce, class assessment/ tutorial/ terminal/ home assignment/ field report/ excursion/ research project, etc. shall be as follows:

**(i)** B.Sc. Honors 1st Semester examination

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (including minor) | 150-350 | 1.5-3.5 | 6-14 |
| English (non-credit)[1] | 50 | 0.5 | 00 |
| Practical | 100-150 | 1-1.5 | 4-6 |
| Viva-voce | 50 | 0.5 | 2 |
| Field report/ excursion etc. | 25 | 0.25 | 1 |
| Total (credit courses) | **375-575** | **3.75-5.75** | **13-23** |

**(ii)** B.Sc. Honors 2nd Semester examination

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (including minor) | 150-35 | 1.5-3.5 | 6-14 |
| Bangladesh Studies (non-credit)[1] | 50 | 0.5 | 00 |
| Practical | 100-150 | 1-1.5 | 4-6 |
| Viva-voce | 50 | 0.5 | 2 |
| Field report/ excursion etc. | 25 | 0.25 | 1 |
| Total (credit courses) | **375-525** | **3.75-5.25** | **13-21** |

**(iii)** B.Sc. Honors 3rd Semester examination

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (including minor) | 150-350 | 1.5-3.5 | 6-14 |
| Practical | 100-150 | 1-1.5 | 4-6 |
| Viva-voce (general) | 50 | 0.5 | 2 |
| Field report/ excursion etc. | 25 | 0.25 | 1 |
| Total (credit courses) | **375-525** | **3.75-5.25** | **15-21** |

**(iv)** B.Sc. Honors 4th Semester examination

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory (including minor) | 150-350 | 1.5-3.5 | 6-14 |
| Practical | 100-150 | 1.0-1.5 | 4-6 |
| Viva-voce | 50 | 0.5 | 2 |
| Field report/ excursion etc. | 25 | 0.25 | 1 |
| Total (credit courses) | **350-525** | **3.50-5.25** | **15-21** |

**v)** B.Sc. Honors 5th Semester examination

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory | 150-350 | 1.5-3.5 | 6-14 |
| Practical | 100-150 | 1.0-1.5 | 4-6 |
| Viva-voce | 50 | 0.5 | 2 |
| Field report/ excursion etc. | 25 | 0.25 | 1 |
| Total (credit courses) | **350-475** | **3.50-4.75** | **13-19** |

**(vi)** B.Sc. Honors 6th Semester examination

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory | 150-350 | 1.5-3.5 | 6-14 |
| Practical | 100-150 | 1.0-1.5 | 4-6 |
| Viva-voce | 50 | 0.5 | 2 |
| Field report/ excursion etc. | 25 | 0.25 | 1 |
| **Total (credit courses)** | **375-525** | **3.75-5.25** | **15-21** |

**(vii)** B.Sc. Honors 7th Semester examination

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory | 150-350 | 1.5-3.5 | 6-14 |
| Practical | 100-200 | 1.0-2.0 | 4-8 |
| Viva-voce | 50 | 0.5 | 2 |
| Field report/excursion/case study etc. | 25 | 0.25 | 1 |
| **Total (credit courses)** | **425-575** | **4.25-5.75** | **17-23** |

**(viii)** B.Sc. Honors 8th Semester examination

| Name of Course | Marks | Units | Credits |
|---|---|---|---|
| Theory | 150-350 | 1.5-3.5 | 6-14 |
| Practical | 100-200 | 1.0-2.0 | 4-8 |
| Viva-voce | 50 | 0.5 | 2 |
| Field report/ excursion etc. | 25 | 0.25 | 1 |
| Project/+lnternship[2] | 50-100 | 0.5-1.0 | 2-4 |
| **Total (credit courses)** | **425-625** | **4.25-6..25** | **18-24** |

[1]A candidate shall not be allowed to continue the B.Sc. Honors programme if he/she fails to obtain the letter grade (LG) "S" in the 'English' and 'Bangladesh studies' courses in 4 (four) academic years from the date of admission. The letter grade "S" corresponds to at least 40% marks.

