



Date :- 25/04/2025

NOTIFICATION

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

Ref. :- Decision of the Academic Council at its meeting held on 22/04/2025.

The Syllabi of B. Sc. in Botany (Third and Fourth Semesters) as per **NATIONAL EDUCATION POLICY – 2020 (2024 Pattern)** and approved by the Academic Council as referred above are hereby notified for implementation with effect from the academic year 2025-26.

Copy of the Syllabi Shall be downloaded from the College Website
(www.kcesmjcollege.in)

Sd/-
Chairman,
Board of Studies

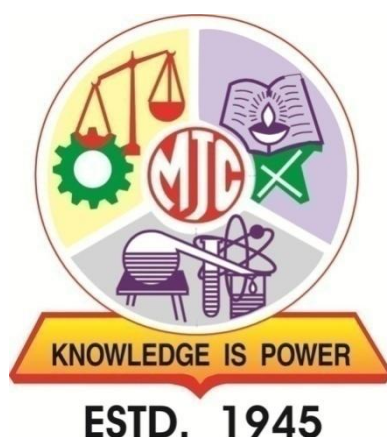
To :

- 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 to
Kavayitri Bahinabai Chaudhari
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: 2025-26]

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 22nd March 2025 resolved to accept therevised 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:

PSO 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 Or Bachelor's Degree- Honours with Research	160	176	8	4

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

F.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1)	Subject-II (M-2)	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT, RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
I (4.5)	I	DSC-1(2T) DSC-2(2P)	DSC-1(2T) DSC-2(2P)	DSC-1(2T) DSC-2(2P)	OE-1(2T)	---	AEC-1(2T) (Eng) VEC-1(2T) (ES) IKS(2T)	CC-1(2T)	22	UG Certificate
	II	DSC-3(2T) DSC-4(2P)	DSC-3(2T) DSC-4(2P)	DSC-3(2T) DSC-4(2P)	OE-2(2T) OE-3(2P)	---	AEC-2(2T) (Eng) VEC-2(2T) (CI)	CC-2(2T)	22	
	Cum. Cr.	8	8	8	6	---	10	4	44	
Exit option: Award of UG Certificate with 44 credits and an additional 4 credits core NSQF course/ Internship OR Continue with Major and Minor.										

S.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1) Major*		Subject-II (M-2) Minor #	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
		Mandatory (DSC)	Elective (DSE)	(MIN)							
2 (5.0)	III	DSC-5(2T) DSC-6(2T) DSC-7(2P)	---	MIN-1(2T) MIN-2(2T) MIN-3(2P)	---	OE-4(2T)	SEC-1(2T)	AEC-3(2T) (MIL)	CC-3(2T) CEP(2)	22	UG Diploma
	IV	DSC-8(2T) DSC-9(2T) DSC-10(2P)	---	MIN-4(2T) MIN-5(2P)	---	OE-5(2T)	SEC-2(2T) SEC-2(2P)	AEC-4(2T) (MIL)	CC-4(2T) ⊗FP(2)	22	
	Cum . 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 4th semester

T.Y. B.Sc.

Year (Level)	Sem	Subject-I (M-1) Major		Subject-II (M-2) Minor	Subject-III (M-3)	Open Elective (OE)	VSC, SEC (VSEC)	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
		Mandatory (DSC)	Elective (DSE)	(MIN)							
3 (5.5)	V	DSC-11(2T) DSC-12(2T) DSC-13(2T) DSC-14(2P) DSC-15(2P)	DSE-1A/B (2T) DSE-2A/B (2P)	---	---	---	VSC-1(2T) VSC-2(2P)	---	OJT/Int (4)	22	UG Degree
	VI	DSC-16(2T) DSC-17(2T) DSC-18(2T) DSC-19(2T) DSC-20(2T) IKS DSC-21(2P) DSC-22(2P)	DSE-3A/B (2T) DSE-4A/B (2P)	---	---	---	VSC-3(2T) VSC-4(2P)	---	---	22	
	Cum . 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 (Level)	Sem	Major Core Subjects		Research Methodology (RM)	VSC, SEC (VSEC)	OE	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
IV (6.0)	VII	DSC-23(4T) DSC-24(4T) DSC-25(4T) DSC-26(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	---	22	UG Honours Degree
	VIII	DSC-27(4T) DSC-28(4T) DSC-29(4T) DSC-30(2P)	DSE-7A/B (2T) DSE-8A/B (2P)	---	---	---	---	OJT/Int (4)	22	
	Cum. 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 (Level)	Sem	Major Core Subjects		Research Methodology (RM)	VSC, SEC (VSEC)	OE	AEC, VEC, IKS	CC, FP, CEP, OJT/Int/RP	Cumulative Credits/Sem	Degree/ Cumulative Credit
IV (6.0)	VII	DSC-23(4T) DSC-24(4T) DSC-26(2P)	DSE-5A/B (2T) DSE-6A/B (2P)	RM(4T)	---	---	---	RP(4)	22	UG Honours with Research Degree
	VIII	DSC-27(4T) DSC-28(4T) DSC-30(2P)	DSE-7A/B (2T) DSE-8A/B (2P)	---	---	---	---	RP(8)	22	
	Cum. 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-5	DSC	BOT-DSC-231	Plant Ecology and Phytogeography	2	2	---	2	20	---	30	---
DSC-6	DSC	BOT-DSC-232	Cell Biology	2	2	---	2	20	---	30	---
DSC-7	DSC	BOT-DSC-233	Practical on BOT-DSC-231 and BOT-DSC-232	2	---	4	4	---	20	---	30
SEC-1	SEC	BOT-SEC-231	Mushroom Cultivation	2	2	---	2	20	---	30	---
CEP	CEP	BOT-CEP-231	Community Engagement Programme	2	---	4	4	50	---	---	---
MIN-1	MIN	BOT-MIN-231	Plant Ecology	2	2	---	2	20	---	30	---
MIN-2	MIN	BOT-MIN-232	Phytochemistry	2	2	---	2	20	---	30	---
MIN-3	MIN	BOT-MIN-233	Practical on BOT-MIN-231 and BOT-MIN-232	2	---	4	4	---	20	---	30
OE-4	OE	BOT-OE-231	Introduction to Biofertilizer	2	2	---	2	20	---	30	---
Semester IV, Level – 5.0											
DSC-8	DSC	BOT-DSC-241	Horticulture	2	2	---	2	20	---	30	---
DSC-9	DSC	BOT-DSC-242	Plant Physiology	2	2	---	2	20	---	30	---
DSC-10	DSC	BOT-DSC-243	Practical on BOT-DSC-241 and BOT-DSC-242	2	---	4	4	---	20	---	30
SEC-2	SEC	BOT-SEC-241	Biofertilizers	2	2	---	2	20	---	30	---
SEC-3	SEC	BOT-SEC-242	Practical on BOT-SEC-241	2	---	4	4	---	20	---	30
FP	FP	BOT-FP-241	Field Project	2	---	4	4	50	---	---	---
MIN-4	MIN	BOT-MIN-241	Medicinal Botany	2	2	---	2	20	---	30	---
MIN-5	MIN	BOT-MIN-242	Practical on BOT-MIN-241	2	---	4	4	---	20	---	30
OE-5	OE	BOT-OE-241	Plant Propagation	2	2	---	2	20	---	30	---

Examination Pattern

Theory Question Paper Pattern:

- 30 (External) +20 (Internal) for 2 credits
 - External examination will be of 1½ hours duration
 - There shall be 3 questions: Q1 carrying 6 marks and Q2, Q3 carrying 12 marks each. The tentative pattern of question papers shall be as follows;
 - Q1 Attempt any 2 out of 3 sub-questions; each 3 marks
 - Q 2 and Q3 Attempt any 3 out of 4 sub-question; each 4 marks.

