



Date :- 01/08/2024

### **NOTIFICATION**

Sub :- CBCS Syllabi of B. Sc. in Botany (Sem. III & IV)

Ref. :- Decision of the Academic Council at its meeting held on 27/07/2024.

The Syllabi of B. Sc. in Botany (Third and Fourth Semesters) as per **NATIONAL EDUCATION POLICY – 2020 (2023 Pattern)** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2024-25.

Copy of the Syllabi Shall be downloaded from the College Website  
([www.kcesmjcollege.in](http://www.kcesmjcollege.in))

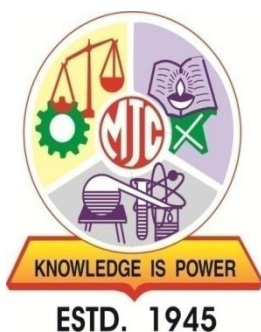
**Sd/-**  
**Chairman,**  
**Board of Studies**

**To :**

- 1) The Head of the Dept., M. J. College, Jalgaon.
- 2) The office of the COE, M. J. College, Jalgaon.
- 3) The office of the Registrar, M. J. College, Jalgaon.

**Knowledge is Power**

Khandesh College Education Society's  
**Moolji Jaitha College, Jalgaon**  
An "Autonomous College"  
Affiliated  
KavayitriBahinabaiChaudhari  
North Maharashtra University, Jalgaon - 425001



## **STRUCTURE AND SYLLABUS**

### **B.Sc. Honours/Honours with Research (S.Y.B.Sc.Botany)**

**Under Choice Based Credit System (CBCS)  
and  
as per NEP-2020 Guidelines**

**[w.e.f.Academic Year:2024-25]**

## Preface

Botany, (the study of plants) viz., including research, environmental management, agriculture, Horticulture, pharmaceuticals, and biotechnology, playing a crucial role in sustainable practices and plant-based solutions. Botanists study the interactions between plants and their environment, including climate change impacts and ecosystem dynamics. Botanists contribute to the development of sustainable agricultural practices that minimize environmental impact and promote food security. Medicinal Botany explore the medicinal properties of plants, identifying compounds with therapeutic potential for treating various diseases. Ecology and Phytogeography involved in restoring degraded ecosystems, such as forests and wetlands, by planting native plant species and managing vegetation.

Botany students can seek employment opportunity in various industries including Education, Research and Development, Agriculture, Biotechnology, Ecology, etc. Some popular Botany jobs include Botanist, Plant Taxonomist, Ecologist, Agronomist, Horticulturist etc. Botany is a vast branch of Biology and it covers numerous specializations that are used in various industries. For instance, Genetics, Biotechnology, Horticulture, Agronomy, Forestry, Plant Ecology, etc.,

Hence, Board of Studies in Botany in its meeting held on 22<sup>nd</sup> March 2025 resolved to accept the revised syllabus for S. Y. B. Sc. (Botany) based on Choice Based Credit System (CBCS) of UGC, NEP-2020 and the Government of Maharashtra guidelines.

### Program Outcomes (PO) for B.Sc. Program:

Program outcomes associated with a B.Sc. degree are as follows:

| PO No. | PO                                                                                                                                                                                                                                                                                      |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | Graduates should have a comprehensive knowledge and understanding of the fundamental principles, theories, and concepts in their chosen field of study.                                                                                                                                 |
| 2      | Graduates should possess the necessary technical skills and competencies related to their discipline, including laboratory techniques and data analysis.                                                                                                                                |
| 3      | Graduates should be able to identify, analyze, and solve complex problems using logical and critical thinking skills. They should be able to apply scientific methods and principles to investigate and find solutions.                                                                 |
| 4      | Graduates should be proficient in effectively communicating scientific information, both orally and in writing.                                                                                                                                                                         |
| 5      | Graduates should have a basic foundation in research methods and be capable of designing and conducting scientific investigations.                                                                                                                                                      |
| 6      | Graduates should be able to work effectively as part of a team, demonstrating the ability to collaborate with others, respect diverse perspectives, and contribute to group projects.                                                                                                   |
| 7      | Graduates should recognize the importance of ongoing learning and professional development. They should be equipped with the skills and motivation to engage in continuous learning, adapt to new technologies and advancements in their field, and stay updated with current research. |

### Programme Specific Outcome (PSO) for B.Sc. Botany Honours/Honours with Research:

After completion of this program, students are expected to learn/understand the:

| PO No. | PSO                                                                                                                                                             |
|--------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1      | S.Y. B.Sc. (Botany) student will have basic knowledge of Plant Science.                                                                                         |
| 2      | Acquire academic excellence with an aptitude for graduation and postgraduation.                                                                                 |
| 3      | A student completing the course is able to understand different branches of Botany such as Plant ecology, physiology, horticulture and Cell Biology             |
| 4      | Build life skills in Techniques of Cell Biology, Plant ecology, physiology and horticulture.                                                                    |
| 5      | After successful completion of the program, students will acquire laboratory, natural field and transferable skills which will help them to boost their career. |
| 6      | Students can apply their knowledge in public as well as private sector and build successful career.                                                             |

### Multiple Entry and Multiple Exit options:

The multiple entry and exit options with the award of UG certificate/ UG diploma/ or three-year degree depending upon the number of credits secured;

| Levels | Qualification Title                                                          | Credit Requirements |         | Semester | Year |
|--------|------------------------------------------------------------------------------|---------------------|---------|----------|------|
|        |                                                                              | Minimum             | Maximum |          |      |
| 4.5    | UG Certificate                                                               | 40                  | 44      | 2        | 1    |
| 5.0    | UG Diploma                                                                   | 80                  | 88      | 4        | 2    |
| 5.5    | Three Year Bachelor's Degree                                                 | 120                 | 132     | 6        | 3    |
| 6.0    | Bachelor's Degree- Honours<br>Or<br>Bachelor's Degree- Honours with Research | 160                 | 176     | 8        | 4    |

### Credit distribution structure for Three/ Four year Honors/ Honours with Research Degree Programme with Multiple Entry and Exit

#### F.Y. B.Sc.

| Year<br>(Level)                                                                                                                                          | Sem         | Major (Core). Subjects                 |                   | Minor<br>Subjects<br>(MIN) | GE/<br>OE    | VSC, SEC<br>(VSEC)      | AEC,<br>VEC, IKS                                      | CC, FP,<br>CEP,<br>OJT/Int, RP | Cumulative<br>Credits/Sem | Degree/<br>Cumulative<br>Cr. |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|----------------------------------------|-------------------|----------------------------|--------------|-------------------------|-------------------------------------------------------|--------------------------------|---------------------------|------------------------------|
|                                                                                                                                                          |             | Mandatory<br>(DSC)                     | Elective<br>(DSE) |                            |              |                         |                                                       |                                |                           |                              |
| 1<br>(4.5)                                                                                                                                               | I           | DSC-1 (2T)<br>DSC-2 (2T)<br>DSC-3 (2P) | —                 | MIN-1 (2T)<br>MIN-2 (2P)   | OE-1<br>(2T) | SEC-1 (2T)<br>SEC-2(1P) | AEC-1 (2T)<br>(ENG)<br>VEC-1 (2T)<br>(ES)<br>IKS (1T) | CC-1 (2)                       | 22                        | UG<br>Certificate            |
|                                                                                                                                                          | II          | DSC-4 (2T)<br>DSC-5 (2T)<br>DSC-6 (2P) | ...               | MIN-3 (2T)<br>MIN-4 (2P)   | OE-2<br>(2T) | SEC-3(2T)<br>SEC-4(1P)  | AEC-2 (2T)<br>(ENG)<br>VEC-2 (2T) (CI)<br>IKS (1T)    | CC-2 (2)                       | 22                        |                              |
|                                                                                                                                                          | Cum.<br>Cr. | 12                                     | ...               | 8                          | 4            | 6                       | 10                                                    | 4                              | 44                        |                              |
| Exit option: Award of UG Certificate in Major with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor. |             |                                        |                   |                            |              |                         |                                                       |                                |                           |                              |

### S.Y. B.Sc.

| Year<br>(Level)                                                                                                                                              | Sem         | Subject-I<br>(M-1)<br>Major*                         |                    | Subject-II<br>(M-2)<br>Minor #      | Subject-III<br>(M-3) | Open<br>Elective<br>(OE) | VSC, SEC<br>(VSEC) | AEC, VEC,<br>IKS   | CC, FP, CEP,<br>OJT/Int/RP | Cumulative<br>Credits/Se<br>m | Degree/<br>Cumulative<br>Credit |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|------------------------------------------------------|--------------------|-------------------------------------|----------------------|--------------------------|--------------------|--------------------|----------------------------|-------------------------------|---------------------------------|
|                                                                                                                                                              |             | Mandator<br>y (DSC)                                  | Electiv<br>e (DSE) | (MIN)                               |                      |                          |                    |                    |                            |                               |                                 |
| 2<br>(5.0)                                                                                                                                                   | III         | DSC-7(2T)<br>DSC-8(2T)<br>DSC-9(2P)<br>DSC-10(2P)    | ---                | MIN-5(2T)<br>MIN-6(2T)<br>MIN-7(2P) | ---                  | OE-3(2T)                 |                    | AEC-3(2T)<br>(MIL) | CC-3(2T)<br>CEP(2)         | 22                            | UG<br>Diploma                   |
|                                                                                                                                                              | IV          | DSC-11(2T)<br>DSC-12(2T)<br>DSC-13(2P)<br>DSC-14(2P) | ---                | MIN-8(2T)<br>MIN-9(2P)              | ---                  | OE-4(2T)<br>OE-5(2P)     |                    | AEC-4(2T)<br>(MIL) | CC-4(2T)<br>☉ FP(2)        | 22                            |                                 |
|                                                                                                                                                              | Cum.<br>Cr. | 12                                                   | ---                | 10                                  | ---                  | 4                        | 6                  | 4                  | 8                          | 44                            |                                 |
| Exit option: Award of UG Diploma in Major and Minor with 88 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major & Minor. |             |                                                      |                    |                                     |                      |                          |                    |                    |                            |                               |                                 |

\* Student must choose one subject as a Major subject out of M-1, M-2 and M-3 that he/she has chosen at First year

#Student must choose one subject as a Minor subject out of M-1, M-2 and M-3 that he/she has chosen at First year (Minor must be other than Major)

⊙ OJT/Internship/CEP should be completed in the summer vacation after 4<sup>th</sup> semester

### T.Y. B.Sc.

| Year<br>(Level) | Sem         | Subject-I<br>(M-1)<br>Major                                                                           |                                      | Subject-II<br>(M-2)<br>Minor | Subject-III<br>(M-3) | Open<br>Elective<br>(OE) | VSC, SEC<br>(VSEC)     | AEC,<br>VEC, IKS | CC, FP, CEP,<br>OJT/Int/RP | Cumulative<br>Credits/Se<br>m | Degree/<br>Cumulative<br>Credit |
|-----------------|-------------|-------------------------------------------------------------------------------------------------------|--------------------------------------|------------------------------|----------------------|--------------------------|------------------------|------------------|----------------------------|-------------------------------|---------------------------------|
|                 |             | Mandator<br>y (DSC)                                                                                   | Elective<br>(DSE)                    | (MIN)                        |                      |                          |                        |                  |                            |                               |                                 |
| 3<br>(5.5)      | V           | DSC-15(2T)<br>DSC-16(2T)<br>DSC-17(2T)<br>DSC-18(2P)<br>DSC-19(2P)                                    | DSE-1A/B<br>(2T)<br>DSE-2A/B<br>(2P) | ---                          | ---                  | ---                      | VSC-1(2T)<br>VSC-2(2P) | ---              | OJT/Int (4)                | 22                            | UG<br>Degree                    |
|                 | VI          | DSC-20(2T)<br>DSC-21(2T)<br>DSC-22(2T)<br>DSC-23(2T)<br>DSC-24(2T)<br>IKS<br>DSC-25(2P)<br>DSC-26(2P) | DSE-3A/B<br>(2T)<br>DSE-4A/B<br>(2P) | ---                          | ---                  | ---                      | VSC-3(2T)<br>VSC-4(2P) | ---              | ---                        | 22                            |                                 |
|                 | Cum.<br>Cr. | 24                                                                                                    | 8                                    | ---                          | ---                  | ---                      | 8                      | ---              | 4                          | 44                            |                                 |
|                 |             | Exit option: Award of UG Degree in Major with 132 credits OR Continue with Major and Minor            |                                      |                              |                      |                          |                        |                  |                            |                               |                                 |