[2]Theoretical course(s) may be offered instead, if a department desires;

**Table for awarding marks for attendance:**

| Attendance | Marks |
|---|---|
| **90% to above** | **10%** |
| **85% to below 90%** | **9%** |
| **80% to below 85%** | **8%** |
| **75% to below 80%** | **7%** |
| **70% to below 75%** | **6%** |
| **65% to below 70%** | **5%** |
| **60% to below 65%** | **4%** |
| **Less than 60%** | **0%** |

**9. Administration:**

Academic Committee of the respective Department shall design curriculum, allocate courses for teaching, constitute Examination Committee and the panel of examiners as per rules of the University.

**10. Academic Calendar:**

The date of beginning and completion of course(s), date of examination, publication of results etc. shall have to be declared by the department concerned through an academic calendar at the beginning of the session. In preparing calendar the following points shall have to be considered:

**10.1** Course(s) shall have to be completed within 3 (three) months, (12 weeks).

**10.2** Examination shall start after two weeks from the date of completion of the course(s).

**10.3** At least two (two) theoretical course examinations shall be held per week.

**10.4** Examination results shall ordinarily be published within 5 (five) weeks from the date of completion of the examination.

**11. Examination Committee:** As per the Ordinance of the University of Rajshahi.

**12. Examinations:**

**12.1** Class Assessment: Each of class assessment examinations on each theory course shall be taken in one lecture period by the individual course teacher(s) during the middle of the programme and/by the end of the course for internal evaluation. Laboratory assessment examination shall be taken by the concerned teacher(s) continuously throughout the year in each laboratory class.

**12.2** Duration of Examination: The duration of examinations of the theory courses shall be 3 hours for 0.50 and 4 hours for 0.75 and 1.00 unit courses. The duration of practical examination shall be 6-12 and 12-24 hours (6 hours per day) per 0.50 and 1.00 unit practical courses respectively. For other fractions of a unit proportionately shall be applied.

**12.3** Submission of Marks: Average of all class assessment of theory courses and average of all laboratory assessment marks shall have to be submitted by the course teacher(s) concerned in sealed envelope to the Chairman of the relevant examination committee before the commencement of the final examination. A course teacher failing to submit the assessment marks before the commencement of the final examination, shall not be allowed to act as an examiner of the course-examination. In such case the decision shall be taken by the relevant examination committee with the approval of the departmental academic committee.

Consolidated average marks of the theory courses, class assessment, viva-voce, laboratory assessment, practical courses etc. shall have to be converted to the letter grade by the relevant examination committee and submitted to the Controller of Examinations before finalizing the result.

**13. Eligibility for Examination:**

**13.1** Percentage of Attendance: In order to be eligible for taking up the B.Sc. Honors examinations, a candidate must have pursued a regular course of study by attending not less than 75% of the total number of classes held (theoretical, practical, class assessment etc.) provided that the academic committee of the department on special grounds and on such documentary evidence that may be necessary, may approve the cases of shortage of attendance not below 60%. A candidate, appearing at the examination under the benefit of this provision shall have to pay in addition to the examination fees, the requisite fee prescribed by the syndicate for the purpose, Candidates having less than 60% attendance shall not be allowed to fill up the examination form.

**13.2** Re-admission: A candidate, who failed to appear at the examination or fails to pass the examination, may on the approval of the relevant department be readmitted to the immediate following session in the first, to 7$^{th}$ semester of the programme. A readmitted candidate shall have to reappear at all courses of the examinations.

**14. Question Setter and Examiners:** For B.Sc (Honors) examination there shall be two question-setters (First and Second setters) in each of the theory course, two script examiners (First and Second Examiners) in each theory course, Project/Field work/Internship Report. In case, the marks awarded by the two examiners differ by 20% or more, the examination committee shall recommend that the answer scripts/thesis be re-examined by the third examiner and the arithmetic mean of the two nearest marks will be counted. If 50% or more answer scripts differ by 20% or more, all scripts of that paper will be reexamined by the 3$^{rd}$ examiner as per the University Ordinance.

**15. Appearing to the Examinations:**

For appearing to B.Sc. Honors examination a candidate shall have to submit his/her application in the prescribed form together with certificates of attendance and fulfill all other conditions prescribed by the University. The application shall be submitted through the Chairman of the Department and Provost of the Hall concerned so as to reach the Controller of Examinations at least 2 (two) weeks before the date fixed for the commencement of the examination.

**16. Medium and Nature of Questions and Answers:**

Question shall be made in English and /or a translated version in Bangla. The medium of answers in the examination of all courses shall be either English or Bangla. However, a mixing of English and Bangla shall never be allowed in answer-script.