Rules of Continuous Internal Evaluation:

The Continuous Internal Evaluation for theory papers shall consist of two methods:

1. Continuous & Comprehensive Evaluation (CCE): CCE will carry a maximum of 30% weightage (30/15 marks) of the total marks for a course. Before the start of the academic session in each semester, the subject teacher should choose any three assessment methods from the following list, with each method carrying 10/5 marks:

- i. Individual Assignments
- ii. Seminars/Classroom Presentations/Quizzes
- iii. Group Discussions/Class Discussion/Group Assignments
- iv. Case studies/Case lets

- v. Participatory & Industry-Integrated Learning/Field visits
- vi. Practical activities/Problem Solving Exercises
- vii. Participation in Seminars/Academic Events/Symposia, etc.
- viii. Mini Projects/Capstone Projects
- ix. Book review/Article review/Article preparation
- x. Any other academic activity
- xi. Each chosen CCE method shall be based on a particular unit of the syllabus, ensuring that three units of the syllabus are mapped to the CCEs.

2. Internal Assessment Tests (IAT): IAT will carry a maximum of 10% weightage (10/5 marks) of the total marks for a course. IAT shall be conducted at the end of the semester and will assess the remaining unit of the syllabus that was not covered by the CCEs. The subject teacher is at liberty to decide which units are to be assessed using CCEs and which unit is to be assessed on the basis of IAT. The overall weightage of Continuous Internal Evaluation (CCE + IAT) shall be 40% of the total marks for the course. The remaining 60% of the marks shall be allocated to the semester-end examinations. The subject teachers are required to communicate the chosen CCE methods and the corresponding syllabus units to the students at the beginning of the semester to ensure clarity and proper preparation.

Practical Examination Credit 2: Pattern (30+20)

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 3 hours duration and shall be conducted as per schedule.
- Practical examination shall be conducted for 2 consecutive days for 2 hr/ day where incubation condition is required.
- There shall be 05 marks for journal and viva-voce. Certified journal is compulsory to appear for practical examination.

Internal Practical Examination (20 marks):

- Internal practical examination of 10 marks will be conducted by department as per schedule given.
- For internal practical examination student must produce the laboratory journal of practicals completed along with the completion certificate signed by the concerned teacher and the Head of the department.
- There shall be continuous assessment of 30 marks based on student performance throughout the semester. This assessment can include quizzes, group discussions, presentations and other activities assigned by the faculty during regular practicals. For details refer internal theory examination guidelines.
- Finally 40 (10+30) marks performance of student will be converted into 20 marks.

SEMESTER-III

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To know the core concept of biotic and abiotic factors ▪ To study various types of ecological adaptation and concepts of population ecology ▪ To study different plant communities and ecosystem concept ▪ To study energy sources of ecological system ▪ To know the functional aspects of ecosystem and phytogeography and its divisions	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Students will Understand core concepts of biotic and abiotic interactions, community concept and succession ▪ Students will analysis the phytogeography or phytogeographical division of India ▪ Students will Evaluate energy sources of ecological system ▪ Students will Assess the adaptation of xerophytic and hydrophytic plants	
Unit	Contents	Hours
Unit I	Introduction and ecological adaptation ▪ Basic concepts; Levels of organization. Abiotic and biotic Components and their interrelationships and dynamism, homeostasis. ▪ Study of xerophytic and hydrophytic adaptations in plants	8
Unit II	Biotic Interaction ▪ Biotic interactions: Competition: Inter- and intraspecific competition; Ammensalism, heterotrophy; mutualism, commensalism, parasitism; herbivory, carnivory, proto cooperation.	7
Unit III	Plant Communities and Ecosystem ▪ Community concept: structure, Habitat and niche; Ecotone and edge effect; ▪ Succession: processes, types; climax concept. Primary vs Secondary succession. ▪ Ecosystem: Structure; Processes; Trophic organization; Food chains and Food webs; Ecological pyramids. Ecosystems of India.	8
Unit IV	Functional Aspects of Ecosystem and Phytogeography ▪ Principles and models of energy flow; Biogeochemical cycles of carbon, nitrogen and phosphorus. ▪ Phytogeography: Principles; Continental drift; Theory of tolerance; Endemism; Brief description of major terrestrial biomes (one each from tropical, temperate & tundra); Phyto-geographical division of India; Local Vegetation.	7
Study Resources	▪ Bhojwani, S.S. and Razdan, M.K., (1996), Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands. ▪ Glick, B.R., Pasternak, J.J. (2003), Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.	

	▪ A. Slater, N.W. Scott and M.R. Fowler (2008), Plant Biotechnology. Second Edition. Oxford. ▪ Snustad, D.P. and Simmons, M.J. (2010), Principles of Genetics. John Wiley and Sons, U.K. ▪ Stewart, C.N. Jr. (2008), Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A. ▪ Chrispeels, M.J. and Sadava, D.E. (1994), Plants, Genes and Agriculture. Jones & Bartlett Publishers. ▪ N. Santosh and A. Madhavi. (2010), Practical Book of Biotechnology and Plant Tissue Culture. S. Chand & Co.	
--	---	--

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To introduce the students with “Cell Science”. ▪ To study Cell wall Plasma membrane, Cell organelles and cell division. ▪ To study the scope and importance of molecular biology. ▪ To study the biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material. ▪ To understand the process of synthesis of proteins and role of genetic code in polypeptide formation.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Students will be well versed with cell science ▪ Student will acquire the knowledge of Cell organelles and cell division ▪ Students will know the scope and importance of molecular biology ▪ Student will familiar with biochemical nature of nucleic acids, their role in living systems, experimental evidences to prove DNA as a genetic material. ▪ Students will be acquainted with knowledge of process of synthesis of proteins and role of genetic code in polypeptide formation.	
Unit	Contents	Hours
Unit I	Introduction of Cell Biology: ▪ Definition and history. ▪ Discovery of cell, definition of cell and cell theory. ▪ Basic properties of cell:- complex and organised, cell reproduction, utilization of energy, response to stimuli, self-regulation and evolution.	8
Unit II	Types of Cell: ▪ Characteristics of prokaryotic and Eukaryotic cells. ▪ Types of prokaryotic cells. ▪ Types of eukaryotic cells. ▪ Viruses and viroids.	7
Unit III	Structural Organization of Cell: ▪ Plasma membrane, cell wall, chemical composition, structure. Functions of cell wall and plasma membrane. ▪ Cytoplasm – Physical nature of matrix chemical organization of matrix ▪ Endoplasmic reticulum ▪ Golgi complex ▪ Mitochondria ▪ Plastids ▪ Nucleus of eukaryotic ▪ Ribosomes ▪ Lysosomes	8

Unit IV	Chromosome: ▪ Number, size, shape, morphology, karyotype euchromatine and heterochromatin. Chemical composition of – chromatin, nucleosome solenoid, loop and scaffold. ▪ Molecular organization – Chromatid chromosomes, arms primary and secondary constriction – telomere, satellite. Type of chromosomes as per position of centromere. ▪ Special type of chromosomes - lamp brush chromosome and salivary gland chromosome, Bacterial and plasmid chromosome	7
Study Resources	▪ Biology – New edition of KARP Gerald Karp ▪ Cell and Molecular biology, E.D.P. De Robertis & De Robertis ▪ Cell biology Vishwa Nath (S. Chand & company ltd.) ▪ Cell Biology E.D.P. De Robertis & De Robertis (Sixth edition, W.B. Saunders company ltd.) ▪ Cell biology Y.K Mehta (Sonali Publication, 2012) ▪ Cytology P.S Verma & V.K Agrawal (S. Chand & company ltd. 2008). ▪ Cell biology C.B. Pawar (1983) ▪ A textbook of Molecular biology Gupta P.K (Rastogi publication, 1999) ▪ Molecular biology, Sambamurty, A.V.S.S (2008) ▪ Cytogenetics, Sunder Rajan, S (2004, Anmol publication) ▪ Concept in molecular biology Sharma V.N, A. Tandon (2004, Anmol publication) ▪ Cell biology, Genetics, Molecular biology, Evolution and Ecology, Verma P.S & V.K. Agrawal (2008, S. Chand & company ltd.) ▪ Genetics (Volume I and II, 2012) C.B. Powar (Himalaya publishing house, Practicals based on the syllabus.	