### Fourth Year B.Sc. (Honours)

| Year<br>(Level )                                               | Sem         | Major Core Subjects                                  |                                | Research<br>Methodolog<br>y<br>(RM) | VSC,<br>SEC<br>(VSEC) | OE  | AEC, VEC,<br>IKS | CC, FP, CEP,<br>OJT/Int/RP | Cumulative<br>Credits/Se<br>m | Degree/<br>Cumulative<br>Credit |
|----------------------------------------------------------------|-------------|------------------------------------------------------|--------------------------------|-------------------------------------|-----------------------|-----|------------------|----------------------------|-------------------------------|---------------------------------|
| IV<br>(6.0)                                                    | VII         | DSC-27(4T)<br>DSC-28(4T)<br>DSC-29(4T)<br>DSC-30(2P) | DSE-5A/B (2T)<br>DSE-6A/B (2P) | RM(4T)                              | ---                   | --- | ---              | ---                        | 22                            | UG<br>Honours<br>Degree         |
|                                                                | VIII        | DSC-31(4T)<br>DSC-32(4T)<br>DSC-33(4T)<br>DSC-34(2P) | DSE-7A/B (2T)<br>DSE-8A/B (2P) | ---                                 | ---                   | --- | ---              | OJT/Int (4)                | 22                            |                                 |
|                                                                | Cum.<br>Cr. | 28                                                   | 8                              | 4                                   | ---                   | --- | ---              | 4                          | 44                            |                                 |
| Four Year UG Honors Degree in Major and Minor with 176 credits |             |                                                      |                                |                                     |                       |     |                  |                            |                               |                                 |

### Fourth Year B.Sc. (Honours with Research)

| Year<br>(Level )                                                              | Sem         | Major Core Subjects                    |                                | Research<br>Methodolog<br>y<br>(RM) | VSC,<br>SEC<br>(VSEC) | OE  | AEC, VEC,<br>IKS | CC, FP, CEP,<br>OJT/Int/RP | Cumulative<br>Credits/Se<br>m | Degree/<br>Cumulative<br>Credit             |
|-------------------------------------------------------------------------------|-------------|----------------------------------------|--------------------------------|-------------------------------------|-----------------------|-----|------------------|----------------------------|-------------------------------|---------------------------------------------|
| IV<br>(6.0)                                                                   | VII         | DSC-27(4T)<br>DSC-28(4T)<br>DSC-30(2P) | DSE-5A/B (2T)<br>DSE-6A/B (2P) | RM(4T)                              | ---                   | --- | ---              | RP(4)                      | 22                            | UG<br>Honours<br>with<br>Research<br>Degree |
|                                                                               | VIII        | DSC-31(4T)<br>DSC-32(4T)<br>DSC-34(2P) | DSE-7A/B (2T)<br>DSE-8A/B (2P) | ---                                 | ---                   | --- | ---              | RP(8)                      | 22                            |                                             |
|                                                                               | Cum.<br>Cr. | 20                                     | 8                              | 4                                   | ---                   | --- | ---              | 12                         | 44                            |                                             |
| Four Year UG Honours with Research Degree in Major and Minor with 176 credits |             |                                        |                                |                                     |                       |     |                  |                            |                               |                                             |

**Sem-** Semester, **DSC-** Department Specific Course, **DSE-** Department Specific Elective, **OE/GE-** Open/Generic elective, **VSC-** Vocational Skill Course, **SEC-** Skill Enhancement Course, **VSEC-** Vocation and Skill Enhancement Course, **AEC-** Ability Enhancement Course, **IKS-** Indian Knowledge System, **VEC-** Value Education Course, **T-** Theory, **P-** Practical, **CC-** Co-curricular, **RM-** Research Methodology, **OJT-** On Job Training, **FP-** Field Project, **Int-** Internship, **RP-** Research Project, **CEP-** Community Extension Programme, **ENG-** English, **CI-** Constitution of India, **MIL-** Modern Indian Language

- Number in bracket indicate credit
- The courses which do not have practical 'P' will be treated as theory 'T'
- If student select subject other than faculty in the subjects M-1, M-2 and M-3, then that subject will be treated as Minor subject, and cannot be selected as Major at second year.

### Details of S.Y. B.Sc. (Botany)

| Course                    | Course Type | Course Code | Course Title                                          | Credits | Teaching Hours/ Week |     |       | Marks    |     |          |     |
|---------------------------|-------------|-------------|-------------------------------------------------------|---------|----------------------|-----|-------|----------|-----|----------|-----|
|                           |             |             |                                                       |         | T                    | P   | Total | Internal |     | External |     |
|                           |             |             |                                                       |         |                      |     |       | T        | P   | T        | P   |
| Semester III, Level – 5.0 |             |             |                                                       |         |                      |     |       |          |     |          |     |
| DSC-7                     | DSC         | BOT-DSC-231 | Plant Ecology and Phytogeography                      | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| DSC-8                     | DSC         | BOT-DSC-232 | Cell Biology                                          | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| DSC-9                     | DSC         | BOT-DSC-233 | Practical course based on BOT-DSC-231                 | 2       | ---                  | 4   | 4     | ---      | 20  | ---      | 30  |
| DSC-10                    | DSC         | BOT-DSC-234 | Practical course based on BOT-DSC-232                 | 2       | ---                  | 4   | 4     | ---      | 20  | ---      | 30  |
| MIN-5                     | MIN         | BOT-MIN-231 | Applied Botany                                        | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| MIN-6                     | MIN         | BOT-MIN-232 | Mushroom Culture                                      | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| MIN-7                     | MIN         | BOT-MIN-233 | Practical course based on BOT-MIN-231 and BOT-MIN-232 | 2       | ---                  | 4   | 4     | ---      | 20  | ---      | 30  |
| OE-3                      | OE          | BOT-OE-231  | Biofertilizer                                         | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| CEP                       | CEP         | BOT-CEP-231 | Community Engagement Program                          | 2       | ---                  | 4   | 4     | 50       | --- | ---      | --- |
| Semester IV, Level – 5.0  |             |             |                                                       |         |                      |     |       |          |     |          |     |
| DSC-11                    | DSC         | BOT-DSC-241 | Horticulture                                          | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| DSC-12                    | DSC         | BOT-DSC-242 | Plant Physiology                                      | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| DSC-13                    | DSC         | BOT-DSC-243 | Practical course based on BOT-DSC-241                 | 2       | ---                  | 4   | 4     | ---      | 20  | ---      | 30  |
| DSC-14                    | DSC         | BOT-DSC-244 | Practical course based on BOT-DSC-242                 | 2       | ---                  | 4   | 4     | ---      | 20  | ---      | 30  |
| MIN-8                     | MIN         | BOT-MIN-241 | Plant Biotechnology                                   | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| MIN-9                     | MIN         | BOT-MIN-242 | Practical course based on BOT-MIN-241                 | 2       | ---                  | 4   | 4     | ---      | 20  | ---      | 30  |
| OE-4                      | OE          | BOT-OE-241  | Plant Propagation                                     | 2       | 2                    | --- | 2     | 20       | --- | 30       | --- |
| OE-5                      | OE          | BOT-OE-242  | Practical course based on BOT-OE-241                  | 2       | ---                  | 4   | 4     | ---      | 20  | ---      | 30  |
| FP                        | FP          | BOT-FP-241  | Field Project                                         | 2       | ---                  | 4   | 4     | 50       | --- | ---      | --- |

### Exam Pattern

- Each theory and practical course will be of 50 marks comprising of 10 marks internal and 40 marks external examination.

### External Theory Examination (30 marks)

- External examination will be of two hours duration for each theory course. There shall be 4 questions each carrying equal marks (10 marks each) while the tentative pattern of question papers shall be as follows;
- Q1 (A), Q2 (A) and Q3 (A), each will be of 6 marks (attempt any 2 out of 3 sub-questions).
- Q1 (B), Q2 (B) and Q3 (B), each will be of 4 marks (attempt any 1 out of 2 sub-questions).

- Q4 will be of 10 marks (attempt any 2 out of 3 sub-questions).

**External Practical Examination (30 marks):**

- Practical examination shall be conducted by the respective department at the end of the semester. Practical examination will be of minimum 3 hours duration and shall be conducted as per schedule. There shall be 05 marks for journal, 10 marks for *viva-voce*. Certified journal is compulsory to appear for practical examination.

**Internal Theory/ Practical Examination(10 marks):**

- Internal theory assessment of the student by respective teacher will be comprehensive and continuous, based on written test/ assignment. The written test may comprise of both objective and subjective type questions.
- Internal practical examination should be conducted by respective department as per schedule given. For internal practical examination student should perform at least one major and one minor experiment and should have completed journal.

# **SEMESTER-III**

**S.Y. B.Sc. Botany (Major)**  
**Semester-III**  
**BOT-DSC-231: Plant Ecology and Phytogeography**

**Total Hours: 30**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <b>Course objectives:</b> <ul style="list-style-type: none"> <li>To know the core concept of biotic and abiotic factors</li> <li>To study various types of ecological adaptation and concepts of population ecology</li> <li>To study different plant communities and ecosystem concept</li> <li>To study energy sources of ecological system</li> <li>To know the functional aspects of ecosystem and phytogeography and its divisions</li> </ul>                     |              |
| <b>Course outcomes</b>   | After studying this course the students will be able to: <ul style="list-style-type: none"> <li>Students will Understand core concepts of biotic and abiotic interactions, community concept and succession</li> <li>Students will analysis the phytogeography or phytogeographical division of India</li> <li>Students will Evaluate energy sources of ecological system</li> <li>Students will Assess the adaptation of xerophytic and hydrophytic plants</li> </ul> |              |
| <b>Unit</b>              | <b>TopicParticular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Hours</b> |
| <b>Unit I</b>            | <b>Introduction and ecological adaptation:</b> <ul style="list-style-type: none"> <li>Basic concepts; Levels of organization. Abiotic and biotic Components andtheir interrelationships and dynamism, homeostasis.</li> <li>Study of xerophytic and hydrophytic adaptations in plants(Morphological)</li> </ul>                                                                                                                                                        | <b>8</b>     |
| <b>Unit II</b>           | <b>Biotic Interaction:</b> <ul style="list-style-type: none"> <li>Biotic interactions: Competition: Inter- and intraspecific competition; Ammensalism, heterotrophy; mutualism, commensalism, parasitism; herbivory, carnivory, proto cooperation.</li> </ul>                                                                                                                                                                                                          | <b>7</b>     |
| <b>Unit III</b>          | <b>Plant Communities and Ecosystem:</b> <ul style="list-style-type: none"> <li><b>Community concept:</b> structure,Habitat and niche; Ecotone and edge effect;</li> <li><b>Succession:</b> processes, types; climax concept. Primary vs Secondary succession.</li> <li><b>Ecosystem:</b> Structure; Processes; Trophic organization; Food chains and Food webs; Ecological pyramids. Ecosystems of India.</li> </ul>                                                   | <b>8</b>     |
| <b>Unit IV</b>           | <b>Functional Aspects of Ecosystem and Phytogeography</b> <ul style="list-style-type: none"> <li>Principles and models of energy flow; Biogeochemical cycles of carbon, nitrogen and phosphorus.</li> <li><b>Phytogeography:</b> Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate &amp; tundra); Phyto-geographical division of India; Local Vegetation.</li> </ul>      | <b>7</b>     |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <b>Study Resources</b> | <ul style="list-style-type: none"> <li>• Bhojwani, S.S. and Razdan, M.K., (1996), Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.</li> <li>• Glick, B.R., Pasternak, J.J. (2003), Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.</li> <li>• A. Slater, N.W. Scott and M.R. Fowler (2008), Plant Biotechnology. Second Edition. Oxford.</li> <li>• Snustad, D.P. and Simmons, M.J. (2010), Principles of Genetics. John Wiley and Sons, U.K.</li> <li>• Stewart, C.N. Jr. (2008), Plant Biotechnology &amp; Genetics: Principles, Techniques and Applications. John Wiley &amp; Sons Inc. U.S.A.</li> <li>• Chrispeels, M.J. and Sadava, D.E. (1994), Plants, Genes and Agriculture. Jones &amp; Bartlett Publishers.</li> <li>• N. Santosh and A. Madhavi. (2010), Practical Book of Biotechnology and Plant Tissue Culture. S. Chand &amp; Co.</li> </ul> |  |
|------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