**17. Theoretical Examination and Board of Viva -voce**

**17.1** A candidate absenting himself/herself in a course in an examination, in which he/she ought to have been present, will be considered 'F' grade in that course.

**17.2** Members of the concerned Examination Committee shall be the members of the Board to conduct viva-voce.

**18. Laboratory Examination**

**18.1** The departmental Academic Committee will assign a teacher or a group of teachers to conduct a particular laboratory class or all the laboratory classes of a particular semester, as well as to conduct the laboratory assessment examination of that class during the scheduled course periods.

**18.2** One copy of the marks of the laboratory assessment examination will be sent to the Chairman of the concerned Examination Committee.

**19. The Grading Systems:**

**19.1** Credit Point (CP): The credit points achieved by an examiner for 0.50 and 1.00 unit courses shall be 2 and 4, respectively. For other fractions of a unit, proportionality should be applied. **Letter Grade (LG), Corresponding Grade (CG), Grade point (GP)** and **Credit Point (CP)** shall be awarded in accordance with provisions shown below:

| Numerical grade | LG | GP/unit | CP / unit |
|---|---|---|---|
| 80% or its above | $A^+$ (A plus) | 4.00 | 4 |
| 75% to less than 80% | A (A regular) | 3.75 | 4 |
| 70% to less than 75% | $A^-$(A minus) | 3.50 | 4 |
| 65% to less than 70% | $B^+$ (B plus) | 3.25 | 4 |
| 60% to less than 65% | B (B regular) | 3.00 | 4 |
| 55% to less than 60% | $B^-$ (B minus) | 2.75 | 4 |
| 50% to less than 55% | $C^+$ (C plus) | 2.50 | 4 |
| 45% to less than 50% | C (C regular) | 2.25 | 4 |
| 40% to less than 45% | D | 2.00 | 4 |
| Less than 40% | F | 0.00 | 0 |
| Incomplete | I | -- | .0 |

Absence from the examination shall be considered incomplete with the letter grade 'I'.

The weighted average of the GPAs of a student in all four years (8 semesters) shall be calculated as per the ordinance of the Rajshahi University.

CGPA = Sum of $[(TCP)_i \times (GPA)_i]$ / Sum of $(TCP)_i$, where $(GP)_i$, = grade point obtained in individual courses, $(CP)_i$ = credit point for respective course, $(GPA)_i$ = grade point average obtained in a year and $(TCP)_i$ = total point of that year. GPA and

CGPA shall be rounded off up to 2 (two) places after decimal to the advantage of the examinee. For instance, GPA = 2.112 shall be rounded off as GPA=2.12.

**20. Award of Degree, Promotions and Improvement of Results:**

**20.1** Degree Requirements: The degree shall be awarded on the basis of CGPA obtained by a candidate in B.Sc. Honors in 1st semester to 8th semester examinations. In order to qualify for the B.Sc. Honors degree a candidate must have to obtain the following within 6 (six) academic years from the date of admission: (i) a minimum CGPA of 2.50; (ii) a minimum GPA of 2.00 in the practical courses in 1st Semester to 8th Semester examinations, (iii) a minimum TCP of 104-128; (iv) "S" letter grade in 'English' and 'Bangladesh studies' course (in 4 academic years from the date of admission).

**20.2** Publications of Results: The overall results of a successful candidate covering all examinations of four academic years shall be declared on the basis of CGPA with the corresponding letter grade (LG). The transcript in English shall show the course number, course title, credit, grade and grade point of individual courses, GPA of each and the CGPA.

**20.3** Promotions: In order to be eligible for promotion from one semester to the next higher semester a candidate must secure (i) at least 2.00/2.25 GPA in each of his/her in 1st Semester to 7th Semester examinations, (ii) at least 2.00 GP in each of his/her 1st Semester to 7th Semester practical course examinations, and (iii) 12.5-15.5 credits for each of 1st Semester to 7th Semester examinations.