S.Y. B.Sc. Botany (Major)
Semester-III
BOT-DSC-233: Practical on BOT-DSC-231 and BOT DSC-232

Total Hours: 60

Credits: 2

Course Objectives	▪ To study the methods of vegetation studies. ▪ To know scope and importance of the discipline. ▪ To study plant communities and ecological adaptations in plants ▪ To introduce the students with “Cell Science”. ▪ To study Cell wall Plasma membrane, Cell organelles and cell division. ▪ To study the types of cell. ▪ To acquaint with the methods of studying mitosis and meiosis. ▪ To provide with the knowledge of different types of chromosomes	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Study the methods of vegetation studies. ▪ Know scope and importance of the discipline. ▪ Study plant communities and ecological adaptations in plants ▪ Introduce with the students with “Cell Science”. ▪ Able to understand Cell wall Plasma membrane, Cell organelles and cell division. ▪ Able to learn about the types of cell. ▪ Acquainted with the methods of studying mitosis and meiosis. ▪ Provided with the knowledge of different types of chromosomes.	
Sr. No.	Contents	Hours
1	Study of xerophytic and hydrophytic adaptations in plants (1 Example each)	4
2	Study of soil with reference to soil texture, water holding capacity, pH	4
3	Study of soil with reference to Test for carbonate, nitrate, and sulphate.	4
4-5	Demonstration, working and uses of any three of the following ecological instruments: i) Rain gauze ii) Cup anemometer iii) Hair hygrometer iv) Soil thermometer v) Minimum and maximum thermometer vi) Dry and wet bulb thermometer	8
6-7	To study the vegetation by list count quadrat method. Calculate frequency density, abundance and plot a graph of frequency classes.	8
8-9	Study of mitotic stages in suitable root tip materials by squash method.	8
10	Study of polytene chromosome (P.S.)	4
11	Study of Lampbrush chromosome (P. S.)	4
12	Types of cell (Photograph and P. S.) i. Prokaryotic cells.	4
13	Types of cell (Photograph and P. S.) ii. Eukaryotic cells	4
14	Study of cell organelles (Photograph) i. Endoplasmic reticulum ii. Golgi complex iii. Lysosomes	4
15	Study of cell organelles (Photograph) i. Mitochondria ii. Plastids	4

	iii. Ribosomes	
Study Resources	▪ Bhojwani, S.S. and Razdan, M.K., (1996), Plant Tissue Culture: Theory and Practice. Elsevier Science Amsterdam. The Netherlands. ▪ Snustad, D.P. and Simmons, M.J. (2010), Principles of Genetics. John Wiley and Sons, U.K. ▪ Stewart, C.N. Jr. (2008), Plant Biotechnology & Genetics: Principles, Techniques and Applications. John Wiley & Sons Inc. U.S.A. ▪ N. Santosh and A. Madhavi. (2010), Practical Book of Biotechnology and Plant Tissue Culture. S. Chand & Co. ▪ Cell and Molecular biology, E.D.P. De Robertis & De Robertis ▪ Cell biology Y.K Mehta (Sonali Publication, 2012) ▪ Cytology P.S Verma & V.K Agrawal (S. Chand & company ltd. 2008). ▪ Molecular biology, Sambamurty, A.V.S.S (2008) ▪ Concept in molecular biology Sharma V.N, A. Tandon (2004, Anmol publication) ▪ Cell biology, Genetics, Molecular biology, Evolution and Ecology, Verma P.S & V.K. Agrawal (2008, S. Chand & company ltd.) ▪ Genetics (Volume I and II, 2012) C.B. Powar (Himalaya publishing house, Practicals based on the syllabus.	

S.Y. B.Sc. Botany (Major)
Semester-III
BOT-SEC-231: Mushroom Cultivation

Total Hours: 30

Credits: 2

Course Objectives	▪ To learn the history, scope and importance of mushroom technology ▪ To understand nutritional and medicinal values of edible mushrooms ▪ To know about the storage, marketing and various food preparations of mushrooms. ▪ To understand the economics of mushroom cultivation	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand history scope and importance of Mushroom Culture Technology ▪ Get the knowledge of nutritional and medicinal values of edible mushrooms ▪ Aware the storage, marketing and various food preparations of mushrooms. ▪ Understand the economics of mushroom cultivation.	
Unit	Contents	Hours
Unit I	Introduction to Mushroom Culture: ▪ Introduction, Scope and importance of Mushroom Culture ▪ Nutritional and medicinal value of edible mushrooms. ▪ Edible and non-edible mushrooms. ▪ Morphology and distinguishing characteristics of following mushrooms: i. Button (<i>Agaricus bisporus</i>) ii. Oyster (<i>Lentinus sajor-caju</i>, Syn. <i>Pleurotus sajor-caju</i>) iii. Paddy straw (<i>Volvariella volvacea</i>)	8
Unit II	Cultivation Technology: ▪ Mushroom farm layout and requirement ▪ Materials for compost preparation, Different formulations, Selection of composting materials, commonly used formulations, Synthetic compost and its advantages. ▪ Spore culture and preparation of spawn. ▪ Casing and its Importance, Quality parameters of casing mixture and commonly used materials for casing. ▪ Cultivation procedure of: a. <i>Agaricus bisporus</i> b. <i>Pleurotus sajor-caju</i>. ▪ Some important tips for growing mushrooms successfully	7
Unit III	Common Problems in mushroom growing: ▪ Media preparation or culture ▪ Preparation of mother spawn (Grain Culture) ▪ Preparation of mother spawn (Sawdust Culture) ▪ Preparation of planting spawn ▪ Outdoor bed tech for <i>Volvariella</i> sp. ▪ Sawdust tech (<i>Pleurotus</i>, <i>Lentinula</i>, <i>Auricularia</i>)	8

Unit IV	Storage ▪ Short-term storage (Refrigeration - upto 24hours) ▪ Long term storage (canning, pickling). Drying, storage in salt solutions. ▪ Marketing Food Preparation ▪ Types of foods prepared from mushroom: Soup, Cutlet, Omlette, Samosa, Pickles and Curry. ▪ Training Centres: National and Regional level.	7
Study Resources	▪ Marimuthu, T. Krishnamoorthi, A.S. Sivaprakasam, K. and Jayarajan. R (1991) Oyster Mushrooms. Department of Plant Pathology. Tamil Nadu Agricultural University, Coimbatore. ▪ Swarninathan, M. (1990) Food and Nutrition. Bappa Co, The Bangalore Printing and Publishing Co. Ltd., No. 88, Mysore Road, Bangalore -560018. ▪ S.C. Tewari, Pankaj Kapoor, (1988). Mushroom Cultivation, Mittal Publications, Delhi. ▪ Nita Bahl (1984-1988) Hand book of Mushrooms, II Edition. Vol. I and Vol. II. ▪ Vijaya Khader (1993) Mushrooms for Livelihood. Kalyani Publishers. Pp 170. ▪ D. P. Tripathi (2005) Mushroom cultivation. Oxford IBH Publishing Co. Pvt. Ltd. Pp 354. ▪ S.C. Tiwari and Pankaj Kapoor. (1988) Mushroom Cultivation. Mittal Publications, Delhi. pp.-127 ▪ 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 ▪ V. Kumarsan, Mushroom Cultivation, Saras Publication, PP-324 ▪ V. N. Pathak, Nagendra Yadav and Manesh Gaur (2018) Mushroom Production and Processing Technology Agrobios, PP-176.	