**S.Y. B.Sc. Botany (Major)**  
**Semester-III**  
**BOT-DSC-232: Cell Biology**

**Total Hours: 30**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |              |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <ul style="list-style-type: none"> <li>To introduce the students with “Cell Science”.</li> <li>To study Cell wall Plasma membrane, Cell organelles and cell division.</li> <li>To study the scope and importance of molecular biology.</li> <li>To study the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.</li> <li>To understand the process of synthesis of proteins and role of genetic code in polypeptide formation.</li> </ul>                                                                                 |              |
| <b>Course outcomes</b>   | After studying this course: <ul style="list-style-type: none"> <li>Students will be well versed with cell science</li> <li>Student will acquire the knowledge of Cell organelles and cell division</li> <li>Students will know the scope and importance of molecular biology</li> <li>Student will familiar with biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material.</li> <li>Students will be acquainted with knowledge of process of synthesis of proteins and role of genetic code in polypeptide formation.</li> </ul> |              |
| <b>Unit</b>              | <b>TopicParticular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Hours</b> |
| <b>Unit I</b>            | <b>Introduction of Cell Biology:</b><br>Definition and history.<br>Discovery of cell, definition of cell and cell theory.<br>Basic properties of cell:- complex and organised, cell reproduction,utilization of energy, response to stimuli, self-regulation and evolution.                                                                                                                                                                                                                                                                                                                          | <b>8</b>     |
| <b>Unit II</b>           | <b>Types of Cell:</b><br>Characteristics of prokaryotic and Eukaryotic cells.<br>Types of prokaryotic cells.<br>Types of eukaryotic cells.<br>Viruses and viroids.                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>7</b>     |
| <b>Unit III</b>          | <b>Structural Organization of Cell:</b><br>Plasma membrane, cell wall, chemical composition, structure. Functions of cell wall and plasma membrane.<br>Cytoplasm – Physical nature of matrix chemical organization of matrix<br>Endoplasmic reticulum<br>Golgi complex<br>Mitochondria<br>Plastids<br>Nucleus of eukaryotic                                                                                                                                                                                                                                                                          | <b>8</b>     |
| <b>Unit IV</b>           | <b>Chromosome:</b><br>Number, size, shape, morphology, karyotype<br>euchromatineandheterochromatin. Chemical composition of – chromatin, nucleosomesolenoid, loop and scaffold.<br>Molecular organization – Chromatid chromosomes, arms primary andsecondary constriction – telomere, satellite. Type of chromosomes as perposition of centromere.                                                                                                                                                                                                                                                   | <b>7</b>     |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                        | Special type of chromosomes - lamp brush chromosome and salivary gland chromosome, Bacterial and plasmid chromosome.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
| <b>Study Resources</b> | <ul style="list-style-type: none"> <li>• Biology – New edition of KARP Gerald Karp</li> <li>• Cell and Molecular biology, E.D.P. De Robertis &amp; De Robertis</li> <li>• Cell biology Vishwa Nath (S. Chand &amp; company ltd.)</li> <li>• Cell Biology E.D.P. De Robertis &amp; De Robertis (Sixth edition, W.B. Saunders company ltd.)</li> <li>• Cell biology Y.K Mehta (Sonali Publication, 2012)</li> <li>• Cytology P.S Verma &amp; V.K Agrawal (S. Chand &amp; company ltd. 2008).</li> <li>• Cell biology C.B. Pawar (1983)</li> <li>• A textbook of Molecular biology Gupta P.K (Rastogi publication, 1999)</li> <li>• Molecular biology, Sambamurty, A.V.S.S (2008)</li> <li>• Cytogenetics Sunder Rajan, S (2004, Anmol publication)</li> <li>• Concept in molecular biology Sharma V.N, A. Tandon (2004, Anmol publication)</li> <li>• Cell biology, Genetics, Molecular biology, Evolution and Ecology, Verma P.S &amp; V.K. Agrawal (2008, S. Chand &amp; company ltd.)</li> <li>• Genetics (Volume I and II, 2012) C.B. Powar (Himalaya publishing house, Practicals based on the syllabus.</li> </ul> |  |

**S.Y. B.Sc. Botany (Major)**  
**Semester-III**  
**BOT-DSC-233: Practical course based on BOT-DSC-231**

**Total Hours: 60**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |
|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course Objectives</b> | <ul style="list-style-type: none"> <li>To study the methods of vegetation studies.</li> <li>To know scope and importance of the discipline.</li> <li>To study plant communities and ecological adaptations in plants</li> <li>To know the methods of testing soil samples and quality</li> <li>To know the techniques of measurements of water quality</li> </ul>                                                               |              |
| <b>Course Outcomes</b>   | <b>After successful completion of this course, students are expected to:</b> <ul style="list-style-type: none"> <li>Study the methods of vegetation studies.</li> <li>Know scope and importance of the discipline.</li> <li>Study plant communities and ecological adaptations in plants</li> <li>Know the methods of testing soil samples and quality</li> <li>Know the techniques of measurements of water quality</li> </ul> |              |
| <b>Sr. No.</b>           | <b>Particulars</b>                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Hours</b> |
| <b>1</b>                 | To determine the minimum size of the quadrat by 'species area curve method'.                                                                                                                                                                                                                                                                                                                                                    | 4            |
| <b>2</b>                 | Study of soil with reference to soil texture, water holding capacity, pH                                                                                                                                                                                                                                                                                                                                                        | 4            |
| <b>3</b>                 | Study of soil with reference to Test for carbonate, nitrate, and sulphate.                                                                                                                                                                                                                                                                                                                                                      | 4            |
| <b>4-5</b>               | Demonstration, working and uses of any three of the following ecological instruments: i) Rain gauge ii) Cup anemometer iii) Hair hygrometer iv) Soil thermometer v) Minimum and maximum thermometer vi) Dry and wet bulb thermometer                                                                                                                                                                                            | 4X4          |
| <b>6-7</b>               | To study the vegetation by list count quadrat method. Calculate frequency density, abundance and plot a graph of frequency classes.                                                                                                                                                                                                                                                                                             | 4X4          |
| <b>8</b>                 | Study of morphological and anatomical adaptation in locally available hydrophyte (any two of each)                                                                                                                                                                                                                                                                                                                              | 4            |
| <b>9</b>                 | Study of morphological and anatomical adaptation in locally available Xerophyte (any two of each)                                                                                                                                                                                                                                                                                                                               | 4            |
| <b>10</b>                | Study of morphological and anatomical adaptation in locally available Epiphyte (any one)                                                                                                                                                                                                                                                                                                                                        | 4            |
| <b>11</b>                | Measurement of water quality based on –hardness, Dissolved oxygen, free CO <sub>2</sub> , Chloride, Total alkalinity                                                                                                                                                                                                                                                                                                            | 4            |
| <b>12</b>                | Measurement of water quality based on –hardness                                                                                                                                                                                                                                                                                                                                                                                 | 4            |
| <b>13</b>                | Measurement of water quality based on – Dissolved oxygen,                                                                                                                                                                                                                                                                                                                                                                       | 4            |
| <b>14</b>                | Measurement of chloride and Total alkalinity in water sample                                                                                                                                                                                                                                                                                                                                                                    | 4            |
| <b>15</b>                | Measurement of water quality based on –free CO <sub>2</sub>                                                                                                                                                                                                                                                                                                                                                                     | 4            |
| <b>Study Resources</b>   | <ul style="list-style-type: none"> <li>Bhojwani, S.S. and Razdan, M.K., (1996), Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam.</li> </ul>                                                                                                                                                                                                                                                               |              |

|  |                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
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|  | <p>The Netherlands.</p> <ul style="list-style-type: none"> <li>• Glick, B.R., Pasternak, J.J. (2003), Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.</li> <li>• A. Slater, N.W. Scott and M.R. Fowler (2008), Plant Biotechnology. Second Edition. Oxford.</li> <li>• Snustad, D.P. and Simmons, M.J. (2010), Principles of Genetics. John Wiley and Sons, U.K.</li> </ul> |  |
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**Note: At least 12 experiments should be performed.**

**S.Y. B.Sc. Botany (Major)**  
**Semester-III**  
**BOT-DSC-234: Practical course based on BOT-DSC-232**

**Total Hours: 60**

**Credits:2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                 |              |
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| <b>Course Objectives</b> | <ul style="list-style-type: none"> <li>To introduce the students with “Cell Science”.</li> <li>To study Cell wall Plasma membrane, Cell organelles and cell division.</li> <li>To study the types of cell.</li> <li>To acquaint with the methods of studying mitosis and meiosis.</li> <li>To provide with the knowledge of different types of chromosomes.</li> </ul>                                                                          |              |
| <b>Course Outcomes</b>   | <p>After studying this course students will be :</p> <ul style="list-style-type: none"> <li>Introduce with the students with “Cell Science”.</li> <li>Able to understand Cell wall Plasma membrane, Cell organelles and cell division.</li> <li>Able to learn about the types of cell.</li> <li>Acquainted with the methods of studying mitosis and meiosis.</li> <li>Provided with the knowledge of different types of chromosomes.</li> </ul> |              |
| <b>Sr. No.</b>           | <b>Particulars</b>                                                                                                                                                                                                                                                                                                                                                                                                                              | <b>Hours</b> |
| 1                        | Study of mitotic stages in suitable root tip materials by squash method.                                                                                                                                                                                                                                                                                                                                                                        | 4            |
| 2                        | Study of mitotic stages in suitable root tip materials by squash method.                                                                                                                                                                                                                                                                                                                                                                        | 4            |
| 3                        | Study of meiotic stages in suitable floral bud materials by smear method                                                                                                                                                                                                                                                                                                                                                                        | 4            |
| 4                        | Study of meiotic stages in suitable floral bud materials by smear method                                                                                                                                                                                                                                                                                                                                                                        | 4            |
| 5                        | Study of polytene chromosome (P.S.)                                                                                                                                                                                                                                                                                                                                                                                                             | 4            |
| 6                        | Study of Lampbrush chromosome (P. S. )                                                                                                                                                                                                                                                                                                                                                                                                          | 4            |
| 7                        | Study of Structure of Plasma membrane                                                                                                                                                                                                                                                                                                                                                                                                           | 4            |
| 8                        | Study of Structure of cell wall                                                                                                                                                                                                                                                                                                                                                                                                                 | 4            |
| 9                        | Types of cell (Photograph and P. S.)<br>i. Prokaryotic cells.                                                                                                                                                                                                                                                                                                                                                                                   | 4            |
| 10                       | Types of cell (Photograph and P. S.)<br>ii. Eukaryotic cells                                                                                                                                                                                                                                                                                                                                                                                    | 4            |
| 11                       | Study of cell organelles (Photograph)<br>i. Endoplasmic reticulum<br>ii. Golgi complex                                                                                                                                                                                                                                                                                                                                                          | 4            |
| 12                       | Study of cell organelles (Photograph)<br>i. Lysosomes<br>ii. Mitochondria                                                                                                                                                                                                                                                                                                                                                                       | 4            |
| 13                       | Study of cell organelles (Photograph)<br>i. Plastids<br>ii. Ribosomes                                                                                                                                                                                                                                                                                                                                                                           | 4            |
| 14                       | Lytic and Lysogenic cycle of Viruses(Photographs)                                                                                                                                                                                                                                                                                                                                                                                               | 4            |
| 15                       | Study of size, shape and structure of chromosomes (Metacentric, acrocentric, telocentric etc.) with the help of Photographs                                                                                                                                                                                                                                                                                                                     | 4            |
| <b>Study Resources</b>   | <ul style="list-style-type: none"> <li>Cell and Molecular biology, E.D.P. De Robertis&amp; De Robertis</li> <li>Cell biology VishwaNath (S. Chand &amp; company ltd.)</li> <li>Cell Biology E.D.P. De Robertis&amp; De Robertis( Sixth edition, W.B.Saunders company ltd.)</li> <li>Cytology P.S Verma&amp; V.K Agrawal (S. Chand &amp; company ltd. 2008).</li> <li>Cell biology C.B.Pawar (1983)</li> </ul>                                   |              |

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|  | <ul style="list-style-type: none"> <li>• A textbook of Molecular biology Gupta P.K (Rastogi publication, 1999)</li> <li>• Molecular biology, Sambamurty, A.V.S.S (2008)</li> </ul> |  |
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**Note: At least 12 experiments should be performed.**

**S.Y. B.Sc. Botany (Minor)**  
**Semester-III**  
**BOT-MIN- 231: Applied Botany**

**Total Hours: 30**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <b>Course objectives:</b> <ul style="list-style-type: none"> <li>To know importance and scope of botanical science in the industries.</li> <li>To study role of microbial plants in fermentations process.</li> <li>To study the process of cultivation of cash crops.</li> <li>To study some plants which are used as herbal cosmetics.</li> <li>To study technique of plant tissue culture and its application.</li> <li>To study the role plants in forensic science</li> </ul>                                                                                                                                                                                                                                                                                                                                                                           |              |
| <b>Course outcomes</b>   | After studying this course the students will be able to: <ul style="list-style-type: none"> <li>Students will understand importance and scope of botanical science in the industries.</li> <li>Students will study role of microbial plants in fermentations process.</li> <li>Students will study the process of cultivation of cash crops.</li> <li>Students will study some plants which are used as herbal cosmetics.</li> <li>Students will study technique of plant tissue culture and its application.</li> <li>Students will study the role plants in forensic science</li> </ul>                                                                                                                                                                                                                                                                    |              |
| <b>Unit</b>              | <b>TopicParticular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>Hours</b> |
| <b>Unit I</b>            | <b>Introduction of Applied Botany and Forensic Science:</b><br>Introduction, Scope and importance of Applied botany and Forensic science.<br>Role of following plants in Forensic Botany <ul style="list-style-type: none"> <li>a) Cannabis sativa (Jute)</li> <li>b) Jatropha curcas (Chandrajyot)</li> <li>c) Argemonemexicana (Yellow poppy)</li> <li>d) Abrusprecatorius (Gunj)</li> <li>e) Datura metal (Datura)</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                             | <b>8</b>     |
| <b>Unit II</b>           | <b>2.1 Herbal Cosmetics:</b><br>Introduction and Definition and multiple benefits of medicinal plants.<br>Types of Herbal cosmetics w.r.t. Botanical source, characteristics, plant part used and uses of the following: <ul style="list-style-type: none"> <li>A. Skin Care: (i) Korphad (ii) Sandal wood (iii) Turmeric (iv) Cucumber</li> <li>B. Hair Care: (i) Henna (ii) Hibiscus (iii) Amla (iv) Shikekai</li> <li>C. Dental Care: (i) Neem (ii) Babool (iii) Khair (iv) Bakul</li> </ul> Preparation of Aloe vera gel (for skin)<br>Preparation of jaswand gel (for hair) <b>2.2 Ayurvedic Medicines</b><br>Preparation of following Ayurvedic medicines with respect to Botanical Source, Part used and methods of preparation: <ul style="list-style-type: none"> <li>Triphalachurna</li> <li>Kumariasav</li> <li>Arjunarishta (Aristha)</li> </ul> | <b>7</b>     |