**20.4** Course Improvement: A promoted student earning a grade less than 2.75 in individual course shall be allowed to improve the grades on courses, not more than one full unit courses of 1st Semester to 7th Semester examinations or their equivalent courses (in case of changes in the curriculum), defined by the departmental academic committee, through the regular examination of the immediate following batch. No improvement shall be allowed in practical course examinations/viva-voce/class assessment/tutorial/terminal/field report/excursion/home assignment and thesis/ dissertation courses. If a candidate fails to improve his/her course grade, the previous grade shall remain valid. If a readmitted candidate fails to appear at the class assessment/ tutorial/terminal/home assignment and thesis dissertation/ research project, his/her previous grades shall remain valid.

**20.5** Result Improvement: A candidate obtaining a CGPA of less than 2.75 at the end of the 8thsemester, within 6 (six) academic years, shall be allowed to improve his/her result, on up to a maximum of 3 (three) full units of the 8th semester theoretical courses in the immediate next semester examination after publication of his/her result. The year of examination, in the case of a result improvement, shall remain same as that of the regular examination. No improvement shall be allowed for practical courses/viva-voce/class assessment/tutorial/terminal/home assignment, thesis/ dissertation/field report/ excursion/ research project. If a candidate fails to improve CGPA with the block of new GP in total, the previous results shall remain valid.

**20.6** Pass Degree: Candidates failing to obtain the required CGPA, (i) for promotion in Honors 7th Semester examination in 4 (four) academic years, in case of readmission in 7th Semester of 5 (five) academic years, with no readmission in 7th Semester from

the date of admission, or (ii) for Honors degree in Honors, 8th Semester examination in 6 (six) academic years from the date of admission,

**20.6.1** but secure a CGPA of at least 2.50 (ignoring TCP) up to Honors 7th Semester examination and

**20.6.2** obtain a LG of "S" in English and Bangladesh studies course in 4 academic years from the date of admission, shall be awarded a B.Sc. pass degree. Such candidates shall not be allowed to improve on the B.Sc. pass degree.

**20.7** Dropping out: Candidates failing to earn the yearly required CGPA after completing regular examinations and subsequently failed again after taking readmission in 1st Semester to 7th Semester shall be dropped out of the programme.

**21. Examination Ethics**

**21.1** Everyone involved in the process of examination has to ensure the security of examination and follow the examination rules of the University.

**21.2** An examinee never be asked any question that hurt his/her religious or ethnic background.

**21.3** If someone (teacher or employee) is involved in examination process has the following relatives as examinee(s) he/she should inform the Chairman of concerned Examination Committee or the Controller of Examinations immediately: (i) husband/wife, (ii) son/daughter, (iii) brother/sister (iv) brother-in law/sister -in- law, (v) son in- law/daughter-in-law. (vi) nephew/niece. (vii) first cousins, (viii) father/mother (ix) Uncle/aunt and (x ) father-in-law/ mother-in-law.

**22. Enforcement of the Ordinance**

This Ordinance shall come in force from the academic session 2020-2021 (examination- 2021) or session 2021-2022 (examination-2022) onwards. Students under the previous ordinance shall have to complete their programme as implied Ordinance. Special consideration may be taken if such students remain in the programme after the due date.