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.

Course 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.

Course 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	Appreciation of Rural Society	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 – Field visit – Assignment
2	Understanding rural and local economy and livelihood	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. Circular economy and migration patterns.	– Field visit – Group discussions in class – Assignment
3	Rural and local Institutions	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 – Field visit – Group presentation of assignment
4	Rural and National Development Programmes	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 – Each student selects one program for field visit – 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)

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To study concept of Ecology and ecological factors ▪ To study the various aspects of plant community ▪ To study the analysis of plant communities ▪ To study concept of ecosystem.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand meaning of Ecology and ecological factors ▪ Understand the plant community ▪ Know how to analyse plant communities by various methods ▪ Understand ecosystems and their components, food chain, food webs, Ecological pyramids, production and productivity and Biogeochemical cycles	
Unit	Contents	Hours
Unit I	Introduction to Plant Ecology and Ecological factors ▪ Definition and historical background ▪ Scope & importance ▪ Abiotic factors (Humidity, light & temperature) ▪ Biotic factors (Symbiosis, epiphytes & parasitism) ▪ Edaphic factors (Soil components, soil formation and soil profile) ▪ Shelford's law of tolerance ▪ Adaptation of hydrophytes (<i>Hydrilla</i> and <i>Eichhornia</i>) and Xerophytes (<i>Nerium</i> and <i>Opuntia</i>)	8
Unit II	Plant communities ▪ Characteristics of community ▪ Species diversity ▪ Growth form, Structure & dominance. ▪ Ecological Succession: Hydrosere and Xerosere	7
Unit III	Analysis of Plant communities: Community classification ▪ Introduction & Structure of Plant community ▪ Qualitative characteristics ▪ Physiognomy and pattern ▪ Biological spectrum ▪ Raunkiaers frequency distribution law ▪ Quantitative characteristics i) Density ii) Basal area ▪ Phytosociological Methods ▪ Line transact method	7
Unit IV	Ecosystem ▪ Introduction & Definition ▪ Components of ecosystem ▪ Types of ecosystem	8

	a) Pond ecosystem b) Grassland ecosystem - Food chain and food webs. - Ecological pyramids, production and productivity. - Biogeochemical cycle: Carbon and Nitrogen	
Study Resources	- Agrawal, K. C. (1996) Environmental Biology, Agro-Botanical Publisher, Bikaner India. - Ambasta, R. S. (1990) Environmental and pollution, Student's friends and co. Varanasi, India - Brij Gopal, N. Bhardwaj (1979) Elements of Ecology, Vikas Publishing House, (P) Ltd., New Delhi, India - Kochhar, P. L. Plant Ecology, Genetic and Evolution, (1972) S. Nagin and Co. Ltd., New Delhi, India. - Kormondy, E. J. (1996) Concepts of Ecology, 4th ed. Prentice Hall, U.S.A. - Mishra, R. and G.S. Puri (2012) Indian Manual of plant Ecology. Scientific Publishers (India) N. Arumugam, V. Kumaresan, (2016) Plant Ecology and Phytogeography, Saras Publication - Nath, Ravindra (1992) Modern College Botany, IInd Edition, Kalyani Publisher, New Delhi, India. - Odum, E. P. (1996) Fundamental of Ecology, Natraj Publishers, Dehra-dun, India P. C. Vasishta. Plant Ecology (1989), Vishal Publications, Delhi. P. S. Verma, V. K. Agrawal . Principles of Ecology. S. Chand & Co. Pvt. Ltd. New Delhi. S. N. Pandey, S. P. Misra (2011). Environment and Ecology, Ane Books Pvt. Ltd. New Delhi (India). - Sharma, P. D. (2010) Ecology and Environment 8th ed. Rastogi Publication, Meerut, India - Subrahmanyam N.S. and Sambamurthy A.V.S.S.. Ecology (200) Narosa Publishing House, New Delhi - Verma P.S. and Agarwal V.K. (1983) Environmental Biology (Principles of Ecology) S. Chand Co. Pvt. Ltd. New Delhi. - Verma, V. (1988) A Text Book of Plant Ecology, Emkay Publication, Delhi.	

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To understand the concept of phyrochemical screening and techniques used in phytochemistry. ▪ To study different primary metabolites in plants. ▪ To study different secondary metabolites in plants. ▪ To know about pigments, vitamins and phytohormones in plant.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Perform phyrochemical screening and techniques used in phytochemistry ▪ Know about primary metabolites in plants. ▪ Know about secondary metabolites in plants. ▪ Know about pigments, vitamins and phytohormones in plant.	
Unit	Contents	Hours
Unit I	Phytochemicals and Phytochemical screening ▪ Phytochemistry: Introduction and Definition ▪ Plants as organic laboratories ▪ Primary and Secondary metabolites ▪ Phytochemical screening • Preparation of extract: Maceration, Infusion, Digestion, Decoction, Soxhlet extraction, Extraction by fermentation. • Chemical tests for detection of phytochemicals - Detection of Carbohydrates- Molish's test - Detection of Proteins- Biuret test and Million's test - Detection of Amino acid- Ninhydrin test - Detection of Fats and oils- Sudan III test - Detection of Alkaloids- Dragendroff's test and Mayer's test - Detection of Flavonoids –Shinoda test - Detection of Tannin-FeCl₃ test ▪ Techniques for separation of phytochemicals • Chromatography: Definition, Types: Paper chromatography and Thin layer chromatography, Significance • Gel Electrophoresis: Definition, Types: paper ▪ Electrophoresis and Gel Electrophoresis, significance	7
Unit II	Primary Metabolites ▪ Carbohydrates: Introduction, Definition, Classification, Characters, Functions, Occurrence and chemical composition of Glucose and Starch ▪ Proteins: Introduction, Definition, Classification, Characters, Functions ▪ Lipids: Introduction, Definition, Classification, Characters, Functions	8
Unit III	Secondary Metabolites ▪ Significance of secondary metabolites ▪ Alkaloids: Definition, Distribution, Functions ▪ Flavonoids: Definition, Distribution, Functions ▪ Terpenes: Definition, Distribution, Functions	7

	▪ Tannin: Definition, Distribution, Functions ▪ Essential oil: Definition, Distribution, Functions ▪ Glycosides: Definition, Distribution, Functions	
Unit IV	Pigments, Vitamins and Phytohormones ▪ Pigments: Definition, Functions, Types: Chlorophyll, Carotenoids, Phycobillins, Anthocynain ▪ Vitamins: Definition, Characters, Classification, Occurance and Deficiency symptoms in human of: Vit. A, Vit. E, Vit. K ,Vit. B1 Vit. B2, Vit. B9, Vit. B12, Vit. C ▪ Phytohormones: Definition, Characters, Types, Role of Auxins, Gibberellins, Cytokinnins, Ethylene and Abscisic acid	8
Study Resources	▪ Evans W. C. (2009). Trease and Evans Pharmacognosy, Sixteenth edition, Sunders Elsevier, Edinburgh. ▪ Harborne J. B. (2010). Phytochemical methods: A guide to modern techniques of plant analysis, Third edition, Springer (India) Private Limited, New Delhi. ▪ Khandelwal K. R. (2011). Practical Pharmacognosy-techniques and experiments, 21st edition, NiraliPrakashan, Pune. ▪ Mukherji S. Ghosh A. K. (2009) Plant Physiology, New Central Book Agency(P) Ltd. ▪ Narayanan L. M., Dulsy F., Nallasingam K., MeyyanPillai R. P., Arumugam N.,Prasannakumar S., Biochemistry, Saras Publication. ▪ Pathan S. N., Vaidya P. B.(Ed.)(1988) Phytochemistry-S. Y. B.Sc., ▪ Patil B. A. (1990). A text book of Phytochemistry-S. Y. B.Sc., GaajPrakashan, Ahmendnagar. ▪ Roseline A. (2011). Pharmacognosy, MJP Publishers, Chennai ▪ Sayaed A. I., Khan N. A.(2011)Textbook of Phytochemistry, Discovery Publishing House Pvt. Ltd., New Delhi ▪ Shah R. M., Kathad H. K. (2012). Pharmacognosy Part II, Global Academic Publishers and Distributors, New Delhi. ▪ Shah R. M., Nayak R. T. (2012). Pharmacognosy Part I, Global Academic Publishers and Distributors, New Delhi. ▪ Singh J, Sayed M. A., Sing J (2010) Natural Product Chemistry, PragatiPrakashan, Meerut	