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|                        | <ul style="list-style-type: none"> <li>• Rosha and Khas oil</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |          |
| <b>Unit III</b>        | <b>Adulteration in Plant Products:</b> <ul style="list-style-type: none"> <li>• Introduction and definition</li> <li>• Standard characteristics, possible adulterants, detection tests for adulteration and hazardous effects of following: <ul style="list-style-type: none"> <li>a. Cereals: Bajra</li> <li>b. Pulses: Chick pea (Gram)</li> <li>c. Oils: Groundnut oil</li> <li>d. Spices: Black Pepper, Red Pepper and Turmeric.</li> <li>e. Beverages: Tea and Coffee</li> </ul> </li> </ul>                                                                                                                                                                                      | <b>8</b> |
| <b>Unit IV</b>         | <ul style="list-style-type: none"> <li>• <b>Social forestry:</b></li> <li>• Introduction, definition, scope and importance</li> <li>• Social forestry practices- Farm forestry, recreation forestry, extension forestry</li> <li>• Choice of species for social forestry</li> <li>• Tree crop husbandry of any one of the following with reference to :a) Method of propagation<br/>b) Planting and after care<br/>c) Harvesting &amp; uses: Eucalyptus/ Neem / Subabul</li> </ul> <p>Social forestry: A tool of integrated rural development.</p>                                                                                                                                     | <b>7</b> |
| <b>Study Resources</b> | <ul style="list-style-type: none"> <li>• Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming AktaPrakashan, Nadiad</li> <li>• S.K. Jain, Manual of Ethno botany, Scientific Publishers, Jodhpur, 1995.</li> <li>• S.K. Jain (ed.) Glimpses of Indian. Ethnobotany, Oxford and I B H, New Delhi – 1981</li> <li>• Dubey, R.C. and D, K.Maheshwari, 2007. A textbook of Microbiology, S.Chand and Company, New Delhi.</li> <li>• S.N. Negi. Hand book of Social Forestry</li> <li>• M. SitaramRao . Social Forestry</li> <li>• Thankamma (1975). Food, drugs &amp; cosmetics. A consumer guide, The Mac Millan company of India Ltd. Delhi, Mumbai.</li> </ul> |          |

**S.Y. B.Sc. Botany (Minor)**  
**Semester-III**  
**BOT-MIN-232: Mushroom Culture**

**Total Hours: 30**

**Credits: 2**

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|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <b>Course objectives:</b> <ul style="list-style-type: none"> <li>To learn the history, scope and importance of mushroom technology</li> <li>To understand nutritional and medicinal values of edible mushrooms</li> <li>To know about the storage, marketing and various food preparations of mushrooms.</li> <li>To understand the economics of mushroom cultivation</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                             |              |
| <b>Course outcomes</b>   | After studying this course the students will be able to: <ul style="list-style-type: none"> <li>Understand history scope and importance of Mushroom Culture Technology</li> <li>Get the knowledge of nutritional and medicinal values of edible mushrooms</li> <li>Aware the storage, marketing and various food preparations of mushrooms.</li> <li>Understand the economics of mushroom cultivation.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                            |              |
| <b>Unit</b>              | <b>Topic Particular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Hours</b> |
| <b>Unit I</b>            | <b>Introduction to Mushroom Culture:</b> <ul style="list-style-type: none"> <li>Introduction, Scope and importance of Mushroom Culture</li> <li>Nutritional and medicinal value of edible mushrooms.</li> <li>Edible and non-edible mushrooms.</li> <li>Morphology and distinguishing characteristics of following mushrooms:               <ol style="list-style-type: none"> <li>Button (<i>Agaricus bisporus</i>)</li> <li>Oyster (<i>Lentinus sajor-caju</i>, Syn. <i>Pleurotus sajor-caju</i>)</li> <li>Paddy straw (<i>Volvariella volvacea</i>)</li> </ol> </li> <li><b>Cultivation Technology:</b></li> <li>Mushroom farm layout and requirement</li> <li>Materials for compost preparation, Different formulations, Selection of composting materials, commonly used formulations, Synthetic compost and its advantages.</li> </ul> | <b>8</b>     |
| <b>Unit II</b>           | <ul style="list-style-type: none"> <li>Spore culture and preparation of spawn.</li> <li>Casing and its Importance, Quality parameters of casing mixture and commonly used materials for casing.</li> <li>Cultivation procedure of: a. <i>Agaricus bisporus</i> b. <i>Pleurotus sajor-caju</i>.</li> <li>Some important tips for growing mushrooms successfully</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>7</b>     |
| <b>Unit III</b>          | <b>Common Problems in mushroom growing:</b> <ul style="list-style-type: none"> <li>Media preparation or culture</li> <li>Preparation of mother spawn (Grain Culture)</li> <li>Preparation of mother spawn (Sawdust Culture)               <ul style="list-style-type: none"> <li>Preparation of planting spawn</li> <li>Outdoor bed tech for <i>Volvariella</i> sp.</li> <li>Sawdust tech (<i>Pleurotus</i>, <i>Lentinula</i>, <i>Auricularia</i>)</li> </ul> </li> </ul>                                                                                                                                                                                                                                                                                                                                                                    | <b>8</b>     |
| <b>Unit IV</b>           | <b>Storage</b> <ul style="list-style-type: none"> <li>Short-term storage (Refrigeration - upto 24 hours)</li> <li>Long term storage (canning, pickling). Drying, storage in salt solutions.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <b>7</b>     |

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|                        | <ul style="list-style-type: none"> <li>• Marketing</li> </ul> <b>Food Preparation</b> <ul style="list-style-type: none"> <li>• Types of foods prepared from mushroom: Soup, Cutlet, Omlette, Samosa, Pickles and Curry.</li> <li>• Training Centres: National and Regional level.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| <b>Study Resources</b> | <ul style="list-style-type: none"> <li>• Marimuthu, T. Krishnamoorthi, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore.</li> <li>• Swarninathan, M. (1990) Food and Nutrition. Bappa Co, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore -560018.</li> <li>• S.C. Tewari. Pankaj Kapoor, (1988). Mushroom Cultivation, Mittal Publications. Delhi.</li> <li>• Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition. Vol. I and Vol. II.</li> <li>• Vijaya Khader (1993) Mushrooms for Livelihood. Kalyani Publishers. Pp 170.</li> <li>• D. P. Tripathi (2005) Mushroom cultivation. Oxford IBH Publishing Co. Pvt. Ltd. Pp 354.</li> <li>• S.C. Tiwari and Pankaj Kapoor. (1988) Mushroom Cultivation. Mittal Publications, Delhi. pp.-127</li> <li>• P.K. Khanna and S. Kappor (2007) Manual of mushroom production. Dept. of Microbiology. College of Basic Sciences and Humanities, Punjab Agriculture University, Ludhiana. pp. 86-90</li> <li>• V. Kumarsan, Mushroom Cultivation, Saras Publication, PP-324</li> <li>• V. N. Pathak, Nagendra Yadav and Manesh Gaur (2018) Mushroom Production and Processing Technology Agrobios, PP-176.</li> </ul> |  |

**S.Y. B.Sc. Botany (Minor)**  
**Semester-III**

**BOT-MIN-233: Practical course based on BOT-MIN-231 and BOT-MIN-232**

**Total Hours: 60**

**Credits: 2**

|                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |       |
|-------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------|
| Course Objectives | <ul style="list-style-type: none"><li>• To learn the method of preparation of Aloe vera gel and Jaswand gel</li><li>• To learn the methods of detection of adulteration in food products</li><li>• To provide the knowledge of mushroom cultivation and its techniques</li><li>• To give the knowledge of spawn and spawn making</li><li>• To make aware with the food products made from mushroom</li></ul>                                                             |       |
| Course Outcomes   | After successful completion of this course, students are expected to: <ul style="list-style-type: none"><li>• Learn the method of preparation of Aloe vera gel and Jaswand gel</li><li>• Study the methods of detection of adulteration in food products</li><li>• Acquainted with the knowledge of mushroom cultivation and its techniques</li><li>• Get the knowledge of spawn and spawn making</li><li>• Be aware with the food products made from mushroom</li></ul> |       |
| Sr. No.           | Particulars                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Hours |
| 1                 | Preparation of following Ayurvedic medicines with respect to Botanical Source, Part used and methods of preparation: Triphalachurna                                                                                                                                                                                                                                                                                                                                      | 4     |
| 2                 | Preparation of following Ayurvedic medicines with respect to Botanical Source, Part used and methods of preparation: Kumariasav                                                                                                                                                                                                                                                                                                                                          | 4     |
| 3                 | Preparation of following Ayurvedic medicines with respect to Botanical Source, Part used and methods of preparation: Arjunarishta (Aristha)                                                                                                                                                                                                                                                                                                                              | 4     |
| 4                 | Preparation of following Ayurvedic medicines with respect to Botanical Source, Part used and methods of preparation: Rosha and Khas oil                                                                                                                                                                                                                                                                                                                                  | 4     |
| 5                 | detection tests for adulteration of following plant products: (Any 4 locally available material)<br>a. Cereals: Bajra<br>b. Pulses: Chick pea (Gram)<br>c. Oils: Groundnut oil<br>d. Spices: Black Pepper, Red Pepper and Turmeric.<br>e. Beverages: Tea and Coffee                                                                                                                                                                                                      | 4     |
| 6                 | Preparation of Aloe vera gel (for skin)                                                                                                                                                                                                                                                                                                                                                                                                                                  | 4     |
| 7                 | Preparation of Jaswand gel (for hair)                                                                                                                                                                                                                                                                                                                                                                                                                                    | 4     |
| 8                 | Study of Method of preparation of Media culture for mushroom cultivation                                                                                                                                                                                                                                                                                                                                                                                                 | 4     |
| 9                 | Study of Method of Preparation of mother spawn (Grain Culture)                                                                                                                                                                                                                                                                                                                                                                                                           | 4     |
| 10                | Study of Method of Preparation of mother spawn (Sawdust Culture)                                                                                                                                                                                                                                                                                                                                                                                                         | 4     |
| 11                | Cultivation procedure of: <i>Agaricusbisporus</i>                                                                                                                                                                                                                                                                                                                                                                                                                        | 4     |
| 12                | Cultivation procedure of: <i>Pleurotussajor-caju</i>                                                                                                                                                                                                                                                                                                                                                                                                                     | 4     |
| 13                | Study of Mushroom farm layout and requirement                                                                                                                                                                                                                                                                                                                                                                                                                            | 4     |
| 14-15             | Study of Methods of preparing foods from mushroom: Soup, Cutlet                                                                                                                                                                                                                                                                                                                                                                                                          | 8     |

|                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |  |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| <p style="text-align: center;"><b>Study<br/>Resources</b></p> | <ul style="list-style-type: none"> <li>• Vayas, S.C, Vayas, S. and Modi, H.A. 1998 Bio-fertilizers and organic Farming AktaPrakashan, Nadiad</li> <li>• S.K. Jain, Manual of Ethno botany, Scientific Publishers, Jodhpur, 1995.</li> <li>• Dubey, R.C. and D, K.Maheshwari, 2007. A textbook of Microbiology, S.Chand and Company, New Delhi.</li> <li>• S.N. Negi. Hand book of Social Forestry</li> <li>• M. SitaramRao . Social Forestry</li> <li>• Thankamma (1975). Food, drugs &amp; cosmetics. A consumer guide, The Mac Millan company of India Ltd. Delhi, Mumbai.</li> <li>• Swarninathan, M. (1990) Food and Nutrition. Bappco, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore - 560018.</li> <li>• S.C. Tewari. Pankaj Kapoor, (1988). Mushroom Cultivation, Mittal Publications. Delhi.</li> <li>• S.C. Tiwari and Pankaj Kapoor. (1988) Mushroom Cultivation. Mittal Publications, Delhi. pp.-127</li> <li>• P.K. Khanna and S. Kappor (2007) Manual of mushroom production. Dept. of Microbiology. College of Basic Sciences and Humanities, Punjab Agriculture University, Ludhiana. pp.86-90</li> <li>• V. Kumarsan, Mushroom Cultivation, Saras Publication, PP-324</li> </ul> |  |
|---------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|