**23. Amendment**

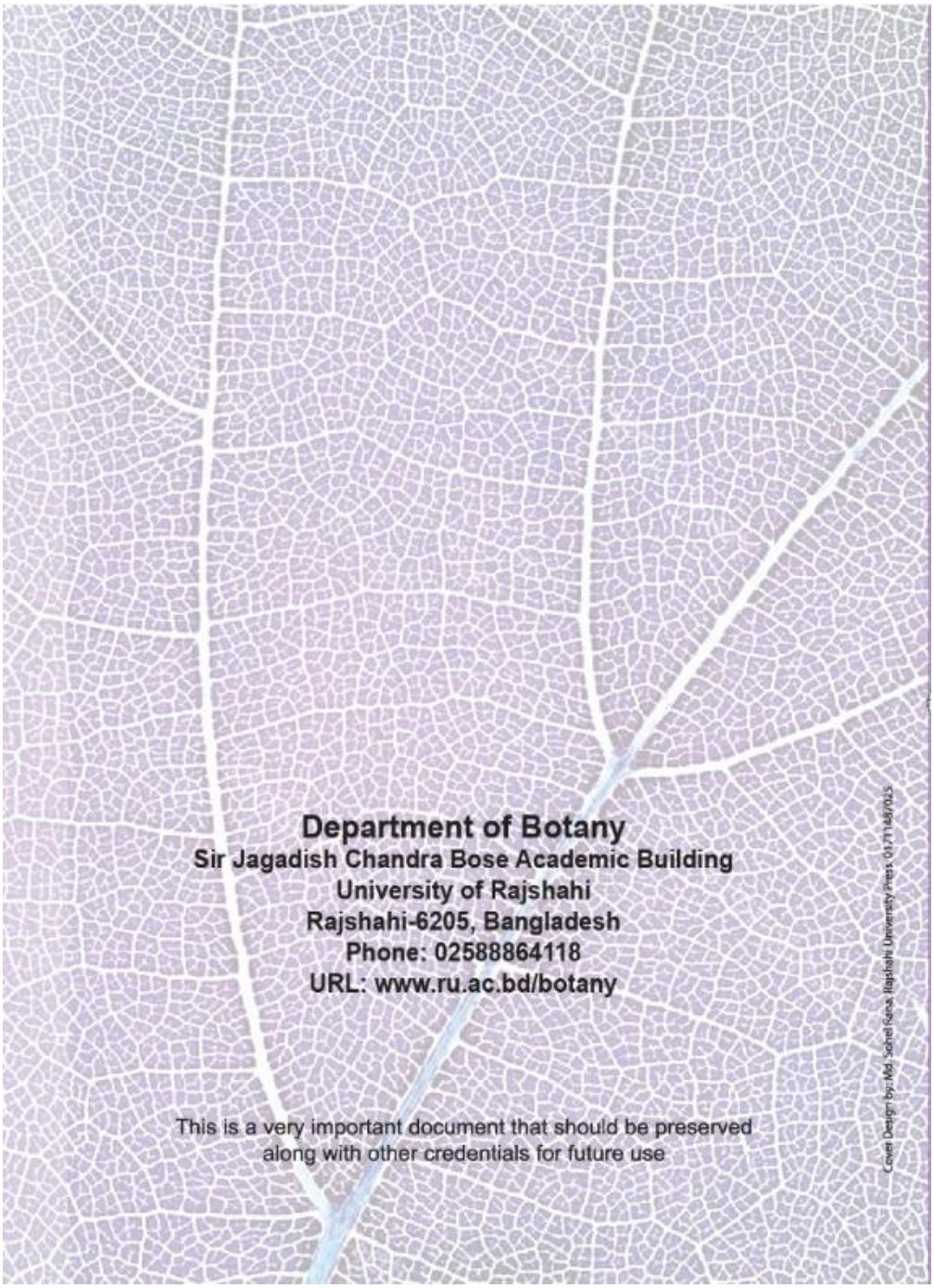
Any proposal to amend this ordinance shall be processed through the Faculty of Biological Sciences and shall have to be passed by the Academic Council of the Rajshahi University.

## CURRICULUM COMMITTEE

Department of Botany, University of Rajshahi, Rajshahi-6205

| | | |
|---|---|---|
| **Convener** | **:** | Professor Dr. Gour Pada Ghosh |
| **Members** | **:** | Professor Dr. Most. Ferdousi Begum |
| | | Professor Dr. A. H. M. Mahabubur Rahman |
| | | Professor Dr. Md. Sarwar Parvez |
| | | Dr. Md. Mostafizur Rahman |
| **Coordinator** | **:** | Professor Dr. Mohammad Shahidul Alam, Chairman, Department of Botany, University of Rajshahi |
| **Course Contributors** | **:** | All Faculty Members |
| **Expert Members** | **:** | Professor Dr. Shaikh Bokhtear Uddin<br>Department of Botany, University of Chittagong |
| | | Professor Dr. Saleh Ahammad Khan<br>Department of Botany, Jahangirnagar University |
| | | Professor Dr. M. Firoz Alam<br>House no.114, Kadirgong Darikharbona, Boalia, Rajshahi-6202 |

*[The Curriculum was approved by the Committee of Curriculum Meeting No. 3rd; Dated: 05.05.2025]*


Department of Botany
Sir Jagadish Chandra Bose Academic Building
University of Rajshahi
Rajshahi-6205, Bangladesh
Phone: 02588864118
URL: www.ru.ac.bd/botany
This is a very important document that should be preserved
along with other credentials for future use
Cover Design by: Md. Sohel Rana, Rajshahi University Press, 01717468705