S.Y. B.Sc. Botany (Minor)
Semester-III
BOT-MIN-233: Practical on BOT-MIN-231 and BOT-MIN-232

Total Hours: 60

Credits: 2

Course Objectives	▪ To prepare plant extract for detection of phytochemicals ▪ To study separation techniques used in phytochemistry ▪ To study different ecological instruments and ecological factors ▪ To study vegetation	
Course Outcomes	After successful completion of this course, students are expected to: ▪ To prepare plant extract and detect phytochemicals present in plant extract ▪ To separate and detect pigments ▪ To understand working and use of ecological instruments and ecological factors ▪ To identify vegetation	
Sr. No.	Contents	Hours
1-2	Extraction of any plant material by Soxhlet apparatus	8
3	Detection of primary metabolite by using chemical test as per theory	4
4-5	Detection of secondary metabolite by using secondary test as per theory	8
6	Extraction and Separation of chlorophyll pigments by paper chromatography	4
7	Separation and detection of anthocyanin pigment	4
8	Demonstration, working and uses of the following ecological instruments. a) Soil thermometer b) Maximum and minimum thermometer c) Cup anemometer d) Hair hygrometer e) Rain Gauge	4
9	Determination of pH and analysis of two soil samples for carbonates, Nitrates & sulphates.	4
10	Study of morphological adaptations of hydrophytes and xerophytes (One each)	4
11	Study of biotic interactions with suitable example: Stem parasite, Root parasite, Epiphytes, Insectivorous plants.	4
12	Determine the frequency & density of herbaceous vegetation by line transect method.	4
13	Quantitative analysis of herbaceous vegetation for frequency, density and abundance	4
14	Identification of vegetation/various plants in college campus/any locality and comparison with Raunkiaer's frequency distribution law.	4
15	Field visit to any ecosystem	4
Study Resources	▪ Kochhar, P. L. Plant Ecology, Genetic and Evolution, (1972) S. Nagin and Co.Ltd., New Delhi, India. ▪ Kormondy, E. J. (1996) Concepts of Ecology, 4th ed. Prentice Hall, U.S.A. ▪ Mishra, R. and G.S. Puri (2012) Indian Manual of plant Ecology. Scientific Publishers (India) ▪ Odum, E. P. (1996) Fundamental of Ecology, Natraj Publishers, Dehra-dun, India ▪ P. C. Vasishta. Plant Ecology (1989), Vishal Publications, Delhi. ▪ P. S. Verma, V. K. Agrawal . Principles of Ecology. S. Chand & Co. Pvt.Ltd. New Delhi.	

	▪ Sharma, P. D. (2010) Ecology and Environment 8th ed. Rastogi Publication, Meerut, India ▪ Evans W. C. (2009). Trease and Evans Pharmacognosy, Sixteenth edition, Sunders Elsevier, Edinburgh. ▪ Harborne J. B. (2010). Phytochemical methods: A guide to modern techniques of plant analysis, Third edition, Springer (India) Private Limited, New Delhi. ▪ Khandelwal K. R. (2011). Practical Pharmacognosy-techniques and experiments, 21st edition, NiraliPrakashan, Pune. ▪ Roseline A. (2011). Pharmacognosy, MJP Publishers, Chennai ▪ Sayaed A. I., Khan N. A.(2011)Textbook of Phytochemistry, Discovery Publishing House Pvt. Ltd., New Delhi ▪ Shah R. M., Kathad H. K. (2012). Pharmacognosy Part II, Global Academic Publishers and Distributors, New Delhi. ▪ Shah R. M., Nayak R. T. (2012). Pharmacognosy Part I, Global Academic Publishers and Distributors, New Delhi. ▪ Singh J, Sayed M. A., Sing J (2010) Natural Product Chemistry, PragatiPrakashan, Meerut	
--	---	--

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To understand core concepts of Biofertilizer and relate with Organic farming ▪ To develop critical understanding on the importance of biofertilizers, organic farming ▪ To develop a basic knowledge of organic farming and important biofertilizer uses and development ▪ To increase the awareness and appreciation of biofertilizers and organic farming	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand core concepts of Biofertilizer and relate with Organic farming ▪ Develop critical understanding on the importance of biofertilizers, organic farming ▪ Develop a basic knowledge of organic farming and importance of biofertilizer uses and development ▪ Increase the awareness and appreciation of biofertilizers and organic farming	
Unit	Contents	Hours
Unit I	▪ 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.	8
Unit II	▪ 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.	7
Unit III	▪ Cyanobacteria (blue green algae), Azolla and Anabaena azolla association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation.	8
Unit IV	▪ 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.	7
Study Resources	▪ Kumaresan, V. (2005). Biotechnology. New Delhi, Delhi: Saras Publication. ▪ Sathe, T.V. (2004). Vermiculture and Organic Farming. New Delhi, Delhi: Daya publishers. ▪ Subha Rao, N.S. (2000). Soil Microbiology. New Delhi, Delhi: Oxford & IBH Publishers.	

SEMESTER-IV

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To know horticulture, its scope, disciplines and importance ▪ To understand different horticultural practices and their methods ▪ To study role played by green and polyhouses in horticulture ▪ To study production technology, harvesting techniques and marketing of crops grown especially in Khandesh region of Maharashtra ▪ To understand methods of preservation and preparation of preserved products prevailing especially in this part of the state	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand horticulture, its scope, disciplines and importance ▪ Understand different horticultural practices and their methods ▪ Study role played by green and polyhouses in horticulture ▪ Study production technology, harvesting techniques and marketing of crops grown especially in Khandesh region of Maharashtra ▪ Understand methods of preservation and preparation of preserved products prevailing especially in this part of the state	
Unit	Contents	Hours
Unit I	Introduction and Propagation of Horticulture Plants: ▪ Historical background, Definition, scope and importance, ▪ Export and import potential of horticulture crops. ▪ Different disciplines of horticulture. ▪ Propagation of Horticultural Plants ▪ Sexual propagation: Advantages and disadvantages ▪ Asexual propagation: i) Methods in brief ii) Advantages and disadvantages	8
Unit II	Methods of cutting, layering, grafting, budding and pruning of plants. ▪ Role of green house and poly-house in Horticulture ▪ Definition, scope and importance ▪ Details about Green-house and poly-house	7
Unit III	▪ 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: a) Brinjal b) Banana	8
Unit IV	▪ Preservation of Fruits and vegetables ▪ Introduction, scope, importance and principles ▪ Methods of preservation a) Temporary preservation i) Asepsis ii) Exclusion of moisture iii) Use of mild antiseptic iv) Pasteurization	7