**Note: At least 12 experiments should be performed.**

**S.Y. B.Sc. Botany (Open Elective)**  
**Semester-III**  
**BOT-OE-231: Biofertilizer**

**Total Hours: 30**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <ul style="list-style-type: none"> <li>To understand core concepts of Biofertilizer and relate with Organic farming</li> <li>To develop critical understanding on the importance of biofertilizers, organic farming</li> <li>To develop a basic knowledge of organic farming and important biofertilizer uses and development</li> <li>To increase the awareness and appreciation of biofertilizers and organic farming</li> </ul>                                                         |              |
| <b>Course outcomes</b>   | <p>After studying this course the students will be able to:</p> <ul style="list-style-type: none"> <li>Understand core concepts of Biofertilizer and relate with Organic farming</li> <li>Develop critical understanding on the importance of biofertilizers, organic farming</li> <li>Develop a basic knowledge of organic farming and importance of biofertilizer uses and development</li> <li>Increase the awareness and appreciation of biofertilizers and organic farming</li> </ul> |              |
| <b>Unit</b>              | <b>Topic Particular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | <b>Hours</b> |
| <b>Unit I</b>            | Organic farming – Green manuring and organic fertilizers, Recycling of biodegradable municipal, agricultural and Industrial wastes – biocompost making methods, types and method of vermicomposting field application. General account about the microbes used as biofertilizer – Rhizobium – isolation, identification, mass multiplication, carrier based inoculants, Actinorrhizal symbiosis.                                                                                           | <b>8</b>     |
| <b>Unit II</b>           | Azospirillum: isolation and mass multiplication – carrier based inoculant, associative effect of different microorganisms. Azotobacter: Classification, characteristics – crop response to Azotobacter inoculum, maintenance and mass multiplication.                                                                                                                                                                                                                                      | <b>7</b>     |
| <b>Unit III</b>          | Cyanobacteria (blue green algae), Azolla and Anabaena azolla association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation.                                                                                                                                                                                                                                                                                                                    | <b>8</b>     |
| <b>Unit IV</b>           | Mycorrhizal association, types of mycorrhizal association, taxonomy, occurrence and distribution, phosphorus nutrition, growth and yield – colonization of VAM – isolation and inoculum production of VAM, and its influence on growth and yield of crop plants.                                                                                                                                                                                                                           | <b>7</b>     |
| <b>Study Resources</b>   | <ul style="list-style-type: none"> <li>Kumaresan, V. (2005). Biotechnology. New Delhi, Delhi: Saras Publication.</li> <li>Sathe, T.V. (2004). Vermiculture and Organic Farming. New Delhi, Delhi: Daya publishers.</li> <li>Subha Rao, N.S. (2000). Soil Microbiology. New Delhi, Delhi: Oxford &amp; IBH Publishers.</li> </ul>                                                                                                                                                           |              |

**S.Y. B.Sc. Botany (Major)**  
**Semester-III**  
**BOT-CEP-231: Community Engagement Program (CEP)**

**Course Structure : 2 Credits**

**Contact hours : 60 hours**

In alignment with the National Education Policy (NEP) 2020, Moolji Jaitha College (Autonomous), Jalgaon is introducing the Community Engagement Program at the undergraduate level. The NEP 2020 emphasizes holistic development, inclusivity, and integrating vocational education with academic learning, aiming to nurture socially responsible individuals. Inspired by NEP 2020, the Community Engagement Program aim to produce knowledgeable, compassionate, and proactive graduates, contributing to a more just, equitable, and sustainable society. This course fosters a strong connection between education and socioeconomic problems of real-world. Students will learn about the challenges faced by vulnerable households and appreciate local wisdom and lifestyles.

**Objectives**

- To engage students in activities that promote emotional, social, and intellectual growth, fostering a well-rounded approach to personal and academic development.
- To provide hands-on experiences that complement classroom learning, enabling students to apply their knowledge insocioeconomic problems of real-world.
- To instil a sense of responsibility towards the community by encouraging students to actively participate in social and environmental initiatives, appreciate rural culture, lifestyle, and wisdom.

**Learning Outcomes**

After completing this course, students will be able to

- Understand rural and/or urban culture, ethos, and socioeconomic realities.
- Develop a sense of empathy with the local community while appreciating the significant contributions of local communities to society and the economy.
- Learn to value the local community wisdom and identify opportunities for contributing to the community's socioeconomic improvements.

**Activities**

- Conduct workshops and interactive sessions on emotional intelligence and social skills.
- Organize debates, discussions, and intellectual challenges that stimulate critical thinking and socioeconomic problem-solving using concern subject.
- Organize field visits where students can work on real-world problems, such as environmental conservation, rural and/or urban planning, or community health.
- Organize internships or service-learning opportunities with local businesses, NGOs, or government agencies.
- Facilitate project-based learning activities that require students to use their academic knowledge to develop solutions to community issues.
- Engage students in community service activities that address local social and environmental issues.
- Organize cultural exchange programs or field trips to rural areas to foster an appreciation of rural culture and wisdom.
- Facilitate collaborative projects involving students, educators, and community members to develop solutions for local challenges, promoting teamwork and collective problem-solving.
- Conduct educational sessions on the status of various agricultural and development programs and the challenges faced by vulnerable households, ensuring inclusivity and accessibility for all students.

| S. No. | Module Title                                                | Module Content                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Assignment submission                                                                                                                                                                                                                                                        | Teaching/ Learning Methodology                                                            |
|--------|-------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------|
| 1      | <b>Appreciation of Rural Society</b>                        | Rural lifestyle, rural society, caste and gender relations, rural values with respect to community, nature and resources, elaboration of “soul of India lies in villages”, rural infrastructure.                                                                                                                                                                                                                                                                 | Prepare a map (physical, visual or digital) of the village you visited and write an essay about inter-family relations in that village.                                                                                                                                      | – Classroom discussions<br>– Field visit<br>– Assignment                                  |
| 2      | <b>Understanding rural and local economy and livelihood</b> | Agriculture, farming, land ownership, water management, animal husbandry, non-farm livelihoods and artisans, rural entrepreneurs, rural markets, migrant labour.                                                                                                                                                                                                                                                                                                 | Describe your analysis of the rural house hold economy, its challenges and possible pathways to address.<br>Circular economy and migration patterns.                                                                                                                         | – Field visit<br>– Group discussions in class<br>– Assignment                             |
| 3      | <b>Rural and local Institutions</b>                         | Traditional rural and community organisations, Self-help Groups, Panchayati raj institutions (Gram Sabha, Gram Panchayat, Standing Committees), Nagarpalikas and municipalities, local civil society, local administration.                                                                                                                                                                                                                                      | How effectively are Panchayati Raj and Urban Local Bodies (ULBs) institutions functioning in the village? What would you suggest to improve their effectiveness? Present a case study (written or audio-visual).                                                             | – Classroom<br>– Field visit<br>– Group presentation of assignment                        |
| 4      | <b>Rural and National Development Programmes</b>            | History of rural development and current national programmes in India: SarvaShikshaAbhiyan, BetiBachao, BetiPadhao, Ayushman Bharat, Swachh Bharat, PM AwaasYojana, Skill India, Gram Panchayat Decentralised Planning, National Rural Livelihood Mission (NRLM), Mahatma Gandhi National Rural Employment Guarantee Act 2005 (MGNREGA), SHRAM, Jal Jeevan Mission, Scheme of Fund for Regeneration of Traditional Industries (SFURTI), AtmaNirbhar Bharat, etc. | Describe the benefits received and challenges faced in the delivery of one of these programmes in the local community; give suggestions about improving the implementation of the programme for the poor. Special focus on the urban informal sector and migrant households. | – Classroom<br>– Each student selects one program for field visit<br>– Written assignment |

Note: The modules are suggestive in nature and students can opt any one activities for community engagement program and field project based on topic appropriate to their regional community context.

Some additional suggestive themes for field-based / community engagement activities are listed below:

- Management curriculum may include aspects of micro-financing in a rural context;
- Chemistry syllabus can have a component of conducting water and soil analysis in surrounding field areas;
- Political science syllabus could include a mapping of local rural governance institutions and their functioning.
- Environment education will include areas such as climate change, pollution, waste management, sanitation, conservation of biological diversity, management of biological resources and biodiversity, forest and wildlife conservation, and sustainable development and living
- Understanding panchayats and constitutional mandate of local governance
- Panchayat administration, Gram Sabha, Mahila Sabha, Gram Panchayat Development Plan (GPDP), local planning of basic services.
- Micro-finance, SHGs, system of savings and credit for local business, linkages to banks, financial inclusion.
- Rural – entrepreneurship, opportunities for small business in local communities, access to financial and technical inputs to new entrepreneurs.
- Renewable energy, access to household and community level solar and bio-mass systems for sustainable energy use.
- Participatory Monitoring and evaluation of socio-economic development programmes, and cost-benefit analysis of project proposals.
- Migrant workers' livelihood security and social services.
- Hygiene and sanitation, improving health and personal behaviours, locally manageable decentralised systems and awareness against stubble burning.
- Water conservation, traditional practices of storage and harvesting, new systems of distribution and maintenance.
- Women's empowerment, gender inequality at home, community and public spaces, safety of girls and women, access to skills, credit and work opportunities.
- Child security, safety and good parenting, nutrition and health, learning and training for child care.
- Rural Marketing, market research, designing opportunities for rural artisans and crafts, and new products based on demand assessment.
- Community Based Research in Rural Settings, undertaking research that values local knowledge, systematises local practices and tools for replication and scale-up.
- Peri-urban development of informal settlements, mapping and enumeration, design of local solutions.

#### **Assessment:**

- Readings from related literature including e-content and reflections from field visits should be maintained by each student in the form of Field Diary (20 Marks)
- Submission of assignments based on modules assignment submission (details mentioned above) (20 Marks)
- Oral/ Group discussion/ Presentation (10 Marks)

# **SEMESTER-IV**

**S.Y. B.Sc. Botany (Major)**  
**Semester-IV**  
**BOT-DSC-241: Horticulture**

**Total Hours: 30**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |              |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <b>Course objectives:</b> <ul style="list-style-type: none"> <li>To know horticulture, its scope, disciplines and importance</li> <li>To understand different horticultural practices and their methods</li> <li>To study role played by green and polyhouses in horticulture</li> <li>To study production technology, harvesting techniques and marketing of crops grown especially in Khandesh region of Maharashtra</li> <li>To understand methods of preservation and preparation of preserved products prevailing especially in this part of the state</li> </ul>                       |              |
| <b>Course outcomes</b>   | After studying this course the students will be able to: <ul style="list-style-type: none"> <li>Understand horticulture, its scope, disciplines and importance</li> <li>Understand different horticultural practices and their methods</li> <li>Study role played by green and polyhouses in horticulture</li> <li>Study production technology, harvesting techniques and marketing of crops grown especially in Khandesh region of Maharashtra</li> <li>Understand methods of preservation and preparation of preserved products prevailing especially in this part of the state</li> </ul> |              |
| <b>Unit</b>              | <b>Topic Particular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Hours</b> |
| <b>Unit I</b>            | <b>Introduction and Propagation of Horticulture Plants:</b><br>Historical background, Definition, scope and importance,<br>Export and import potential of horticulture crops.<br>Different disciplines of horticulture.<br>Propagation of Horticultural Plants<br>Sexual propagation: Advantages and disadvantages<br>Asexual propagation:<br>i) Methods in brief<br>ii) Advantages and disadvantages                                                                                                                                                                                        | <b>8</b>     |
| <b>Unit II</b>           | <b>Methods of cutting, layering, grafting, budding and pruning of plants.</b><br><b>Role of green house and poly-house in Horticulture</b><br>Definition, scope and importance<br>Details about Green-house and poly-house                                                                                                                                                                                                                                                                                                                                                                   | <b>7</b>     |
| <b>Unit III</b>          | Production technology of some important horticultural crops w.r.t. commercial varieties, climate, soil, cultivation practice, pest and disease management, harvesting and methods of marketing:<br>a) Brinjal b) Banana                                                                                                                                                                                                                                                                                                                                                                      | <b>8</b>     |
| <b>Unit IV</b>           | <ul style="list-style-type: none"> <li>Preservation of Fruits and vegetables</li> <li>Introduction, scope, importance and principles</li> <li>Methods of preservation<br/>               a) Temporary preservation<br/>               i) Asepsis             </li> </ul>                                                                                                                                                                                                                                                                                                                     | <b>7</b>     |