	v) Low temperature b) Permanent preservation i) Sterilization and processing: use of sugar, salts, vinegar or chemicals ii) Drying iii) Ionization radiation c) Preparation of preserved products: i) Mixed fruit jam ii) Wood apple or guava jelly iii) Lemon/ Orange squash iv) Tomato ketchup v) Ready to serve (RTS)	
Study Resources	▪ Azad K.C. and Sharma V.K. (2000). Horticulture Technology (Vol I and II). Deep and Deep publications, New Delhi, India. ▪ Bal J.S. (1997) Fruit Growing, Kalyani publication, New delhi, Ludhiyana, India. ▪ Bose, T (1996). Fruits tropical and subtropical. Nayaprakashan, Calcutta, India. ▪ 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. ▪ GirdharlalSiddhappa G.S. and Tondon G.L. (1998). Preservation of fruits and vegetables, ICAR New Delhi, India. ▪ Hartmann, H.T. and Kester (1989). Plant propagation principle and practice. Prentice Hall of India (P) Ltd. New Delhi, India. ▪ Kha, M.R. (1995). Horticulture and Gardening. NiraliPrakashan, Pune, India. ▪ Sen, S (1992). Economic Botany. New Central Book Agency, Calcutta, India. ▪ Sharma, N.K. and Arora, S.K. (1985). New Routes to increase Brinjal production. Fmr. Parlim 20(6) 11-12. ▪ Sharma, V.K. (2004). Advances in Horticulture. Deep & Depp Publication, New Delhi, India.	

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To know importance and scope of plant physiology. ▪ To study plants and plant cells in relation to water. ▪ To study the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways. ▪ To study respiration in higher plants with particular emphasis on aerobic and anaerobic respiration. ▪ To study movement of sap and absorption of water in plant body.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Get the knowledge importance and scope of plant physiology. ▪ Study the plants and plant cells in relation to water. ▪ Get the process of photosynthesis in higher plants with particular emphasis on light and dark reactions, C3 and C4 pathways. ▪ Study respiration in higher plants with particular emphasis on aerobic and anaerobic respiration. ▪ Study movement of sap and absorption of water in plant body.	
Unit	Contents	Hours
Unit I	▪ Introduction, scope and Importance ▪ Properties of water: physical and chemical ▪ Diffusion: Definition, mechanism of Diffusion with suitable example, ▪ Diffusion Pressure, Graham's Law of Diffusion and significance of Diffusion ▪ Ascent of Sap ▪ 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. ▪ Imbibition: definition, mechanism, Imbibition pressure, Importance of Imbibition ▪ Mineral Nutrition	8
Unit II	Transpiration: ▪ Introduction, Definition ▪ Types of transpiration ▪ Structure of stomata ▪ Mechanism of opening and closing of stomata. ▪ Theories of transpiration: a) Stewards theory b) K⁺ Pump theory ▪ Significance of transpiration. ▪ Factors affecting transpiration	7
Unit III	Photosynthesis ▪ Introduction and Definition ▪ Photosynthetic pigments: Chlorophylls, Carotenoids, Phycobillins and their role.	8

	- Two Pigment System: PS-I and PS-II - Mechanism of Photosynthesis (a) Light reaction: Cyclic and Non-cyclic Photophosphorylation (b) Dark Reaction: C₃ and C₄ cycle - Factors affecting on photosynthesis	
Unit IV	Respiration - Introduction and definition - Types of Respiration: Aerobic and Anaerobic - Respiratory quotient - Mechanism of Aerobic Respiration: (a) Glycolysis (b) Kreb's Cycle (c) ETS - Anaerobic Respiration: Alcoholic fermentation - Factors affecting the process of Respiration	7
Study Resources	- Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiyana, India. - Jain, V.K. (1997) Fundamentals of Plant Physiology. S. Chand & Company Ltd. New Delhi, India. - Kochhar, P.L. (1962) A Text Book of Plant Physiology. Atmaram & Sons, New Delhi, India. - Kumar, A. and S.S. Purohit (1998) Plant Physiology, fundamentals and Application. AgroBotanical, Bikaner, India. - Meyer, B.S. & D.B. Anderson (1952) Plant Physiology. Affiliated East-west Press Pvt. Ltd., New Delhi, India. - Mukharji & Ghose, A.K. (1996) Plant Physiology. Tata MacGraw Hill Publishing company Ltd. New Delhi, India. - Pandey & Sinha (1999) Plant Physiology. Vikas Publishing House Pvt. Ltd. New Delhi, India. - Sarbhai, B.P. (1995) Elements of Plant Physiology. Anmol publication Pvt. Ltd., New Delhi, India. - Srivastava, H.C. (1994) Plant Physiology. Rastogi Publication, Meerut, India. - Sundara Rajan (2000) College Botany (Plant Physiology and Molecular Biology Vol. IV, Himalaya Publishing House, New Delhi, India. - Varma, V. (1984) Introduction to Plant Physiology. Emkay Publications, New Delhi. - Varma, V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand & Company New Delhi, India.	

S.Y. B.Sc. Botany (Major)
Semester-IV
BOT-DSC-243: Practical on BOT-DSC-241 and BOT-DSC-242

Total Hours: 60

Credits: 2

Course Objectives	▪ To know horticulture, its scope, disciplines and importance ▪ To understand different horticultural practices and their methods ▪ To study role played by green and polyhouses in horticulture ▪ To know importance and scope of plant physiology. ▪ To study plants and plant cells in relation to water. ▪ To study movement of sap and absorption of water in plant body.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand horticulture, its scope, disciplines and importance ▪ Understand different horticultural practices and their methods ▪ Study role played by green and polyhouses in horticulture ▪ Get the knowledge importance and scope of plant physiology. ▪ Study the plants and plant cells in relation to water. ▪ Study movement of sap and absorption of water in plant body.	
Sr. No.	Contents	Hours
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	Preparation of Jam/Jelly	4
7	Preparation of Squash/Ketchup	4
8	To determine DPD by using potato tuber.	4
9	Determination of osmotic potential of plant cell sap by plasmolytic Method.	4
10-11	Study the effect of two environmental factors (intensity of light and quality of light) on photosynthesis by suitable plant	8
12-13	Study the effect of two environmental factors (light and wind) on transpiration by excised twig.	8
14	Demonstration experiments. 1. Osmosis by Curling experiment. 2. Osmosis-Thistle funnel experiment. 3. Kuhne's tube experiment	4
15	Demonstration experiments. 1. Ganong's respirometer 2. Relative Transpiration. 3. Imbibition Pressure.	4
Study Resources	▪ Bal J.S. (1997) Fruit Growing, Kalyani publication, New delhi, Ludhiyana, India. ▪ GirdharlalSiddhappa G.S. and Tondon G.L. (1998). Preservation of fruits and vegetables, ICAR New Delhi, India.	

	▪ Hartmann, H.T. and Kester (1989). Plant propagation principle and practice. Prentice Hall of India (P) Ltd. New Delhi, India. ▪ Sen, S (1992). Economic Botany. New Central Book Agency, Calcutta, India. ▪ Amar Singh (1977) Practical Plant Physiology. Kalyani Publication, New Delhi, Ludhiyana, India. ▪ Jain, V.K. (1997) Fundamentals of Plant Physiology. S. Chand & Company Ltd. New Delhi, India. ▪ Kumar, A. and S.S. Purohit (1998) Plant Physiology, fundamentals and Application. AgroBotanical, Bikaner, India. ▪ Meyer, B.S. & D.B. Anderson (1952) Plant Physiology. Affiliated East-west Press Pvt. Ltd., New Delhi, India. ▪ Mukharji & Ghose, A.K. (1996) Plant Physiology. Tata MacGraw Hill Publishing company Ltd. New Delhi, India. ▪ Sarbhai, B.P. (1995) Elements of Plant Physiology. Anmol publication Pvt. Ltd., New Delhi, India. ▪ Varma, V. (1995) A Text Book of Plant Physiology and Biochemistry. S. Chand & Company New Delhi, India.	
--	---	--

S.Y. B.Sc. Botany (Major)
Semester-IV
BOT-SEC-241: Biofertilizers

Total Hours: 30

Credits: 2

Course Objectives	▪ To understand core concepts of Biofertilizer and relate with Organic farming ▪ To develop critical understanding on the importance of biofertilizers, organic farming ▪ To develop a basic knowledge of organic farming and important biofertilizer uses and development ▪ To increase the awareness and appreciation of biofertilizers and organic farming	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand core concepts of Biofertilizer and relate with Organic farming ▪ Develop critical understanding on the importance of biofertilizers, organic farming ▪ Develop a basic knowledge of organic farming and importance of biofertilizer uses and development ▪ Increase the awareness and appreciation of biofertilizers and organic farming	
Unit	Contents	Hours
Unit I	▪ 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.	8
Unit II	▪ 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.	7
Unit III	▪ Cyanobacteria (blue green algae), Azolla and Anabaena azollae association, nitrogen fixation, factors affecting growth, blue green algae and Azolla in rice cultivation.	8
Unit IV	▪ 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.	7
Study Resources	▪ Kumaresan, V. (2005). Biotechnology. New Delhi: Saras Publication ▪ Subha Rao, N.S. (2000). Soil Microbiology New Delhi, Oxford & IBH Publishers. ▪ Dubey, R.C. (2005). A Textbook of Biotechnology. S. Chand & Co, New Delhi. ▪ John Jothi Prakash, E. (2004). Outlines of Plant Biotechnology. Emkay Publications, New Delhi. ▪ Sathe, T.V. (2004). Vermiculture and Organic Farming. Daya Publications	

	New Delhi. ▪ Somani, L.L. (2004). Handbook of Biofertilizers. Agrotech Publishing Academy, Udaipur-313002 ▪ Sharma, A. K. (2005). A Hand Book of organic farming. Agrobios, Jodhpur, India, Rajasthan ▪ Vayas, S.C., Vayas, S. and Modi, H.A. (1998). Biofertilizers and Organic Farming. AktaPrakashan, Nadiad. ▪ Trueman's Biofertilizers. (2018). Trueman Book Company, Jalandhar.	
--	---	--

S.Y. B.Sc. Botany (Major)
Semester-IV
BOT-SEC-242: Practical on BOT-SEC-241

Total Hours: 60

Credits: 2

Course Objectives	▪ To understand the methods of isolation of mycorrhiza from roots ▪ To develop critical understanding on the importance of biocontrol, organic farming ▪ To develop a basic knowledge of organic farming and important biofertilizer uses and development ▪ To increase the awareness of isolation of BGA for further use ▪ To understand the testing methods for organic matter of different types of compost.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand the methods of isolation of mycorrhiza from roots ▪ Develop critical understanding on the importance of biocontrol, organic farming ▪ Develop a basic knowledge of organic farming and important biofertilizer uses and development ▪ Aware of isolation of BGA for further use ▪ Understand the testing methods for organic matter of different types of compost.	
Sr. No.	Contents	Hours
1	Isolation of Anabaena from Azolla leaf	4
2	Study of Rhizobium from root nodules of leguminous plants by Gramstaining method	4
3-5	Test for pH, NO ₂ , SO ₄ , Cl and organic matter of different composts	12
6	Observation of mycorrhizae from roots	4
7	Isolation of arbuscular mycorrhizal spores from rhizospheric soil	4
8-9	Spots, Specimen /photographs of earthworm, Azolla, arbuscules, vesicles	8
10-11	Biocontrol photographs-pheromons trap, Trichoderma, Pseudomonas, Neem etc, Identification and application	8
12	Photographs of biocompost methods	4
13-15	Projects on any topic mentioned in the syllabus, with Rhizobium technology, AMF technology, Organic farming, vermicomposting,biocompost, Azolla culture	12
Study Resources	▪ Kumaresan, V. (2005). Biotechnology. New Delhi: Saras Publication ▪ Subha Rao, N.S. (2000). Soil Microbiology New Delhi, Oxford & IBH Publishers. ▪ Dubey, R.C. (2005). A Textbook of Biotechnology. S. Chand & Co, New Delhi. ▪ John Jothi Prakash, E. (2004). Outlines of Plant Biotechnology. Emkay Publications, New Delhi. ▪ Sathe, T.V. (2004). Vermiculture and Organic Farming. Daya Publications New Delhi. ▪ Somani, L.L. (2004). Handbook of Biofertilizers. Agrotech Publishing Academy, Udaipur-313002 ▪ Sharma, A. K. (2005). A Hand Book of organic farming. Agrobios, Jodhpur,	

	India, Rajasthan ▪ Vayas, S.C., Vayas, S. and Modi, H.A. (1998). Biofertilizers and Organic Farming. AktaPrakashan, Nadiad. ▪ Trueman'sBiofertilizers. (2018). Trueman Book Company, Jalandhar.	
--	---	--

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

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.

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To recognize the basic medicinal plants ▪ To apply techniques of conservation and propagation of medicinal plants. ▪ To setup process of harvesting, drying and storage of medicinal herbs ▪ To propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Recognize the basic medicinal plants ▪ Apply techniques of conservation and propagation of medicinal plants. ▪ Setup process of harvesting, drying and storage of medicinal herbs ▪ Propose new strategies to enhance growth of medicinal herbs considering the practical issues pertinent to India	
Unit	Contents	Hours
Unit I	History and Traditional Systems of Medicine ▪ History, Scope and Importance of Medicinal Plants; Traditional systems of medicine; Definition and Scope ▪ Ayurveda: History, origin, panchamahabhutas, saptadhatu and tridosha concepts, Rasayana, plants used in ayurvedic treatments. ▪ Unani: History, concept: Al-Umoom al-tabiyyah, tumor treatments/therapy, polyherbal formulations.	7
Unit II	Conservation and Augmentation ▪ Conservation of Endemic and endangered medicinal plants, Red list criteria ▪ In situ conservation: Biosphere reserves, sacred groves, National Parks ▪ Ex situ conservation: Botanic Gardens, Ethnomedicinal plant Gardens.	8
Unit III	Ethnobotany and Folk Medicine ▪ Ethnobotany and Folk medicines. Definition ▪ Ethnobotany in India: Methods to study ethnobotany ▪ Applications of Ethnobotany: National interacts, ethnomedicine	7
Unit IV	▪ Brief description of selected plants and derived drugs, namely Guggul (<i>Commiphora</i>) Arjuna (<i>Terminalia arjuna</i>) for cardioprotection, turmeric (<i>Curcuma longa</i>) for wound healing, antioxidant and anticancer properties, Cincona and Artemisia for Malaria, Rauwolfia as tranquilizer	8
Study Resources	▪ Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press. ▪ AYUSH (www.indianmedicine.nic.in). <i>About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy</i>. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India. ▪ CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). <i>AushGyanya: Handbook of Medicinal and Aromatic Plant Cultivation</i>.	