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|------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
|                        | ii) Exclusion of moisture<br>iii) Use of mild antiseptic<br>iv) Pasteurization<br>v) Low temperature<br>b) Permanent preservation<br>i) Sterilization and processing: use of sugar, salts, vinegar or chemicals<br>ii) Drying<br>iii) Ionization radiation<br>c) Preparation of preserved products:<br>i) Mixed fruit jam<br>ii) Wood apple or guava jelly<br>iii) Lemon/ Orange squash<br>iv) Tomato ketchup<br>v) Ready to serve (RTS)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |
| <b>Study Resources</b> | <ul style="list-style-type: none"> <li>• Azad K.C. and Sharma V.K. (2000). Horticulture Technology (Vol I and II). Deep and Deep publications, New Delhi, India.</li> <li>• Bal J.S. (1997) Fruit Growing, Kalyani publication, New delhi, Ludhiyana, India.</li> <li>• Bose, T (1996). Fruits tropical and subtropical. Nayaprakashan, Calcutta, India.</li> <li>• Edmond, J.B. Senn, T.L. Anderew, F.S. and Halfacr, R.G. (1990). Fundamentals of Horticulture. Tata McGraw-Hill Publishing Company Ltd. New Delhi., India.</li> <li>• GirdharlalSiddhappa G.S. and Tondon G.L. (1998). Preservation of fruits and vegetables, ICAR New Delhi, India.</li> <li>• Hartmann, H.T. and Kester (1989). Plant propagation principle and practice. Prentice Hall of India (P) Ltd. New Delhi, India.</li> <li>• Kha, M.R. (1995). Horticulture and Gardening. NiraliPrakashan, Pune, India.</li> <li>• Sen, S (1992). Economic Botany. New Central Book Agency, Calcutta, India.</li> <li>• Sharma, N.K. and Arora, S.K. (1985). New Routes to increase Brinjal production. Fmr. Parlim 20(6) 11-12.</li> <li>• Sharma, V.K. (2004). Advances in Horticulture. Deep &amp; Depp Publication, New Delhi, India.</li> </ul> |  |

**S.Y. B.Sc. Botany (Major)**  
**Semester-IV**  
**BOT-DSC-242: Plant Physiology**

**Total Hours: 30**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <ul style="list-style-type: none"> <li>To know importance and scope of plant physiology.</li> <li>To study plants and plant cells in relation to water.</li> <li>To study the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.</li> <li>To study respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.</li> <li>To study movement of sap and absorption of water in plant body.</li> </ul>                                                                                                                                                                                                                                       |              |
| <b>Course outcomes</b>   | <p>After studying this course the students will be able to:</p> <ul style="list-style-type: none"> <li>Get the knowledge importance and scope of plant physiology.</li> <li>Study the plants and plant cells in relation to water.</li> <li>Get the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways.</li> <li>Study respiration in higher plants with particular emphasis on aerobic and anaerobic respiration.</li> <li>Study movement of sap and absorption of water in plant body.</li> </ul>                                                                                                                                                                       |              |
| <b>Unit</b>              | <b>TopicParticular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | <b>Hours</b> |
| <b>Unit I</b>            | <b>Introduction, scope and Importance</b> <ul style="list-style-type: none"> <li>Properties of water: physical and chemical</li> <li>Diffusion: Definition, mechanism of Diffusion with suitable example,</li> <li>Diffusion Pressure, Graham's Law of Diffusion and significance of Diffusion</li> <li>Osmosis: Introduction Definition, mechanism of osmosis with suitable osmometer, Osmotic pressure, Wall pressure and Turgor pressure, DPD and its relationship with OP, TP, WP, Type of solution-Isotonic, hypotonic and hypertonic solution. Types of osmosis-endo and exosmosis, Plasmolysis and deplasmolysis significance.</li> <li>Imbibition: definition, mechanism, Imbibition pressure, Importance of Imbibition</li> </ul> | <b>8</b>     |
| <b>Unit II</b>           | <b>Transpiration:</b> <ul style="list-style-type: none"> <li>Introduction, Definition</li> <li>Types of transpiration</li> <li>Structure of stomata</li> <li>Mechanism of opening and closing of stomata.</li> <li>Theories of transpiration: a) Stewards theory b) K<sup>+</sup> Pump theory</li> <li>Significance of transpiration.</li> <li>Factors affecting transpiration</li> </ul>                                                                                                                                                                                                                                                                                                                                                  | <b>7</b>     |
| <b>Unit III</b>          | <b>Photosynthesis</b> <ul style="list-style-type: none"> <li>Introduction and Definition</li> <li>Photosynthetic pigments: Chlorophylls, Carotenoids,</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | <b>8</b>     |

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|                        | <p>Phycobillins and their role.</p> <ul style="list-style-type: none"> <li>• Two Pigment System: PS-I and PS-II</li> <li>• Mechanism of Photosynthesis               <ul style="list-style-type: none"> <li>(a) Light reaction: Cyclic and Non-cyclic Photophosphorylation</li> <li>(b) Dark Reaction: <math>C_3</math> and <math>C_4</math> cycle</li> </ul> </li> <li>• Factors affecting on photosynthesis</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |          |
| <b>Unit IV</b>         | <p><b>Respiration</b></p> <ul style="list-style-type: none"> <li>• Introduction and definition</li> <li>• Types of Respiration: Aerobic and Anaerobic</li> <li>• Respiratory quotient</li> <li>• Mechanism of Aerobic Respiration:               <ul style="list-style-type: none"> <li>(a) Glycolysis</li> <li>(b) Kreb's Cycle</li> <li>(c) ETS</li> </ul> </li> <li>• Anaerobic Respiration: Alcoholic respiration</li> <li>• Factors affecting the process of Respiration</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>7</b> |
| <b>Study Resources</b> | <ul style="list-style-type: none"> <li>• Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiyana, India.</li> <li>• Jain, V.K. (1997) Fundamentals of Plant Physiology. S. Chand &amp; Company Ltd. New Delhi, India.</li> <li>• Kochhar, P.L. (1962) A Text Book of Plant Physiology. Atmaram &amp; Sons, New Delhi, India.</li> <li>• Kumar, A. and S.S. Purohit (1998) Plant Physiology, fundamentals and Application. AgroBotanical, Bikaner, India.</li> <li>• Meyer, B.S. &amp; D.B. Anderson (1952) Plant Physiology. Affiliated East-west Press Pvt. Ltd., New Delhi, India.</li> <li>• Mukharji &amp; Ghose, A.K. (1996) Plant Physiology. Tata MacGraw Hill Publishing company Ltd. New Delhi, India.</li> <li>• Pandey &amp; Sinha (1999) Plant Physiology. Vikas Publishing House Pvt. Ltd. New Delhi, India.</li> <li>• Sarbhai, B.P. (1995) Elements of Plant Physiology. Anmol publication Pvt. Ltd., New Delhi, India.</li> <li>• Srivastava, H.C. (1994) Plant Physiology. Rastogi Publication, Meerut, India.</li> <li>• SundaraRajan (2000) College Botany (Plant Physiology and Molecular Biology Vol. IV, Himalaya Publishing House, New Delhi, India.</li> <li>• Varma, V. (1984) Introduction to Plant Physiology. Emkay Publications, New Delhi.</li> <li>• Varma, V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand &amp; Company New Delhi, India.</li> </ul> |          |

**S.Y. B.Sc. Botany (Major)**  
**Semester-IV**  
**BOT-DSC-243: Practical course based on BOT-DSC-241**

**Total Hours: 60**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |              |
|--------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course Objectives</b> | <ul style="list-style-type: none"> <li>To know methods of propagations</li> <li>To understand different horticultural practices and their methods</li> <li>To study role played by green and polyhouses in horticulture</li> <li>To study production technology, harvesting techniques and marketing of crops grown especially in Khandesh region of Maharashtra</li> <li>To understand methods of preservation and preparation of preserved products prevailing especially in this part of the state</li> </ul> |              |
| <b>Course Outcomes</b>   | After successful completion of this course, students are expected to: <ul style="list-style-type: none"> <li>Understand propagation methods of cutting</li> <li>Understand different horticultural practices and their methods</li> <li>Well versed with the role played by green and polyhouses in horticulture</li> <li>Acquired the knowledge of banana and Brinjal cultivation</li> <li>Familiar with the temporary preservation, permanent preservation and preparation of preserved products</li> </ul>    |              |
| <b>Sr. No.</b>           | <b>Particulars</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <b>Hours</b> |
| 1                        | Propagation by cuttings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4            |
| 2                        | Propagation by layering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4            |
| 3                        | Propagation by grafting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4            |
| 4                        | Propagation by budding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4            |
| 5                        | Preparation of potting mixture, potting and repotting.                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4            |
| 6-7                      | Study of layout, requirement and construction of Green-house                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 4X4          |
| 8-9                      | Study of layout, requirement and construction of poly-house                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4X4          |
| 10                       | Study of cultivation practices of banana                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 4            |
| 11                       | Study of cultivation practices of brinjal                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 4            |
| 12                       | Study of methods of temporary preservation (Any 2)<br>i) Asepsis<br>ii) Exclusion of moisture<br>iii) Use of mild antiseptic<br>iv) Pasteurization<br>v) Low temperature                                                                                                                                                                                                                                                                                                                                         | 4            |
| 13                       | Study of methods of permanent preservation (Any 2)<br>i) Sterilization and processing: use of sugar, salts, vinegar or chemicals<br>ii) Drying<br>iii) Ionization radiation                                                                                                                                                                                                                                                                                                                                      | 4            |
| 14-15                    | Study of preparation of preserved products (Any 2):<br>i) Mixed fruit jam<br>ii) Wood apple or guava jelly<br>iii) Lemon/ Orange squash<br>iv) Tomato ketchup                                                                                                                                                                                                                                                                                                                                                    | 4X4          |
| <b>Study Resources</b>   | <ul style="list-style-type: none"> <li>Azad K.C. and Sharma V.K. (2000). Horticulture Technology (Vol I and II). Deep and Deep publications, New Delhi, India.</li> <li>Bose, T (1996). Fruits tropical and subtropical. Nayaprakashan,</li> </ul>                                                                                                                                                                                                                                                               |              |

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|  | <p>Calcutta, India.</p> <ul style="list-style-type: none"> <li>• Edmond, J.B. Senn, T.L. Anderew, F.S. and Halfacr, R.G. (1990). Fundamentals of Horticulture. Tata McGraw-Hill Publishing Company Ltd. New Delhi., India.</li> <li>• Hartmann, H.T. and Kester (1989). Plant propagation principle and practice. Prentice Hall of India (P) Ltd. New Delhi, India.</li> <li>• Kha, M.R. (1995). Horticulture and Gardening. NiraliPrakashan, Pune, India.</li> <li>• Sen, S (1992). Economic Botany. New Central Book Agency, Calcutta, India.</li> <li>• Sharma, N.K. and Arora, S.K. (1985). New Routes to increase Brinjal production. Fmr. Parlim 20(6) 11-12.</li> </ul> |  |
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**Note: At least 12 experiments should be performed.**

**S.Y. B.Sc. Botany (Major)**  
**Semester-IV**  
**BOT-DSC-244: Practical course based on BOT-DSC-242**

**Total Hours: 60**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                  |              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course Objectives</b> | <ul style="list-style-type: none"><li>Students will learn the methodologies and working of experiments of DPD, plasmolysis, transpiration and demonstration experiments.</li><li>To make Students to aware of citric acid fermentation</li><li>Student will learn respiratory quotient of different plant parts by Ganong's respirometer</li></ul>                                                                                               |              |
| <b>Course Outcomes</b>   | After successful completion of this course students will be able to- <ul style="list-style-type: none"><li>Acquired the knowledge of methodologies and working of experiments of plasmolysis, transpiration, assessment of minerals from plant ash and demonstration experiments.</li><li>Familiar with citric acid fermentation</li><li>Well versed with learn respiratory quotient of different plant parts by Ganong's respirometer</li></ul> |              |
| <b>Sr. No.</b>           | <b>Particular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                | <b>Hours</b> |
| 1                        | To determine DPD by using potato tuber.                                                                                                                                                                                                                                                                                                                                                                                                          | 4            |
| 2                        | Determination of osmotic potential of plant cell sap by plasmolytic Method.                                                                                                                                                                                                                                                                                                                                                                      | 4            |
| 3-4                      | Study the effect of two environmental factors (light and wind) on transpiration by excised twig.                                                                                                                                                                                                                                                                                                                                                 | 4X4          |
| 5-6                      | Qualitative assessment of minerals in plant ash (any two from Macro and Micro elements)                                                                                                                                                                                                                                                                                                                                                          | 4X4          |
| 7-9                      | Study the effect of two environmental factors (intensity of light and quality of light ) on photosynthesis by suitable plant                                                                                                                                                                                                                                                                                                                     | 4X4X4        |
| 10-12                    | Demonstration experiments.<br>1. Osmosis by Curling experiment.<br>2. Osmosis-Thistle funnel experiment.<br>3. Bolting (Specimen or photograph)<br>Demonstration experiments.<br>1. Suction due to transpiration.<br>2. Relative Transpiration.<br>3. Imbibition Pressure.<br>4. Ringing Experiment                                                                                                                                              | 4X4X4        |
| 13-14                    | Citric Acid Fermentation                                                                                                                                                                                                                                                                                                                                                                                                                         | 4X4          |
| 15                       | Determination of respiratory quotient of different plant parts by Ganong's respirometer                                                                                                                                                                                                                                                                                                                                                          | 4            |
| <b>Study Resources</b>   | <ul style="list-style-type: none"><li>Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiyana, India.</li><li>Jain, V.K. (1997) Fundamentals of Plant Physiology. S. Chand&amp; Company Ltd. New Delhi, India.</li><li>Kumar, A. and S.S. Purohit (1998) Plant Physiology, fundamentals and Application. AgroBotanical, Bikaner, India.</li></ul>                                                                |              |