	▪ Dev, S. (1997). Ethnotherapeutics and modern drug development: The potential of Ayurveda. <i>Current Science</i> 73:909–928. ▪ Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16thedn. Philadelphia, PA: Elsevier Saunders Ltd. ▪ Jain, S.K. and Jain, Vartika. (eds.) (2017). Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects. Deep Publications, Delhi ▪ Kapoor, L. D. (2001). <i>Handbook of Ayurvedic medicinal plants</i>. Boca Raton, FL: CRC Press. ▪ Saroya, A.S. (2017). Ethnobotany. ICAR publication. ▪ Sharma, R. (2003). Medicinal Plants of India-An Encyclopaedia. Delhi: Daya Publishing House. ▪ Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi. ▪ Thakur, R. S., H. S. Puri, and Husain, A. (1989). <i>Major medicinal plants of India</i>. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.	
--	--	--

S.Y. B.Sc. Botany (Minor)
Semester-IV
BOT-MIN-242: Practical on BOT-MIN-241

Total Hours: 60

Credits: 2

Course Objectives	To demonstration and practice cultural practices for seed / vegetative / clonally propagated medicinal plants (Menthaarvensis, Satavari, Aloe vera etc.)	
Course Outcomes	After successful completion of this course, students are expected to: Demonstration and practice of cultural practices for seed / vegetative / clonally propagated medicinal plants (Menthaarvensis, Satava, Aloe vera etc.)	
Sr. No.	Contents	Hours
1	Harvesting, drying and storage of Stevia	4
2	Harvesting, drying and storage of Kalmegh	4
3	Harvesting, drying and storage of Satavar	4
4	Harvesting of Mints, Basil	4
5	Distillation of Mints	4
6	Distillation of Basil	4
7	Extraction of alkaloids form Ashwagandha	4
8	Extraction of Withanoloids from Withania	4
9	To study harvesting, drying grading, and value addition techniques for medicinal plants.	4
10	To study storage, processing for medicinal plants.	4
11	To study value addition techniques for medicinal plants.	4
12	To study harvesting techniques of aromatic plants.	4
13	To study drying grading of aromatic plants	4
14	To study storage and processing of aromatic plants.	4
15	To study value addition techniques of aromatic plants	4
Study Resources	- Akerele, O., Heywood, V. and Synge, H. (1991). The Conservation of Medicinal Plants. Cambridge University Press. - AYUSH (www.indianmedicine.nic.in). <i>About the systems—An overview of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homeopathy</i>. New Delhi: Department of Ayurveda, Yoga and Naturopathy, Unani, Siddha and Homoeopathy (AYUSH), Ministry and Family Welfare, Government of India. - CSIR- Central Institute of Medicinal and Aromatic Plants, Lucknow (2016). <i>AushGyanya: Handbook of Medicinal and Aromatic Plant Cultivation</i>. - Dev, S. (1997). Ethnotherapeutics and modern drug development: The potential of Ayurveda. <i>Current Science</i> 73:909–928. - Evans, W.C. (2009). Trease and Evans Pharmacognosy, 16thedn. Philadelphia, PA: Elsevier Saunders Ltd. - Jain, S.K. and Jain, Vartika. (eds.) (2017). <i>Methods and Approaches in Ethnobotany: Concepts, Practices and Prospects</i>. Deep Publications, Delhi - Kapoor, L. D. (2001). <i>Handbook of Ayurvedic medicinal plants</i>. Boca Raton, FL: CRC Press.	

	▪ Saroya, A.S. (2017). Ethnobotany. ICAR publication. ▪ Sharma, R. (2003). Medicinal Plants of India-An Encyclopaedia. Delhi: Daya Publishing House. ▪ Sharma, R. (2013) Agro Techniques of Medicinal Plants. Daya Publishing House, Delhi. ▪ Thakur, R. S., H. S. Puri, and Husain, A. (1989). <i>Major medicinal plants of India</i>. Central Institute of Medicinal and Aromatic Plants, Lucknow, India.	
--	--	--

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

Total Hours: 30

Credits: 2

Course Objectives	▪ To understand core concepts of various plant propagation structures and their utilization. ▪ To understand advantages and disadvantages of vegetative, asexual and sexual plant propagation methods. ▪ To assess the benefits of asexual propagation of certain economically valuable plants using apomictic and adventive polyembryony. ▪ To demonstrate skills related to vegetative plant propagation techniques such as cuttings, layering, grafting and budding. ▪ To apply a specific macro-propagation technique for a given plant species.	
Course Outcomes	After successful completion of this course, students are expected to: ▪ Understand core concepts of various plant propagation structures and their utilization. ▪ Understand advantages and disadvantages of vegetative, asexual and sexual plant propagation methods. ▪ Assess the benefits of asexual propagation of certain economically valuable plants using apomictic and adventives polyembryony. ▪ Demonstrate skills related to vegetative plant propagation techniques such as cuttings, layering, grafting and budding. ▪ Apply a specific macro-propagation technique for a given plant species.	
Unit	Contents	Hours
Unit I	Basic concepts of propagation ▪ Propagation: Definition, need and potentialities for plant multiplication; asexual and sexual methods of propagation - advantages and disadvantages. ▪ Propagation facilities: Mist chamber, humidifiers, greenhouses, glasshouses, cold frames, hot beds, poly-houses, phytotrons nursery - tools and implements. ▪ Identification and propagation by division and separation: Bulbs, pseudo bulbs, corms, tubers and rhizomes; runners, stolons, suckers and offsets.	8
Unit II	Apomictics in plant propagation ▪ Apomixis: Definition, facultative and obligate; types – recurrent, non-recurrent, adventitious and vegetative; advantages and disadvantages. ▪ Polyembryony: Definition, classification, horticultural significance; chimera and bud sport. ▪ Propagation of mango, Citrus and Allium using apomictic embryos.	7
Unit III	Propagation by cuttings and layering ▪ Cuttings: Definition, different methods of cuttings; root and leaf cuttings. ▪ Stem cuttings: Definition of stem tip and section cuttings; plant propagation by herbaceous, soft wood, semi hard wood, hard wood and coniferous stem cuttings. ▪ Physiological and bio chemical basis of rooting; factors influencing rooting of cuttings; Use of plant growth regulators in rooting of cuttings. ▪ Layering: Definition, principle and factors influencing layering.	8

	Plant propagation by layering: Ground layering – tip layering, simple layering, trench layering, mound (stool) layering and compound (serpentine layering). Air layering technique – application in woody trees.	
Unit IV	Propagation by grafting and budding - Grafting: Definition, principle, types, graft incompatibility, collection of scion wood stick, scion-stock relationship, and their influences, bud wood certification; micro grafting. - Propagation by veneer, whip, cleft, side and bark grafting techniques. - Budding: Definition; techniques of ‘T’, inverted ‘T’, patch and chip budding.	7
Study Resources	- Sharma RR and Manish Srivastav.2004. Plant Propagation and Nursery Management International Book Distributing Co. Lucknow. - Hartman, HT and Kester, D.E.1976. Plant Propagation: Principles and Practices, Prentice Hall of India Pvt. Ltd. Bombay. - Sadhu, M.K. 1996. Plant Propagation. New Age International Publishers, New Delhi. - Web resources suggested by the teacher concerned and college librarian including reading material.	

Skills acquired and Job prospects for the Botany students

The present syllabus of S. Y. B. Sc. Botany deals with the study of various disciplines of 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. Phytochemistry includes the chemical compounds produced by plants, exploring their potential applications in medicine and other industries. Nursery or horticulture studies in botany can contribute to the development and cultivation of ornamental plants, improving the aesthetics and functionality of landscapes. Students can conduct research on various aspects of plant life, including genetics, physiology, biofertilizers and its impact on crop improvement.

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., are some popular Botany specializations that students can specifically opt for and make their careers.

Here are some of the recent trends in the field of botany which offer good placements to students after their specialization in their specific subject like ecology, horticulture, genetics, medicinal botany, biofertilizers, etc.

IOT: sensor based technologies are used for research purposes to study the environment and collect useful information from the surroundings.

CRISPR: Latest technologies used by the scientists for improving the production technologies and generate high quality crops.

Climate Adaptability: Conduct special research on how plants respond to the changing weather conditions.

Plant Medicines: Utilize the plants effectively to produce medicines which can help find a cure to various diseases and are budget friendly.

Modern Farming Techniques: Continuously upgrading the existing farming technologies which can help save the natural resources while improving the quality of the crop production