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|  | <ul style="list-style-type: none"> <li>• Meyer, B.S. &amp; D.B. Anderson (1952) Plant Physiology. Affiliated East-west Press Pvt. Ltd., New Delhi, India.</li> <li>• Mukharji &amp; Ghose, A.K. (1996) Plant Physiology. Tata MacGraw Hill Publishing company Ltd. New Delhi, India.</li> <li>• Pandey &amp; Sinha (1999) Plant Physiology. Vikas Publishing House Pvt. Ltd. New Delhi, India.</li> <li>• Sarbhai, B.P. (1995) Elements of Plant Physiology. Anmol publication Pvt. Ltd., New Delhi, India.</li> <li>• Srivastava, H.C. (1994) Plant Physiology. Rastogi Publication, Meerut, India.</li> </ul> |  |
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**Note: At least 12 experiments should be performed.**

**S.Y. B.Sc. Botany (Minor)**  
**Semester-IV**  
**BOT-MIN-241: Plant Biotechnology**

**Total Hours: 30**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <ul style="list-style-type: none"><li>• To know the scope and importance of plant biotechnology</li><li>• To study various techniques in plant tissue culture</li><li>• To study the role of enzymes and vectors in plant genome modification</li><li>• To study different methods of gene cloning and gene transfer</li><li>• To know the applications of transgenic technology</li></ul>                                                                                                             |              |
| <b>Course outcomes</b>   | After studying this course the students will be able to: <ul style="list-style-type: none"><li>• Understand core and fundamental concepts of plant and tissue culture</li><li>• Develop their competency on different types of plant tissue culture</li><li>• Explore knowledge of enzymes and vectors for genetic manipulation</li><li>• Examine gene cloning and evaluate different methods of gene transfer</li><li>• Analyze the major concerns and application of transgenic technology</li></ul> |              |
| <b>Unit</b>              | <b>TopicParticular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | <b>Hours</b> |
| <b>Unit I</b>            | <b>Fundamentals Plant Tissue Culture:</b><br>Definitions, scope & importance of plant tissue culture.<br>Concepts of cell differentiation and totipotency.<br>Requirements of plant tissue culture laboratory.<br>Requirement for basal media. Formulation of nutrient media;<br>Sterilization, role of vitamins and hormones                                                                                                                                                                          | <b>8</b>     |
| <b>Unit II</b>           | <b>In vitro Culture:</b><br>Embryogenesis (somatic and zygotic); Organ culture, Embryo culture, Anther and triploid culture, Callus culture, Protoplast isolation, culture and fusion.<br>Tissue culture applications including micropropagation, androgenesis and production of virus free plants,                                                                                                                                                                                                    | <b>7</b>     |
| <b>Unit III</b>          | <b>Cryopreservation and Germplasm Conservation:</b> <ul style="list-style-type: none"><li>• Definition and concept, techniques of cryopreservation, cold storage, long term and short term storage, application.</li><li>• Germplasm conservation: Preservation of cell, tissue, organ, whole organism.</li><li>• Concept of Gene Bank, DNA Bank, Seed Bank, Pollen Bank etc.</li></ul>                                                                                                                | <b>8</b>     |
| <b>Unit IV</b>           | <b>Biotechnology and Society:</b> <ul style="list-style-type: none"><li>• Biotechnology- Benefits, GM foods and its safety, Recombinant foods and religious beliefs.</li><li>• Recombinant therapeutic product for human health care.</li><li>• Patenting of biotechnological inventions and Intellectual property rights.</li></ul>                                                                                                                                                                   | <b>7</b>     |
| <b>Study Resources</b>   | <ul style="list-style-type: none"><li>• Bhojwani, S.S. and Razdan, M.K., (1996), Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands.</li><li>• Glick, B.R., Pasternak, J.J. (2003), Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press,</li></ul>                                                                                                                                                                                  |              |

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|  | <p>Washington.</p> <ul style="list-style-type: none"> <li>• A. Slater, N.W. Scott and M.R. Fowler (2008), Plant Biotechnology. Second Edition. Oxford.</li> <li>• Snustad, D.P. and Simmons, M.J. (2010), Principles of Genetics. John Wiley and Sons, U.K.</li> <li>• Stewart, C.N. Jr. (2008), Plant Biotechnology &amp; Genetics: Principles, Techniques and Applications. John Wiley &amp; Sons Inc. U.S.A.</li> <li>• Chrispeels, M.J. and Sadava, D.E. (1994), Plants, Genes and Agriculture. Jones &amp; Bartlett Publishers.</li> <li>• N. Santosh and A. Madhavi. (2010), Practical Book of Biotechnology and Plant Tissue Culture. S. Chand &amp; Co.</li> </ul> |  |
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**S.Y. B.Sc. Botany (Minor)**  
**Semester-IV**  
**BOT-MIN-242: Practical course based on BOT-MIN-241**

**Total Hours: 60**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |              |
|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course Objectives</b> | <ul style="list-style-type: none"><li>• To Explain the various components of plant tissue culture media</li><li>• To establish and maintain plants in tissue culture and micropropagation</li><li>• To develop understanding of techniques for tissue culture</li></ul>                                                                                                                                                                                                 |              |
| <b>Course Outcomes</b>   | The students will be able to <ul style="list-style-type: none"><li>• To Explain the various components of plant tissue culture media</li><li>• To establish and maintain plants in tissue culture and micropropagation</li><li>• To develop understanding of techniques for tissue culture</li></ul>                                                                                                                                                                    |              |
| <b>Sr. No.</b>           | <b>Particulars</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                      | <b>Hours</b> |
| <b>1</b>                 | Study of laboratory safety measures and various instruments used for plant biotechnology: Laminar air Flow cabinet, pH meter, Autoclave, Mechanical shaker and Electrophoresis, Spectrophotometer, Centrifuge (any four)                                                                                                                                                                                                                                                | 4            |
| <b>2&amp;3</b>           | Preparation of stock solutions of MS (Murashige& Skoog, 1962) :Basalmedium and plant growth regulator.                                                                                                                                                                                                                                                                                                                                                                  | 8            |
| <b>4</b>                 | Preparation of explants and inoculation on nutrient media for callus induction.                                                                                                                                                                                                                                                                                                                                                                                         | 4            |
| <b>5</b>                 | Sub-culture of callus and regeneration of plants from callus.                                                                                                                                                                                                                                                                                                                                                                                                           | 4            |
| <b>6</b>                 | Hardening techniques of tissue culture plantlets.                                                                                                                                                                                                                                                                                                                                                                                                                       | 4            |
| <b>7</b>                 | Isolation and culturing of anther for haploid production.                                                                                                                                                                                                                                                                                                                                                                                                               | 4            |
| <b>8</b>                 | Techniques for shoot tip /root tip/ eye bud culture.                                                                                                                                                                                                                                                                                                                                                                                                                    | 4            |
| <b>9</b>                 | Isolation of DNA using any suitable method                                                                                                                                                                                                                                                                                                                                                                                                                              | 4            |
| <b>10</b>                | DNA separation with the help of gel electrophoresis                                                                                                                                                                                                                                                                                                                                                                                                                     | 4            |
| <b>11</b>                | Isolation of Protein using any suitable method                                                                                                                                                                                                                                                                                                                                                                                                                          | 4            |
| <b>12</b>                | Separation of protein with the help of SDS gel electrophoresis                                                                                                                                                                                                                                                                                                                                                                                                          | 4            |
| <b>13</b>                | Study of Gene transfer techniques                                                                                                                                                                                                                                                                                                                                                                                                                                       | 4            |
| <b>14</b>                | Study of Protoplst isolation methods (By photograph)                                                                                                                                                                                                                                                                                                                                                                                                                    | 4            |
| <b>15</b>                | Study of protoplast fusion techniques (By photograph)                                                                                                                                                                                                                                                                                                                                                                                                                   | 4            |
| <b>Study Resources</b>   | <ul style="list-style-type: none"><li>• Glick, B.R., Pasternak, J.J. (2003), Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.</li><li>• A. Slater, N.W. Scott and M.R. Fowler (2008), Plant Biotechnology. Second Edition. Oxford.</li><li>• Snustad, D.P. and Simmons, M.J. (2010), Principles of Genetics. John Wiley and Sons, U.K.</li><li>• Stewart, C.N. Jr. (2008), Plant Biotechnology &amp; Genetics:</li></ul> |              |

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|  | <p>Principles, Techniques and Applications. John Wiley &amp; Sons Inc. U.S.A.</p> <ul style="list-style-type: none"> <li>• N. Santosh and A. Madhavi. (2010), Practical Book of Biotechnology and Plant Tissue Culture. S. Chand &amp; Co.</li> </ul> |  |
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**Note: At least 12 experiments should be performed.**

**S.Y. B.Sc. Botany (Open Elective)**  
**Semester-IV**  
**BOT-OE-241: Plant Propagation**

**Total Hours: 30**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |              |
|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course objectives</b> | <ul style="list-style-type: none"> <li>To understand core concepts of various plant propagation structures and their utilization.</li> <li>To understand advantages and disadvantages of vegetative, asexual and sexual plant propagation methods.</li> <li>To assess the benefits of asexual propagation of certain economically valuable plants using apomictic and adventive polyembryony.</li> <li>To demonstrate skills related to vegetative plant propagation techniques such as cuttings, layering, grafting and budding.</li> <li>To apply a specific macro-propagation technique for a given plant species.</li> </ul>                                                  |              |
| <b>Course outcomes</b>   | <p>After studying this course the students will be able to:</p> <ul style="list-style-type: none"> <li>Understand core concepts of various plant propagation structures and their utilization.</li> <li>Understand advantages and disadvantages of vegetative, asexual and sexual plant propagation methods.</li> <li>Assess the benefits of asexual propagation of certain economically valuable plants using apomictic and adventive polyembryony.</li> <li>Demonstrate skills related to vegetative plant propagation techniques such as cuttings, layering, grafting and budding.</li> <li>Apply a specific macro-propagation technique for a given plant species.</li> </ul> |              |
| <b>Unit</b>              | <b>TopicParticular</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>Hours</b> |
| <b>Unit I</b>            | <b>Basic concepts of propagation</b><br>Propagation: Definition, need and potentialities for plant multiplication; asexual and sexual methods of propagation - advantages and disadvantages.<br>Propagation facilities: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery - tools and implements.<br>Identification and propagation by division and separation: Bulbs, pseudo bulbs, corms, tubers and rhizomes; runners, stolons, suckers and offsets.                                                                                                                                                                 | <b>8</b>     |
| <b>Unit II</b>           | <b>Apomictics in plant propagation</b><br>Apomixis: Definition, facultative and obligate; types – recurrent, non-recurrent, adventitious and vegetative; advantages and disadvantages.<br>Polyembryony: Definition, classification, horticultural significance; chimera and bud sport.<br>Propagation of mango, Citrus and Allium using apomictic embryos.                                                                                                                                                                                                                                                                                                                        | <b>7</b>     |
| <b>Unit III</b>          | <b>Propagation by cuttings and layering</b><br>Cuttings: Definition, different methods of cuttings; root and leaf cuttings.<br>Stem cuttings: Definition of stem tip and section cuttings; plant propagation by herbaceous, soft wood, semi hard wood, hard wood and coniferous stem cuttings.<br>Physiological and bio chemical basis of rooting; factors influencing rooting of cuttings; Use of plant growth regulators in rooting of cuttings.<br>Layering: Definition, principle and factors influencing layering.<br>Plant propagation by layering: Ground layering – tip layering, simple                                                                                  | <b>8</b>     |

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |          |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|                        | layering, trenchlayering, mound (stool) layering and compound (serpentine layering). Air layering technique – application in woody trees.                                                                                                                                                                                                                                                                                                                                                                                      |          |
| <b>Unit IV</b>         | <b>Propagation by grafting and budding</b><br>Grafting: Definition, principle, types, graft incompatibility, collection of scion woodstick, scion-stock relationship, and their influences, bud wood certification; micro grafting.<br>Propagation by veneer, whip, cleft, side and bark grafting techniques.<br>Budding: Definition; techniques of 'T', inverted 'T', patch and chip budding.                                                                                                                                 | <b>7</b> |
| <b>Study Resources</b> | <ul style="list-style-type: none"> <li>• Sharma RR and Manish Srivastav. 2004. Plant Propagation and Nursery Management International Book Distributing Co. Lucknow.</li> <li>• Hartman, HT and Kester, D.E. 1976. Plant Propagation: Principles and Practices, Prentice Hall of India Pvt. Ltd. Bombay.</li> <li>• Sadhu, M.K. 1996. Plant Propagation. New Age International Publishers, New Delhi.</li> <li>• Web resources suggested by the teacher concerned and college librarian including reading material.</li> </ul> |          |

**S.Y. B.Sc. Botany (Open Elective)**  
**Semester-IV**

**BOT-OE-242: Practical based on BOT-OE-241**

**Total Hours: 60**

**Credits: 2**

|                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |              |
|--------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|
| <b>Course Objectives</b> | <ul style="list-style-type: none"> <li>To make use of different plant propagation structures for plant multiplication.</li> <li>To explore the specialized organs or asexual propagules in some plants for their proliferation.</li> <li>To demonstrate skills on micropropagation of plants through vegetative propagation techniques.</li> <li>To evaluate and use a suitable propagation technique for a given plant species.</li> </ul>                                                                          |              |
| <b>Course Outcomes</b>   | <p>After studying this course the students will be able to:</p> <ul style="list-style-type: none"> <li>Make use of different plant propagation structures for plant multiplication.</li> <li>Explore the specialized organs or asexual propagules in some plants for their proliferation.</li> <li>Demonstrate skills on micropropagation of plants through vegetative propagation techniques.</li> <li>Evaluate and use a suitable propagation technique for a given plant species.</li> </ul>                      |              |
| <b>Sr. No.</b>           | <b>Particulars</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <b>Hours</b> |
| <b>1-3</b>               | To study the Preparation of nursery beds – flat, raised and sunken beds.                                                                                                                                                                                                                                                                                                                                                                                                                                             | 12           |
| <b>4</b>                 | To study the Propagation through apomictic.                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 4            |
| <b>5-6</b>               | To study the Propagation by separation and division technique.                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8            |
| <b>7</b>                 | To study the Propagation by cuttings.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4            |
| <b>8</b>                 | To study the Propagation by layering                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4            |
| <b>9</b>                 | To study the Propagation by grafting.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4            |
| <b>10</b>                | To study the Propagation by budding.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 4            |
| <b>11-12</b>             | To study the Preparation of potting mixture.                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 08           |
| <b>13-14</b>             | To study the Potting and repotting                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 08           |
| <b>15</b>                | Visit to Green House/polyhouse/ Nursery and submission of report                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 04           |
| <b>Study Resources</b>   | <ul style="list-style-type: none"> <li>Sharma RR and Manish Srivastav.2004. Plant Propagation and Nursery Management International Book Distributing Co. Lucknow.</li> <li>Hartman, HT and Kester, D.E.1976. Plant Propagation: Principles and Practices, Prentice Hall of India Pvt. Ltd. Bombay.</li> <li>Sadhu, M.K. 1996. Plant Propagation. New Age International Publishers, New Delhi.</li> <li>Web resources suggested by the teacher concerned and college librarian including reading material.</li> </ul> |              |

**Note: At least 12 experiments should be performed.**

**S.Y. B.Sc. Botany (Major)**  
**Semester-IV**  
**BOT-FP-241: Field Projects**

**Credits : 2**

**Contact hours : 60**

**Preamble**

In alignment with the National Education Policy (NEP) 2020, Moolji Jaitha College (Autonomous), Jalgaon is introducing the Field Project at the undergraduate level. The NEP 2020 emphasizes holistic development, inclusivity, and integrating vocational education with academic learning, aiming to nurture socially responsible individuals. This course fosters a strong connection between education and real-world applications. These initiatives aim to bridge the gap between theoretical knowledge and practical experience, helping students develop critical thinking, problem-solving skills, and a sense of civic responsibility.

**Objectives**

- To provide students with practical exposure in rural and urban socioeconomic context.
- To develop students abilities to apply subject knowledge to address real world problems
- To foster critical thinking and innovative approaches to solve socioeconomic issues.

**Outcomes**

After completing this course, students will be able to

- Participate actively in field projects that benefit local communities and promote sustainable development practices.
- Analyse the socio economic data using appropriate methods showcasing improved problem-solving skills, technical proficiency.
- Demonstrate the ability to apply theoretical knowledge to real-world situations effectively and exhibit communication skills.

**Course structure**

The course is divided into four probable phases

**I] Orientation and preparation**

- Introduce to the course, objectives and expectation
- Overview of socioeconomic development issues in rural and urban context
- Training on working methodology and data collection techniques
- Review existing literature related to topic to understand the background and context.

**II] Work plan and Field visit**

- Visit the potential sites to get a sense of the environment and logistical requirements.
- Create a detailed project plan outlining the steps, timeline, resources needed, and roles of team members.
- Obtain necessary approvals (Ethical/ local authorities/organizations/communities)
- Gather materials and resources (recording devices, cameras, notebooks and supplies)
- Conduct Preliminary Survey, choose appropriate methods for data collection and analysis (e.g., surveys, interviews, observations).

**III] Data collection and analysis**

- Pilot test to identify issues with data collection.
- Collect data systematically, ensuring consistency and accuracy.
- Keep detailed records of all data (field notes, recordings, photographs etc)

- Organize and analyse the data (manual/ software)

#### **IV] Interpretation and Reporting**

- Interpret your findings in the context to objectives.
- Write and submit a comprehensive report detailing your methodology, findings, analysis, and conclusions. (Include visuals - charts, graphs, and photographs).
- Prepare a presentation to share findings with peers/ instructors/ community.

#### **Assessment**

- Field work participation, field note book, team work etc. (10 Marks)
- Data Collection and Analysis (15 Marks)
- Field project report (15 Marks)
- Presentation of Findings(10 Marks)

#### **Examples of activities to be conducted under field projects**

- **Biodiversity Survey:** Conduct a biodiversity survey in a local park or nature reserve, documenting plant and animal species.
- **Water Quality Testing:** Test water samples from different sources (e.g., rivers, lakes, groundwater) for pollutants and compare results.
- **Soil Analysis:** Collect soil samples from various locations and analyse their composition and quality.
- **Wildlife Tracking:** Use camera traps or tracking devices to monitor and study the behaviour of local wildlife.
- **Urban Heat Island Effect:** Measure and map temperature differences in various parts of a city.
- **Land Use Mapping:** Create maps showing different land uses in a region and analyze changes over time.
- **Cultural Heritage Documentation:** Document and analyze local cultural heritage sites or practices.
- **Community Interviews:** Conduct interviews with community members to understand social dynamics and traditions.
- **Ethnographic Study:** Participate in and observe community events to gather ethnographic data.
- **Crop Yield Analysis:** Study the factors affecting crop yield in different fields or under different farming practices.
- **Pest Management:** Investigate the effectiveness of various pest management techniques in local farms.
- **Sustainable Farming Practices:** Evaluate the impact of sustainable farming practices on soil health and crop productivity.
- **Community Needs Assessment:** Conduct surveys and interviews to identify the needs and concerns of a community.
- **Social Network Analysis:** Study the social networks within a community to understand relationships and influence.
- **Public Health Study:** Investigate public health issues in a community, such as access to healthcare or prevalence of diseases.
- **Infrastructure Survey:** Assess the condition and effectiveness of local infrastructure, such as roads, bridges, and buildings.
- **Renewable Energy Potential:** Evaluate the potential for renewable energy sources (e.g., solar, wind) in a specific area.
- **Water Management:** Study and improve local water management systems, including irrigation and drainage.
- **Literacy Program Evaluation:** Evaluate the effectiveness of local literacy programs and suggest improvements.
- **Educational Resource Assessment:** Assess the availability and quality of educational resources in local schools.
- **Market Analysis:** Conduct a market analysis for a local business or industry.
- **Entrepreneurship Project:** Develop a business plan for a local entrepreneurial venture
- **Local History Documentation:** Research and document the history of a local site, building, or community.

- **Oral History Project:** Conduct interviews with local residents to collect oral histories and preserve community memories.
- **Archival Research:** Explore local archives to uncover historical documents and artifacts related to a specific topic or period.
- **Community Mural:** Design and create a mural in collaboration with community members that reflects local culture and history.
- **Public Art Installation:** Develop and install a public art project that engages the local community.
- **Art Exhibit Curation:** Curate an exhibit featuring works by local artists, highlighting themes relevant to the community.
- **Music Documentation:** Record and document traditional or contemporary music from the local area.
- **Community Concerts:** Organize and perform in community concerts that showcase local musical talent.
- **Community Theatre Production:** Develop and produce a play that involves community members as actors and crew.
- **Site-Specific Theatre:** Create a theatrical performance that takes place in a non-traditional venue, such as a historic site or public space.
- **Cultural Mapping:** Map cultural resources and heritage sites within the community and analyze their significance.
- **Festival Documentation:** Document and analyze local festivals or cultural events, exploring their history and impact.
- **Ethnographic Study:** Conduct an ethnographic study of a particular cultural practice or community group.
- **Public Philosophy Discussions:** Organize and facilitate public discussions on philosophical topics relevant to the community.
- **Community Documentary:** Create a documentary film about a local issue, event, or group.
- **Digital Storytelling:** Develop digital storytelling projects that capture and share local stories.
- **Language Survey:** Conduct a survey of languages spoken in the community and analyze patterns of language use and change.
- **Dialect Study:** Study and document local dialects or accents, exploring their features and origins.
- **Language Preservation:** Work with community members to document and preserve endangered languages or dialects.
- **Gentrification Impact Study:** Examine the effects of gentrification on local communities, including displacement and economic changes.
- **Crime and Safety Analysis:** Study crime patterns and perceptions of safety within a community.
- **Ritual and Festival Study:** Participate in and document local rituals or festivals to understand their social and cultural significance.
- **Migration Patterns Study:** Analyze migration patterns and their effects on both the sending and receiving communities.
- **Food and Culture Study:** Investigate the role of food in cultural practices and social interactions within a community.
- **Local Governance Analysis:** Study the structure and functioning of local government and its impact on the community.
- **Political Participation Study:** Analyze patterns of political participation and engagement within a community.
- **Public Policy Impact Assessment:** Evaluate the impact of specific public policies on local communities.
- **Election Study:** Analyze voting behavior and patterns in local elections.
- **Mental Health Survey:** Conduct surveys to assess the mental health needs and resources in a community.
- **Social Behavior Observation:** Observe and analyze social behaviors in public spaces, such as parks or markets.
- **Stress and Coping Study:** Investigate sources of stress and coping mechanisms within a community.
- **Community Support Systems:** Study the role and effectiveness of community support systems and networks.
- **Youth Development Programs:** Evaluate the impact of youth development programs on community wellbeing.
- **Educational Equity Study:** Assess disparities in educational resources and outcomes in local schools.

- **Parent and Teacher Interviews:** Conduct interviews to understand perceptions of educational quality and challenges.
- **After-School Program Evaluation:** Evaluate the effectiveness of after-school programs in supporting student development.
- **Educational Attainment Study:** Analyze factors influencing educational attainment in a community.
- **Local Economy Analysis:** Study the structure and dynamics of the local economy, including key industries and employment patterns.
- **Small Business Survey:** Conduct surveys of local small businesses to understand their challenges and successes.
- **Economic Impact of Events:** Analyze the economic impact of local events or festivals on the community.
- **Income Inequality Study:** Investigate patterns and causes of income inequality within a community.
- **Housing Affordability Analysis:** Study housing affordability issues and their impact on residents.
- **Gender Roles and Expectations:** Study gender roles and expectations within a community and their impact on individuals.
- **Women's Health Study:** Investigate issues related to women's health and access to healthcare.
- **Gender-Based Violence Survey:** Conduct surveys to understand the prevalence and impact of gender-based violence.
- **Workplace Equality Study:** Analyze gender equality in local workplaces, including pay equity and job opportunities.
- **Urban Development Projects:** Study the impact of urban development projects on local communities.
- **Public Space Usage:** Analyze how public spaces are used and perceived by different community members.
- **Transportation Study:** Investigate transportation needs and challenges within a community.
- **Green Space Analysis:** Study the availability and usage of green spaces in urban areas and their impact on residents.